Science at a Run

A workshop presentation for STAO 2010
By Sherri Owen

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Energy Chain Scavenger Hunt

Summary

Students follow the transformations of energy. Like a choose-your-own-adventure, each form of energy can change into a variety of other forms, which lead to more and different transformations. This activity focuses on energy that begins as sunlight and eventually becomes heat and is lost.

Materials

- Recording sheets (appendix B)
- Game direction cards (appendix A)
- Pencils
- Clipboards optional

Procedure

1. Hand out clip-boards and pencils and worksheets. If this is the first group, hand out clothes pins and cards and have the students pin the cards up in the low branches of trees within set boundaries.
2. Carefully and fully explain the procedure using an example sheet, this game can be confusing.
3. All the energy starts from the sun, then it can be changed into one of the listed forms (chemical, wind, electricity, falling water). The player finds a card with one of those four names on it. He/she writes down that form of energy just found. He/she then writes down what kinds of energy that could be changed into (the "to find" energies).
    a. The player is now looking for one of the "to find" energies only and when he/she finds one he/she writes it down.
    b. This should form a chain of one energy turning into another and another. Some chains are short and some are long. Try to get the students to find as many different chains as possible.
4. Have students do the front and the back of their worksheets.
5. In the classroom draw out the chains on the white board using arrows to link the energies. See diagram in appendix C.
    a. Fill in any missing links.
    b. Eventually all energy is changed into heat and that heat escapes from the earth and into space.
    c. We do not run out of energy because the sun continues to shine and input more energy to the earth.
6. Explain that each arrow represents a device (or process) that changes one form of energy into another.
    a. E.g. a light bulb changes electricity into light.
    b. Fill in all the devices represented by arrows.
    c. Take time to explain what a turbine is and how it works, the shaking flashlight is a good way to demonstrate how an electric current is generated by a magnet moving across a wire.

Energy Flow Sentences

Summary

Students are assigned to represent different kinds of energy. When a device is shown, students must arrange themselves to form a sentence, ensuring that the correct energy goes into and out of the device.

Note

This activity builds from the Energy Flow Scavenger Hunt very well.

Materials

A full list of the necessary cards is found in appendix D.

- Energy Cards
- Device Cards
- Unwanted By-product Cards

Procedure

1. Hand out large energy cards (green) and by-product cards (tan), one to each student, double up cards if necessary.
2. Hold up a device card (red) and invite up the student with the energy card that names the energy that goes into to the device (e.g. electricity goes into a light bulb). Invite up the student (or students) who represent the energy that comes out (e.g. light and unwanted heat come out of a light bulb).
3. Once the students have the hang of this, start timing how long it takes them to arrange themselves into a proper sentence.

Popsicle Stick game

Summary

Students are divided into two teams; each team must layout Popsicle sticks end to end in a line as long and fast as possible. One group gets a large amount of sticks immediately; the other group gets only three sticks every five seconds. The first team will take an early lead, but the second team will win in the end. At the end it is revealed that the first team represented fossil fuels and the second team represented renewable energy.

Materials

- One large box of Popsicle sticks

Procedure

1. Create two teams and have them stand in opposite each other at a starting line.
2. The objective of the game is to lay the sticks out in a straight line, each stick touching the one behind it as far and fast as possible.
3. Team A gets a fist-full to start with all at once; Team B gets only three every five seconds.
4. Team A will take an early lead, but then run out; they represented fossil fuels and will not get any more for another three hundred million years.
    a. Fossil fuels take hundreds of millions of years to produce; we are using them very quickly.
5. Team B represents renewable energy and will continue to receive three sticks every five seconds, eventually overtaking fossil fuel.
    a. Renewable energy provides some energy every day, but not as much as fossil fuel.
6. Examples of renewable energy sources: wind, falling water, sun, plants.
7. Give out extra sticks to those who can give valid ways of conserving energy. Do not allow repeats.
8. At the end, join the two lines and explain that we are in it together. Remember, there are not two teams; we are all in this together.
    a. Because fossil fuels are becoming more difficult to find and extract they are becoming more expensive and will eventually be so rare that most people will not be able to afford them. In addition, some types of extraction being used now (e.g. tar sands) are creating much more pollution and emitting tremendous amounts of greenhouse gases before the fuels even hit the market.
    b. Remind students that much of our electricity comes from power plants that burn fossil fuels.

