Teacher Follow Up Guide

GENERAL ENERGY

Introduction to Energy

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

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

What is the difference between an energy transfer and an energy transformation?

An **energy transfer** *is the movement of energy from place to place and an* **energy transformation** *is the change of energy from one form to another.*

CHALLENGE: What is the difference between Sources of energy and Types of energy?

Sources *of energy are used to produce the* ***Types*** *of energy we use in our lives. Example: wind, hydropower, solar, biomass, geothermal, coal, natural gas, etc., are used to produce electricity.*

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 black wire then through the buzzer and returns through the red wire 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. In the filament, some of the electricity is transformed into light and heat. The rest of the electricity 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. Some of the electricity in the filament is transformed into light and heat. The rest 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.

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 (try and use the schematic symbols below). What are the inputs and outputs of this system?

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

Now label how energy is transformed within the circuit.

The chemical energy from the battery is transformed into electricity (electric currents), which is transferred along the wire to the light bulb. In the light bulb, some of the electricity is transformed into heat and light, and the rest of the electricity is transferred along the wire back to the battery.

Explain to a friend the difference between a series circuit and a parallel circuit.

A **series circuit** *has more than one output device and all the electricity passes through each component of the circuit on a single path. A* **parallel circui***t also has more than one output device, but it has 2 or more complete pathways to and from the battery (or energy source).*

Electrical Safety

What is the difference between a conductor and an insulator?

Electricity can easily 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 lines, never pull a plug out by the cord, and never insert a metal object into an appliance.

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 electricity travels through distribution lines through neighborhoods. A pole transformer is used to decrease the voltage before electricity 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.

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.)

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

Take a virtual tour of the PUD's Woods Creek Hydro Project. You'll find it at www.snopud.com/education (click on Elementary School programming, then scroll to the bottom of the page).

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

ADDITIONAL RESOURCES

The PUD has a Career Connected Learning Page on its website. Go to www.snopud.com/CCL. Here you'll find:

- *Career Video Interviews*
- *Virtual Field trip of PUD's Woods Creek Hydro Plant*

If you want to stay up-to-date on all of our offerings including teacher workshops, kid events and career connected learning resources, sign up for the PUD's Learning Lines E-newsletter. Subscribe at snopud.com/education-mailing.

HELPFUL ENERGY 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/education**

QUESTIONS?

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