4H EGL 60

Leader Guide

FESC
Florida Energy Systems Consortium

UF | IFAS Extension
UNIVERSITY of FLORIDA

Gator Engineering

SAVE

Steps in Achieving Viable Energy

ENERGY

Basic Forms

Potential
- Chemical
- Nuclear
- Gravity
- Mechanical

Kinetic
- Radiant
- Thermal
- Motion
- Sound
- Electricity

Sources

Nonrenewable Energy
- Gasoline
- Nuclear
- Coal
- Natural Gas

Renewable Energy
- Wind
- Biomass
- Hydro
- Solar
- Geothermal

Impacts

Negative Decisions
- Polluting
- Creating Excess Waste
- Using Nonrenewable Resources

Positive Decisions
- Using Renewable Resources
- Using the 4Rs
- Being Efficient

Users

Energy Sectors
- Residential
- Commercial
- Transportation
- Industrial

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Welcome to SAVE

Energy is all around us, forming our very way of life. It keeps us warm, gives us light, grows our food, and helps us move. Life would be impossible without all this energy. There are lots of ways energy can be used - many are good and helpful, but some can be dangerous and damaging to our world. That is why it is important to know what energy is, where it comes from and how to use it wisely!

The **SAVE** project provides youth, ages 11 to 13, with a journey through this exciting world of energy. **SAVE** stands for Steps in Achieving Viable Energy. The **SAVE** Leader's/Helper's Guide has been designed to supplement the Youth Book for club and individual projects. While working through the activities within their project book, youth will not only discover important information, but they will use reflective questions, discussions, and journaling activities to gain even greater insight into the world of energy.

Your Role as Project Leader/Helper

A hands-on approach to learning distinguishes experiential learning from traditional education. In 4-H, leaders and helpers provide the setting for the experiential learning to occur. Youth make discoveries for themselves as you take on the role of mentor or coach, providing support and guidance when needed.

Youth are encouraged to ask for help from an adult on numerous occasions. The main task of the leader is to help youth complete their project learning experience to the fullest. In order to accomplish this task, you will need to:

- Read through both the Project Book and the Leader/Helper's Guide to become familiar with the subject matter, learning objectives, and activities.
- Help facilitate and organize activities as needed by providing transportation, materials, and supplemental activities to enrich the experience.
- Help guide youth through the experiential learning questions (both Reflect and Apply questions are asked at the end of each activity). Validate that their conclusions and answers are correct as they process and learn from their experiences.
- Provide more research-based information to enhance the understanding of various topics within the Project Book.
- Provide a safe, supportive environment for youth. You provide a significant contribution to youth as a mentor and coach through 4-H projects.

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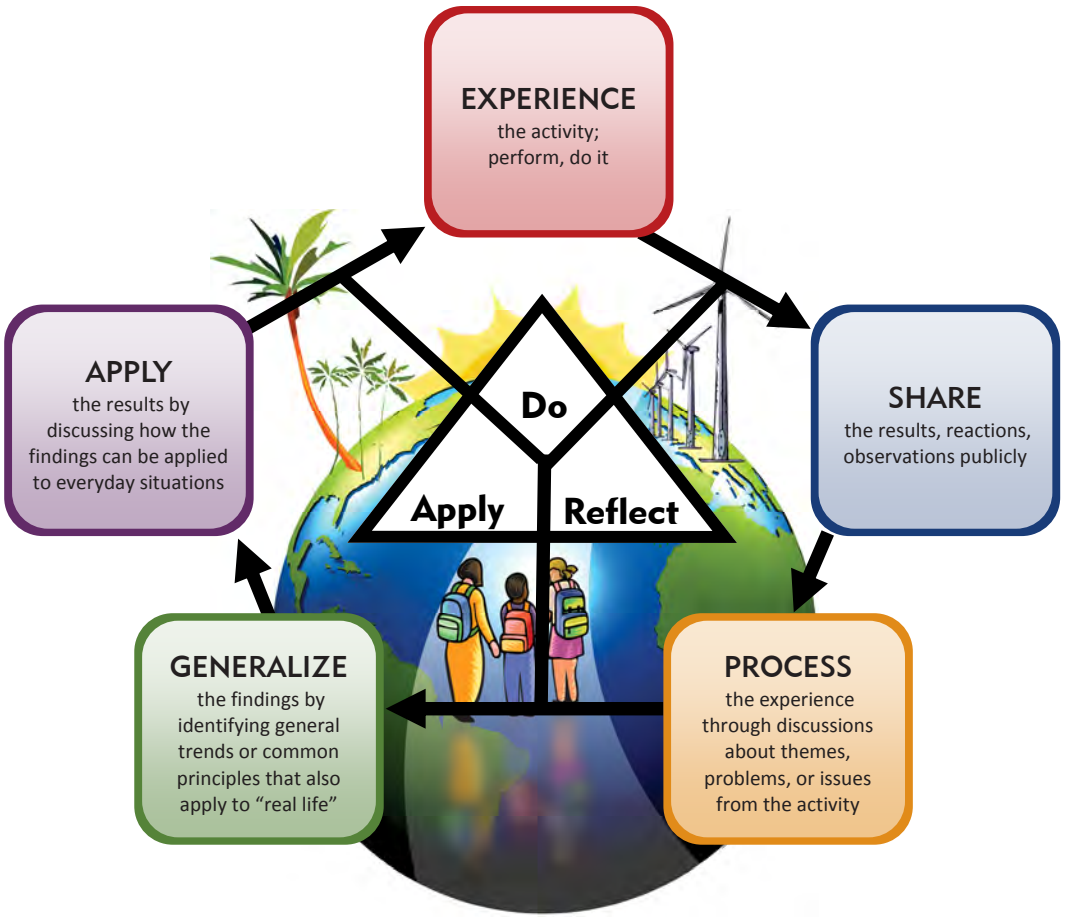
Learn by Doing: *Experiential Learning in 4-H*

4-H has adopted a process that allows youth to learn through a carefully planned "doing" experience that is followed by leader-led discussion using purposeful questions. The experiential learning model by Kolb (1984), as modified by 4-H, includes the five specific steps shown in the diagram below. When this model is used, youth both experience and process the activity. They learn from thoughts and ideas about the experience with each step contributing to their learning.



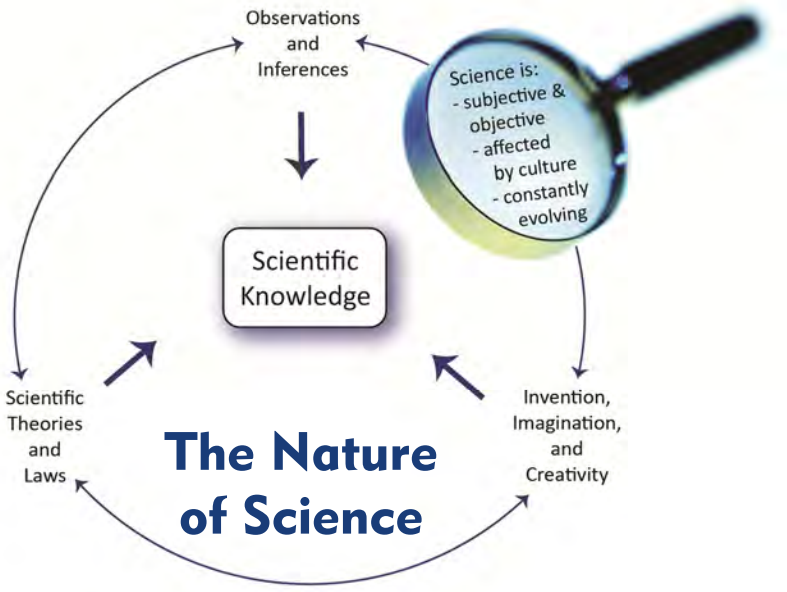
Providing an experience alone does not create experiential learning. Experiences lead to learning when the participant understands what happened, sees patterns of observations, generalizes from those observations, and understands how to use the generalization again in a new situation. The most important outcome of an experiential learning process is that participants show they have gained new knowledge and practiced the life skill and project skill targeted. Additional benefits for youth participating in the experiential learning process, no matter the individual learning style, include learning from each other by sharing knowledge and skills; working together, sharing information, and evaluating themselves and others; taking responsibility for their own learning; relating experiences to their own lives; and sharing what they learned with others.

The **SAVE** curriculum encourages youth to not only learn through the use of the experiential process described above, but also through an experimental process. The basis for the scientific processing promoted in this curriculum is provided on the next page.

The Science in SAVE

Both the **SAVE** Project Book and Teacher's Book use various science terms, concepts, and processes necessary for the building of important science skills. The information given to the youth in the Project Book is provided below and addresses the scientific perspective adopted within this curriculum.

How would you define the word ***science***? Some would say "science" simply refers to a body of knowledge (what we know about our world). Others see "science" as a method for investigating the world (how we know what we know) and linking those investigations to values and beliefs that form the foundation for the development of all scientific knowledge. These differences in opinions often drive scientists to discover new and wonderful things about this world. The first definition is how we define scientific knowledge throughout this project. The second definition for science, also called the **Nature of Science**, is the one that we will be using throughout this project book to define "science". There are several key characteristics that you must know about the Nature of Science before you begin looking at the world of energy.



Scientific knowledge develops through:

1. making ***observations*** (based on what we sense) and ***inferences*** (based on what we think);
2. the use of scientific ***laws*** (statements or descriptions of relationships among things we can observe) and scientific ***theories*** (explanations that are inferred from what we observe);
3. our own personal invention, imagination and creativity (as we make ***hypotheses***, attempt to explain our observations, or suggest possible solutions).

But, the development of scientific knowledge is affected by three very powerful characteristics of science.

