Missoula Urban Demonstration Project
YOUTH EDUCATION PROGRAM in Sustainability
629 Phillips Street, Missoula, MT 59802
Office: 406.721.7513 Tool Library: 406.549.6790
info@mudproject.org www.mudproject.org

Energy Options

Lessons in Energy: Consumption, Conservation and Alternatives

Objectives:

1. Identify the kinds and sources of power in a typical home.
2. Understand where our power comes from.
3. Understand how pervasive the use of power is.
4. Identify alternative energy sources and understand their benefits.
5. Be able to suggest practical energy-saving improvements in our own homes.

OPI Content Standards Addressed in this Module

End of Grade 4

- Science 5.4: Use scientific knowledge to make inferences and propose solutions for simple environmental problems
- Social Studies 3.3: Describe and illustrate ways in which people interact with their physical environment (e.g., land use, location of communities, methods of construction, design of shelters)
- Social Studies 5.4: Describe how personal economic decisions, (e.g., deciding what to buy, what to recycle, how much to contribute to people in need) affect the lives of people in Montana, United States and the World.

End of Grade 8

- Science 2.7: Give examples and describe how energy is transferred and conserved (e.g.; electric to light and heat [light bulb], chemical to mechanical [fuel to propulsion])
- Science 5.4: Use scientific knowledge to investigate problems and their proposed solutions and evaluate those solutions while considering environmental impacts.
- Social Studies 3.3: Analyze diverse land use and explain the historical and contemporary effects of this use on the environment, with an emphasis on Montana.
- Social Studies 3.7: Describe major changes in a local area that have been caused by human beings (e.g. a new highway, a fire, construction of a new dam, logging, mining) and analyze the probably effects on the community and environment.

End of Grade 12

- Social Studies 3.2: Differentiate and analyze the relationships among various regional and global patterns of geographic phenomena, (e.g., land forms, soils, climate, vegetation, natural resources, population)
- Social Studies 3.3: Assess the major impacts of human modifications on the environment (e.g., global warming, deforestation, erosion, pollution).

Introduction

Welcome students to MUD and have them sit in a semicircle. Introduce yourself and ask them to go around the circle saying their name, grade (if they are in different grades), and one thing about themselves (their favorite plant, vegetable, etc.) Tell them that each letter in MUD stands for something and ask if anyone knows what the "M" stands for. Even little kids can guess "Missoula" if prompted! Next ask if they know what the "U" and the "D" stand for. Check to be sure that they know what the word "urban" means before proceeding! Explain that MUD exists to show people how to live sustainably inside of a city. Have students think of different ways that you can live sustainably (you may need to explain what sustainably means and why it is something we want!) One way to live sustainably is to conserve energy!

If sunny and at site- prep sun tea/solar cooker

Activity 1: Wake Up Energy
(Grades 4-12)

Materials:

- Chalkboard/Dry erase board

Ask the students what the first thing they did when they got up this morning was. Did they turn on the lights? Then what? Did they go to the bathroom or take a shower? Was the heat on? Did they listen to the radio or watch TV? Make a list of their answers on the board.

Put a check next to all of the things that require energy. Ask the students if they know what all of these things have in common. After they guess energy, see if they know where it all comes from. Discuss the different kinds of energy sources in a house.

These should include:

- oil/natural gas (for heating and perhaps cooking)
- electricity (for lights and most appliances)
- passive solar (for heating- ever stood in front of a window on a cold, sunny day?)
- human power (for making peanut butter and jelly sandwiches and brushing teeth).

Cross-referencing the list of "things people do in the morning" can help identify some of the different types of activities and gadgets that consume energy.

Ask students if they know the difference between renewable energy and non-renewable energy. Determine which of the activities they used in the morning were renewable and which were non-renewable (most will likely be non-renewable).

Activity 2: Montana Energy Sources
(Grades 4-12)

Materials:

- Montana Energy Sources map
- Energy source cards
  - oil well
  - oil refinery
  - coal mine
  - coal power plant
  - natural gas
  - wind farm
  - hydroelectric/dam
  - solar energy
- Sticky tack
- Montana Energy Sources map legend

Ask students if they know where we get our energy from in Montana. Place laminated energy source cards around the state, showing where the energy source is located. If the students (or you) aren't sure, use the map legend to place the cards. Ask the students what type of energy is used most in Montana. How does the oil in Eastern Montana get to Missoula?

Note: There are wind farms in development (near Springdale, near Harlowton, outside Great Falls, eastern Montana) because Montana is **5th in the nation** for Wind Energy Potential

Note: Solar energy would go outside of the borders of Montana because it's everywhere!

Activity 3: Energy's Journey

3a. Energy Paths (Grades 4-12)

Materials:

- Chalkboard/Dry erase board

As a class, brainstorm the pathways of one of the energy-intensive household power types (oil, natural gas, or electricity) from its source to your house and beyond.

For example, oil is sucked up from an oil well, loaded into trucks, boats, or a pipeline by oil workers, taken to a refinery, refined, loaded into different trucks or boats, stored in large tanks by oil distributors, loaded into another truck to be taken to your home, stored in your oil tank, partially used, and partially released as air pollution. One facilitator should record all of these steps on the chalkboard as they are mentioned.

Oil → drilling → extraction → transportation (truck/pipe line)→ refinery → transportation/storage → transport/store (gas stations)

Once the class has finished tracing the pathway of a nonrenewable energy source, do the same for passive solar/active solar power. Passive solar energy travels from the sun, enters your house through a window (no trucks are necessary), and is absorbed by you or a different thermal mass. Active solar energy uses photovoltaic cells to absorb solar energy. Converters transform this solar energy into usable electric energy. Again, no trucks are required.

After the class has finished analyzing the path of passive or active solar energy, arrange the brainstormed ideas into steps. Ask for one volunteer to draw each of the steps outlined on both lists. Line them up at the chalkboard in the correct order, and connect each stop with an arrow when they are finished. Based on these charts, what source of power requires the least amount of energy getting to your house?

Coal → excavation → trucks → train → power plant → power lines (electricity) → home

Don't forget to mention the pollution caused by burning coal.

Natural gas → drilling → extraction → transferred through pipe lines → processing plant → pipe lines to local distribution center → pipe lines to home

Water → dam/ hydroelectric power plant → power lines → grid → home

Wind → turbine (electricity) → power grid

3b. Pros and Cons (Grades 4-12)

Materials:

- Chalkboard/Dry erase board

Ask the students if they can name some of the positive and negative effects of energy production and consumption. Make a list of PROs and CONs. Be sure to include the Greenhouse Effect if not mentioned: Both electricity production and oil consumption contribute to the Greenhouse Effect. Does anybody know what the Greenhouse Effect is (when carbon dioxide levels get too high and the Earth's temperature becomes abnormally high)?

Are there more pros or cons? What do you think are the energy sources with the least amount of CONs and the most PROs? (renewable) Are there any ways to lessen the amount of negative effects of energy production and consumption?

Activity 4: Energy Saving Pictionary
(all ages)

Materials:

- "Energy Saving Tip" Cards
- Chalkboard / dry erase board
- Stopwatch / clock

Divide the students into two groups. Starting with Team A, have one student come to the board and draw one "Energy Saving Tip" card. The student will have one minute to try and have their team guess which energy saving tip they are drawing. After Team A guesses correctly, or the minute is up, it is Team B's turn. Continue until every student gets a chance to draw. After each team completes a drawing, ask the students to reflect on how the "energy saving tip" is sustainable/ saves energy. The team with the most points in the end is the Energy Saving Champs!

Activity 5: Conservation Contract
(all ages)

Materials:

- Conservation Contract examples
- Paper
- Colored pencils

Have the students decide on one or more ways they will conserve energy for the next week. Using the posted example as a guide, students should write out a contract stating their commitments to conserving energy. Post the contracts in the classroom. (Ask the teacher to check in daily with the students to find out how they are doing and if they are running into difficulties sticking to their contracts. If possible, schedule a follow up visit to check on the success of the Conservation Contracts.)

Activity 6: Solar Cooker
(all ages)

Materials:

- Pizza box(s)
- Aluminum Foil
- Plastic Wrap
- Black construction paper
- Exacto Knife
- Scissors
- Newspaper
- Stick(s)
- Tape
- Glue
- Solar cooker instructions

Ask the students to review the difference between renewable and nonrenewable energy, and types of each. How can the sun be used as an energy source? (light and heat)

Explain that today we are each going to use the sun's light energy to make an oven. How do you usually cook food? (oven, toaster, microwave) How is energy being used to cook the food? (heat) Explain that the oven converts the sun's light energy into heat energy for cooking.

Use the Solar oven instructions as a guide to making the solar cooker. If there are enough pizza boxes for each student/groups of students, pass out per group:
1 Pizza box
1 sheet of black construction paper
2 sheet of tin foil- be careful to leave this in good condition!
1 pencil or pen
1 stick

As you work through each step, ask the purpose of each of the materials:

Q: Aluminum Foil?
A: To gather more light. Light bounces off of the foil into the oven. A mirror could work as well.

Q: Saran wrap?
A: Insulation so heat can't escape. It has to be transparent so light can get through.

Q: Rolls of Newspaper?
A: Added insulation- like insulation in the walls of buildings.

Q: Black paper?
A: Absorbs the light. Compare this to wearing a white shirt or a black shirt on a summer day.

If using a demonstration solar cooker: when students' solar cookers are completed, show them what was cooked inside of the demonstration solar cooker. Ask the students to reflect on how a solar cooker can save energy.

Activity 6: Make Your Own Pinwheel
(all ages)

Materials:

- Pinwheel pattern
- Colored pencils
- Scissors
- Paper fasteners
- Straws

1. Cut out the pinwheel on the solid lines.
2. Color both sides of the square.
3. Cut the dotted lines from the four corners to the center circle. (try not to cut the center circle!)
4. Poke a hole through the four dark circles in the corners.
5. Make the holes on the four points meet at the center circle.
6. Push the end of the paper fastener through the four holes, then through the center circle.
7. Place the straw behind the pinwheel and push the ends of the fastener through the hole in the straw