BRIEF DESCRIPTION
All good things come to an end. Everyone has heard this saying at some point in their lives but have you ever stopped to think that the conservation of our natural resources is a necessity if we don’t want to see them vanish forever. One of these resources, clean groundwater, can be polluted by numerous sources or used up entirely. In this activity, students will learn about recycling and wise use to conserve Tennessee’s natural resources.

SUPPORTING INFORMATION
Natural resources are the raw materials we use for housing, clothing, transporting, heating, cooking, and so on. They include the air we breathe, the water we drink, the land we farm, and the space we use for living and recreation. In short, they are all the things we use in our physical environment to meet our needs and wants. We can put them into three categories: renewable, non-renewable, and perpetual resources.

In a human time frame, perpetual resources such as solar energy, wind, and tides last forever. Non-renewable resources, however, exist in fixed amounts and once they’re used up, they’re gone forever. For example, fossil fuels are formed through natural processes that take millions of years. If we use all the available fossil fuels, no additional amounts of them will ever be available to us—at least not for millions of years. Other non-renewable resources such as copper and other metals were created billions of years ago during the explosion of giant stars.

These non-renewable resources are not created through natural processes here on Earth. The only way we could get more of them is to mine them on other planets.

LEVEL: 5th grade
SUBJECT: Science
SKILLS: Discussing, representing, summarizing, interpreting, predicting
OBJECTIVES
The student will
- Identify renewable, non-renewable, perpetual, reusable, and recyclable resources and explain the differences among them.
- Play a game that simulates society's use of renewable and non-renewable resources.

ESTIMATED TEACHING TIME
Two 50-minute periods
MATERIALS
Copies of student page, pens or pencils, paper, large amount of popcorn (or nuts or candies), 88 cookies or crackers (activity #4 only), large jar or other container, 44 slips of paper, and 15 paper or plastic bags

VOCABULARY
natural resources, renewable, non-renewable, perpetual, fossil fuels, grasslands, precipitation, sustainable yield, recycle, and bauxite
Renewable resources are materials that can be replenished through natural and/or human processes. For example, even though trees die naturally or are harvested, new trees are naturally reseeded or can be replanted by humans. And even though people consume livestock, new animals are constantly being raised. It is important to realize that renewable resources need to be carefully managed. People can use a renewable resource in a way that it cannot recover itself. For example, in the early 1900’s the passenger pigeon was hunted so heavily and irresponsibly that its numbers dwindled and it became extinct. Grasslands can become overgrazed to the point where the soil loses its ability to support plant life and the area becomes much like a desert. Groundwater supplies may be pumped out of the ground faster than precipitation can trickle down to replenish them.

The maximum rate at which people can use a renewable resource without reducing the ability of the resource to renew itself is called sustainable yield. For example, a sustainable yield of timber would mean harvesting only the amount of trees that the forest could grow. This term also applies to water and wildlife. The sustainable yield of any resource varies from region to region, and it can be altered through various management practices.

When people recycle or re-use natural resources, they decrease the demand on the resource and save energy. (Of course, the recycling process itself also consumes energy.) For example, when people recycle aluminum cans, less bauxite needs to be mined to create “new” aluminum. Recycling aluminum saves lots of energy as well. With paper products, the equation is more complicated since paper fibers cannot be recycled indefinitely and new fiber from trees must be added to the papermaking cycle. However, recycling keeps paper out of landfills and incinerators. Many resources, including renewable and non-renewable ones, can be recycled and reused.

**GETTING STARTED**
Make a copy of the student page for each team of four students.

**PROCEDURE**
Activity I: SORTING WHAT’S WHAT
1. Write the terms “renewable resource,” “non-renewable resource,” and “perpetual resource” on the chalkboard. Ask students to write a definition or give a few examples for each. Tell them not to worry if they’re not sure what the terms mean. By the end of the activity they will have a better understanding.

2. Divide the group into teams of four. Explain that teams will be working together to come up with a one-or two-sentence definition for each of the three terms.

3. Give each team a copy of the student page. Have them cut out the clues and give one to each team member.

4. Each student should read their clue card and share the information with the rest of their team. Then, each team should use these bits of information to synthesize a definition for “renewable,” “non-renewable,” and “perpetual” resources. Everyone on the team should understand each of the clues and agree with their team’s definitions.
5. Teams should then discuss the questions on the student page, with one member designated to record their responses and one designated to report them.

6. Review each of the questions with the entire group, with each team reporting its answers

Activity II: GREED OR NEED
1. Divide the group into teams of four. Give each team 16 pieces of popcorn (nuts or candies can also be used). Explain that students will play a game in which the popcorn represents the team’s supply of a renewable resource that is replenished after each round of play. Each student can take freely from the team supply; however, the team should keep in mind the following rules: (a) At the end of the game, each team member will get to eat all the popcorn or candy that he or she amassed. (b) Each team member needs to take at least one piece per round to be sustained. (c) At the end of each round, the resource will be replenished by one-half of its existing amount.

2. Allow students to take freely from their team’s popcorn pile. Students should record how many pieces they have taken and how many are left in the team pile.

3. Find out how many pieces each group has in its central pile, and give the group half that amount in new pieces.

4. Play three or four more rounds, stopping after each to find out if any of the students didn’t survive. Then provide each group with the prescribed amount of new popcorn.

5. After four or five rounds, have the students share what happened in their teams. In which teams did all the students survive? Which students had the most popcorn in their personal supplies? Which team had the most popcorn in its collective pile? Which teams think they would be able to keep eating popcorn forever as long as the resource kept renewing itself? On these teams, how many pieces were these students taking each round?

6. Discuss these questions with the entire group:
(a) What are the advantages and disadvantages of using a resource in a sustainable way? (Advantage: It can last forever. Disadvantage: You need to control your use of it.)

(b) What advantages and disadvantages are there to using a resource in a non-sustainable way? (Advantages: People will have a large amount of the resource available when they want it; they can make a lot of money in the short term. Disadvantage: They can destroy the resource base for themselves and future generations).

(c) In this activity, the population of each group stayed same. In reality however, the human population is increasing rapidly. What would have happened if one or two or three additional people would have been added to your group?

NOTE-Some of the groups may run out of resources right away or after only two rounds. But one or more of the groups should figure out a way to collect at least one piece of popcorn each round and still have leftovers in their collective pile to be “renewed” each round. During the discussion, be sure to introduce the concept of “sustainable yield.” (See Supporting Information.)

Activity III: POPCORN GENERATION
1. Fill a large jar or other container with popcorn. Mark 14 slips of paper as follows: Two “1st Generation,” four “2nd Generation,” and eight “3rd Generation.” Put the slips into a
NOTE-You should have extra popcorn available after the demonstration is over for the students that don’t participate directly in the demonstration.

2. Have 14 students each draw a slip of paper from the sack. They should not tell anyone what the paper says. Give these students a lunch bag and explain that they will be part of a demonstration.

3. Ask the two 1st Generation students to come up to the big jar of popcorn. Explain that the food in the jar represents the world’s supply of a non-renewable resource. Tell them they can take as much of it as they want. Let them fill their bags while the rest of the group watches.

4. When the 1st Generation students have gotten their fill, invite the four 2nd Generation students to go up and take as much of the remaining popcorn as they want. After they’ve finished, have the 3rd Generation students come up and take what’s left.

5. Discuss with the students what is happening to the world’s popcorn supply. What happened to the total amount of the resource? How much was left for each successive generation? Was anything left for a 4th generation? Did any of the students who were part of the demonstration think about those who might be eating after them, or were they only trying to get as much popcorn as they could?

6. What parallels do the students see between what happened in the demonstration and what happens in the real world?

NOTE-Students may eat as much of the popcorn as they can without any thought as to who will come after them. By the time the 3rd Generation students are finished, there should be little or no popcorn left for the 4th. Even if the students don’t eat as much as they can, they will eat some and the 4th generation will have very little. The students should realize that as new generations come along, there will be less and less of the resource available to them, and eventually there will be nothing.

Activity IV: GLOBAL COOKIE JAR

1. Before your group arrives, label different parts of the room with signs saying Africa, South America, North America, Europe and the Middle East, Russia, and Asia. Prepare slips of paper, one for each student. For a group of thirty students, label eighteen “Asia,” four “Europe and the Middle East,” three “Africa,” two “South America,” two “Russia,” and one “North America.” (For different size groups, adjust these numbers, keeping approximately the same ratio.) Put these slips in a bag. You will also need to bring a jar or box of 88 cookies or crackers (“Global Cookie Jar.”) You can also use individually wrapped candies.

2. When the students arrive, have each pick a slip and go to the section of the room assigned to that region. Display a large map of the world so students can see the regions they belong to. Tell them that they represent the relative population of the regions. Each group should appoint an “ambassador” to represent their region.
3. Tell the regions that they will receive a certain number of cookies, which represent their Gross National Product (the total value of goods and service that their region produces in a year). Give Africa two cookies, Russia three cookies, Asia nine cookies, Europe and the Middle East twelve cookies, South America twenty cookies, and North America thirty cookies. (Ask students why they think the wealthy countries are wealthy. Possible reasons: agricultural system, stable government, educated population, climate, etc.).

4. Explain that each person must have at least one cookie to survive. Students can exchange cookies freely between regions but only the appointed ambassador can leave the group’s designated area.

5. Allow the game to go on for 15 minutes. Let the students work out the inequalities of “wealth” any way they think. Take notes on what you hear and see happening.

6. Announce the end of the activity. Discuss students’ experiences by using the following questions:
   (a) What was your overall experience?
   (b) What was your initial reaction?
   (c) How did you feel when you looked around the room and saw who had what?
   (d) Did you think you would survive?
   (e) Did you ask others for food? How?
   (f) What did you do with your food? Share it, hide it? eat it?
   (g) What choices are available to nations that do not have enough money to buy food from other countries?
   (h) What are some important ideas involved in this game?
   (i) What is missing from the game that would make it more realistic?

ANSWERS TO THE QUESTIONS ON THE STUDENT PAGE
1. Renewable: corn, trees, tuna, salmon
   Non-renewable: oil, coal, gold, sand
   Perpetual: sunshine, tides, hot springs, breeze, river

2. Answers will vary depending on what’s in your classroom.

3. Answers will vary. For example, students may suggest that wood may be used as a substitute for plastic or metal in chairs and other equipment.

4. Answers will vary. Students may suggest that some materials are cheaper that others, that products made from renewable resources are better since the materials to make them can always be available, or that some materials from non-renewable resources are superior to others because they’re lighter in weight or have other properties.

5. If the students don’t come up with answers to this question, don’t worry. And don’t give them an answer! The activities should teach students conditions under which this could occur.

6. Solar energy, winds, tides, etc.

EVALUATION OPTIONS
Have each student write in his or her own words what renewable and non-renewable resources are. Then have the students answer these questions:
1. If a resource is renewable, does that mean it will continue to exist no matter what people do? Explain your answer.

2. What two factors would you say are most important in determining how fast natural resources are used? (This question may be difficult for some students. By recalling the activities, though, they should be able to deduce that the number of people using a resource and the amount each person uses are very important in determining how fast resources get used.)

EDUCATOR’S NOTES
CLUES & QUESTIONS

CLUES

1. On Earth, there are only limited amounts of fossil fuels such as oil, coal, and natural gas. There are also only limited amounts of minerals such as iron, copper, and phosphates. These resources either cannot be replaced by natural processes or require millions of years to replenish.

2. Some non-renewable and renewable natural resources can be recycled or reused. This process decreases the rate at which the supplies of these resources are depleted. For example, aluminum cans can be recycled and turned into new cans or other aluminum products many times over. Recycling reduces the need to mine bauxite, the mineral used to make aluminum.

3. Renewable natural resources include plants, animals, and water, when they are properly cared for. Minerals and fossil fuels such as coal and oil, are examples of non-renewable natural resources.

4. Trees, wildlife, water, and many other natural resources are replaced by natural processes. Plants and animals can also be replenished by human activities. Water is continuously cycled and reused. Sunlight, wind, geothermal heat, tides, and flowing water are perpetual resources.

QUESTIONS

1. Categorize the following as renewable, non-renewable, or perpetual resources:
   (a) a field of corn   (b) oil in the Arctic tundra   (c) coal in the Appalachian Mountains
   (d) sunshine       (e) tides in the Bay of Fundy    (f) trees in a forest
   (g) tuna in the ocean (h) gold mines in western U.S. (i) hot springs in Alaska
   (j) sand on a beach  (k) breeze over the plains  (l) salmon in streams (m) water in a river

2. Look around the classroom and list as many items as you can that are made from renewable natural resources. Make a separate list of all the items made from non-renewable natural resources.

3. What renewable natural resources could be used to replace the non-renewable ones used in the items you listed in Question 2? What non-renewable resources could be used in place of the renewable ones?

4. What advantages and disadvantages might there be for using renewable natural resources in place of non-renewable ones?

5. Under what circumstances, if any, would a renewable natural resource not be renewable?

6. Which resources, if any, would continue to be available no matter how much people used them?
When we think of energy sources, our mind often thinks about coal, electricity, etc. Because fossil fuels take millions of years to form, it becomes increasingly important that we begin to rely more on perpetual sources of energy such as solar, wind and tides. Not only will these sources of energy conserve our resources, but will also reduce sources of pollution and contamination of water and air.

**SUPPORTING INFORMATION**

Energy sources are classified as renewable or non-renewable and perpetual. Non-renewable energy sources exist in fixed amounts; once they’re used up, they’re gone forever. For example, fossil fuels are formed through natural processes that take millions of years. If we use all available fossil fuels, no additional amounts will be available again for millions of years.

On the other hand, renewable and perpetual energy sources can be replenished through natural, or resource management practices. For example, even though trees die naturally or get harvested, new trees are naturally reseeded or are replanted by humans. It is important to realize that such renewable sources need to be carefully managed, because people can use them in such a way that human efforts of renewal management would still be unable to maintain the resources. Perpetual sources of energy include sources, such as solar energy, wind, and tides, which in human terms last forever.

When we determine the degree of use of any energy alternative, the major factors are the energy source’s estimated short-, intermediate-, and long-term supplies; its net yield of useful energy; its cost; and its potentially harmful environmental and social impacts. Each energy alternative has certain

**LEVEL:** 5th grade  
**SUBJECT:** Science  
**SKILLS:** researching, defining problems, organizing information, identifying attributes and components, summarizing, evaluating

**OBJECTIVES**

The student will:
- identify different energy sources.  
- discuss the pros and cons of various energy sources from economic, social, and environmental perspectives.  
- describe some of the ways people use energy in their daily lives.

**ESTIMATED TEACHING TIME**

2-4 class periods

**MATERIALS**

paper and pencils, resource materials, art supplies

**VOCABULARY**

non-renewable energy, renewable energy, perpetual sources, net yield
advantages and disadvantages.

GETTING STARTED
Gather library materials on energy resources.

PROCEDURE
Activity I: ENERGY ROUND-UP

1. Make a list of the following energy sources where everyone can see them: coal, oil, natural gas, nuclear, solar, geothermal, biomass, wind, hydropower, synthetic fuels (e.g. hydrogen), and so on.

2. Divide the class into small groups, and from the list assign one energy source to each group.

3. Give the groups time to research their energy source and to develop a report containing information on the following:
   (a) Its availability
   (b) The technologies for extracting or processing it
   (c) Its economic potential and the feasibility of its small- and large-scale use
   (d) Pros and cons of its environmental and social impacts
   (e) The history of its use
   (f) The sustainability of its use
   (g) Its potential as a future energy source in the United States or other countries

4. Have the groups present their reports to the entire class. Students should take notes on each group’s report.

5. After all groups have reported, each group should briefly outline a national energy policy that they’d like enacted. Such a policy should address issues such as energy conservation and alternative fuels.

6. Have the students share their energy policies. Discuss the pros and cons of each and give the groups time to revise their policies after they hear all reports.

Activity II: FINDING OUT ABOUT FUEL

1. For one day, have students keep track of all the activities they do that directly or indirectly require energy. Tell them to make a list of those activities.

2. The next day, use individual lists to create a group list of activities that require energy. Add any other activities the students think of.

3. Assign students to small groups. Then assign three or more of the listed activities to each group.

4. Have each group find out the following:
   (a) What types(s) of energy is used for each activity? (fuel for heating or cooling, electricity for lights and appliances)
   (b) Where does the energy come from? (oil, coal, nuclear, natural gas, solar, hydropower, wind)
   (c) How does it get from its source to where it is used?
   (d) What are the environmental consequences of using the energy for that particular activity?

EVALUATION OPTIONS
Have the groups design posters or other visual displays portraying the information they found in step four.
EXTENSIONS AND VARIATIONS
Assign each student group to examine particular provinces, states, regions, or foreign countries. Students can then research what main energy sources those areas produce and what types of energy the people consume. As an alternative, have students find out which areas produce and consume the energy source assigned to their student group in Activity I. Students can begin by researching the state or county, or by researching the energy sources themselves.

EDUCATOR’S NOTES