# THE ELECTRIC HOOKUP

#### **Objectives:**

The student will do the following:

- 1. Determine the wattage of various household appliances.
- 2. Calculate the number of kilowatt-hours used by appliances.
- 3. Identify the need to limit the use of appliances to conserve energy.
- 4. Identify costs per kilowatt-hour (kWh) of appliances.

**Subjects:** General Science Physical Science

**Time:** 3 class periods (over 2 weeks)

### Materials:

student sheets (included)

### **Background Information**

A list of all the energy-using appliances and equipment in an average American home would show why it is estimated that a well-equipped home consumes as much as 35,000,000 British thermal units (BTU) of energy each year to operate. Considering that much of this energy is wasted, a great opportunity for energy conservation exists.

The first step toward conservation is to gain a better understanding of the energy consumption of each appliance or piece of equipment. An appliance's wattage is an indicator of how much electricity is used while operating the appliance. An appliance requiring 1,000 watts would use one kilowatt-hour of electricity during one hour of operation. For example, the average mixer uses 127 watts. This 127 watts divided by 1000 watts/kilowatt-hour of operation equals 0.127 kilowatt-hour. If the mixer is used for 6 minutes, 0.0127 kilowatt-hour of electricity has been used.

#### Procedure

1. Introduce the activity by sharing with the class the information in the background section above.

- 2. Distribute the student sheet "Wattage Ratings," included. Have the students bring in wattage ratings from various appliances around their homes. Ask each student to choose appliances that use different amounts of energy and that produce different kinds of energy from the electricity they use (e.g., heat, sound, or motion). Caution the students not to move large appliances by themselves to obtain wattage ratings. Have them seek permission and aid from parents to locate wattage rating information. (Check the owner's manuals before moving appliances.) Use appliances in the school as examples. Students may be assigned different equipment to ensure a wide range and thorough investigation of household appliances. Student sheet answers (in terms of kilowatt-hours of energy required) may be expanded to annual use by determining daily or weekly use and multiplying. If you prefer, use the student sheet "APPLIANCE ENERGY USE," included.
- 3. Distribute the student sheet "HOW TO READ YOUR METER," included.
  - A. Tell the students to record daily meter readings at home for two weeks, and then to bring in an old utility bill along with the data they will have accumulated.
  - B. Review the information recorded on their utility bills. Then, have each student calculate the charge per kilowatt-hour by dividing the energy charge by the number of kilowatt-hours used in his/her home for that month's bill. (Be sure to use only the energy charge; do not include other fees the utility may assess.) Typical residential rates in the Valley region average less than \$0.06 per kWh.
  - C. Have each student relate the amount spent on one month's electric bill to something that is pertinent to his/her own life. For example, students may relate the electric bill to car payments, the cost of music tapes, stereo equipment, schoolbooks, or athletic shoes. Solicit several examples from the class.
- 4. After completing the activities on the student sheets, distribute the student sheet "MAKING CHOICES" included. Are the students willing to change their habits and attitudes, and possibly their lifestyles, to conserve energy?
- 5. Continue with the follow-up below.

### FOLLOW-UP

- 1. Discuss the negative feelings the students may have about conserving electrical energy. What are the negative aspects of conservation? (By now, the benefits should be obvious-saving money and resources.) Conservation often takes self-discipline, development of routine habits, imposing rules upon oneself, lifestyle changes, and changes in purchasing patterns. Oftentimes these things are not fun or easy for people to accept. What ways can the students think of to motivate themselves and others to conserve?
- 2. Discuss some practical ways in which students can improve energy conservation in their own homes. Ask, "In what area is your family conserving energy best?" (for example, turning off lights). Ask, "In what area is your family not conserving energy well?" (for example, leaving the TV on while no one is watching). Are any of the students' families involved in serious energy conservation efforts such as the use of solar water heaters, automatic timers on heating/cooling systems, high-efficiency appliances and/or lighting, or other innovative conservation methods? Can the students recommend effective conservation practices to their classmates?

# **Student Sheet**

### WATTAGE RATINGS

Check four different appliances for their wattage ratings. Using the conversion to kilowatthours(kWh) calculate the electricity usage for each appliance.

Appliance:	
watts/1000 watts/kWh per hour of operation =k	ςWh
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watts/1000 watts/kWh per hour of operation =k	ςWh
Appliance:	
watts/1000 watts/kWh per hour of operation =k	ςWh
Appliance:	
watts/1000 watts/kWh per hour of operation =k	ςWh
Appliance:	
watts/1000 watts/kWh per hour of operation =k	ςWh

## ELECTRICAL APPLIANCE ENERGY TABLE

Appliance Wattage	Kilowatt-hours of	Ounces of Oil	Ounces of Coal
Rating	Electricity Used per	Burned per Hour	Burned per Hour
_	Hour	_	-
10	0.01	0.01	0.13
25	0.025	0.025	0.33
40	0.04	0.4	0.5
60	0.06	0.6	0.8
100	0.1	1	1.33
150	0.15	1.5	2
200	0.2	2	2.66
300	0.3	3	4
500	0.5	5	6.66
750	0.75	7.5	10
1000	1	10	13.33
1500	1.5	15	20
2000	2	20	26.66
5000	5	50	66.66
10000	10	100	133.33

### Student Sheet APPLIANCE ENERGY USE

Think about burning ten 100-watt light bulbs for one hour. That's the amount of electricity equivalent to one kilowatt-hour. Just as you pay for gallons of gas, quarts of milk, and loaves of bread, you pay for kilowatt-hours of electricity.

