Teacher Follow Up Guide

GENERAL ENERGY

Watt Do You Know About Energy?

List the different forms of energy and give an example for each one.

Examples – **Thermal/Heat:** *rubbing your hands together (friction), lighting a match;* **Sound:** *bell, musical instrument;* **Radiant/Light:** *light bulb, sunshine;* **Electrical:** *electricity;* **Chemical:** *battery, food;* **Motion:** *wind, running*

What is the difference between Renewable and Non-renewable resources?

Renewable means that you harness something from the Earth that never gets used up or taken away. These energy sources can be replenished over and over again through natural and/or human processes in a short amount of time. (Examples: hydropower, wind, solar, biomass and geothermal.) Non-renewable means that you take something out of the Earth that can't be put back or made again. These energy sources can be used up because they exist in fixed amounts. (Examples: coal, natural gas, oil/petroleum, uranium/nuclear.)

ELECTRICITY

Basic Circuits

Give examples of closed circuits and open circuits in the classroom.

Closed circuits: computers, lights, etc., that are on. Open circuits: computers, lights, etc., that are off.

Explain how electricity is transferred through a closed circuit with a battery and a buzzer.

Electricity leaves the negative end of the battery, travels through the wires then through the buzzer and returns to the positive end of the battery.

What 3 things are needed to complete an electrical circuit?

Conductors/connectors (wires), output device (buzzer, bulb, motor, etc.) and an energy source (battery)

How does electricity flow through a light bulb?

Electricity enters the bulb through the tip of the bulb and travels through the filament giving off heat and light and then it leaves from the side of the base. OR Electricity enters the bulb through the side of the base of the bulb and travels through the filament giving off heat and light and then it leaves from the tip of the bulb.

What did all the working circuits with a light bulb have in common? (see "Will the Light Bulb Light?" worksheet)

There were contacts on both the tip and the side of the bulb and on the positive and negative ends of the battery.

How many electrical contact points (ends) does a battery have? A wire? A light bulb? A buzzer? WHY?

They all have 2. Electricity needs a closed path to travel along. All of the parts of a circuit need 2 ends so that they can be connected in a way that gives the electricity a circular path with no openings.

CHALLENGE: Do batteries have electricity inside of them? What is inside?

No, batteries don't have electricity inside of them. There is chemical energy in batteries that is transformed into electricity.

Advanced Circuits

What is a short circuit and why is it dangerous?

A short circuit is a circuit that gives the electricity a path to travel on, but it's missing an output device. It is dangerous because it gets really hot and can cause a fire.

What is voltage?

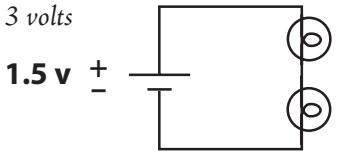
Voltage is the measurement of electrical pressure.

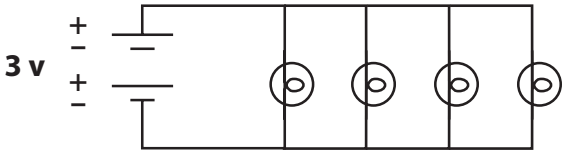
Explain to a friend the difference between a series circuit and a parallel circuit. Don't forget to tell about the voltage difference.

A series circuit has more than one output device and all the electricity passes through each component of the circuit on a single path. It only has one pathway so the output devices share the voltage equally. A parallel circuit has 2 or more complete pathways to and from the battery (or energy source) so each output device has the same voltage as the source because each output device has its own path to the battery.

If you have 1 D battery and 2 bulbs in a series circuit, how many volts does each bulb get? If you have 2 D batteries and 4 bulbs in a parallel circuit, how many volts does each bulb get? Draw a schematic diagram of each of these circuits.

0.75 volts, 3 volts





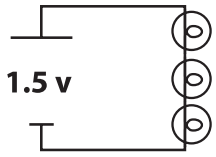
Why would you want your holiday lights to be made with a parallel circuit instead of a series circuit?

If the bulbs were wired in series, when one bulb goes out, they all would go out. If you wire the bulbs in parallel circuits, all the bulbs would still light except for the ones that are burnt out.

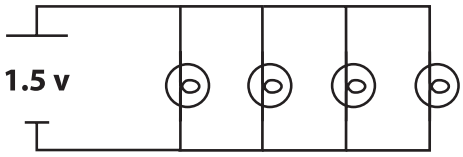
Do you think that your house wires are wired in series or parallel circuits? How could you easily prove it?

Your house is wired with parallel circuits. When a light bulb is removed or turned off, the other light bulbs are not affected since they each have their own path to the power source.

