

Electrical Audit

This lesson is part of a series of short / informal lessons to be used at the McCall Outdoor Science School during field programs

1. Write the definition of electricity on the board.
 - **Electricity** – a type of energy produced by the flow of electrons¹
2. Ask all students to place a pen and a blank piece of paper (or science notebooks) on their desks.
3. Have students do an energy audit on electrical items at MOSS using the Watts Up Pro.
4. Have your group fill out the MOSS Appliance Energy Usage Chart. Allow about 15 minutes for exploration and 15 for discussion.

Discussion

1. What item you test used the most energy? The least? Were any of these surprising?
2. Where does the energy for our electricity come from? (In Idaho: hydropower)
3. What are other sources of electrical energy? (Nuclear, biomass, coal, geothermal, natural gas, solar, wind)
4. What are potential energy sources we can use here at MOSS? What are the pros and cons of these uses?

Energy Source: Biomass

BIOMASS is recently living organic material from plants and animals that can be burned to produce electrical energy. Because plants and other photosynthesizing organisms, like algae, convert sunlight energy into stored energy, they can be used as a source of fuel. Some examples of biomass include: wood and materials made from wood, animal waste, plants such as corn or jatropha, algae, and biodegradable trash. Biomass is considered to be a

¹ Ibid

renewable form of energy, because plants can be regenerated fairly quickly and biomass waste is consistently generated.

If this biomass is burned directly, the heat produced can be used to heat water and create steam. This steam can turn a turbine and generate electricity. Additionally, animal waste and decomposing organic matter produce methane gas which can also be burned to produce electricity.

Energy Source: Coal

COAL is a black rock that can be burned to produce electricity. There are 4 main kinds of coal and each type contains different amounts of carbon, hydrogen, and oxygen; therefore, each type contains different amounts of energy. Coal is a fossil fuel that was formed from ancient plants. After millions of years of being buried under dirt, plants, and water, these plants were converted into coal. Because coal takes so long to form, it is considered a nonrenewable resource.

Energy Source: Geothermal Energy

GEOHERMAL ENERGY is heat that comes from within the earth that can be used to produce electricity. Extremely high temperatures are continuously produced inside the core of the earth by the decay of radioactive particles.² Geothermal energy is considered a renewable source because water is constantly circulated throughout the earth and heat from within the earth is continuously generated. The pressure of the water or steam produced, however, can decline and many plants return water to the reservoir in order to increase this lost pressure.³

² The NEED Project. "Secondary Energy Infobook." *National Energy Education Development Project*. 2011. www.need.org (accessed May 2, 2012).

³ U.S.Department of Energy. *Energy Efficiency & Renewable Energy: Geothermal Technologies Program*. December 19, 2011. <http://www1.eere.energy.gov/geothermal/faqs.html> (accessed July 19, 2012).

Energy Source: Water Power: Dams, Tides, and Waves

WATER POWER refers to the kinetic energy of moving water. Fast-flowing water, waterfalls, ocean tides, and waves all contain kinetic energy that can be harnessed to generate electricity. Because water is renewed naturally through the Earth's water cycle, water power is considered a renewable energy source.

Also, sediments (soil, sand, leaves) can build up in reservoirs—the bodies of water held by dams. That sediment reduces water quality for organisms that live in the water and can choke out the sun's light. Migrating fish, such as salmon, may have trouble swimming around dams. Changing the path of a stream affects any organisms dependent on that stream. It may also cause erosion along riverbanks. There are some efforts to remove dams and restore rivers and their surrounding ecosystems to their natural state. For instance, the Elwha Dam in Washington state was removed in 2012 to help restore the river and fisheries.⁴

⁴ Elwha Watershed Information Resource, "Elwha River Watershed: Dam Removal," <http://www.elwhainfo.org/elwha-river-watershed/dam-removal/decisions-remove-dams> (accessed July 19, 2012).

Energy Source: Natural Gas

NATURAL GAS is a colorless, odorless gas. It is a fossil fuel that was formed from ancient plants and tiny animals were buried under layers of earth for millions of years. Over time, this heat and pressure transformed the organic material into a carbon-rich gas. Because it takes so long to form, natural gas is considered a nonrenewable source of energy. The main component of natural gas is methane, a greenhouse gas.

Energy Source: Nuclear Energy

NUCLEAR ENERGY is the energy stored in atoms. When atoms are split apart in a process called fission, the energy is released and can be used to produce electricity. Uranium is one type of atom that is used as a fuel for nuclear fission. Uranium is a nonrenewable metal that is naturally found in rocks, soil, and water.⁵ However, uranium is found in very small amounts (only two parts per million in the crust of the earth).⁶

Energy Source: Solar Energy

SOLAR ENERGY is a renewable source of energy from the sun that can be converted into electrical energy. Photovoltaic (PV) cells are often used to convert solar energy into electricity. Space shuttles, watches, and homes and office buildings can all use PV cells. Solar Thermal/Electric Power Plants can also generate electricity from the sun's energy by heating a liquid to produce steam. This steam is then used to generate electricity.⁷

Energy Source: Wind Energy

⁵ U.S. Environmental Protection Agency, "Radiation Protection: Uranium," <http://www.epa.gov/rpdweb00/radionuclides/uranium.html> (accessed July 20, 2012).

⁶ Union of Concerned Scientists, "Nuclear Power: How Nuclear Power Works," http://www.ucsusa.org/nuclear_power/nuclear_power_technology/how-nuclear-power-works.html (accessed July 20, 2012).

⁷ U.S. Energy Information Administration, "Renewable Resources: Solar Explained," http://www.eia.gov/energyexplained/index.cfm?page=solar_home, (accessed July 20, 2012).

WIND ENERGY is produced by the uneven heating of the earth's surface by the sun. Because different surfaces absorb or reflect sunlight in different amounts, the atmosphere is warmed unevenly, creating wind. This wind energy can be converted into electricity with wind turbines. Wind turbines can be installed on land or offshore. Flowing wind causes the blades of a turbine to turn which causes an electric generator to turn and produce electricity.

MOSS Appliance Energy Usage Chart

Item plugged into Watts Up Pro	Prediction if it will be higher or lower then the first tested device	Reading (watts)	Device turned on? (yes/no)
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			

10.			
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