Home Energy Detective Kit

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May 2006

Dear Cape Cod and Martha's Vineyard resident,

Thank you for your interest in the Cape Light Compact's Kill-A-Watt Library Project. Your efforts to control your electric usage will pay dividends for many years to come in both financial and environmental terms. Understanding how we use this precious resource, electricity, is the first step towards gaining control of our electric bills and minimizing the adverse environmental impact of wasted electricity.

At first we thought the project was the brainchild of one of the Cape Light Compact staff but as we researched the internet for supporting materials we discovered that the Town of Caledon, Ontario has had the identical program in place since 2003. We would like to acknowledge Caledon's accomplishment and extend our sincere thanks to David Jobe of the CoolCaledon project for allowing us to use their comprehensive Home Electricity Detective Guide. The guide is very well written and easily understood. Caledon's generosity in allowing us to use it is a testament to their commitment to energy efficiency and the environment and has allowed us to launch our project much more quickly than if we had tried to write one from scratch; for their generosity we are most grateful.

Use the Kill-A-Watt meter as described in the guide to help locate the sources of energy consumption in your home. After you've finished your detective work, if you would like the Cape Light Compact to provide you with a home energy audit which includes financial incentives

for energy efficiency, please call toll-free (800) 797-6699 to sign up. Happy kilowatt hunting!

Best regards,

Bob Mahoney
Chairman, Cape Light Compact

Excerpt from David Jobe, CoolCaledon Director's letter:

Thank you for seeking out our website. The power of the internet is truly wonderful. We are proud of what we have put together and are willing to share our more detailed information with community organizations such as yours.

Our Guide was compiled by members of our committee and is on our website http://www.coolcaledon.org/PDFs/Home_Detective_kit.pdf, it accompanies the Kill-a-Watt devices we have in our local library branches. We are pleased with the level of interest. As energy prices have been rising, we are noticing increased borrowings. People are using the kit for various reasons - to check out how much electricity certain appliances of interest are using, to test how usage patterns can impact consumption, or as part of the purchase decision process, to test the consumption of different appliances choices. But at the end of the day, I hear comments relating to an increased awareness of how much electricity things, and ergo our lifestyles, use. To me awareness is the beginning - towards appreciation, value and ultimately conservation.

Regards, David COOL Caledon Program Director

Home Electricity Detective Guide

A COOL Caledon Project
October 2003

Please copy this guide to share with your family and friends.

Acknowledgements
Kill A Watt power meters were purchased and donated to the Caledon Libraries by Dr. Richard Ehrlich, Chair of the Caledon Clean Air Clean Energy initiative: www.woodrising.com/cca/stepup.htm

Kill A Watt power meters were provided at cost by John Gilbert, COOL Caledon task force, President of Metalon Technology Ltd.: www.metalon.ca

Project coordinated and Home Electricity Detective Guide developed by Barb Campbell, COOL Caledon task force

The Caledon Libraries Kill A Watt Project is an initiative of the COOL Caledon task force, with special contributions by Carol Seglins, Gayle Larmond, Kasey Livingston and David Jobe.

COOL Caledon
The COOL Caledon task force, an initiative spearheaded by Carol Seglins as Mayor of Caledon, was established under the direction of Caledon Town Council to address climate change and air quality issues. Specifically, COOL Caledon works to reduce greenhouse gas emissions that cause climate change, and to provide cleaner air and a healthier environment for Town of Caledon residents.

COOL Caledon task force members and resource persons include community volunteers and representatives of the Caledon Chamber of Commerce, Caledon Town Council, Town of Caledon staff, Peel Health, Woodrising Consulting, the Schad Foundation, Peel Federation of Agriculture, Environment Canada Ontario Climate Centre, Metalon

Technology, Caledon Countryside Alliance, Credit Valley Conservation, and the Central Ontario Smart Growth Panel. New volunteers are always welcome - please contact coolcaledon@town.caledon.on.ca if you are interested in participating.