1. Science can be both ***subjective*** and ***objective***. Every scientist has previous education, beliefs, set of experiences, and expectations that influence their work. These background factors will affect the questions that they choose to ask and how they might eventually interpret their results. However, scientific researchers use objective methods and tools (such as observation, reproducibility, and consensus) to collect information that will hopefully answer their questions. Therefore, a balance of the subjective and objective nature of science creates the scientific knowledge base we have today and will discover tomorrow.
2. Since the study of science involves people, the ***culture*** that those scientists are a part of play a large role in the development of scientific knowledge. Cultural impacts can come from power structures, funding sources, politics, social groups, socioeconomic factors, philosophy, or religion.
3. Finally, and most importantly, science is ***constantly evolving***. Science is not some absolute answer somewhere that we just need to "find". Our world is too complex for it to be that simple. Instead, science is a dynamic process that continues to guide scientists deeper and deeper in order to better understand what we observe in the world around us and how those observations relate to other questions and observations. In this process, scientists use previous scientific knowledge to suggest new possibilities, to test new ideas or to challenge what was found based on other discoveries.

Diagram and text based on: Lederman, N. G. (2007). Nature of science: Past, present, and future. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research in science education.* Englewood cliffs, NJ: Erlbaum Publishers.

So, how do scientists "do science"?

The first thing to know in asking this question is that there is NO ONE WAY TO DO SCIENCE! There is no step-by-step manual to teach you how. But, there are a set of tools that scientists use to investigate the world around them.

The process of gathering scientific knowledge often begins with questions that arise from an ***observation***. Scientists often look at the world around them and begin to ask questions. These questions can come from a practical problem, a surprising observation, or out of simple curiosity. ***Research questions*** could be simple like "What is that?" or "Where did that come from?" or "How could that work better?" to more complicated questions like "What relationship exists between the force of the wind and the shape of the blade on a windmill?" Scientists often question things they don't understand or want to know more about. They work together by sharing questions and thoughts with one another in order to generate stronger ideas and possible solutions, as well as to look at the issue from multiple points of view.

Once scientists have a question (or set of questions), they begin the process of finding answers. Often scientists have an idea about what they think will happen or an explanation of what they will observe. This ***hypothesis*** focuses the research process and helps them create ways to ***test*** possible solutions in hopes of providing evidence for answers. This testing results in ***data*** collected from additional observations that either supports the scientist's hypothesis, opposes the hypothesis, inspires a new or revised hypothesis, or brings to light problems with ***assumptions*** the scientist may have made. From these results come the discovery of new ideas or solutions for a variety of problems, as well as new questions and hypotheses for the scientist to explore.

Text based on: Lederman (2007) and Year of Science (2009)

So, are YOU a scientist?

The previous two sections told you important information about science. Now it's your turn. Write a brief paragraph to describe what you think it takes to do science. Have your youth do this activity as well and compare the answers that are generated.

Welcome to The Toolbox

The Toolbox provides you with definitions and prompting questions to help youth better understand the scientific concepts covered throughout the lessons.

Definition	Prompt
Observation: *a statement that describe natural phenomena - observations must be based on information from your senses and confirmed by other observers with ease.*	
Research Question: *a main question that drives and guides the investigation.*	***Prompt:*** What question are you trying to answer?
Hypothesis (*pl.* ***Hypotheses):*** *a possible explanation for some observation, phenomenon, or scientific problem that can be tested.*	***Prompt:*** What do you think the answer is to that question?
Test (*or* ***Experiment):*** *a particular process or method used to investigate answers to the questions posed in the research.*	
Variables: *a factor or condition within the test which is likely to change or vary when testing a hypothesis.*	***Prompt:*** What parts of your test are going to change in order as you perform your experiment?
Independent Variable: *a variable whose value is independent of changes in the values of any other variable; it is the variable that you change on purpose; the variable you are testing the effect of.*	***Prompt:*** What variables were changed on purpose during this test?
Dependent Variable: *a variable whose value is affected by changes made to any other variables.*	***Prompt:*** What changed because of the changes you made to your independent variable?
Control: *the standard of comparison used in an experiment; what you compare your results to.*	***Prompt:*** What is the measurement that you are going to compare your other results to?
Data: *facts, collected from observations, and from which conclusions can be made.*	
Reliability: *whether the measurements for a test will give the same results.*	***Prompt:*** Can you reproduce your measurements at different times?
Precision: *the number of times an experimenter is able to generate the same measurement*	***Prompt:*** How often are you able to reproduce your measurements?
Accuracy: *the degree of closeness a measured quantity is to the true or actual value*	***Prompt:*** How close are your measurements to the true value of what's being measured?
Validity: *the extent to which a measure accurately reflects the concept that it is intended to measure*	***Prompt:*** How well would your findings apply to situations other than the one you tested?
Assumptions: *something that is taken for granted before or during the scientific process which may or may not be true.*	
Inferences: *a logical conclusion based on the observations made.*	

Youth Introduction to SAVE

Energy Concept Map:

The inside cover of every SAVE project book has a copy of the Energy Concept Map. This map has been designed to reinforce the information youth will be learning throughout the unit. Specifically, youth will learn about four energy areas: Forms, Sources, Users, and Impacts. Then, using the activities in this unit and the concept map, youth will begin to understand the interconnections between the four energy areas.

If you plan to complete this unit as a club or in an after-school group setting, you may want to consider creating the SAVE Display Board described at the SAVE Web site: www.florida4h.org/SAVE/Resources.

Welcome:

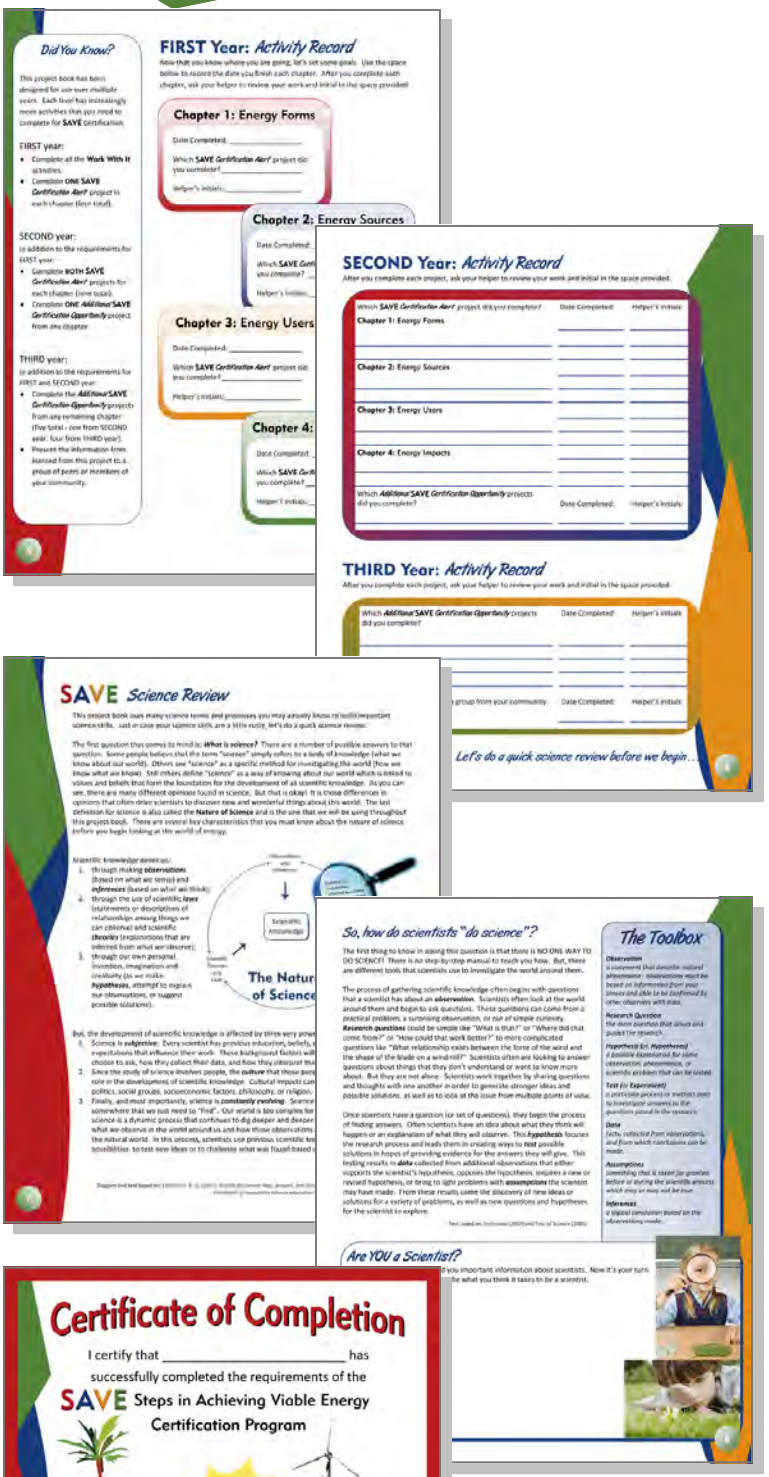
The Table of Contents provides a quick look ahead at what topics youth will cover as you journey through the exciting world of energy.

Get Ready For Your Journey:

Since 4-H strives to engage youth in their own learning, they are encouraged to plan and make decisions for themselves about what they want to learn and do as part of their chosen project. Get Ready for Your Journey leads youth through an initial exploration of the project book in order to peak their interest in the upcoming topics as well as help them begin the decision process.

If you are working with a group of youth, have them brainstorm a list of their own ideas. Then have them agree on one or two things the group will do together related to what they are learning about energy. Encourage activities that engage youth in leadership and community service.

LIFE SKILLS: Setting Goals, Planning



Activity Record:

This unit has been designed so that youth can participate in the project for several years. These pages provide youth with the requirements for each of the three years as well as a place for them to record the goals which they have set for themselves within this unit.

Many opportunities for youth to explore the world of energy exist within this unit. In addition to the activities within each lesson, youth are encouraged to become SAVE certified. To learn more about this process, please visit: www.florida4h.org/SAVE/Certification.

