

Energy and Control – Conservation of Energy

Grade 5 Science and Technology

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Activity #1 - How Important Is Conserving Energy Anyway?

Relevant Curriculum Expectations

- distinguish between a renewable and a non-renewable source of energy
- list various sources of energy and identify them as renewable or non-renewable
- describe the advantages and disadvantages of using renewable energy sources as opposed to non-renewable sources

Materials

- small index cards
- *Energy Is Essential! Is There Enough?* Handout
- display of products that are made from or use oil products (examples: fuel – oil, gasoline, propane, natural gas; plastics – water bottle, glasses, watch, calculator, computer disk, video games, toys; polyester clothing, thread, plastic spool, mineral oil, petroleum jelly, plastic cutlery, styrofoam, fertilizer, asphalt, house paint, camera film, to name some!) (display can include pictures and real items)
- display of products that come from trees or that use trees (examples: lumber, paper, cloth – rayon, chemicals – turpentine, pitch, creosote; rubber, sticky tape – cellophane, fruit, nuts, recreation, maple syrup)

Group Size

-partners for brainstorming, then class discussion

Description of Activity

1. As a class, it is important to come to a consensus about the definition of **renewable** and **non-renewable sources of energy**. Ensure that the students do not confuse the terms recyclable and renewable. To guide the students, have them think about the meanings of new and renew, and also how the prefix ‘non’ changes the meaning of a word.

The major difference between renewable and non-renewable is how long it takes nature to renew or replenish it.

A **renewable energy source** can be replaced within a reasonable length of time which is usually considered to be within our lifetime. As long as it is carefully maintained, it is considered to unlimited.

A **non-renewable energy source** cannot be replaced within our lifetime. It is therefore available in a limited supply. Someday we will run out!

The students should record their definitions on the Handout.

2. At this time, the display of materials that are produced from petroleum and wood products should be shown. Ask the students what they think these products have in common. This will be a good lead-in to discuss sources of energy.
3. Have partners brainstorm a list of sources of energy on small index cards and then sort them into renewable and non-renewable categories. NOTE: Electricity is a secondary energy source that can be generated from renewable or non-renewable energy sources. Have the students record their findings on the chart, allowing them to compare their ideas with others.
4. Pose the question, “Do you think it is better to use renewable or non-renewable sources of energy?” Many students will assume that renewable sources are better, however there are advantages and disadvantages to both forms of energy. As a class, have the students generate one advantage and one disadvantage for each form of energy that they have identified. Have them record this on their chart.

Debriefing Notes

These discussions can be largely facilitated by the teacher, or alternately, the students can read ahead to become familiar with the concepts and subsequently discuss and summarize what they have learned. After completing their charts, a logical follow-up discussion would be about the importance of conserving energy or trying not to use too much energy in light of the disadvantages they have identified for both renewable and non-renewable energy sources. Also draw their attention to the other products that come from oil and wood resources. Perhaps it is better to save these resources for more important uses other than burning them for fuel!

Assessment

Students’ recorded information or observation of discussion contributions can be used to assess the learning.

Activity #1 – Energy Is Essential! Is There Enough? Student Worksheet

(Suggestions for answers – Use a blank version of this table as a handout for student answers)

Renewable Energy - A renewable energy source can be replaced within a reasonable length of time which is usually considered to be within our lifetime. As long as it is carefully maintained, it is considered to unlimited.

Renewable Energy Sources

Source	Advantage	Disadvantage
Food	<ul style="list-style-type: none"> - keeps us healthy - can grow more when needed 	<ul style="list-style-type: none"> - takes up land from natural landscapes - uses fertilizers
Wood	<ul style="list-style-type: none"> - can produce more when needed - many useful products 	<ul style="list-style-type: none"> - need to cut down forests where animals live
Wind	<ul style="list-style-type: none"> - wind is always blowing (caused by the sun heating the air above the land) 	<ul style="list-style-type: none"> - wind turbines are large and take up a lot of land - land must be kept as open space without anything blocking the wind
Sun (Solar)	<ul style="list-style-type: none"> - the sun shines every day 	<ul style="list-style-type: none"> - solar collectors are very expensive - you need a sunny place to take advantage of the sun (no trees or tall buildings in the way)
Moving Water	<ul style="list-style-type: none"> - rivers are common in Canada 	<ul style="list-style-type: none"> - hydroelectric dams destroy river valleys and large areas of trees must be cut down to have power lines to carry the electricity

Note: Electricity is a secondary energy source that can be generated from renewable and non-renewable energy sources.