Carbon Cycle Musical Chairs

Summary

Students will represent carbon. The hoops will represent places carbon is stored. Like musical chairs, students will mingle about until the music stops, then rush to find a home. Each hoop will hold only a limited number of students; those without a hoop are forced into the atmosphere. Amounts of carbon stored in various locations will vary.

Materials

- 4 hula hoops
- Music (optional)
- Four signs labelled as described

Procedure

1. Explain that the students will represent carbon and there is a fixed amount of carbon in the earth's biosphere. The carbon can exist only in certain places; these places will be represented by hoops.
2. Set up 5 hoops
    a. One hula hoop is trees and other plants
    b. One hula hoop is the ocean
    c. One hoop is limestone bedrock
    d. One hoop is fossil fuel, buried in the ground
    e. The remaining students with no hoop represent the atmosphere
2. In each hoop place a sign that shows what the hoop represents and how many people can be in the hoop.
    a. Trees and Plants can hold 1/5 of the students
    b. Ocean can hold 1/5 of the students
    c. Bedrock can hold 1/5 of the students
    d. Fossil fuel can hold 1/5 of the students
    e. The remaining 1/5 of students are outside of the hoops, they are in the atmosphere
3. Assign students to hoops randomly, following the proportions indicated above.
4. Have the students mingle randomly, or walk in a 'conga-line' circle around the space. On the signal, every student must find a new hoop, but the content of the hoops cannot be exceeded.
    a. Left over students are in the atmosphere.
5. Play a few times, like musical chairs. Discuss some of the ways carbon is moved around from place to place.
    a. Carbon in the atmosphere mixes with rainwater and is pulled into the ocean
    b. Plants absorb carbon in the process of photosynthesis and store it in their bodies

    c. Ancient plants were buried and their carbon stored underground and turned into fossil fuels
    d. Sea animals absorb carbon from the ocean and turn it into shells, when the animals die, the shells fall as sediment and can be compacted into bedrock.
6. Then, begin reducing the number of students that can be in the Fossil Fuel hoop
    a. This represents the harvest and burning of fossil fuels
    b. The carbon previously stored in the fossil fuels is now joining the eco-sphere
    c. With nowhere else to go, the carbon will end up in the atmosphere
7. Have the students note that the amount of carbon in the atmosphere is increasing
    a. Discuss effects of increased carbon in the atmosphere
8. When the fossil fuel hoop has been reduced by half, increase the amount of carbon allowed in the Ocean hoop.
    a. Explain to the students that when CO2 is absorbed into the ocean, it becomes more acidic, corals and shelled animals including microscopic organisms begin to dissolve
9. Consider reducing the number of students allowed in the Trees and Plants
    a. This reduction represents the large scale cutting of trees and reduction of plant communities due to development
10. When the students realize that the carbon in the atmosphere is steadily increasing, discuss with them solutions, ways to reduce carbon
    a. Increasing the amount of carbon in the oceans will result in increased acidification and huge loss of biodiversity
    b. Carbon can be stored in bedrock and as fossil fuels, but those processes take hundreds of thousands of years and will not make a significant difference
    c. The only option available in the game is to increase the carbon stored in plants and trees, this is done by planting more carbon storing trees, and not cutting them down. Or, if the wood must be cut, it should be used for long-term projects so the wood will not decay or burn and release the carbon it stores.
    d. This is a launching pad for discussing Carbon Capture and Storage; however the author has little knowledge of this technology.
11. Play the game again a couple of times, increasing the number of students allowed in the Plants and Trees hoop.

