The Measurement and Cost of Electrical Energy

The next time you use a toaster or radio, try to find the label on the appliance that tells you how much electrical energy it uses in one second. Recall from your previous studies that a unit of energy is called a **joule** (J). If a device uses energy at the rate of one joule per second, then its power rating is one **watt** (W). In other words, one watt equals one joule per second. This equation could be expressed as:

$$1\,\text{W} = \frac{1\,\text{J}}{1\,\text{s}}$$

This equation could be expressed another way:

$$1\,\text{W}\cdot\text{s} = 1\,\text{J}$$

Energy can be thus measured in either joules or in **watt seconds** (W·s). This unit is, however, too small to be practical for measuring electrical energy consumed in a household. Instead, a larger energy unit, called the **kilowatt hour** (kW·h), is used. One kilowatt equals 1000 W, and one hour equals 3600 s. Therefore,

$$1\,\text{kW}\cdot\text{h} = 1000\,\text{W}\cdot 3600\,\text{s}$$
$$1000\,\text{W} \times 3600\,\text{s} = 3\,600\,000\,\text{W}\cdot\text{s}$$

Suppose your local electric company charges you seven cents for each kilowatt hour of electricity. Suppose also that in your home there is a television set that consumes at a rate of 200 watts and that the television set is on for 150 hours in an average month. How much would the monthly cost of power for the television be? First, change the watts to kilowatts.

$$200\,\text{W} = 0.2\,\text{kW}$$

Next, multiply the number of kilowatts by the number of hours the television runs.

$$0.2\,\text{kW} \times 150\,\text{h} = 30\,\text{kW}\cdot\text{h}$$

Last, multiply the number of kilowatt hours by the cost per kilowatt hour.

$$30\,\text{kW}\cdot\text{h} \times \frac{\$0.07}{\text{kW}\cdot\text{h}} = \$2.10$$

In Activity 4-18, estimate the power used by various appliances in your home, and calculate the cost of the power.

Activity 4–18

Surveying the Cost of Electrical Energy

1. Make a list of several electric appliances in your home.
2. On a single day, record which appliances are used and for how long they are used.
3. Using Table 4-2, or the power rating indicated on the appliances, estimate the total number of kilowatt hours consumed by the appliances in a 24 h period.
4. Find out the cost per kilowatt hour of electricity in your home. Use your result from Question 3 to calculate the cost of running appliances in your household over a period of 24 h.
5. Think of some benefits to cutting back your consumption of kilowatt hours.
6. What could you do to reduce the number of kilowatt hours consumed by
   (a) your household?
   (b) your school?

Table 4-2 *Power Rating of Typical Household Appliances*

ELECTRIC APPLIANCE	POWER RATING
kitchen stove	12 000 W
clothes dryer	4 600 W
kettle	1 500 W
toaster	1 000 W
coffee maker	600 W
vacuum cleaner	500 W
colour TV	200 W
desk lamp	60 W
clock	4 W

A Safe Supply of Electricity

To measure the actual amount of electricity you use, your house or apartment building is equipped with a meter. If electricity is delivered through overhead wires, the meter is likely to be on the outside of the building. If the electricity comes through underground cables, the meter may be in the basement. If there are several households in the building, there may be a separate meter for each one. The meter consists of a motor with a counting mechanism. The more current that is being used, the faster the counting mechanism turns, indicating the amount of energy that is being used. Your household is billed by the electric company on the basis of a reading taken from the meter.

There are several safety features in any properly wired household. At the location of the meter, there are three wires, two hot wires and one neutral wire. After passing through the meter, the three wires go to the service entrance panel, or fusebox. There, a master switch can be used to turn off all the power in the household. Once the electricity goes into the household circuits, devices such as fuses and circuit breakers ensure that the electricity has a safe passage.

Probing

Most smaller, relatively low-power household electrical devices, such as desk lamps, have the common two-prong plug. Other devices, such as home computers, have three-prong plugs. Very high-power appliances, such as electric stoves, have four-prong plugs. Find out why some appliances must use three- or four-prong outlets instead of a two-prong outlet.

Appliance	Rating /1000	Consumption in 24hrs	Cost x$0.07
Stove	12000w/1000 = 12 kw	12kw x 24h = 288kwh	288kwh x$0.07 = $20.16
Clothes Dryer	4,600 w/ 1000 = 4.6kw	4.6kw x 24h = 110.4kwh	110.4kwh x 0.07 = $7.73
Kettle	1500W		
toaster	1000W		
coffee maker	600W		
vacuum	500W		
T.V.	200W		
lamp	60W		
clock	4W		
A.C.	9000W		
Stereo	850W		

Calculate Backwards What is the power rating for these items if they cost this much over 24 hrs?

Iron			$1.85
Coffee maker			$2.52
Cell Phone			0.005

Calculate these : Sask Power charges $0.063/kWh

2. Compare Incandescent bulbs to Compact Florencent Lightbulbs.
(calculate the cost per day X 30 days in a month)

Incandescent	40 w		
CFL Equivalent	11w		
Incandescent	60w		
CFL equivalent	18w		
Incandescent	100w		
CFL equivalent	30w		