Answers to ***EXTRA CHALLENGE*** on worksheet:



Each bulb gets 0.5 volts



Each bulb gets 1.5 volts

Electrical Safety

What is the difference between a conductor and an insulator?

Electricity can flow through a conductor (water and metal are good conductors), but not through an insulator (rubber and glass are typical insulators).

How can electricity be dangerous?

Electricity can shock you, burn you, throw you across a room or even electrocute you. (A shock is a flow of electricity passing through the body, causing muscle spasms. Electrocution is a strong flow of electricity passing through the body, causing death.)

List 5 ways you can keep you and your family safe around electricity.

Stay away from power lines on the ground, never climb trees near power lines, don't touch anything electrical when you're wet, stay away from damaged wires, don't overload outlets with too many plugs, fly your kite away from power line, never pull a plug out by the cord, and never insert a metal object into an appliance

Circuit Systems

What does a switch do in a circuit?

A switch is a mechanical device used to open or close a circuit.

Draw and label a closed circuit with a battery, a bulb and a wire. What are the inputs and outputs of this system?

Input: battery (chemical energy) – Output: bulb (light and heat energy)

Now label how energy is transformed within the circuit.

The chemical energy from the battery is being transformed into electrical energy that moves along the wire to the light bulb where it is transformed into light and heat energy. It is then transformed back into electrical energy that moves along the wire back to the battery.

SOURCES OF ENERGY

The Journey of Hydropower

Explain in words or pictures how we generate electricity with water to turn on a lamp at your house. Use the following terms: reservoir, dam, penstock, turbine, generator, transmission lines, substation, distribution lines, pole transformer, house wires, outlet, and lights.

Rivers filled with water from melted snow and rain are dammed up which forms a reservoir. Some of the water then flows through a penstock to the hydro plant. When the water comes out of the penstock, the force of the water strikes the turbine blades causing them to rotate. The spinning turbine causes the generator to spin. The generator has 2 parts: coils of copper wire and magnets. The spinning magnets cause electrons in the wire to move creating electricity. After the transformer increases the voltage, the electricity travels through transmission lines until it comes into a substation. The substation decreases the voltage, and then it travels through distribution lines through neighborhoods. A pole transformer is used to decrease the voltage before it enters a house. The house wires carry the electricity through the walls and are connected to outlets. When you plug in a lamp, the electricity travels through the lamp, and it lights up when the electricity travels through it.

Think of generating electricity using hydropower as a big system. What is the input? What is the main output?

Input: moving water; Output: electricity for homes and businesses

What other inputs, besides water, could be used to spin a turbine for generating electricity?

Steam from burning coal, biomass or fossil fuels; steam from the earth (geothermal energy), wind, tides

The Power of the Wind

What were the 5 different blade variables that were tested? What other blade variables could you test?

The blade variables that were tested included: number of blades, blade angle, blade mass, blade length and blade shape. Other variables you could test are different blade materials, changing the length of the dowel, adding depth to the blades (making them 3D), etc.

What other variables (besides blades) could you test on a wind turbine to try and increase electrical output?

Other variables could be placement of the turbine, height of the turbine, direction the turbine is facing, etc.

What are the advantages and disadvantages of using wind to generate electricity?

Advantages: *Wind is a renewable energy source; it can be used in a wide variety of places; it is usually windy at night when the sun isn't out for solar power; it's typically cheaper, doesn't cause air pollution.*
Disadvantages: *The wind doesn't blow all the time and it isn't consistent; most windy places are far from cities where electricity is needed the most; wind farms may require large amounts of land; aesthetics.*

Is wind energy a good source of electricity for the future? Why or why not? Make sure you justify your answer.

Individual student opinions

ENERGY CONSERVATION

Energy Choices Game

What are some ways you use energy at home and/or school?

Lights, computers, video games, heating, TV/DVD player, fridge, microwave, toaster, clock, radio, hair dryer, cell phone

What are some ways that YOU can save energy at home or school?

Turn off the lights when you leave a room, turn off the TV/DVD player/video game console/computer when not using them, dress warmer instead of turning up the heat, decide what you want in the refrigerator before you open the door, take shorter showers or use less bath water

What 3 electrical devices could you give up and why did you select these items?

Individual student opinions

Have students quiz themselves with the "Energy, Knowledge and You" review sheet that the PUD teacher provided.

HELPFUL WEBSITES

National Energy Education Development Project (free energy curriculum): **www.need.org**

Energy Kids by the US Energy Information Administration: **www.eia.gov/kids**

Snohomish County PUD energy education: **www.snopud.com** (click on Education)

QUESTIONS?:

EDUCATION@SNOPUD.COM OR 425.783.8292