The Carbon Cycle Game

Summary

This game is played in two parts. In the first part students take the roll of ancient plants and must collect carbon and energy by getting Popsicle sticks, while being chased by insects. When done, the plant pockets are transformed into fossil fuels. The second part involved the students who are now fossil fuels being chased by students who are consumers. The consumers use up the energy sticks, but the carbon sticks are returned to the atmosphere.

Materials

- Plant Pocket Cards (see appendix E)
- 4 insect cards
- Arm bands or pinnies
- Playing field with two end zones (see appendix F)
- Consumer cards
- two bins
- two sets of differently coloured popsicle sticks, 100 each

Procedure

1. Give each student a plant pocket. Inform students that these pockets are plants from a very, very long time ago. The plants the students are representing first appeared 354 MYA (million years ago) in the Carboniferous Era.
2. Explain that each student needs to gather three Popsicle sticks representing energy and three sticks representing carbon to fill the pockets in his/her plant (each component will have its own coloured set of sticks).
    a. Energy Sticks are stored at one end of the playing area in the SUN bin.
    b. Carbon Sticks are stored at the other end in the ATMOSPHERE bin.
    c. Students must cross back and forth, collecting one stick at a time.
3. Several students are assigned the role of insects.
    a. When an insect tags a plant for its energy, the plant must give up one Popsicle stick (of either colour). The insects do not have a role in the carbon cycle; they just keep the game interesting.
4. Play the game until most of the students have filled their plant pockets.
    a. At the beginning of the game and then again part way through the game, draw the students' attention to the carbon stick bin; it represents the atmosphere. Note that carbon is being removed; there is less carbon in the atmosphere half way through the game than at the beginning.
    b. Students who finish early can be given another plant pocket to fill.

    c. When almost all the carbon sticks are gone, stop the game and bring the students all together as a group.
5. The next part of the game symbolizes the plants being buried and transformed into fossil fuels.
    a. Plants die and are buried underground, bringing with them the stored sun energy and carbon. The plants are crushed and heated for a very long time. Explain that the plants have now become coal, oil and natural gas.
    b. Hand out the fossil fuel labels and have the students use paperclips to cover up the plant picture on their pockets with the labels reading coal, oil and natural gas.
6. Look at the atmosphere bin; ask what is different about the air if most of the carbon is stored in the ground as fossil fuels. This is the atmosphere that the plants and animals today have evolved to live in.
7. Now the students have pockets that represent fossil fuels.
8. Take out two or three students and give them new pockets that represent fossil fuel consumers (car, furnace etc.).
    a. When burned, the fossil fuels will release their millions of years of stored energy in one burst.
    b. The students cannot refill their pockets fossil fuel pockets, be sure to collect up the SUN and ATMOSPHERE bins and remove them from the playing field.
9. The next part of the game is played like “octopus”. On your signal, the fossil fuel students must sprint from one end of the field to the other and avoid being tagged by a consumer.
10. When tagged, a fossil fuel gives up one energy stick, which the consumer then puts into his/her pocket. The matching carbon stick is returned to the atmosphere bin.
11. The fossil fuel students must continue to run back and forth on your signal. Occasionally add more consumers. Note that consumers must go to increasingly greater lengths to gather their fossil fuels as demand rises and supply diminishes.
12. When most of the fossil fuels have been consumed, look at the atmosphere bin. What effect is all that carbon having on our climate and planet as a whole? How can we get rid of the carbon and store it safely away again?

Fuel Up!

Summary

The purpose of this activity is for students to learn the difference between renewable and non-renewable energy sources and examples of each.
Materials