In addition to being a place for goal setting, these pages also act as the time line for goal completion. As a leader or helper, you will be asked to hold youth accountable for their progress throughout the project. In order to help you with this responsibility, a place for the completion date and your initials has been provided next to each goal.

SAVE Science Review

The SAVE Science Review gives youth a brief overview of important science ideas and terms that they will need to be familiar with in order to make the most of their project experience. As you may have already noticed, these pages have also been included as a part of the introduction for this book in order to help you prepare for any questions that might come your way.

Certificate of Completion

Finally, the Certificate of Completion for SAVE has been included in the youth project book. This certificate provides spaces for up to three years of recognition for completing the requirements of the SAVE project. In addition to this certificate, youth may also be given their SAVE Certification. This certificate can be found on the SAVE Web site at: www.florida4h.org/SAVE/Certification.

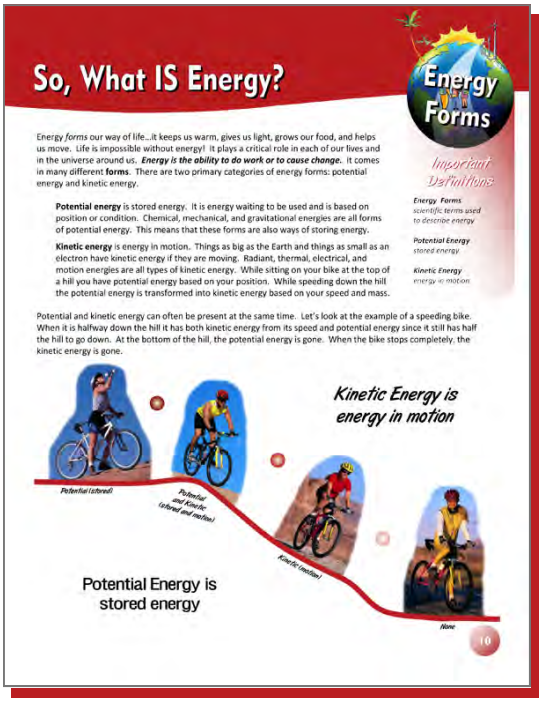
Chapter 1: Energy Forms

Lesson 1: So, What Is Energy?

Life Skills: Making Observations; Categorizing & Critical Thinking; Organizing & Recording Data

Background Basics

This lesson begins the exploration of energy by helping youth answer the basic question: What is energy?



Energy *forms* our way of life…it keeps us warm, gives us light, grows our food, and helps us move. Life is impossible without energy! It plays a critical role in each of our lives and in the universe around us. ***Energy is the ability to do work or to cause change.*** It comes in many different **forms**. There are two primary categories of energy forms: potential energy and kinetic energy.

> **Potential energy** is stored energy. It is energy waiting to be used and is based on position or condition. Chemical, mechanical, and gravitational energies are all forms of potential energy. This means that these forms are also ways of storing energy.
>
> **Kinetic energy** is energy in motion. Things as big as the Earth and things as small as an electron have kinetic energy if they are moving. Radiant, thermal, electrical, and motion energies are all types of kinetic energy. While sitting on your bike at the top of a hill you have potential energy based on your position. While speeding down the hill the potential energy is transformed into kinetic energy based on your speed and mass.

Concept Check Questions

Use the following prompts and questions to check comprehension of important ideas throughout the lesson:

- ? So, what is energy?
- ? What are the differences between potential and kinetic energy? *Be sure to have them give examples.*
- ? What is the difference between an energy form and an energy source?
- ? Where can we find energy?
- ? What are the different types of energy forms?
- ? What forms of energy do we use daily?

Potential and kinetic energy can often be present at the same time. Let's look at the example of a speeding bike. When it is halfway down the hill it has both kinetic energy from its speed and potential energy since it still has half the hill to go down. At the bottom of the hill, the potential energy is gone. When the bike stops completely, the kinetic energy is gone.

Checklist

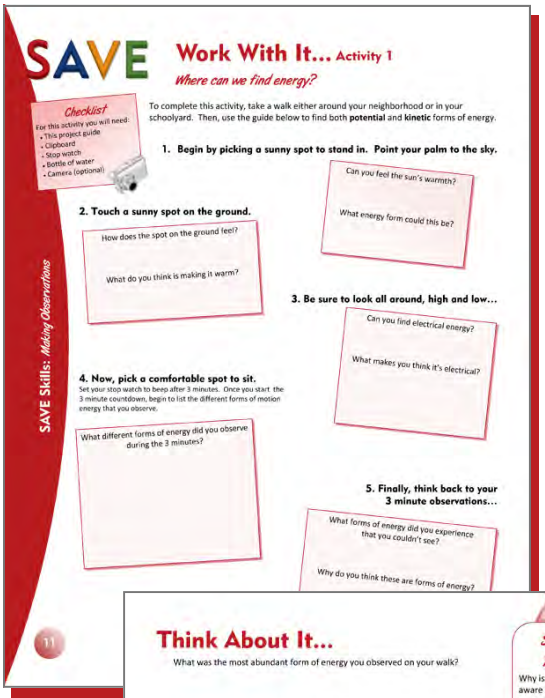
For this activity youth will need:

- This project guide
- Clipboard
- Stop watch
- Bottle of water
- Camera (optional)

Facilitating the Activity

Throughout this unit, each activity is labeled with a G or an I, which indicates whether the activity is recommended for Groups or Individuals (respectively). In this activity, youth are asked to answer a set of questions based on their observations of energy during a walk through their neighborhood or school yard.

G If you choose to have youth perform this activity in small groups, set aside some time for coming back together to discuss each group's findings. The So What Do You Think? questions throughout the youth book can also be used to generate discussions or organize debates for the group about some of the controversial topics in energy. The question for this lesson is: ***Why is it so important to be aware of the world that is around us?***


SAVE

Work With It... Activity 1

Where can we find energy?

Checklist

For this activity you will need:
- This project guide
- Clipboard
- Stop watch
- Bottle of water
- Camera (optional)

To complete this activity, take a walk either around your neighborhood or in your schoolyard. Then, use the guide below to find both **potential** and **kinetic** forms of energy.

1. Begin by picking a sunny spot to stand in. Point your palm to the sky.

Can you feel the sun's warmth?

What energy form could this be?

2. Touch a sunny spot on the ground.

How does the spot on the ground feel?

What do you think is making it warm?

3. Be sure to look all around, high and low...

Can you find electrical energy?

What makes you think it's electrical?

4. Now, pick a comfortable spot to sit.

Set your stop watch to beep after 3 minutes. Once you start the 3 minute countdown, begin to list the different forms of motion energy that you observe.

What different forms of energy did you observe during the 3 minutes?

5. Finally, think back to your 3 minute observations...

What forms of energy did you experience that you couldn't see?

Why do you think these are forms of energy?

SAVE Skills: *Making Observations*

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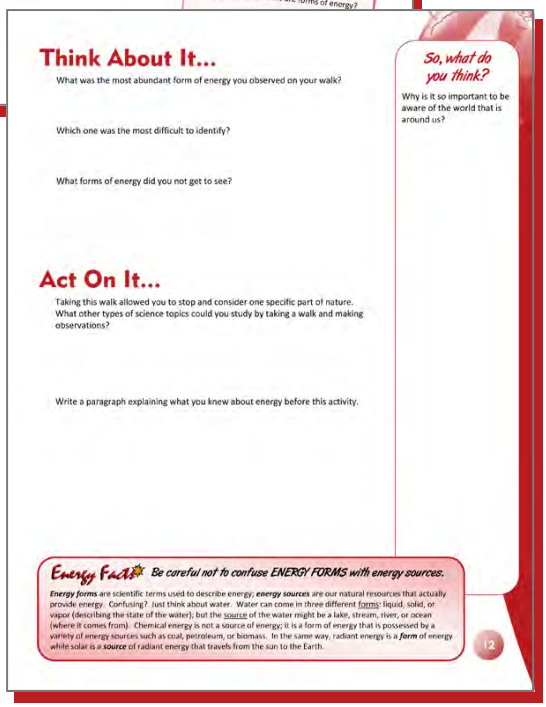
Think About It...

What was the most abundant form of energy you observed on your walk?

Which one was the most difficult to identify?

What forms of energy did you not get to see?

So, what do you think?

Why is it so important to be aware of the world that is around us?

Act On It...

Taking this walk allowed you to stop and consider one specific part of nature. What other types of science topics could you study by taking a walk and making observations?

Write a paragraph explaining what you knew about energy before this activity.

Energy Fact! Be careful not to confuse ENERGY FORMS with energy sources.

Energy forms are scientific terms used to describe energy; ***energy sources*** are our natural resources that actually provide energy. Confusing? Just think about water. Water can come in three different forms: liquid, solid, or vapor (describing the state of the water); but the source of the water might be a lake, stream, river, or ocean (where it comes from). Chemical energy is not a source of energy; it is a form of energy that is possessed by a variety of energy sources such as coal, petroleum, or biomass. In the same way, radiant energy is a ***form*** of energy while solar is a ***source*** of radiant energy that travels from the sun to the Earth.

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Answers to Think About It...

Answers will vary to most Think About It... and Act On It... questions. However, some key ideas to prompt youth have been included where appropriate.