Activity #1 – Energy Is Essential! Is There Enough? Student Worksheet

(Suggestions for answers – Use a blank version of this table as a handout for student answers)

Non-renewable Energy – A non-renewable energy source cannot be replaced within our lifetime. It is therefore available in a limited supply. Someday we will run out!

Non-renewable Energy Sources

Source	Advantage	Disadvantage
Crude Oil (Petroleum)	-many useful products -not expensive and it is found all over the world	-takes millions of years to form -spills damage the environment -burning it causes pollution
Natural Gas	-clean burning fuel -easily transported through pipelines	-not renewable, will run out eventually -building pipelines destroys natural habitats
Propane	-is a gas, very light to transport -good source of heat for cooking	-not renewable -burning it causes pollution
Coal	-very plentiful on earth -not expensive	-very dirty burning fuel, emissions linked to increasing respiratory problems in children
Uranium (Nuclear Energy)	-produces large amount of electricity	-a limited supply on earth -produces harmful radioactive by products

Note: Electricity is a secondary energy source that can be generated from renewable and non-renewable energy sources.

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Activity #2 - Where is Energy?

Relevant Curriculum Expectations

- describe how energy is stored and transferred in a given device or system
- recognize that energy cannot be created or destroyed but can only be changed from one form to another
- explain how humans rely on energy transfers from a variety of products and systems to survive

Materials

- Where Is Energy? Handout
- Energy Chain cards cut out for each group

Group Size

- small discussion groups of 2 to 4

Description of Activity

1. You can start them off by asking what source of energy a fireplace uses. Some students will say firewood which is a renewable source of energy while others will say natural gas which is a non-renewable source of energy. Ask them to name some other things that use energy, either renewable or non-renewable.
2. In small groups, the students should begin thinking about things that require an energy source to function. In their chart, they should record as many things as they can think of and try to identify the source of energy.
3. When the students have had enough time to discuss and record their ideas, a class discussion / debriefing would allow the students to add to their charts.
4. Have the students think about a favourite fruit. Pose the question, "When we eat this fruit, what do we get from it?" They should answer that it gives them energy to do things. Then pose the question, "Where did the energy come from?" The energy comes from the fruit in the form of chemical energy. Then question them again, "But how did the chemical energy get into the fruit? It grew on the tree/plant like that. Question them

again, "Then how did the tree/plant get the energy?" The energy came from the sun.

Summarize the discussion. (You or the students can do this.) "The energy comes from the sun to the plant first. The plant then grows and produces fruit. To do that it changes the sun's energy into chemical energy. Then when we eat the fruit and digest it. this changes the chemical energy into energy for us to keep warm, learn, play and stay healthy, just to name a few." "We can conclude that energy is stored in certain things and then it can be transferred and changed to be used by other things. Without that we would not be able to survive."

5. Have the students think of other things besides food that they need to survive. We need to stay warm. We need a variety of foods. We need clean water. How does using energy help us with these needs?
6. Give small groups (2 to 4) an energy chain to put in order. Samples found on Activity Sheet #2A. They can glue the chain (linked by arrows) onto a chart paper for display when they are confident of the order. Have them draw illustrations on each link.
7. Challenge them to create their own energy chain for display.

Debriefing Notes

The students should develop an awareness of the importance of energy in their own lives and how much we depend on it everyday all around us.

Assessment

Energy chains can be evaluated for accuracy and completeness. The more original and complex the chain, the better the mark!

Activity #2 – Where is Energy? Student Worksheet

Item	Energy Used	Renewable or non-renewable

Activity #2 – Where is Energy?