COOL Caledon is developing a local action plan that will result in the reduction of greenhouse gas emissions and other harmful air pollutants, thereby making Caledon a leading community in this regard. The action plan will be implemented through a partnership consisting of the Town of Caledon, the business community and local residents. COOL Caledon is currently working on four community projects:

- Home Electricity Consumption Auditing (including the Caledon Libraries Kill A Watt Project)
- Tree Planting and Stewardship
- Transportation Alternatives
- Public Communications

Thanks to generous contributions from Husky Injection Molding Systems and the Schad Foundation, COOL Caledon has been able to move forward quickly on these projects to make Caledon a healthier community.

Kill A Watt Power Meters
To obtain your own Kill A Watt power meter, contact Metalon Technology at their toll-free number, 1-888-METALON (1-888-638-2566). The price in October 2003 was $69.95 plus tax. You can obtain additional information on other energy-saving products at the Metalon web site: www.metalon.ca.
[Editor's Note: Locally, meters are available through www.efi.org]

How to Be a Home Electricity Detective

With electricity blackouts becoming more common and smog from coal-fired power generation plants making Caledon's children and seniors ill, we can all benefit from reducing our home electricity consumption.

My work as a Home Electricity Detective began when our hydro bill said that we were using 29 kilowatt-hours (kWh) of electricity per day in our new house – much higher than our old house. After doing some investigation and implementing basic energy conservation measures, our average daily consumption is now down to 15 kWh per day – and I'm always working on ways to bring it down even further!

By saving 14 kWh per day, we are saving about $360 each year, even with Ontario's current electricity price frozen at an artificially low level. This is good for the environment too, because power generation plants produce greenhouse gases that cause climate change, as well as other harmful pollutants – including mercury, nitrogen oxide and sulphur dioxide - that cause smog and other health

problems.

By reducing our electricity consumption, our household is now responsible for fewer greenhouse gas and smog emissions, including 4.5 fewer tonnes of carbon dioxide (the major greenhouse gas) being released into the atmosphere each year. Imagine what Caledon can do if we all work together to reduce our electricity consumption – we'll save money and do our part to make Ontario a healthier place to live.

To become a Home Electricity Detective, follow these easy steps:

1) Find out how much electricity you are using now.
2) Use a Kill A Watt power meter to measure consumption of home electrical devices.
3) Understand your home's overall electricity consumption.

If you have borrowed the Kill A Watt power meter from the Library, you may wish to start with Step #2 and return to the other steps later. Be sure to read the detailed suggestions for using the Kill A Watt, starting on page 4 of this guide. The detailed Kill A Watt manual is included at the back of this guide.

For ideas on how to reduce your electricity consumption, check out Dr. Richard Ehrlich's "Clean Air, Clean Energy" articles in the local newspapers. Previous articles are available at: www.woodrising.com/cca/stepup.htm.

Thank you for using the COOL Caledon Home Electricity Detective Guide. If you have any feedback or suggestions for improvement, please send your comments to COOL Caledon at coolcaledon@town.caledon.on.ca. Have fun!

1) Find Out How Much Electricity You Are Using Now

In Caledon, our electricity bills come from Hydro One. In some months, Hydro One comes to your house and reads your electricity meter. In other months they simply estimate what your meter reading might be, based on your past usage. In the months when they've actually come to your house to take a reading, your bill includes a comparison chart showing your average electricity consumption measured in kilowatt-hours per day, along with your past electricity consumption rates from other time periods. (A kilowatt-hour is the amount of electricity required to burn a 100-Watt light bulb for 10 hours. Households typically use 15-30 kWh per day.)
A sample Hydro One comparison chart is shown

below:

Time Period	Number of Days	Average electricity you used per day (kWh)
March 21, 2003 - June 19, 2003	90	14
December 17, 2002 - March 21, 2003	94	19
September 18, 2002 - December 17, 2002	90	16

Typically, you'll find that your daily electrical consumption will be higher in winter due to home heating requirements and, if you use air conditioning or own a pool, you'll have high consumption in the summer as well. Spring and fall consumption will usually be lower.

Rather than waiting several months to see your daily electricity usage, learn how to read your own electricity meter. It's easy! (See Appendix A: Reading Your Electricity Meter.) This allows you to take electricity consumption measurements as often as you want – every month or even every day.

- To see how much electricity (in kilowatt-hours) you have used since the last meter reading, simply subtract the previous meter reading from today's meter reading.

➢ To take this a step further and get your average daily electricity consumption, divide the number of kilowatt-hours of electricity you have used by the number of days since the last meter reading.

When you are first trying out new electricity conservation measures in your home and want to see how well they're working, you'll want to check your daily consumption rate more often. To assist in your detective work, it can be especially interesting to see how much power you're using at intensive usage times such as laundry day or a frigid winter week.

2. Use a Kill A Watt Power Meter to Measure Consumption of Home Electrical Devices

The Kill A Watt Power Meter can tell you the actual electrical consumption of small to medium electrical devices in your home. It will also help you to discover the hidden draws or phantom loads that are surprisingly common when electrical devices are turned off. You may discover that it's time for a new refrigerator or that you really should unplug that old television.

To operate the Kill A Watt meter, you simply plug it into an electrical socket and plug the electrical device that you want to measure into the Kill A Watt

meter. You may find it convenient to plug the Kill A Watt meter into a small extension cord so it is possible to read the measurement without crawling under a counter or behind a fridge. The voltage will appear on the display first, and should be 110120V. (Note that the Kill A Watt cannot be used to measure the electrical consumption of 220V appliances such as many ovens or dryers. To determine the consumption of these appliances, read Appendix B: Measuring Your Home's Electricity Consumption using a Watch.)

If you push the **Watt/VA** button (centre) you will get an instant reading of the number of Watts the device is drawing. For example, you can check that a lamp with a 60W bulb draws around 60 Watts. Try turning the electrical device off to see if any electricity is being consumed when the device is not in use. Typically, you'll find that this happens with devices that have built-in clocks, instant-on capabilities (e.g. TV with remote control), or peripherals that don't turn off when you turn off the main device (e.g. computer speakers). To save electricity, you may find it worthwhile to unplug these devices or put groups of them together (e.g. computer + peripherals) on a single power bar that is switched off when they are not in use.

For appliances that cycle on and off like refrigerators

or coffee makers, you will need to leave the meter on for a period of time (e.g. an hour or even overnight) to get a more accurate idea of how much power they use. To see the total number of kilowatt-hours used since the device was plugged into the Kill A Watt, push the **KWH/Hour** button once. Push it again and you will see the time in hours since the appliance was plugged into the Kill A Watt. For a large appliance like a refrigerator, you can use the Kill A Watt to estimate the kilowatt-hours used by the appliance daily or for the entire year, and compare this to the specifications for other models available on the market.

Have fun trying it out! Walk around your house and look for everything that's plugged into the wall. If you're interested in trying out the other buttons on the Kill A Watt power meter, read the manual included in this package. Here are some ideas for using the power meter in your home:

- You may be surprised to find that an old TV that you almost never watch draws 25 Watts when it's turned off – this really happened with a seldom-used TV that my parents had in their basement exercise room. Now they unplug it between trips to the treadmill.

- Your VCR, stereo and satellite receiver may draw significant power when turned off. You likely want to leave the VCR on to tape shows, but some of the components could be plugged into a power

bar that is turned off when you're not using them.

- Check out your computer too – it's most efficient to put all computer peripherals on a single power bar that gets turned off whenever you shut the computer down. I found that my PC and peripherals were drawing as much power as a light bulb when I was away from my desk, so now I turn my computer off if I'll be away for a few hours.

- Items with a clock or display will draw a bit of electricity at all times, although usually very little.

- Got an older room air conditioner? Check it out.

- Try measuring the overnight consumption of the old refrigerator or chest freezer downstairs. You may be surprised to find that your old fridge is actually quite efficient, or perhaps you could save a bundle by recycling it and getting a nice new one.

Caution: *Please read the Kill A Watt manual at the back of this guide and the labels on the Kill A Watt device. At the time of writing this guide, the maximum wattage that the Kill A Watt can handle is 1875 Watts (also written as 1875 VA) – larger than most household electrical devices. Please confirm the maximum wattage for the specific Kill A Watt device that you are using before plugging it into energy-hungry appliances like stoves and dryers. Fortunately, many of these high-powered appliances have a 220V plug that cannot be connected to the Kill A Watt*

meter.

3. Understand Your Home's Overall Electricity Consumption

Once you've reviewed the electrical devices and appliances in your home, and have taken steps to reduce your electricity usage, you are well on your way to understanding your home's total electricity consumption. If you're interested in learning more, there are several techniques you can try. For example:

- Track Your Electricity Usage Regularly: For a month, read your meter every day (see Appendix A: Reading Your Meter) at the same time and write it down, along with any comments regarding your electricity usage on that day. Do you notice any trends? For example, your consumption will increase on laundry day – but it won't be too bad if you dry your clothes out doors on a line. Our water comes from a well, and our consumption went way up on the day that we were watering some newly planted trees. If there is a day when your consumption is considerably different from other days, see if you can determine what caused the increase – or decrease. It might be caused by something that you can change.

 Try tracking your usage in different seasons of

the year when your household activities might change. When you're not actively tracking your usage, always keep an eye on your electricity bills in case your average daily consumption changes. Remember that you can always go back to an old bill and find the last date that Hydro One read your meter. Then you can take a current reading, subtract to get the difference in kilowatt-hours since Hydro One's last meter reading, and divide by the number of days that have passed since then to determine your average daily electricity consumption.

As an example, I had been tracking our electricity usage when I noticed a sudden spike in our daily kilowatt-hours used. After some detective work, I discovered that a repairman had changed our furnace fan to a setting that used 500-600 Watts all the time. When I changed the fan setting back, our daily consumption returned to its usual level.

When summer came, I was surprised to see our daily electricity consumption increase again after a quiet spring. After some investigation, I realized that our basement dehumidifier, which only runs in hot weather, was drawing a tremendous amount of electricity most of the time. Since there was only one storage area that needed to be kept dry, I discovered that I could greatly reduce the dehumidifier's power consumption by keeping the

door to that room closed.

- **Measure the Electrical Consumption of Larger Appliances:** The Kill A Watt can only be used to measure the electrical consumption of devices that can be plugged into it and that draw less power than the Kill A Watt's maximum wattage. For large electrical appliances like dryers, ovens, furnaces and well pumps, you can check their power consumption specifications or – even better – actually measure your home's electrical consumption while they're in use. It only takes a couple of minutes of your time and a digital watch. See Appendix B: Measuring Your Home's Electricity Consumption Using a Watch.

- **Watch Your Meter Move:** Get in the habit of glancing at your electricity meter whenever you walk past it and become familiar with how fast it usually moves. When there isn't much going on in your house, it should move quite slowly. If you see it spinning quickly when there is no obvious reason (you're not using the furnace, oven, hair dryer, well pump, space heater, air conditioner etc.), do some investigation and see if you can find out why. You may discover surprises like I did!

- **Try the Breaker Test:** This test is best done with two people and an electrical panel with

labelled breakers.

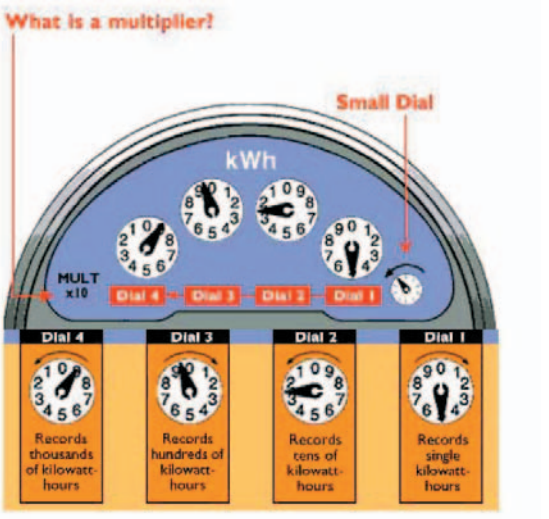
- Go through your house, turning off lights and other electrical appliances and devices as much as possible.

- Then turn off all the breakers on your electrical panel, simulating a power failure. Keep in mind that this may cause complications in some homes, so use your discretion in deciding whether to turn off all breakers. In our house, the digital clocks will all flash 12:00, but that's as bad as it gets.

- Turn on each breaker one at a time, keeping all other breakers turned off, and see which ones cause your electricity meter to move. You may want to measure the number of seconds for a meter revolution, as described in Appendix B. When the meter is turning more quickly, more electricity is being consumed.

- If you cannot understand why there is a significant electrical draw associated with a particular breaker, e.g. a rarely-used guest room, do some investigation to determine the source of the electrical consumption.

Appendix A: Reading Your Electricity Meter



Electricity meters usually have 4 or 5 main dials. Read the dials from left to right and write down the figures in the same order. Not all meters have 5 main dials, but if yours does, the fifth one records tens of thousands of kilowatt hours. (Don't worry about the very small dial, if you have one. It's a test dial to verify the correct reading of dial #1 - you don't need to read it.)

A few points to remember

- Some of the pointers rotate clockwise, others counter-clockwise.
- When a dial pointer is between two numbers, read

the smaller of the two.

- When the dial pointer rests almost squarely on the number, as it does on Dial #4, the dial to the immediate right will determine which number you record.
- On Dial #3, the pointer is between 9 and 0, indicating that this dial has not yet completed a full revolution. This means that the correct reading for Dial #4 is 8. (If the pointer on Dial #3 had gone past 0, indicating the completion of a full revolution, the reading for Dial #4 would have been 9.)

Here's an example:
Using the sample diagram above, read the dials from left to right. In this case, the first number to record is 8 (not 9, for the reasons discussed above), the second digit is 9, the third is 2, and the fourth is 5, for a meter reading of 8,925.

The multiplier
If your electricity meter has four main dials, you'll see the words "mult x 10" on the face of your meter — that means when you calculate your usage, you should multiply the reading by 10. Thus the reading on the meter above indicates a total usage of (8,925 X 10) = 89,250 Kilowatt-hours of electricity since the meter started running.

If your meter has five main dials, you don't have to multiply.

If your meter has a different multiplier, it will be noted on the meter.

What is a kilowatt-hour?
Electricity consumption is measured in kilowatt-hours. One kilowatt hour (kWh) is 1,000 Watts of electricity used in one hour. That's equivalent to the power required to light a 100-Watt light bulb for 10 hours, or to operate a standard 5,000 Watt electric clothes dryer for approximately 12 minutes.

Example:
To learn how much electricity you consume in a week, read your meter on a Monday evening, then read it again on the following Monday evening. Subtract the two readings to get the amount of electricity consumed over the week, measured in kilowatt-hours. To calculate your daily average electricity consumption, divide the number of kilowatt-hours by 7 days.

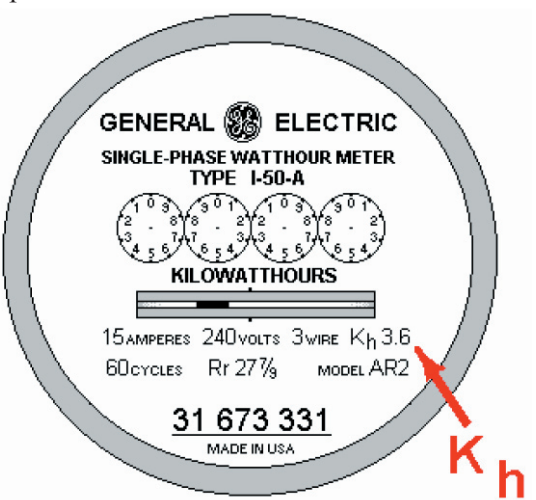
Reference: www.hydroonenetworks.com/en/efficiency

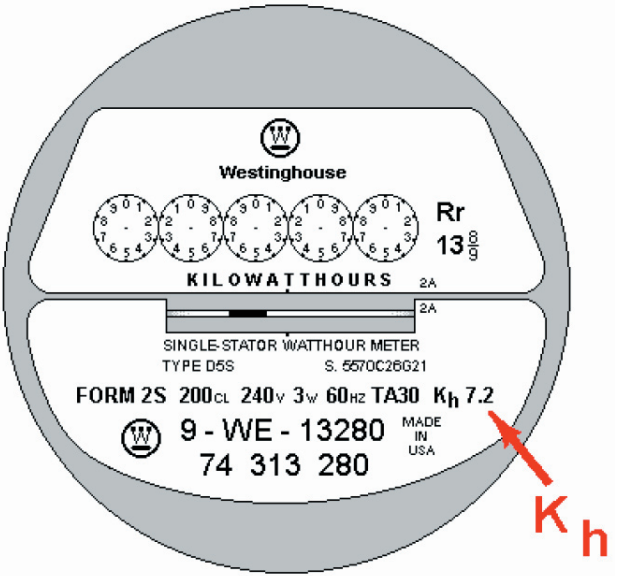
Appendix B: Measuring Your Home's Electricity Consumption using a Watch

You can measure your home's total electrical load at any time by using a stop watch or other digital watch while observing your electricity meter. Follow the steps below to make this measurement.

1. First find your home's electricity meter. To use this method, it must be a traditional style kilowatt-hour meter with a rotating disk.

2. Next, read the constant on the face of the name-plate shown as Kh. This value is the number of watt-hours equivalent to one rotation of the disk. See the example meters below:





3. Start your stopwatch (or read your digital watch) when you see the black mark on the meter's rotating disk pass by. Watch for the black mark to return, measuring the number of seconds it takes for one or more disk revolutions. If the disk is rotating rapidly, you'll get a more accurate measurement if you time more than one rotation, i.e. measure the time that it takes for the black mark to reappear several times.

4. Finally, take the three values and use the equation below to calculate the Watts measured by the electricity meter. For example, if your home's entire

electrical load is one lamp with a 60W bulb, the number of Watts measured would be 60.

K_h = Meter constant (read from your meter as described in #2 above)

Rev = Number of complete revolutions of disk (count one each time the black mark goes by)

T = Total time in seconds for the number of disk revolutions that you've counted

$$\textbf{Watts} = \frac{K_h \times \textbf{Rev} \times 3600}{T}$$

Here is an example calculation for the second electricity meter displayed above. From looking at the meter, we see that K_h = 7.2. Let's say the time measured for 5 rotations of the disk was 24 seconds. Thus, **Rev** = 5 and **T** = 24 seconds. Solving for the electrical demand we have:

$$\textbf{Power Currently Being Used} = \frac{(\textbf{7.2}\ \text{Watt-hours/Rev}) \times (\textbf{5}\ \text{Rev}) \times (\textbf{3600}\ \text{seconds/hour})}{\textbf{24}\ \text{seconds}}$$

$$= \textbf{5400 Watts = 5.4 Kilowatts}$$

5. To determine the power consumption of a large electrical appliance that you cannot measure with the

Kill A Watt power meter, e.g. central air conditioning, a furnace or an oven:

- First ensure that you are not using any other major electrical devices such as your oven, well pump, furnace, toaster, space heater or hair dryer.
- Measure your home's approximate base power usage in Watts as described in steps #3-4. For example, you might be using 800 Watts at the time.
- Then turn on your central air conditioning (or whatever you are measuring), and measure your home's power usage again as described in steps #3-4, e.g. 3000 Watts.
- Subtract your home's base usage from the higher usage number to get the approximate added power consumption of the device you are interested in, e.g.:

Approximate Power Used by Appliance = **3000** Watts (with appliance) – **800** Watts (base)
= **2200 Watts** = **2.2 Kilowatts**

Reference: www.nooutage.com – online source for backup & alternate power systems & information

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1. The LCD shows all meter readings. Volts, Current, Watts, Frequency, Power Factor, and VA. The unit will start to accumulate KWH and powered duration time (hour) after power is applied.

2. Press Volt Key for true RMS Voltage (Volts) display.

3. Press Amp Key for true RMS output current (Amps) display.

4. The Watt/VA Key is a toggle function key. Press the Watt/VA key once to display Watt meter, then press key to display VA meter. The LCF will display Watts as the active power, where VA is the apparent Power. (VA=Vrms Arms)

5. The HZ/PF is a toggle function key. Press the HZ/PF key once to display the frequency (Hertz), then press key to display the Power Factor. HZ is the Frequency of output. Voltage where PF is the Power Factor (PF=W/Vrms Arms)

6. The KWH /Hour is a toggle function key. Press the KWH/Hour key once to show the cumulative energy consumption since power was applied to the unit. Then press key to display the cumulative time since power was applied to the unit.

7. Consumption will be displayed in Kilowatt-Hours (from 0.01 KWH to 9999 KWH). Time will initially be displayed in Hours: Minutes (from 00:00) and switch to Hours (to 9999 KWH). Counters will recycle to zero when they reach their maxiumum. To reset, remove power from unit momentarily.

Typical Residential Appliance Usage		
Location	Item	Annual Consumption (kWh/year)
Kitchen	Coffee Maker	90
	Dishwasher	120
	Microwave Oven	140
	Refrigerator - Freezer	940
	Freezer	680
Lighting	18W Compact Fluorescent	20
	60W Incandescent Lamp	40
	100W Incandescent Lamp	70
	Torchiere Lamp - Halogen	440
Bedroom and Bathroom	Hair Dryer	40
	Waterbed Heater	1070
Laundry Room	Clothes Dryer	1000
	Clothes Washer	110
Home Electronics	Cable Box	110
	Computer (CPU & Monitor)	260
	Compact Stereo	110
	Rack Stereo	150
	Color Television	260
	VCR	70
Heating and Cooling	Dehumidifier	970
	Furnace Fan	400
	Window Fan	10
Water Heating	Water Heater -- Family of 4	4770
	Water Heater -- Family of 2	2340
Miscellaneous	Clock/Radio	20
	Lawn Mower	30
	Pool Pump	790
	Well Pump	80
Total Standby		500

Operating Characteristics of Electric Appliances in the Residential Sector (Notes and Sources on back)

Notes: 1) Power draw will vary due to appliance components and modes of operation. 2) [omitted] 3) Excludes electricity for water heating and clothes drying. 4) Cycles/year. 5) Energy consumption is not multiplicative for multiple units. Electricity consumption increases approximately 40 kWh per additional unit. 6) Gallons/day.

Sources: BTS/A.D. Little, Electricity Consumption by Small End Uses in Residential Buildings, August 1998, Exhibit 6-8, p. 6-10 for coffee maker, cable box, clothes washer, computer, dehumidifier, dishwasher, furnace fan, microwave oven, pool pump, torchiere lamp-halogen, waterbed heater, and well pump; LBNL, Energy Data Sourcebook for the U.S. Residential Sector, LBNL-40297, September 1997, p. 100-102 for clothes dryers, Table 10.2, p. 108 for lighting, and p. 62-67 for water heaters; LBNL, Miscellaneous Electricity Use in the U.S. Residential Sector, LBNL-40295, April 1998, Appendix D, p. D-1-D-9 for hair dryer, window fan, and lawn mower; EIA, Supplement to AEO 2000, Dec. 1999, Table 21 for refrigerator and freezer; BTS/LBNL, Energy Use of Home Audio Products in the U.S., Dec. 1999, Table 4-9, 28 and p. 31-35 for audio electronics; BTS/LBNL, Energy Use of Televisions and Videocassette Recorders in the U.S., Mar. 1999, Tables 3-6 - 3-8, p. 19-22, and Tables 4-6 - 4-8, p. 32-34; GAMA, Consumer's Directory of Certified Efficiency Ratings for Heating and Water Heating Equipment, April 2000 for water heater power draw; and LBNL for total standby.