The chart below shows the average number of kilowatt-hours of electricity that various appliances use.\* If you are interested in how much it costs to operate one of these appliances for a month or a year contact your local utilities company.

Kitchen Appliances Range w/self-cleaning oven Range w/oven Microwave oven Frying pan Coffee maker Toaster Mixer Food disposer Dishwasher	<u>Average</u> <u>Anually</u> 1224 1152 300 190 110 40 10 30 1560** 2160	
Refrigerator/freezer 16-25 cu ft side-by-side model, automatic defrost		
Refrigerator/freezer 14 cu ft automatic defrost	1800	150
Refrigerator/freezer 14 cu ft manual defrost	1200	100
Refrigerator/freezer 17 cu ft, 2-door, high efficiency, automatic defrost	1200	100
Freezer, 15 cu ft automatic defrost	1200	150
Freezer, 15 cu ft manual defrost	1800	100
Laundry Appliances Clothes dryer Clothes washer Hand iron	1000 624** 150	83 52 13
Other Appliances Quick recovery water heater Vacuum cleaner Clock Toothbrush	5400*** 50 18 0.5	$450 \\ 4 \\ 2 \\ 0.04$

### Student Sheet APPLIANCE ENERGY USE (continued)

	Average kWh Used	
		Average kWh Used
<u>Entertainment Appliances</u>	<u>Annually</u>	<u>Monthly</u>
Color TV	660	55
Tube Type	440	37
Solid State	440	37
B&W TV		
Tube Type	350	29
Solid State	120	10
Radio/phonograph	110	9
<u>Comfort Appliances</u> Electric furnace Heat pump	13200**** 66000****	(Seasonal) (Seasonal)
Air conditioner, Central, per ton	1500****	(Seasonal)
Air conditioner, Room, one ton	1500	(Seasonal)
Dehumidifier	400	33
Electric Blanket	150	(Seasonal)
Attic fan	300	(Seasonal)
Ceiling fan	130	(Seasonal)

\* These figures are averages and will vary depending on the user's habits and lifestyle

\*\* Includes kWh for heating water used by appliance.

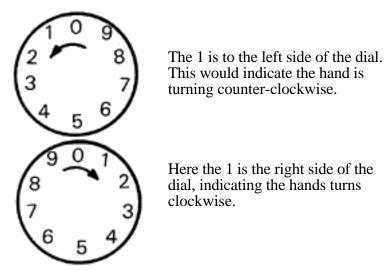
\*\*\* This value accounts for all hot water usage, including dish washing and clothes washing. \*\*\*\* Heat only.

\*\*\*\* Based on 1,500 sq. ft house insulated to meet TVA standards for energy efficiency. If your house does not meet these standards it may use considerable more electricity during the heating and cooling seasons.

### Student Sheet HOW TO READ YOUR METER

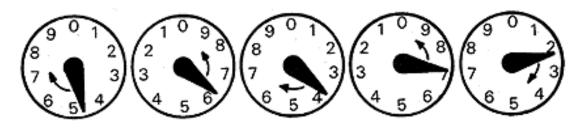
In order to read an electric meter you must read from left to right. You must also determine which way the hands are turning on each dial.

Example:



Write down the number each hand has passed. This may not be the number nearest the hand. For instance, if the hand has passed the 4 and is almost to the 5, you still read it as 4. Write down the numbers in the same order as you read the dials from left to right.

In the example given, the reading is 46372. If the last reading was 45109, subtract 45109 from 46372. This will give you the number of kWh used.



That is all there is to reading a meter, with one exception. If a hand points straight at a number and you do not know if it has passed the number or not, then look at the dial to the right. Has its hand passed zero?

To analyze your family's electricity use, read your meter daily for about two weeks, at approximately the same time each day. Record the readings on the following table.

DATE	TIME	READING	kWh USED	COST
DITL	THVIL		DAILY	(kWh X*)
1.			DI ILI	
1.				
2.				
3.				
4.				
5.				
6.				
7.				
1.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
_ · ··				

#### DAILY USE OF ELECTRICITY IN MY HOME

\* Current kWh cost; e.g. \$0.056 per kWh in 1990.

#### Student Sheet MAKING CHOICES

Pretend that the government has announced that, because of an energy crisis, electricity will be rationed. According to a new regulation, homeowners will be permitted to own and use no more than 12 electrical items other than lighting and heating/air conditioning systems. Listed below are a variety of items, which use electricity and are often found in American homes. Choose the 12 items you feel would be most essential to you and rank them from 1 to 12 (1 being the most important, 12 the least). Be prepared to defend your choices.

Television	Electric can opener
Automatic coffeepot	Makeup mirror
Dishwasher	Waffle iron
Blender	Vacuum cleaner
Electric mixer	Fan
Electric shaver	Sewing machine
Electric clock	Water heater
Curlers/curling iron	Stereo
Electric typewriter	Electric stove
Microwave oven	Toaster oven
Telephone answering machine	Freezer
Electric blanket	Computer
Garbage disposal	VCR
Refrigerator	Iron
Washer/dryer	Griddle
Food processor	Crock pot
Electric knife	Power tools
Toaster	Hair dryer