Energy Chains Cards

sun shines	tree grows	apple grows on tree	person picks apple
person eats apple	person runs and plays	sun shines	water evaporates
clouds form	rain falls	water fills river	river has waterfall
waterfall makes electricity	electricity transmitted to house	radio turned on	person listens to music
sun shines	plants grow	plants die and are buried under ground	millions of years change plant remains to oil
oil drilling gets oil from ground	oil is refined to gasoline	gasoline is pumped into car	car takes person to grocery store
person buys food	person cooks food	person eats food	person uses energy to learn how to ride a bicycle
sun shines	tree grows	tree cut for wood	lumber used to build house

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Activity #3 – Let’s Build Something Energetic!

Relevant Curriculum Expectations

- design a device that can transform one form of energy to another

Materials

- construction paper, paper, boxboard, scissors, glue, straws, elastics, stapler with staples, balloons, bamboo skewers, spools, jar lids, toilet rolls and any other building materials that the students would like to bring to class
- Cart Plan
- Boat Plan
- *Let’s Build Something Energetic!* Handout

Group Size

- small groups of 2 to 4

Description of Activity

1. The purpose of this activity is to design a device that can transform potential energy into the energy of movement (kinetic energy). This activity uses simple items that should be easily acquired. (If a classroom has access to batteries and motors, the project could become more sophisticated but it should not be a limiting factor if those items are not available.) The potential energy available in a wound elastic or an inflated balloon can be utilized in the students’ devices. Gravity (moving things down a ramp) can also be a source of potential energy. The benefit of these energy sources, besides availability and price, is that they can be used to discuss further the concept of renewable energy. If batteries are used, they may not be renewable!
2. To help the students understand how these sources of energy can be used, they can first build a prototype according to the provided plans. This way all students should experience initial success and it will give them a concrete example upon which to base their own improved design. Alternately, the teacher could construct the prototype examples for the students to examine before they begin their own plan. (This step can be omitted if the students have other prior experience with building.)

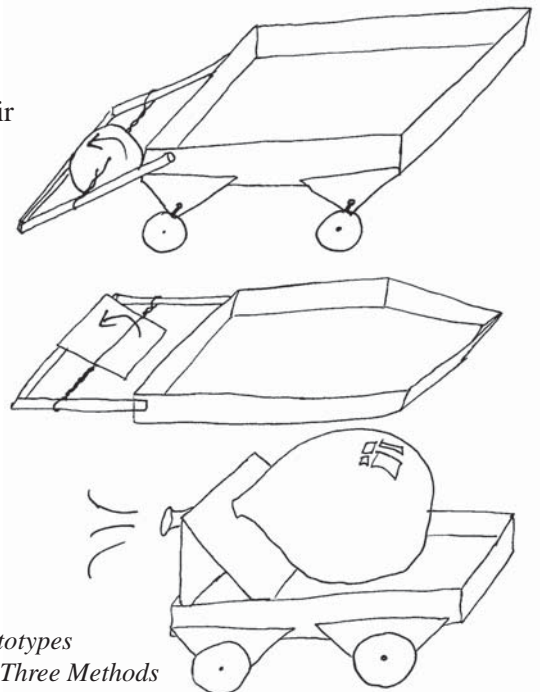
3. In small groups, the students can then discuss ideas for their own devices with improvements and design modifications to the appearance and function. They should begin to sketch and make lists of materials that they require. Their plan could include process writing giving step by step instructions for construction.
4. The second stage of the project will be to construct the device.
5. When the devices are completed, there should be a “Show and Tell” to explain what the device is / does, what improvement modifications have been included and how the energy is transformed from one form of energy to another.

Assessment

The device, the plan and its presentation can be evaluated from the perspective of Science and Technology (success of energy transfer in device, use of appropriate vocabulary, ability to communicate how energy is transferred), Language Arts (cooperative skills working in group, process writing skills, oral communication (presentation) skills) and Mathematics (measurement skills).

Extensions

Students could have competition races with their vehicles, or a “car” show of their 14 cars” designed with renewable energy.



*Sketches of Prototypes
Demonstrating Three Methods
for Propelling the Device*