What was the most abundant form of energy you observed on your walk? ***The more common kinetic forms of energy that youth would have seen or experienced would be radiant, thermal and motion energy, or potential forms such as chemical or gravitational energy.***

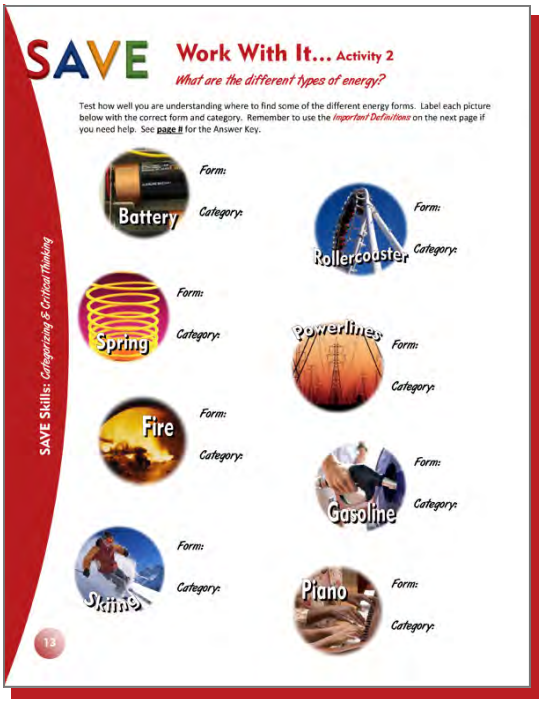
Which one was the most difficult to identify? ***This is most likely a potential energy form: mechanical, chemical, and gravitational energy. Another common form they may not have noticed is electrical energy.***

What forms of energy did you not get to see? ***As with the previous question, these forms are most likely potential energy forms: mechanical, chemical, and gravitational energy, though on a walk, youth may or may not have observed electrical energy.***

Answers to Act On It...

Taking this walk allowed you to stop and consider one specific part of nature. What other types of science topics could you study by taking a walk and making observations? ***These responses can vary greatly. Just make sure the responses are logical and appropriate.***

Write a paragraph explaining what you knew about energy before this activity. ***Check youth responses. If you are doing this project in a group setting, you can also ask a few to share their paragraphs with the group.***



Facilitating the Activity

G I

Using their critical thinking skills, youth are asked to determine the form and category of energy for each of the eight examples given.

G This activity can be done in a group setting by using the skill station materials available on the project Web site: www.florida4h.org/SAVE/Resources.

Answers to Think About It...

What are some similarities between the potential and kinetic energy forms? ***Both have the ability to cause change or to do work.***

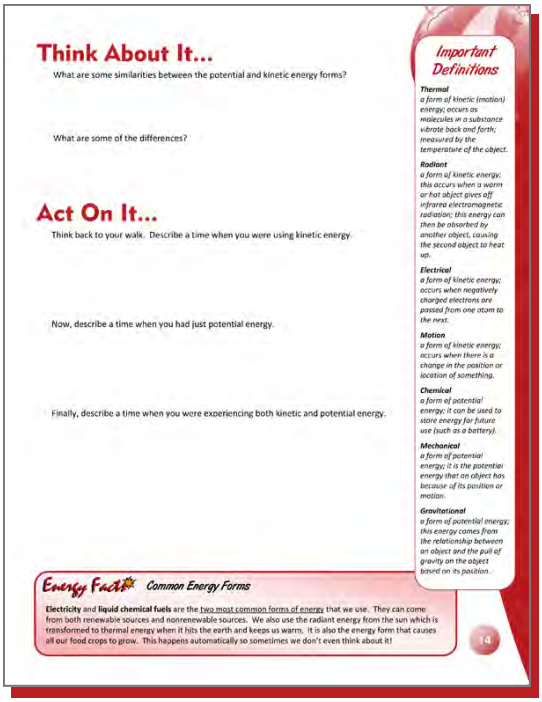
What are some of the differences? ***Potential energy is energy that is stored up, while kinetic energy is energy in motion. It is also often easier to observe kinetic forms of energy than it is potential energy forms.***

Answers to Act On It...

Think back to your walk. Describe a time when you were experiencing kinetic energy. ***These responses can vary greatly. Just make sure the responses are logical, appropriate, and involve an explanation of the energy in motion.***

Now, describe a time when you had potential energy. ***These responses can vary greatly. Just make sure the responses are logical, appropriate, and involve an explanation of how the energy was stored.***

Finally, describe a time when you were experiencing both kinetic and potential energy. ***These responses can vary greatly. Just make sure the responses are logical and appropriate.***




SAVE Work With It... Activity 3

What forms of energy do we use daily?

Use the Energy Journal pages at the end of the Project Book to document your energy use over the next 24 hours. Each time you do something that involves using energy, write down: the activity, what type of energy form it involves, how long you do it, and how much energy you think it uses on a scale from 1 to 5 (1 = very low energy use, 5 = very high energy use). You should have at least **TEN (10)** entries by the end of the 24-hour period.

's SAVE

Think About It...

Which activity from the Energy Journal used the most energy? Why do you think that is?

Which activity used the least amount of energy?

Think about the different energy forms. What were some forms of energy that you might have used that you either forgot to write down or chose to not include?

What was the easiest form of energy to forget? Why was it so easy to forget?

Act On It...

Often people find that writing things down, like you did in your journal, helps to organize their thoughts and lets them think about their actions. What are some times that people write things down in order to help them organize their thoughts and analyze what they are doing?

Why do you think writing this kind of information down helps people?

SAVE Skills: *Organizing & Recording Data*

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Facilitating the Activity

The Energy Journal (pages 51 and 52 of this document) is an important part of the SAVE unit. This provides youth with an opportunity to begin identifying and connecting with their own energy use over 24 hours. Have youth complete this activity individually to make the greatest impact.

Answers to Think About It...

Which activity from the Energy Journal used the most energy? Why do you think that is? ***Responses vary, but may include traveling, heating, lighting, or air conditioning.***

Which activity used the least amount of energy? ***Responses vary, but may include small electronics.***

Think about the different energy forms. What were some forms of energy that you might have used that you either forgot to write down or chose to not include?
Responses vary.

What was the easiest form of energy to forget? Why was it so easy to forget? ***Chemical or radiant - these are so common we don't take notice, and we can't really "see" them.***

Answers to Act On It...

Often people find that writing things down, like you did in your journal, helps to organize their thoughts and lets them think about their actions. What are some times that people write things down in order to help them organize their thoughts and analyze what they are doing? ***Responses may include making a grocery list, keeping a checkbook, writing assignments in a planner.***

Why do you think documenting this kind of information helps people? ***Responses should include being able to remind people of ideas, appointments or other information that is important and worth remembering.***


SAVE *CERTIFICATION ALERT*...R1 or W3

Which activity did you select?

Use the space below to record your responses to the activity:

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SAVE Certification Alert...

In addition to the Energy Journal, youth are also encouraged to complete the activities necessary to achieve SAVE Certification. The appropriate activities for this lesson have been listed at the top of the journal page and can be found on pages 91-93 in the youth book. The number of SAVE Certification Activities that youth must complete is listed on page 5 of the youth book on their Activity Record page.

Chapter 1: Energy Forms

Lesson 2: Does Energy Always Stay The Same?

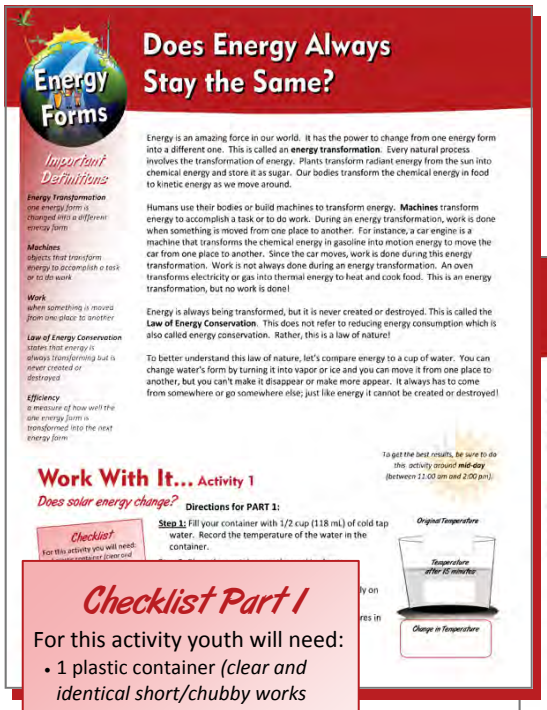
Life Skills: Predicting, Testing & Comparing Data; Designing an Experiment; Organizing & Recording Data

Background Basics

Energy is an amazing part of our world. It has the ability to change from one form into a different one. This is called an **energy transformation**. Every natural process involves the transformation of energy. Plants transform radiant energy from the sun into chemical energy and store it as sugar. Our bodies transform the chemical energy in food to kinetic energy as we move around.

Humans use their bodies or build machines to transform energy. **Machines** transform energy to accomplish a task or to do work. During an energy transformation, work is done when something is moved from one place to another against some resistance. For instance, a car engine is a machine that transforms the chemical energy in gasoline into motion energy to move the car from one place to another. Since the car accelerates, pushing against friction, work is done. Work is not always done during an energy transformation. An oven transforms electricity or gas into thermal energy to heat and cook food. This is an energy transformation, but no work is done!

Energy is always being transformed, but it is never created or destroyed. This is called the **Law of Energy Conservation**. This does not refer to reducing energy consumption which is also called energy conservation. Rather, this is a fundamental law of nature! To better understand this law of nature, let's compare energy to a cup of water. You can change water's form by turning it into vapor or ice and you can move it from one place to another, but you can't make it disappear or make more appear. It always has to come from somewhere or go somewhere else; just like energy it cannot be created or destroyed!


Does Energy Always Stay the Same?

Energy Forms

Important Definitions:

Energy Transformation
one energy form is changed into a different energy form

Machines
objects that transform energy to accomplish a task or to do work

Work
when something is moved from one place to another

Law of Energy Conservation
states that energy is always transforming but is never created or destroyed

Efficiency
a measure of how well the one energy form is transformed into the next energy form

Energy is an amazing force in our world. It has the power to change from one energy form into a different one. This is called an **energy transformation**. Every natural process involves the transformation of energy. Plants transform radiant energy from the sun into chemical energy and store it as sugar. Our bodies transform the chemical energy in food to kinetic energy as we move around.

