Title: Energy Efficiency – Batteries
Grades: 4
Subjects: Science, Language Arts
Time: 60 minutes

Objectives

- Identify and describe how an individual's action in regards to using energy efficiently is a form of waste management and can affect change and improve the environment.
- Research a topic and respond to a specific question that addresses the topic.
- Present information in drawings and graphic representations.

Standards

Technology Standard 3: Understand the relationship among science, technology, society and the individual.

- Benchmark # 1: Know that technologies often have costs as well as benefits (e.g., as new technologies are developed, man's need for energy increases, resources are used and more pollution/waste is created) and this can have an enormous effect on people and other living things.
- Benchmark **#** 4: Know that new inventions reflect people's needs and wants, and when these change, technology changes to reflect the new needs and wants (e.g., upgrades to new energy using devices require more and more energy usage).
- Benchmark # 5: Understand that technology may affect the environment both negatively and positively (e.g., paper batteries have the potential to improve environmental conditions, while traditional batteries add toxins to the environment if not disposed of properly).

Language Arts Standard 7: Use reading skills and strategies to understand and interpret a variety of informational text.

- Benchmark # 6: Use prior knowledge and experience to understand and respond to new information.

Language Arts Standard 8: Use listening and speaking strategies for different purposes.

- Benchmark # 3: Respond to questions and comments (e.g., gives reasons in support of opinions).
- Benchmark # 5: Use strategies to convey a clear main point when speaking (e.g., express ideas in a logical manner, use specific vocabulary to present information).

Materials

- Assorted types and sizes of batteries
- Internet access
- Battery charger
- Poster board and markers
- Paper and Pencils

Overview: Demand for energy has increased considerably in the past hundred years. Energy is used to power our electrical devices, to heat our homes and businesses and to fuel most forms of transportation. In using energy we consume valuable natural resources and create waste products that have an affect on the environment. Since it is highly unlikely the need for energy will decrease in the future, it is vitally important that we learn to use energy wisely, reducing not only the amount we consume, but also the amount of solid waste we create from its consumption.
While energy conservation is an important concept for students to understand, energy efficiency is also a factor that needs to be addressed. Energy efficiency is the use of technology that requires less energy to perform the same function. For example, using rechargeable batteries is more energy efficient that using single use batteries.

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All batteries add pollutants of the environment when they are disposed of improperly. Some battery components, such as paperboard and carbon powder, are mostly organic and can reenter the environment without much of an impact. Other components, such as steel, nickel, and plastic, while not toxic to the environment, will remain in a landfill for many years to come, since they decompose slowly. Heavy metal components, such as cadmium, lead and mercury, are highly toxic and are harmful to the environment and the organisms that inhabit it. Improper disposal of single use batteries are one example of how toxic materials end up in landfills.

Kid's Speak: We use more and more energy each and every day. We use it to make electricity, heat and fuel. It powers our laptops and TVs, gives us hot water and warm, comfy spaces, and helps transport us from place to place. It is very important that we learn not to waste the energy we use in our everyday lives, and to use it in an efficient manner.

Eco-Fact: Americans dispose of approximately 180,000 tons of batteries each year. Of that number 14,000 tons are rechargeable batteries.

Procedures:
Before Conducting the Lesson:

- Provide students with the Eco-Fact and the following additional facts about batteries. Over three billion single use household batteries are sold each year and about 180,000 of those end up in landfills. Approximately every person in the US disposes of eight single use batteries annually.
- Ask students to brainstorm a list of things people use batteries for to provide a source of power. Some suggestions might include: cell phones, remote controls, handheld video games, cameras, smoke alarms, watches, laptop computers, flashlights, calculators, toys, cars. Record their response for use later in the lesson.
- Display a variety of batteries and battery charger. Explain to students that batteries are a convenient way of providing power to portable objects. Batteries come in many shapes and sizes. They can be used alone or grouped together to provide additional energy to an object. Some are single use and some are rechargeable. However, batteries contain toxic materials (e.g., lead, mercury and cadmium). To dispose of batteries properly they should be recycled and not be placed in the trash. In this lesson students will learn about the need for finding alternatives for single use batteries.

Conducting the Lesson:
Introduce the lesson by telling students about The Paper Battery:

- Swedish scientists have just created a new type of battery that does not require the use of any metal. The batteries are made from paper. The paper fiber is soaked in sodium chloride. The paper fiber is created from Cladophora algae, which is an environmental troublemaker because it affects the quality of drinking water. Scientists are excited about the potential of the paper battery because it addresses two environmental issues. Scientists also claim that the materials used to make these new batteries are completely recyclable.

- Explain to students that in the interim, while scientists explore the possibilities of the paper battery, there are other methods that can be used to decrease the waste created by them. Divide the students into study groups. Have each group review the list of battery-operated items that was generated earlier. Ask groups to research alternatives to single use batteries for these products, and brainstorm options to use these products more efficiently so as to conserve battery life.

- Pose the following question: What can consumers do to minimize battery waste and still benefit from the convenience this product provides? Ask student to develop a list of suggestions that can address this question.

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Possible alternatives may include:

- Use rechargeable batteries for items such as remote controls and handheld video games. These batteries can be used repeatedly and therefore create less waste because they can be used for a longer period of time.
- Pair the reusable batteries with a hand cranked or solar powered battery charger. This option is even more beneficial since there is no additional energy source used to charge the batteries.
- Choose products, such as solar powered calculators and LED flashlights. Solar powered devices use the power of the sun and LED's have longer battery life because the bulbs use less energy to create the light.
- Turn off battery operated products when not in use, such as toys with on/off switches.
- When battery operated materials are going to be stored, remove the batteries so that if the product is accidentally turned on it does not needlessly waste battery life.
- Use a battery tester to verify a battery is dead before disposing of it. A product that uses multiple batteries may not function if one or two batteries need replacing. That does not mean all the batteries are in need of replacement.
- Extend battery life by storing unused batteries in a cool, dry place.
- Bring the students together as a whole group and discuss their ideas as well as ideas listed above. Create a class list of ways consumers can use batteries more effectively.

After Conducting the Lesson:

- Students in each group will select one suggestion they feel is most effective for addressing the battery question and create a poster to educate the public on one simple thing they can do to help manage single-cell battery waste.

Adaptations: The teacher could provide students with a list of battery-operated products that student groups could investigate.

Extensions: Students can investigate how to properly recycle batteries containing hazardous waste and identify the reason why it is necessary. (It is important that batteries are disposed of properly, so that toxic materials are not able to leak out of landfills and contaminate water and soil.) Visit: http://www.batteryrecycling.com/ to learn more about how and where to recycle batteries.

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