An Electricity Efficiency Makeover

I. Major Uses of Electricity in the Home

A. In rough order of electricity usage in an average home:

Appliances

- Refrigerator
- Clothes Washer & Dryer
- Air Conditioner
- Stove
- Dishwasher

Lighting

Entertainment/computers

"Phantom Loads"

B. Assumptions and notation

For the rest of the examples, we will use the following electric rates:

LPEA residential power: $0.075/kWh

Grid-tied solar power (no battery bank): $0.25/kWh

Notations like "HP #xx" refer to articles in Home Power magazine, issue #xx

kWh means kilowatt-hours (thousands of watt-hours). This is what you are billed for using on your LPEA bill. If you run a 1500 watt hair dryer for half an hour, that's 1500 watts x 1/2 hour = 750 watt-hours = 0.75 kWh

II. Appliances: large loads that are frequently used

Generally, using any large appliance that uses electricity to generate heat is a bad choice for a renewable energy system. This includes electric stoves, water heaters, clothes dryers, and baseboard heaters. Converting sunlight into electricity with elaborate equipment just to convert it back to heat is extremely inefficient and results in oversized and expensive renewable systems.

The good news is that increasingly tough standards in the Federal Government's "Energy Star" program have resulted in a wide variety of mainstream appliances that are almost as efficient as the specialized high-efficiency brands of the past.

A. Refrigerators

In the past, only a few companies made specialized, low-power refrigerators that were appropriate for use in a renewable-energy system, and model and feature selection was extremely limited.

Now, due to increased pressure from increasingly strict Energy Star standards, many models are available (we got ours from Sears) that can be effectively run from a renewable energy system. See the Energy Star website for model comparisons.

B. Clothes Washers

Again, with stricter Energy Star standards has come a greater selection of energy-efficient washers.

Front-loaders are much more energy efficient and water-efficient than top-loaders

In the past, the Staber brand washer has received high praise from the Home Power staff for its low power consumption and easy servicing (just take off the front panel)

Now, more mainstream models match the Staber, at least in efficiency, and so you have a wider array of options to choose from.

Be careful that the washer does not have its own hidden loads. For example the Maytag Neptune model washer consumes 10 watts of power after it is finished running until the door is opened (see HP #92, p42). The article describes a way to rewire your outlet with a timer switch, but if you don't want to get involved in this type of thing, you may need to do more research up front.

C. Clothes Dryers

Are they needed for most clothes? Our area has extremely low humidity.

We use a long clothes bar in the laundry area, and just hang our clothes on it already on hangers. Underwear & socks go on a folding drying rack. The system can hold several loads of laundry, and everything is dry by morning with no power used!

Benefits:

- Dry your clothes most of the time without electricity
- Add humidity to the inside air
- Only use the dryer for really wet things that need to be dried quickly.

D. Air Conditioner

Aside from upgrading to a more efficient model, your best bet is to use other strategies to reduce the need for an air conditioner in the first place. Our house requires no air conditioning due to numerous passive cooling features we built in. A complete discussion is beyond the scope of this piece, but briefly we:

- Built the house partly into the side of a hill
- Increased wall & roof insulation by 1.5 to 2x normal
- Have overhangs over each south-facing window that are sized to let in the winter sun (which is low in the sky) but block out the summer sun (which is high in the sky). You can use awnings to produce the same effect with even more flexibility and control.

E. Stoves

Here we are discussing only natural gas/propane stoves, as electric stoves are far too costly to run on a renewable energy system

"Glow bars" in most of the newer gas stoves are used to ignite the gas in the oven instead of a pilot light. These draw 600 watts or more the whole time the stove is on (see HP #31, p85 and HP #46, p20). Most appliance salespeople aren't even aware of the glow bar issue.

- Cost/hour to run a 600 watt glow bar would be $0.045/hour at utility rates, or $0.15/hour at renewable energy rates
- At an average usage of 2/3 hour/day, this is $0.90/month at utility rates, or $3.00/month at renewable energy rates

Peerless Premier gas stoves, HP #40, p108

- These use an electric spark to ignite a conventional pilot light, but the pilot light only remains on until you shut off the stove, not all the time.
- Can be used with either natural gas or adjusted for use with propane
- Oven can be lighted with a match if there's no power, which a "glow bar" oven cannot

F. Dishwashers

Along with the clothes dryer and the air conditioner, this is an appliance we opted to do without. A dishwasher can be handy, but can also consume electricity for motors and dish drying. Consider cutting back your use of the dishwasher, or opening it up before the heating element comes on to dry the dishes so they can air-dry. Again, it's

very dry here in Colorado, so the dishes will dry quickly and add humidity to the interior air.