Materials

- Three colours of armbands or pinnies
- Popsicle sticks

Procedure

1. Divide the students into two even groups and give them arm bands/ pinnies, colour coded by group:
    a. Group A represents fossil fuels (coal, oil, natural gas); each student is given five popsicle sticks to represent their energy and five 'mystery' sticks
    b. Group B represents consumers; they will chase and tag Group A to get and use their energy (popsicle sticks)
2. Outline the playing boundaries and inform students of the rules (listed below).
    a. When a fossil fuel is tagged, he/she must give up one energy stick and one 'mystery' stick to the consumer.
    b. There are no immediate touchbacks.
    c. After being tagged, fossil fuels get a five second ('Mississippi') getaway from all players.
    d. Fossil fuels cannot be tagged while handing over an energy stick to a consumer.
    e. Once the fossil fuel players lose their last stick of energy, they must 'freeze' in place.
3. Play the game, it is really just a game of tag with teams.
4. The game will end when the consumers take up all the fossil fuel Popsicle sticks. The fossil fuel players have no more energy/sticks to give and are frozen in place.
5. Discuss the early ending: What happened? Why did the game stop?
6. Play the game again, but introduce renewable energy sources (wind, sun, moving water, geothermal, etc.):
    a. Take away half of the original fossil fuel players and give them a new arm band/ pinnie colour to represent renewable energy.
    b. The renewable energy players are given the same rights as the fossils (listed in step 2). They start with only two energy sticks (The sun isn't always shinning, the wind isn't always blowing, etc.),

but will collect two more from the instructor every minute. These players will not distribute pollution sticks as they represent cleaner sources of energy.

c. Every minute, use a whistle or other prearranged signal to call in the renewable energy players so that they may collect two more energy sticks.

7. Once again, the fossil fuel players will run out of energy sticks and will freeze. However, the renewable energy players will never run out of energy, as their supply is continuously replenished. Once the fossil fuels are used up and the renewable energy students appear to be tiring, end the game. Ask the students to explain how round two was different from round one (i.e. with renewable energy, the game never really ended; the fossil fuel supply lasted longer once renewable energy was introduced; etc.).

Appendix A – Energy Chain Scavenger Hunt Cards

Wind **Find:** **Electricity or Motion**	**Food** **Find:** **Motion or Heat or Food 2nd**
Electricity **Find:** **Light or Motion or Heat or Sound**	**Fossil Fuel** **Find:** **Electricity or Motion or Heat**
Chemical **Find:** **Food or Bio-Mass or Fossil Fuel**	**Sound** **Find:** **Heat**
Bio-Mass **(burning or rot)** **Find:** **Heat**	**Food 2nd** **Find:** **Motion or Heat or Sound**