Humans use their bodies or build machines to transform energy. **Machines** transform energy to accomplish a task or to do work. During an energy transformation, work is done when something is moved from one place to another. For instance, a car engine is a machine that transforms the chemical energy in gasoline into motion energy to move the car from one place to another. Since the car moves, work is done during this energy transformation. Work is not always done during an energy transformation. An oven transforms electricity or gas into thermal energy to heat and cook food. This is an energy transformation, but no work is done!

Energy is always being transformed, but it is never created or destroyed. This is called the **Law of Energy Conservation**. This does not refer to reducing energy consumption which is also called energy conservation. Rather, this is a law of nature!

To better understand this law of nature, let's compare energy to a cup of water. You can change water's form by turning it into vapor or ice and you can move it from one place to another, but you can't make it disappear or make more appear. It always has to come from somewhere or go somewhere else; just like energy it cannot be created or destroyed!

To get the best results, be sure to do this activity around **mid-day** (between 11:00 am and 2:00 pm).

Work With It... Activity 1

Does solar energy change?

Directions for PART 1:

Step 1: Fill your container with 1/2 cup (118 mL) of cold tap water. Record the temperature of the water in the container.

Original Temperature

Temperature after 15 minutes

Change in Temperature

Checklist

For this activity you will need:

- 1 plastic container *(clear and identical short/chubby works best)*
- Water
- Thermometer
- 1 metal cookie sheet
- Camera (optional)

Facilitating the Activity

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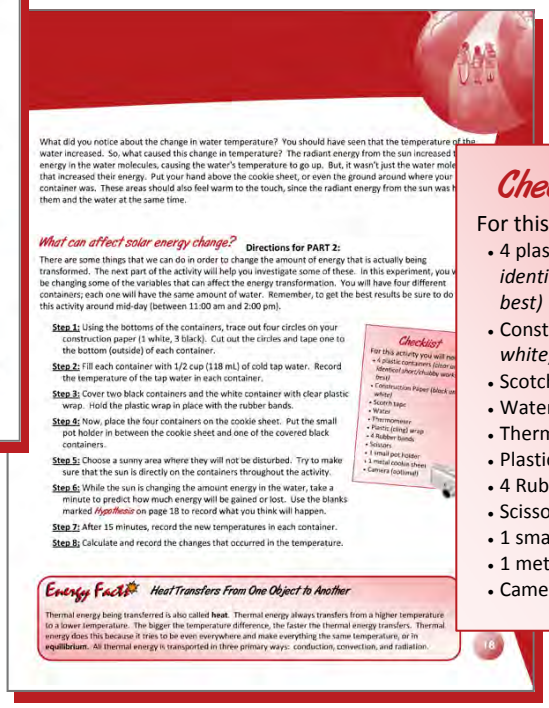
This activity can either be done independently or in small groups. If you choose to have youth perform this activity in small groups, set aside some time for coming back together to discuss each group's findings. Be sure to remind youth to record their observations using the pages provided.


What did you notice about the change in water temperature? You should have seen that the temperature of the water increased. So, what caused this change in temperature? The radiant energy from the sun increased the energy in the water molecules, causing the water's temperature to go up. But, it wasn't just the water molecules that increased their energy. Put your hand above the cookie sheet, or even the ground around where your container was. These areas should also feel warm to the touch, since the radiant energy from the sun was heating them and the water at the same time.

What can affect solar energy change? Directions for PART 2:

There are some things that we can do in order to change the amount of energy that is actually being transformed. The next part of the activity will help you investigate some of these. In this experiment, you will be changing some of the variables that can affect the energy transformation. You will have four different containers; each one will have the same amount of water. Remember, to get the best results be sure to do this activity around mid-day (between 11:00 am and 2:00 pm).

Step 1: Using the bottoms of the containers, trace out four circles on your construction paper (1 white, 3 black). Cut out the circles and tape one to the bottom (outside) of each container.

Step 2: Fill each container with 1/2 cup (118 mL) of cold tap water. Record the temperature of the tap water in each container.

Step 3: Cover two black containers and the white container with clear plastic wrap. Hold the plastic wrap in place with the rubber bands.

Step 4: Now, place the four containers on the cookie sheet. Put the small pot holder in between the cookie sheet and one of the covered black containers.

Step 5: Choose a sunny area where they will not be disturbed. Try to make sure that the sun is directly on the containers throughout the activity.

Step 6: While the sun is changing the amount energy in the water, take a minute to predict how much energy will be gained or lost. Use the blanks marked *Hypothesis* on page 18 to record what you think will happen.

Step 7: After 15 minutes, record the new temperatures in each container.

Step 8: Calculate and record the changes that occurred in the temperature.

Energy Fact! *Heat Transfers From One Object to Another*

Thermal energy being transferred is also called **heat**. Thermal energy always transfers from a higher temperature to a lower temperature. The bigger the temperature difference, the faster the thermal energy transfers. Thermal energy does this because it tries to be even everywhere and make everything the same temperature, or in **equilibrium**. All thermal energy is transported in three primary ways: conduction, convection, and radiation.

18

Checklist

For this activity you will need:

- 4 plastic containers *(clear and identical short/chubby works best)*
- Construction Paper (*black and white)*
- Scotch tape
- Water
- Thermometer
- Plastic (cling) wrap
- 4 Rubber bands
- Scissors
- 1 small pot holder
- 1 metal cookie sheet
- Camera (optional)

Answers to Think About It...

What generalizations can you make about what you saw in this activity? ***Black absorbs more radiant energy than white, a cover reduces the thermal losses due to convection, and insulation reduces the thermal losses due to conduction.***

Which container had the most thermal energy? How do you know? ***The container with the black bottom and covered with plastic wrap. The temperature was higher.***

Which had the least thermal energy? ***The container with the uncovered top and black bottom.***

What do you think made the temperatures in these two containers so different? ***The radiant energy absorption was maximized and the thermal energy losses were minimized. This created a higher internal energy and temperature.***

Think about the differences between your predictions and what you actually saw. Even though hypotheses are not always true, why should we still try to predict what will happen? ***Making predictions helps scientists refine their assumptions, but it also acts as a check to see if maybe there was something wrong in the experiment's setup.***

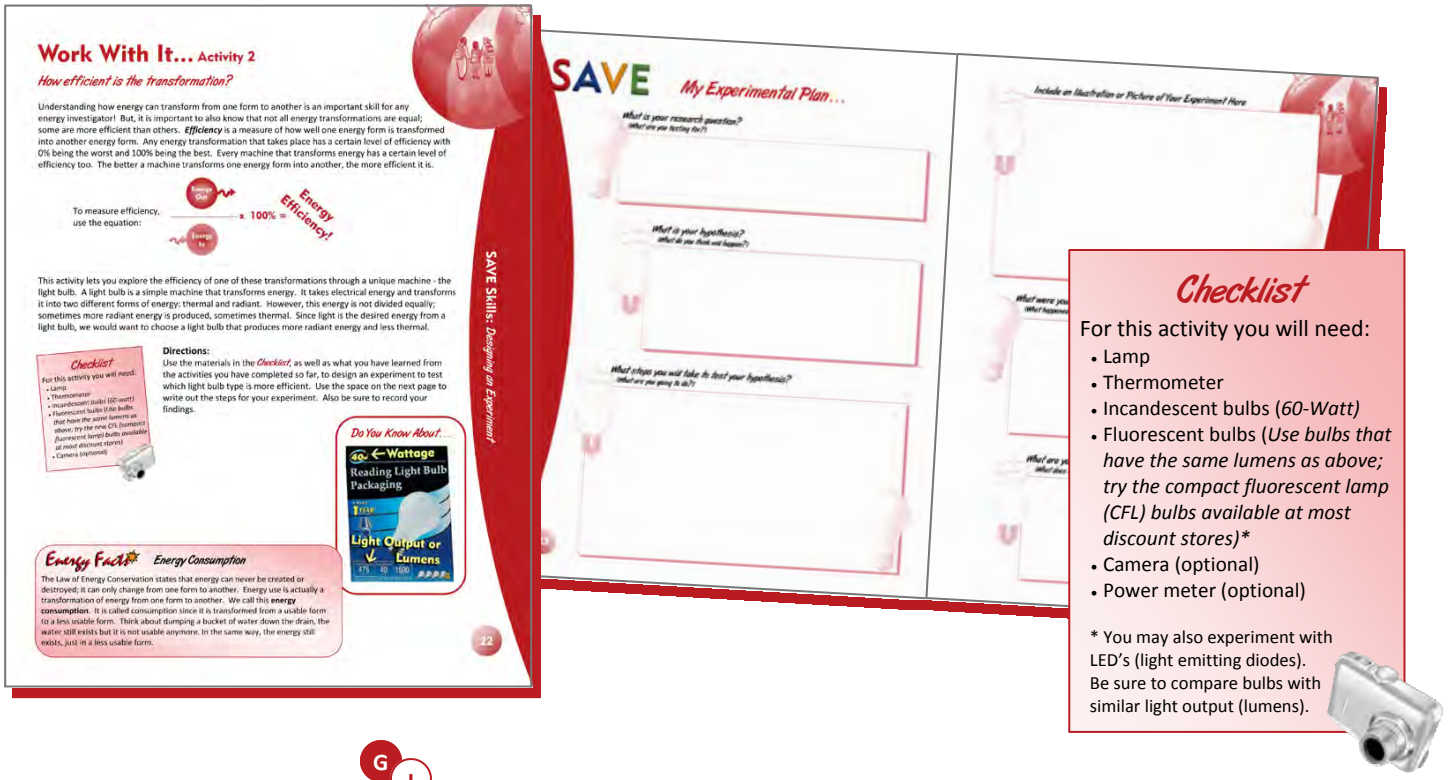
Do hypotheses (predictions) always have to be right? Explain your answer. ***No, hypotheses do not have to always be right. You can eliminate many wrong ideas by finding out what DOESN'T work.***

Answers to Act On It...