G. Energy Star web site (www.energystar.gov) compares models of many different types of appliances:

$$$ List types of appliances that are rated

H. Advantage of Replacing Appliances when using renewable energy

Estimate how much it would cost to replace a typical appliance, a refrigerator, for example, with a more energy-efficient model

Take the new cost of the efficient fridge: $800

Subtract the donation or trade-in value of the old one: $100

$$$ See how much of a discount on a new solar system you would get by decreasing that load

III. Lighting: compact fluorescents

A. Old-style fluorescent fixtures used a “magnetic ballast” which caused the troublesome start-up buzzing and low-level flickering during operation. They were also not available in many shapes, “normal” fixtures would not accommodate them.

B. The new “Compact Fluorescents” use an “electronic ballast” and operate at a high frequency which eliminates the annoying flickering and gives a better color temperature. They are also available in a wide variety of shapes to fit most any existing light fixture, including dimming and 3-way fixtures.

C. **Warning:** most compact fluorescent models **will not work with dimmers**

When dimmed, normal compact fluorescent bulbs will ficker, heat up and prematurely fail.

If you want to use a compact fluorescent bulb on a dimmable circuit, you must check that the bulb you are buying is designed for this. These bulbs are readily available, but tend to cost somewhat more.

D. Compact fluorescents save about 70% of the energy used by an incandescent bulb of similar brightness. Here is a general rule of thumb you can use when choosing compact fluorescents to replace incandescent bulbs.

15 watt CF = 60 watt incandescent

20 watt CF = 75 watt incandescent

24 watt CF = 100 watt incandescent

E. Compact fluorescent bulb lifetimes are typically rated at 5,000 to 10,000 hours, whereas incandescents typically last 750 to 1000 hours

In a business environment, this can result in substantial savings just from decreased labor replacing bulbs

F. In a business environment, compact fluorescent bulbs will typically pay for themselves in 3-6 months (although they will last much longer). In a home, where the bulbs are not used as many hours/year, full payback may take a year or more and the bulbs may last up to 5 years.

G. **A Business Example:**

The Steaming Bean Coffee Company changed 2/3 of its lighting to compact fluorescent bulbs.

By doing so, they will save 8000 Kilowatt-Hours per year, 3/4 of the electricity used by an average Colorado home, for an overall yearly cost savings of $550.

This change also avoids the release of over 18,000 pounds of the greenhouse gas Carbon Dioxide (CO_2) each year.

H. $$$ Look at Tri-State web site for info on Compact fluorescents

IV. Phantom Loads: electricity you may not know you're using

A. Phantom loads

Just because the switch says "OFF" doesn't mean a device is off. Many modern appliances are never really OFF. They contain clocks, memories, remote controls, microprocessors, and instant ON features that consume electricity when plugged in. That's 24 hours a day, 7 days a week… While these Phantom Loads are often small, they add up if several are constantly on line. Some Phantom Loads are easy to spot- things like clocks and timers have displays. Other Phantom Loads are truly hidden- the device seems OFF when switched OFF, but it really isn't.

B. $$$ Estimate the number of phantom loads in our house. Multiply by 24/7 "on" state to estimate monthly charge, % of total bill

C. You can turn off unneeded phantom loads by plugging a computer-type outlet strip into your wall outlet, and plugging the Phantom Load(s) into the strip. Then when you turn off the strip, the Phantom Loads receive no power and so cannot waste any.

D. Savings achieved by using switched power outlet strips to turn off Phantom Loads

If you use LPEA power, you're paying an average of $0.075 per kilowatt-hour for electricity. A small phantom load of 4 watts costs you about $2.70 yearly. If you make your own electricity, then the savings situation is even better. A grid-tied renewable energy system (no battery bank) generates power at about $0.25 per kilowatt-hour. The same 4 watt phantom load costs home power producers about $8.75 per year. If you use the plug strip for several phantom loads (common in entertainment centers or computers), it pays for itself in a few months and we get to use our power elsewhere. Regardless of the electrical power source, phantom loads waste energy because they don't do anything in return for their electricity consumption.

E. These small Phantom Loads, when taken to the scale of the whole country, add up to enormous amounts of power:

1993 Estimate: Home Power #37, page 46, article on Phantom Loads estimates total phantom loads in a typical US household at 77 watts. Over some 93 million households, this results in some 43 million kWh wasted on phantom loads.

1996 Estimate: Home Power #55, page 36, article on Phantom Loads estimates total phantom loads in 100 million US households waste some 32 million kWh on phantom loads.

Even this smaller estimate is enough to completely power 3.5 million typical US households, or the entire country of Greece!

V. **How our own residential electricity use has decreased over time**

A. A graph of our family of four's residential electricity use in a 2000 square foot home: