“Energy is All Around Us”

Energy is the ability to do work. We can look for evidence of energy in our surroundings. Here are some hints: look for light, heat, movement.

Look around you for evidence of energy (define “evidence”: everything that is used to reveal and determine the truth). Where do you see the evidence of energy in our environment? What kinds of work can this energy do?

Wind	move things (mechanical), make electricity
Sun	heat (thermal), electricity (thermal turbine or photovoltaic)
Wood	heat (thermal), electricity (thermal turbine)
Water	move things (mechanical), make electricity (mechanical turbine)
Plants	food energy, electricity (thermal turbine)

Energy can be stored as well. Some hints of stored energy: something with weight is stored at an elevation where energy can be released if it drops. Something with biological energy potential has grown, and it can be burned (fast decomposition) or composted (slow decomposition). What kind of energy is released in the process of this decomposition?

The sun can make electricity or heat for us. I have two solar pathfinders set up here. Look straight down into the lens from above, and you can see the trees that will block the sun through the day at this site. Which of these solar pathfinders is in a better spot to benefit from the sun’s energy? (You can use these pathfinders to determine where is the best place to put your solar array or your solar water heater. If you only have one pathfinder, or if you don’t have trees, a student can be a moveable “tree.”).

The power of wind increases as the cube of its speed. Define “square” and then “cube”: square is a a number times itself, cuber is a number-times-itself-times-itself. What is the cube of 1 (1x1x1)? What is the cube of 2 (2x2x2)? 3? The power numbers get bigger a LOT faster than the speed numbers, don’t they?

Heat is transferred three ways: convection, conduction, and radiation. The heat you feel from the sun, or from your wood stove, is radiation. The currents you sometimes see in a pot of water that is being heated are convection. Let’s demonstrate conduction: place your hand on one side of this cookie sheet, and keep it there till the sheet warms up. Test the temperature with this thermometer, on both spot you covered, and the part you did not cover. Which is warmer? Heat always moves from a warmer area (your hand) to a colder area (the sheet).

The Watershed Model

Heat also drives the water cycle by evaporating moisture. Look at this model watershed, and tell me how the water cycle works here. Who will volunteer to make it “rain” on the top of the watershed with this spray bottle? Where can you harvest energy from the water flowing on this watershed? What are some of the impacts that energy harvest might have?

1. Briefly discuss how well the model represents reality for the concept of watersheds and drainage divides.

Answers will vary. Students may agree that the hills and valleys in the model offer a good physical model of how rain interacts with a landscape, showing how rain falls to one side or the other across a divide and that specific areas represent the watershed of a stream. A problem students may have with the model is understanding its scale. They may also find it hard to visualize that the white plastic represents Earth's surface.

2. Make up your own description or definitions for the following terms.

* Watershed

The area of land for which all the water that lands on it drains off in the same place.

* Drainage divide

Lines that run along the highest local point of land (such as a ridge) where rain that falls on one side goes downhill in one direction and rain that falls on the other side goes downhill in a different direction. Drainage divides separate neighboring watershed basins. They form imaginary lines around river basins.

3. Some questions to ask, to stimulate thought:

Where can drinking water come from?
It can come from groundwater or watersheds.

Where does our drinking water come from? How does it get here?
Answers will vary depending on your location.

What would be the best place to harvest energy from this watershed?
Look for places with volume or "drop" (rapid elevation change).

How would you protect fish habitat while harvesting energy?
Design your diversions to leave in-stream flows. Use fish screens on diversions.

What might happen if the boundary between two countries runs through one watershed?
Allow students to speculate.

4. Now have students create their Environmental Address based on watersheds. For example, a student who lived 3 miles north of Prairie City, Oregon, would have an Environmental Address like this:

Jane Smith
Dixie Creek Watershed
John Day River Watershed
Columbia River Watershed
North America

To find Jane, you would start in North America, find the Columbia River Watershed, and so forth.

PART B: Explore Your Watershed in Google Earth

3. Starting at the largest river in your watershed, use the tilt and zoom features of Google Earth to "fly" upstream along smaller and smaller tributaries. What differences do you see in the landscape, landcover, and population densities near the areas' largest streams compared to its smallest tributaries?

Answers will vary. Students may notice that the land is generally flatter and population is concentrated where rivers are large. Upstream, landscapes get steeper. Land use patterns may also be different along larger rivers and their tributaries.

4. Write a description of your watershed. Include information about the shape of the land and how the land is used. What purposes do the dams in your watershed serve? Indicate how the population density of the area changed from 1990 to 2000. Use screen shots of different views in your Google Earth map to support or illustrate your description.

Answers will vary. Assess student answers based on the clarity and completeness of their descriptions. After a class of students have completed this assignment, consider using samples of their work to generate a rubric for future grading.

5. In places where rivers are designated as a political boundary between two adjacent states or countries, the two entities may have disputes about the river. For instance, they might argue about which one has the right to use the water or set rules about what waste products can be discharged into the river. Briefly discuss some advantages and disadvantages of using drainage divides rather than rivers as political boundaries.

Answers will vary. Advantages of using drainage divides as boundaries include the lack of potential disputes over water: each entity is entitled to all the water that falls within its boundaries. One disadvantage is that drainage divides are not always obvious boundaries as rivers are.

Here's the first law of energy: energy is neither created nor destroyed, it only changes forms. Where do you see energy changing forms? Examples:

- Sunlight changing into stored energy in plants (including trees)
- Wind energy changing into movement in trees
- Thermal energy changing into stored energy in water vapor (look for evidence of stored energy in the clouds)

What would happen to this scene with no energy in it? Let students speculate. Of course, with no energy, we'd have a bare rock in the dark.

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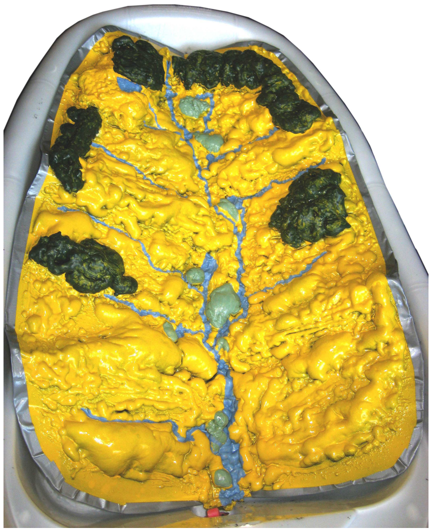

Watershed Model made with "great Stuff"

"Science Day" Energy Education Station

What's a Watershed?

GLOSSARY:

Aquifer: a geologic formation(s) that is water bearing. A geological formation or structure that stores and/or transmits water, such as to wells and springs.

Base flow: sustained flow of a stream in the absence of direct runoff.

Cubic feet per second (cfs): a rate of the flow, in streams and rivers, for example.

Divide: The summit area that makes up the watershed boundary between drainage basins that are next to each other.

Elevation: The vertical distance of a point above or below a reference surface, such as sea level.

Headwaters: the source and upper reaches of a stream.

Model: Something that allows for investigation of the properties of the system and, in some cases, prediction of future outcomes.

Natural Resources: Materials that occur in nature and are essential or useful to humans, such as water, air, land, forests, fish, wildlife, topsoil, and minerals.

Pass: Point used to cross a ridge that divides two watersheds.

Peak flow: the maximum instantaneous discharge of a stream or river at a given location.

Riparian: Of or growing on a bank of a river or stream.

Saddle: A low point on a ridge, generally a divide between the heads of streams flowing in opposite directions.

Topography: The graphic representation of a landform on a map by the use of contour lines.

Watershed: Land area where precipitation runs off into streams, rivers, lakes, and reservoirs. Also called a "drainage basin."

Model watershed instructions: http://www.iwla.org/index.php?ht=a/GetDocumentAction/i/2194

“Bring list” for Outdoor School:

Activity:

___ folding table

___ watershed model

  ___ spray bottles filled with water

  ___ no-sugar jello mix (dark color)

___ dark cookie sheet

___ IR thermometer

___ __________________

Demo stuff:

___ solar panel

___ (2) Solar Pathfinders

___ Anemometer

___ __________________

Solar cooking stuff:

___ Solar oven

___ pot for water

___ lots of water!

___ potholders

___ handwipes

___ __________________

Supplies:

___ talking points (page 1 of this doc)

___ pens

___ clipboard

___ __________________

Personal:

___ cell phone

___ driving directions

___ lunch

___ sunscreen & hat

___ briefcase

___ camera

___ __________________

___ __________________