What's a Watt?

Grades 3 – 5

Concept:
Conservation reduces our energy demands. Thee cost of electricity to run different electrical devices varies.

Objective: Students Will:
• observe that different appliances use different amounts of energy.

• learn how a watt-rate meter works

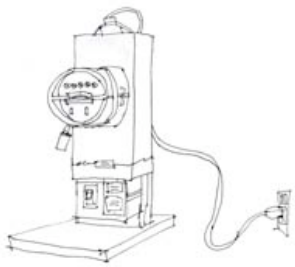
State Standards:
• ENERGY
Understand energy, its transformations, and interactions with matter.
Describe and explain various energy transfers and resulting transformations.
Trace the flow of energy transformations in a system.
Explain the principle that energy is conserved, neither created nor destroyed.
Identify how technological advances have changed humankind's use of energy.

Time: 45 minutes

Materials:
Watt-rate meter, clock with second hand, and various common appliances or devices with a wide range of levels of consumption.

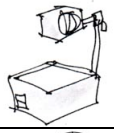
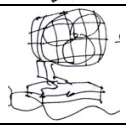
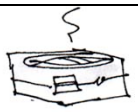
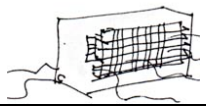
Call the EWEB Energy/Water Team, 687-3526 to borrow the Watt- Rate Meter.

Teachers please stress electrical safety while using the Watt –Rate Meter and do not have the students operate the Watt-Rate Meter.



Background:
Electricity is brought to a house through a three-wire cable. An electric meter connected to the household circuit breaker or fuse box shows how much electricity is used. The two energized wires bring electricity from the fuse box to power outlets (plug-ins), utility boxes (lighting), and wall switches. Each energized wire is at 120 volts relative to ground and 240 relative to each other. The third wire, or neutral, is brought to a grounding bar in the circuit breaker box, or attached to a cold water pipe, as well as to all power outlets, utility boxes, and wall switches. Every appliance that is plugged into an outlet also has a ground connection. The appliance ground is connected to the metal or plastic case of the appliance. At each power or lighting outlet no current flows until a lamp or appliance is plugged and switched on. However, there is always voltage at that point whether current flows or not. It is like a water tap; the pressure is always present although there is no flow until it is turned on.

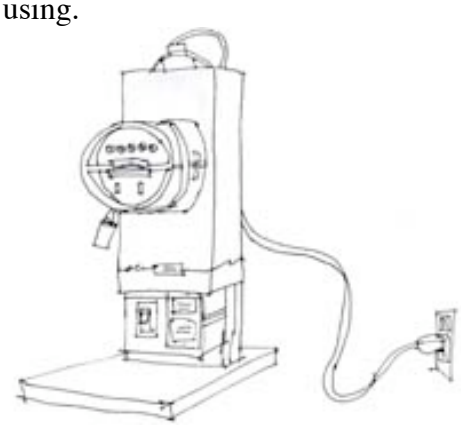
Examples:

100 watt incandescent bulb		Compact fluorescent bulb	
Hair dryer		Electric drill	
Overhead Projector		Radio	
Fan		Hot Plate	
Portable electric heater			

Procedure:

- Time one revolution of the watt-rate meter dial using a 100W bulb. This data should equal 120 seconds for all watt-rate (electrical) meter. It can be used as a standard for students studying appliances.

- Help students understand that the faster the dial goes, the more power (watts) the device is using.



- Using the watt-rate meter, show students electrical consumption of many common electrical appliances and equipment in the classroom.
- Switch appliances several times (e.g. from hair dryer to overhead projector) so students can see how speed of the dial changes.

- Have students determine the watts per hour used y different electrical appliances and equipment. They can do this by timing revolutions off the dial and then calculating watts for that period of time. The 100-watt time is the starting point for calculations. Explain that all watt-rate meters, including the ones in their homes, measure watts at the same speed.

- Have the students record their findings in a chart with three columns. In the first column, record the number of second it takes for the dial to turn one time. Since they know that 100 watts takes 2 minutes (120 seconds) for one revolution, they can fill in the third column with the number of watts the appliance uses. Have them compare their findings with the chart on the next page.

One turn of the dial in seconds	Watts
7.5	1600
11.25	1200
13	1000
15	800
30	400
45	300
60	200
75	175
90	150
105	125
120	100
240	50

- Point out the relationship between increased electrical consumption and the generation of heat (a hair dryer is a good example).
- Discuss watt, kilowatt, and kilowatt-hours.
- Show students that each appliance or device has electrical consumption imprinted somewhere on the appliance or device.
- Calculate the cost of using the lights in a classroom for one school (176 days). Example: 42 lamps per room x 34 watts each = 42 x 34 = 1428 watts or 1.428 kilowatts per hour x 6 hours = 8.568 kWh (kilowatt-hours) x $0.04 per kilowatt-hour = $.034 per day per classroom. $0.34 x 175 days of school per year= $59.98 per year per classroom just for lights.

(Note: the 4 cents per kWh rate is the rate customers pay for electricity in Eugene OR in 1995. This rate needs to be modified for specific areas. In Rhode Island, for instance, customers pay 26 cents per kWh. All conditions being the same, it would

cost a typical classroom in Rhode Island $389.84 per year just for lights.)

- Discuss the two results conservation measures offer—using valuable resources wisely and saving money.

- Discuss ways students can conserve energy in their daily lives. Some facts about conservation that may be useful to use in discussion include: Heat is measured in BTU's (British thermal units) – a common measuring unit of energy. One BTU is the amount of heat needed to raise 1 pound of water 1 degree Fahrenheit. One BTU is approximately the equal to the amount of heat generated from one wooden kitchen match.

The ballasts that charge the gas inside fluorescent lights are much more energy efficient that they were 25 years ago. Years ago, it actually saved energy to leave the lights on in a room if you would return within 15 minutes. Today's ballasts, however, are very efficient and require very little energy to ignite the gas in a fluorescent tube. Many people still believe that leaving lights on saves energy. It does save energy to turn off the lights even if you're going to be gone for only a few seconds.

A lot of energy is used to heat a school. Discuss some ways to help save energy on heating both at home and at school.

Teacher Information

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