Now, think bigger than this activity. Why is the radiant energy from the sun so important for Earth? ***Without the sun's radiant energy, the earth would be too cold to sustain life. Plants would not be able to grow.***

What do you think would happen if the amount of radiant energy from the sun changed (either increased or decreased)?***The climate on the earth can change dramatically if only raised or lowered a few degrees. This could cause serious problems for plants and animals as well as could cause significant changes to weather patterns.***

How is the Earth like one of the containers? ***Responses vary, but may include that the atmosphere (like the sides of the container) allows energy to pass through and traps the energy, thereby warming the Earth.***



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Facilitating the Activity

This activity can be done individually or in small groups. Youth will pair their previous science experiment experiences with what they have learned about energy to design their own experiment. This activity may prove to be especially challenging for youth who have had few opportunities to participate in a traditional science experiment. Here are some things that you may need to remind them of.

Science Terms

These terms are often used when dealing with science experiments. Use the Toolbox on page 6 of this book to provide youth with definitions if they are having trouble grasping these concepts.

Research Question

Hypothesis

Experiment

Variables

? Keep in mind what you are trying to find out. *Ask youth to explain what information they are looking for. In this case, we are looking to see which bulb gives off more thermal energy since that means that energy is being wasted as heat rather than being efficiently converted into light energy.*

? Keep everything as consistent as possible between the two setups. *Variables are very important in a science experiment. When you are comparing two items, it is important to keep everything as consistent as possible (same type of thermometer, same lamp, even the same distance that the thermometer is from the bulb). Each of those things has an impact on the outcome. So, the only thing that should be different are those variables you want to intentionally change (in this case, the type of light bulb).*

Another cornerstone in science is the ability to replicate an experiment. So, be sure to remind youth how important it is to record their steps and findings in the pages provided (pages 23-24).

Be sure to set aside some time for coming back together to discuss each group's findings if youth have completed this activity in small groups.

Answers to Think About It…

Why do you think is it so important to make machines as efficient as possible? ***Because efficient machines are able to perform efficient energy transformations making better use of limited energy resources.***

Look at your data from this activity. Which bulb would you say is more efficient? Why do you think it is more efficient than the other one? ***The more efficient light bulb is the CFL. It is more efficient because it provides the same amount of light but makes less heat so it requires less electricity. If you were to use an LED, it would be more efficient. However, at the present time, it is difficult to find LEDs with the same light output (lumens) that you can get from an incandescent of CFL bulb.***

Use the results from the light bulb activity to calculate the wattage you would use if you replaced 10 incandescent light bulbs (60 Watts each) with 10 more efficient compact fluorescent light bulbs?

What was the difference in the total wattages? ***10 x (60-13) = 470 W***

What does this difference mean to you as an energy consumer? ***The amount of money used every month on electricity on the electric bill will go down and your energy impact will be reduced.***

Answers to Act On It…

You had to design an experiment to test which light bulb was more efficient. How could you use this same problem solving skill in other areas of your life? ***Responses vary.***

Think about your home.

If you could save 47 Watts for each light bulb per month by using one CFL instead of a incandescent light bulb, how many Watts would you save for switching out all the light bulbs in your house? ***47 x (# of lights) = answer***

What other ways can you think of to save money spent on lighting your house (without making the switch to CFLs)? ***Responses vary, but may include other low wattage bulbs such as LED's, turning off the lights, reducing the number of lights, occupancy sensors, timers, etc.***


SAVE

So, what do you think?

Does a simple act, like changing a light bulb from incandescent to CFL, actually make a difference in saving energy for our world?

Think About It...

Why do you think is it so important to make machines as efficient as possible?

Look at your data from this activity. Which bulb would you say is more efficient? Why do you think it is more efficient than the other one?

Use the results from the light bulb activity to calculate the wattage you would use if you replaced 13 incandescent light bulbs (60 watts each) with 13 more efficient compact fluorescent light bulbs?

What was the difference in the total wattages?

What does this difference mean to you as an energy consumer?

Act On It...

You had to design an experiment to test which light bulb was more efficient. How could you use this same problem solving skill in other areas of your life?

Think about your home.

If you could save xx watts for each light bulb per month by using one CFL instead of a incandescent light bulb, how many watts would you save for switching out all the light bulbs in your house?

What other ways can you think of to save money when you use the lights in your house (without making the switch to CFLs)?

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To generate additional an discussion or debate, have youth explore their thoughts on this lesson's So What Do You Think? question: ***Does a simple act, like changing a light bulb from incandescent to CFL, actually make a difference in saving energy for our world?***

Facilitating the Activity

This activity challenges youth to find transformations that may have taken place in their energy use over the 24 hours they previously recorded. Have youth complete this task for the previous ten, plus two more activities. Be sure they fill out all the information for forms and transformations.

Work With It... Activity 3

What changes did our daily energy go through?

Using the information you collected for your Energy Journal, decide what energy transformations may have taken place for the entries you recorded. Add **TWO (2)** more activities to the end of your list. Be sure to fill out all the information for forms and transformations.

Think About It...

You have now learned to be aware of your energy use and the efficiency of the machines you use to transform that energy. How efficient would you say your activities been?

What was the most common transformation that you have recorded in your journal?

Think about the different transformations energy can go through. There are most likely some that you have not included in your journal.

What are those transformations?

Why do you think you've not seen this transformation?

Where might you see this transformation take place?

Act On It...

Think about the transformation that takes place from when you eat your food to when you use that energy to move your body. Your body, in this example, is a machine.

What makes the human body a more efficient machine?

What would make it less efficient?

SAVE Skills: *Organizing & Recording Data*

26

Answers to Think About It...

You have now learned to be aware of the various energy forms you encounter and the efficiency of the machines you use to transform that energy. How efficient would you say your activities have been? ***Responses vary.***

What was the most common transformation that you have recorded in your journal? ***Responses vary.***

Think about the different transformations energy can go through. There are most likely some that you have not included in your journal.

What are those transformations? ***Responses likely would be chemical energy (transformation in body), radiant to chemical energy (in plants), electrical energy (transformed to heat or air conditioning in homes).***

Why do you think you've not seen this transformation? ***Depends on the previous responses. However, common answers might include that they are naturally occurring, or that you can't directly observe them.***

Where might you see this transformation take place? ***Depends on previous answers.***

Answers to Act On It...

Think about the transformation that takes place from when you eat your food to when you use that energy to move your body. Your body, in this example, is a machine.

What makes the human body a more efficient machine? ***Eating healthy food, getting plenty of exercise, and drinking lots of water every day.***

What would make it less efficient? ***Participating in negative health activities - smoking, drinking soda or other high-sugar drinks, eating foods high in bad fats and sugars, and not exercising.***

SAVE Certification Alert...

The activities for this lesson have been listed at the top of the first journal page. These activities can be found on page 91 in the youth book.

In addition to the required SAVE Certification Activities, youth working on their second and third year will need to complete Additional SAVE Certification Opportunities. These are found throughout the lessons. This lesson's opportunity is: **Interview somebody in an energy-related field (such as an employee of your local utilities provider or who works with heaters and air conditioners). Ask them how their job relates to energy and what they are doing to help people use energy more wisely. Maybe they can show you around the place they work!**

However, if you have a group of first year youth, you may want to still use this type of activity by inviting someone from an energy -related field to speak to the group instead.

Concept Check Questions

You can use the following prompts and questions to check comprehension of important ideas:

- ? Does energy always stay the same?
- ? Does solar energy change?
- ? What factors can affect the change in solar energy?
- ? How is the efficiency of a machine determined?
- ? What are some common energy transformations in our daily life?

Chapter 2: Energy Sources

Lesson 3: Where Does Energy Come From?

Life Skills: Building/Constructing; Predicting, Testing & Comparing Data; Interpreting, Categorizing & Graphing Data; Organizing & Recording Data


Energy Sources

Where Does Energy Come From?

Important Definitions

Renewable Energy Sources
sources of energy which naturally keep giving energy; usually will not contribute to pollution and global warming

Viable
usable, healthy, and able to be developed

Nonrenewable Energy Sources
sources of concentrated energy which are easier to collect and use, but are limited in amount because it takes time to replenish the source; usually will contribute to pollution and global warming

You began your energy journey by finding out what energy is, the different forms it can come in, and how it can transform from one form into another. Then next stop on your journey will let you search out the answers to questions such as: Where does energy come from? Does is come from the electrical socket? Does it come from the gasoline tank? Actually, the energy we use normally starts its journey far before it gets to us at the electrical socket or the gas tank...*it all starts at the source*. You could also say that all the energy we use comes from energy resources or energy supplies. ***Energy sources*** can be renewable or nonrenewable.

Renewable energy sources naturally keep giving energy. They include solar radiation, wind, biomass (plants and other biological materials), geothermal, waves, tides, and hydropower. Renewable sources are all around us but they often fluctuate which means sometimes they are available and sometimes they are not. For instance, solar and wind energy fluctuate depending on the time of day and the weather. Normally, using renewable energy sources does not directly pollute the environment or contribute to global warming. Renewable energy sources are ***viable*** because they are usable, healthy, and able to be developed into our future energy sources.

Because we currently use so much energy for the way we live, we use many ***nonrenewable energy sources*** whose energy is very concentrated and easier for us to collect and use than renewable sources. These energy sources include fossil fuels such as gasoline, oil, and coal. Uranium is also a source of nonrenewable energy, but it does not contribute to global warming like most other non-renewables. Nonrenewable means it cannot replenish as fast as it is being used and will eventually run out. Most nonrenewable energy sources are polluting and contribute to global warming. Because of these things, they are not viable for our future energy needs.

Work With It... Activity 1

Where can energy come from?

Humans have long used the various energies from the sun. Even before America became a nation, people were using the sun's energy to cook foods. Now, it's your turn to use this great resource to prepare a solar snack! One way that energy transformations are used to help people complete a task uses a special kind of machine - a solar oven. A solar oven takes radiant energy from the sun and then transforms it into thermal energy, cooking your food in the process. You can even make your own solar oven. To get the best results, be sure to do this activity around **mid-day** (between 11:00 am and 2:00 pm).

Insert 4-H photo of solar oven

29

Background Basics

This lesson continues the energy journey by introducing youth to where energy comes from.

You began your energy journey by finding out what energy is, the different forms in which it can exist, and how it can transform from one form into another. The next stop on your journey will let you search out the answers to questions such as: Where does energy come from? Does is come from the electrical socket? Does it come from the gasoline tank? Actually, the energy we use normally starts its journey far before it gets to us at the electrical socket or the gas tank...***it all starts at the source***. You could also say that all the energy we use comes from energy resources or energy supplies. ***Energy sources*** can be renewable or nonrenewable and can come in a variety of different forms.

Renewable energy sources naturally keep giving energy. They include solar radiation, wind, biomass (plants and other biological materials), geothermal, waves, tides, and hydropower. Renewable sources are all around us but they often fluctuate which means sometimes they are available and sometimes they are not. For instance, solar and wind energy fluctuate depending on the time of day and the weather. Normally, renewable energy sources do not directly pollute the environment or contribute to global warming. Renewable energy sources are ***viable*** because they are capable of being developed into our future energy sources.

Because we currently use so much energy for the way we live, we use many ***nonrenewable energy sources*** whose energy is very concentrated and easier for us to collect and use than renewable sources. These energy sources include fossil fuels such as gasoline, oil, and coal. Uranium is also a source of nonrenewable energy, but it does not contribute to global warming like most other non-renewables. Nonrenewable means it cannot replenish as fast as it is being used and will eventually run out. Most nonrenewable energy sources are polluting and contribute to global warming. Because of these things, they are not viable as renewable energy sources to meet our future energy needs.

Concept Check Questions

Use the following prompts and questions to check comprehension of important ideas throughout the lesson:

- ? Where can energy come from?
- ? How can using different designs change the results of an experiment?
- ? What sources do we use most?
- ? What sources does my daily energy use come from?
- ? What is the difference between an energy form and an energy source?

Facilitating the Activity - Part 1

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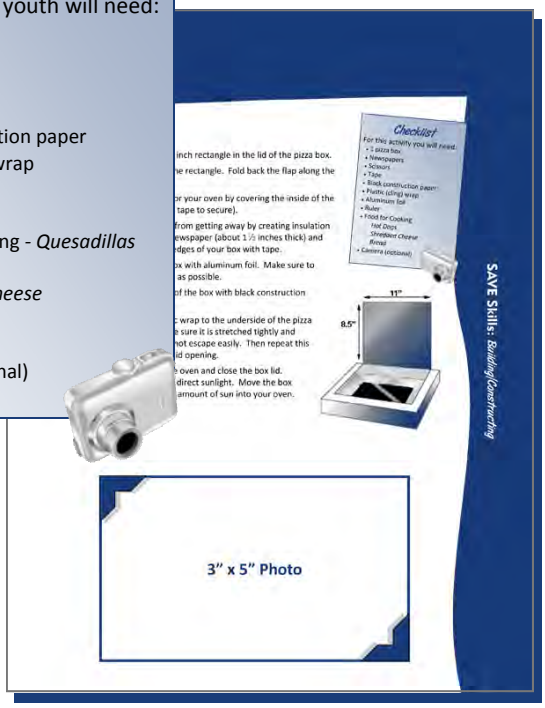
This activity can either be done independently or in small groups. If you choose to have youth perform this activity in small groups, set aside some time for coming back together to discuss each group's findings. The first part uses a "pizza box" design for their solar oven.

Checklist

For this activity youth will need:

- 1 pizza box
- Newspapers
- Scissors
- Tape
- Black construction paper
- Plastic (cling) wrap
- Aluminum foil
- Ruler
- Food for Cooking - *Quesadillas*
  - *Salsa*
  - *Shredded Cheese*
  - *Black Beans*
  - *Tortillas*
- Camera (optional)



Suggestions for Group Work

G There are several additional activities that you could also incorporate into this lesson in order to reinforce the powerful energy that comes from the sun. Here are some ideas:

SOLAR TOP CHEF **-** Make a competition for creating the best solar oven design to cook some food item (such as a cheese or black bean quesadillas) using solar energy. Divide youth into their small groups in order to plan out their design. Then, allow them a set amount of time to construct their solar oven. Encourage them to use their experiences with this lesson to design the most efficient oven possible.

SOLAR CAR-AZY **-** This activity is detailed in Lesson 3 of the SAVE Teacher's Edition, available on the SAVE Web site at www.florida4h.org/SAVE/TeacherEdition.shtml. This activity allows youth to explore the power of photovoltaic cells (PV Cells) through building and experimenting with a solar car.

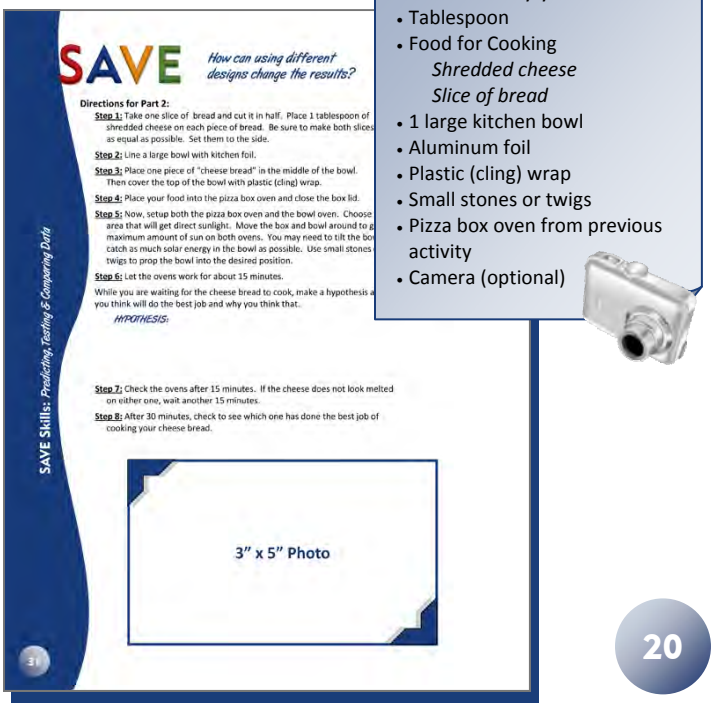
Facilitating the Activity - Part 2

This part of the activity encourages youth to experiment with a different design concept for using radiation to cook food. Youth then compare the "pizza box" design to the "bowl" design in order to determine which design best cooks their food. Be sure to reiterate that in order for a true comparison to be made, youth must try to keep equal as many variables as possible - what type of food is cooked, how much, similar materials. Once Part 1 and Part 2 are completed, you may want youth to compete in the SOLAR TOP CHEF, described above in the Suggestions for Group Work.

Checklist

For this activity youth will need:

- Tablespoon
- Food for Cooking
  - *Shredded cheese*
  - *Slice of bread*
- 1 large kitchen bowl
- Aluminum foil
- Plastic (cling) wrap
- Small stones or twigs
- Pizza box oven from previous activity
- Camera (optional)



Facilitating the Activity (continued)

Finally, please remind youth to complete the Record Your Observations section. This section asks them to record not only what they saw, but also what results were found and how their hypothesis compared to the results. You may find it necessary to remind youth that predictions and hypotheses do not need to always be correct. Knowing what didn't work can be just as valuable as being right about what did work. In addition to these reminders, you may also want to caution youth about the unevenness of the sun's cooking ability. Therefore, some foods may cook unevenly, providing a potential issue for food-borne illnesses. Instruct them not to use meats or eggs when testing their solar ovens.

Answers to Think About It...

What are some of the advantages of using solar energy to cook with? ***Responses may include: solar energy is renewable, a cleaner way of heating food, better for the environment.***

What are the disadvantages of using solar energy? ***Responses may include: the sun is not always available, it's hard to capture and store the sun's energy, cooking food takes longer than in a microwave or oven.***

Of the two solar oven designs, which one worked the best? What about the oven's design do you think helped it be more successful? ***Responses vary, but reasons may include that more absorption, less convection, and less conduction took place.***

When you compared your hypothesis to your observations, you either predicted correctly or incorrectly.

If your hypothesis was the same as what you observed, explain why you thought that is what you would see. ***Responses vary.***

If your hypothesis was different than what you observed, explain what you did not consider that may have impacted the results. ***Responses vary.***

Answers to Act On It...

In the design of your solar oven, you used newspaper for insulation. What other objects use insulation to keep heat from escaping? ***Homes, buildings, cars, ovens, refrigerators, winter jackets.***

What information could you use from what you learned in the activities from the previous lessons that would help you build a better solar oven? ***Responses vary.*** You can build and test it out if you wish! ***If youth choose to do this activity, ask them to share their experiences with the group.***

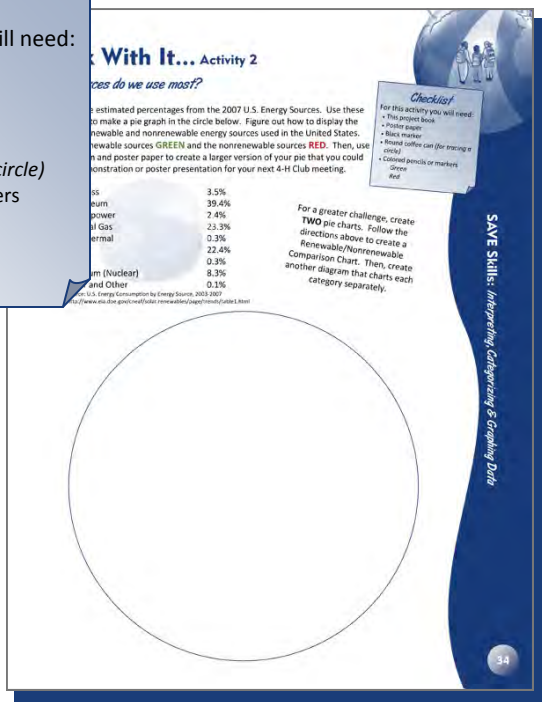
Facilitating the Activity

This activity has been designed for youth to complete on their own. In addition to using the data provided on this page, youth would also benefit from visiting the Energy Information Administration at: http://www.eia.doe.gov. This Web site is full of information and statistics about the world of energy as it exists today, including State Energy Profiles which youth can use to explore energy consumption in their own state.