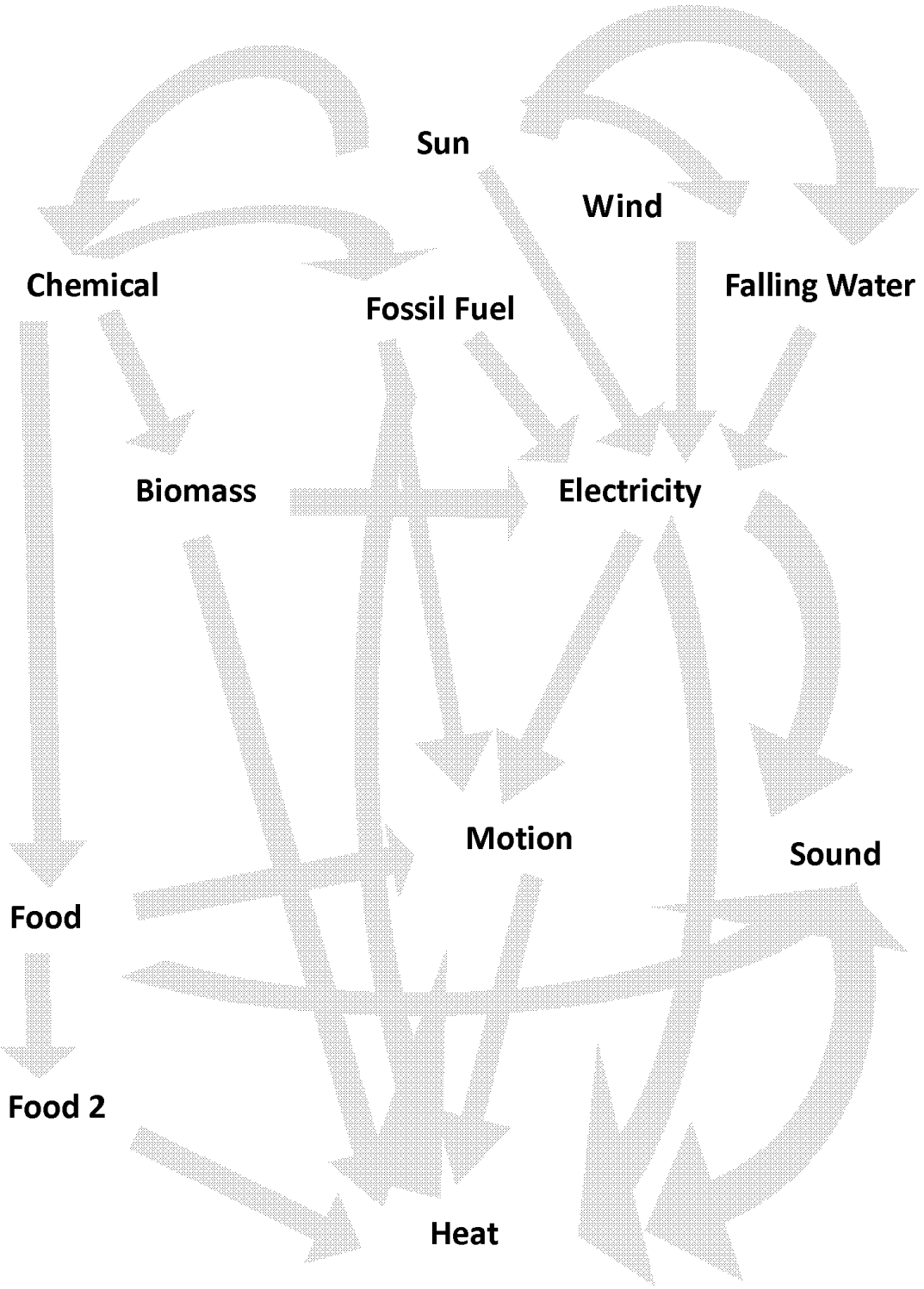
Motion **Find:** *Heat*	**Heat** End, all energy lost
Falling Water **Find:** **Motion or Electricity**	**Light** **Find:** **Heat**

Appendix B – Energy Scavenger Hunt Worksheets

1st Sun	
To find: Electricity or Wind or Chemical or Falling Water	
2nd _____	To find:
3rd _____	To find:
4th _____	To find:
5th _____	To find:
6th	To find:

1st Sun	
To find: Electricity or Wind or Chemical or Falling Water	
2nd _____	To find:
3rd _____	To find:
4th _____	To find:
5th _____	To find:
6th	To find:

Appendix C – Energy Map



Appendix D- Energy Sentence Cards Summary

Energy Cards Required:

- Electricity
- Sound
- Chemical
- Sound
- Light
- Motion
- Heat

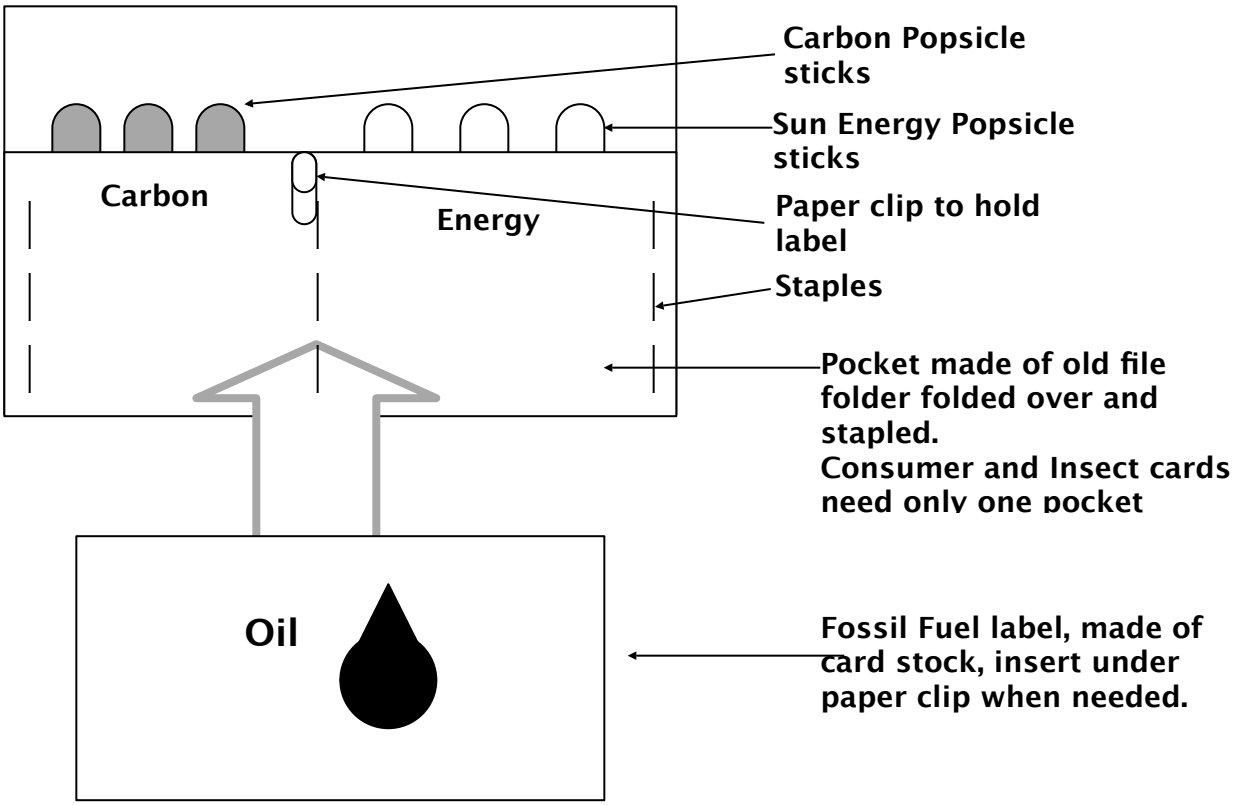
Device Cards Required:

- Radio
- Speaker
- Microphone
- Television
- Oven
- Stove
- Fan
- Heater
- Battery
- Furnace
- Human Body
- Car
- Telephone
- Battery Charger
- Voltaic Cell
- Turbine
- Lamp
- Green Plant

Unwanted Byproducts Cards

- Unwanted Heat
- Unwanted Noise
- Green House Gases
- Smog


Game play area
Sun
Bin with plain
Popsicle sticks
Atmosphere
Bin with coloured
Popsicle sticks


Carbon Popsicle sticks
Sun Energy Popsicle sticks
Carbon
Energy
Paper clip to hold label
Staples
Pocket made of old file folder folded over and stapled.
Consumer and Insect cards need only one pocket
Oil
Fossil Fuel label, made of card stock, insert under paper clip when needed.

Electricity	Radio	Sound
Electricity	Speaker	Sound
Sound	Microphone	Electricity
Electricity	Television	Sound & Light
Electricity	Oven	Heat
Electricity	Stove	Heat
Electricity	Fan	Motion
Electricity	Heater	Heat
Chemical	Battery	Electricity
Chemical	Furnace	Heat
Chemical	Human Body	Motion
Chemical	Human Body	Heat
Chemical	Human Body	Electricity
Chemical	Car	Motion
Sound	Telephone	Electricity
Electricity	Telephone	Sound
Electricity	Battery Charger	Chemical
Light	Voltaic Cell	Electricity
Motion	Turbine	Electricity
Electricity	Lamp	Light
Light	Green Plant	Chemical

All activities were created by Sherri Owen and Amanda Kennedy. Sherri is happy to answer questions through her email: sherri.owen@osee.ca.

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For more information on this organization please visit www.osee.ca.

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For more information on these centres please visit www.car

Ancient Plant