Checklist

For this activity youth will need:

- This project book
- Poster paper
- Black marker
- Compass or large, round container *(for tracing a circle)*
- Colored pencils or markers
  - *Green*
  - *Red*

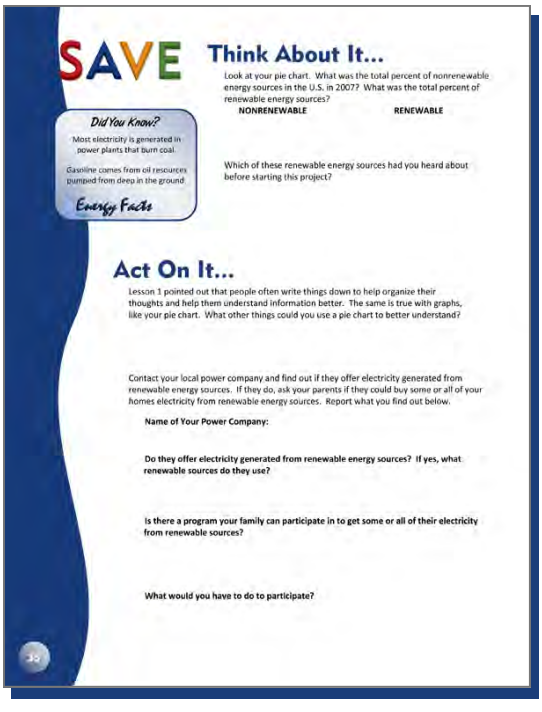


Answers to Think About It...

Look at your pie chart. What was the total percent of nonrenewable energy sources in the U.S. in 2007? What was the total percent of renewable energy sources?

NON RENEWABLE	RENEWABLE
93.4%	6.6%

Are these overall percentages what you guessed? Explain your answer.
Responses vary.



Answers to Act On It...

Lesson 1 pointed out that people often write things down to help organize their thoughts and help them understand information better. The same is true with graphs, like your pie chart. What other things could you use a pie chart to better understand? ***Responses vary, but could include anything that is divided into portions or percentages - like some period of time (a day, week, or even an hour) or the number of people or objects in different categories.***

Contact your local power company and find out if they offer electricity generated from renewable energy sources. If they do, ask your parents if they could buy some or all of your home's electricity from renewable energy sources. Report what you find out below. ***Responses vary.***

1. **Name of Your Power Company:**
2. **Do they offer electricity generated from renewable energy sources? If yes, what renewable sources do they use?**
3. **Is there a program your family can participate in to get some or all of their electricity from renewable sources?**
4. **What would you have to do to participate?**

Facilitating the Activity

This activity challenges youth to identify the sources of the energy they use every day. Specifically, youth need to determine the source of the twelve (12) energy activities they have already recorded. In addition to these twelve, they also need to add on two (2) more activities, filling in all the information to date (forms, transformations, and sources).

Answers to Think About It...

What was the most common source of energy that you have recorded in your journal? ***Most common response should be nonrenewable source (such as coal or natural gas depending on what they learned from their local energy company).***

You have now made several visits to your Energy Journal. Have your thoughts about energy changed? How have they changed? ***Responses vary.***

Is it becoming easier or harder to complete the Energy Journal? Why? ***Responses vary.***

Answers to Think About It...

Think about the many sources that energy can come from. Why does so much of our energy come from nonrenewable sources? ***At one time, the resources of the earth seemed unlimited, so we developed our technologies around using these nonrenewable forms of energy. Now that we know how limited these resources are, we are trying to replace nonrenewable with renewable sources, but it is taking time to develop the new technologies for achieving this.***

What do you think is the most viable renewable energy source for where you live? ***Responses vary based on home state.***

Explain how a different location might have a different renewable energy source that would be more viable. Try to use a specific example. ***Places with high mountains and valleys, such as California, often get high gusts of wind that would make it easier to harness the power of wind.***

SAVE Certification Alert...

The activities for this lesson have been listed at the top of the first journal page. These activities can be found on page 91 and 92 in the youth book. For youth in their second or third year, the Additional SAVE Certification Opportunity for this lesson is: **Use the Web to search out different solar oven designs. Your Web searches might even help you find some great ways people have put this type of technology to help others, just like Janice Kamenir-Reznik did to help the people of Darfur. If you want to read her story, just use your favorite search engine and search for "Janice Kamenir-Reznik, Darfur, solar cooking".**

Chapter 2: Energy Sources

Lesson 4: Does Energy Last Forever?

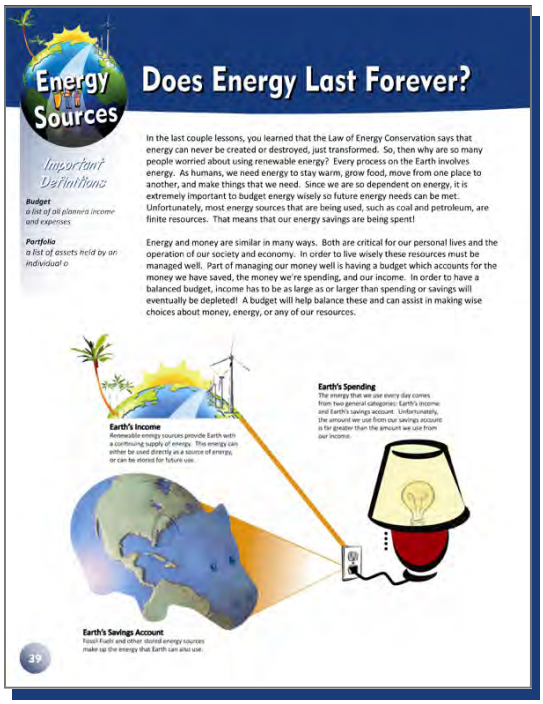
Life Skills: Analyzing & Graphing Data; Researching Problems & Summarizing

Background Basics

The exploration of energy continues in this lesson as youth examine limitations of our resources and the need for budgeting our energy use.

In the last couple of lessons, youth learned that the Law of Energy Conservation says that energy can never be created or destroyed, just transformed. So, then why are so many people worried about running out of energy resources? Every process on the Earth involves energy. As humans, we need energy to stay warm, grow food, move from one place to another, and make things that we need. Since we are so dependent on energy, it is extremely important to budget energy wisely so future energy needs can be met. Unfortunately, most energy sources that are being used, such as coal and petroleum, are finite resources. That means that our energy savings are being spent!

Energy and money are similar in many ways. Both are critical for our personal lives and the operation of our society and economy. In order to live wisely these resources must be managed well. Part of managing our money well is having a budget which accounts for the money we have saved, the money we are spending, and our income. In order to have a balanced budget, income has to be as large as or larger than spending or savings will eventually be depleted! A budget will help balance these and can assist in making wise choices about money, energy, or any of our resources.



Concept Check Questions

Use the following prompts and questions to check comprehension of important ideas throughout the lesson:

- ? What is an energy?
- ? Does energy last forever?
- ? How is energy being spent?
- ? What are renewable energy sources? *Be sure to have them speak about as many types as they can.*
- ? What patterns exist in my daily energy use?

Graphic Notes…

The graphic on this page has been designed to convey a current picture of our energy consumption. The lamp on the right is our energy use (Energy Spending). This energy comes from two places - either nonrenewable resources (Earth's Savings Account) and renewable resources (Earth's Income). One of the two lines has been drawn distinctively thicker, since we draw the majority of our energy from the "savings account".

As an additional activity, youth could create their own depiction of our energy use now, and how it might look if we used more renewable resources.

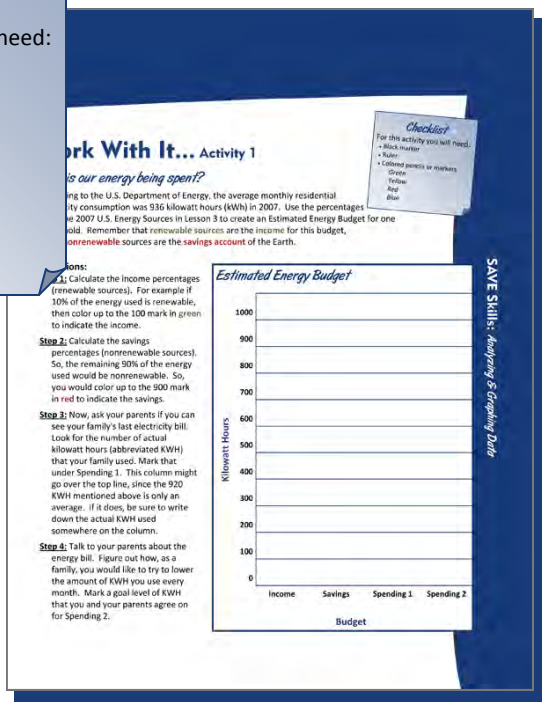
Facilitating the Activity

This activity has been designed for youth to complete on their own. However, once youth have completed this activity, you could lead a group discussion using the So What Do You Think question on page 41. This lesson's question is: **Where can individuals have the greatest impact on their energy budget - changes in income, savings, or in spending? Why?**

Checklist

For this activity youth will need:

- Black marker
- Ruler
- Recent utility bill
- Colored pencils or markers
  - *Green*
  - *Yellow*
  - *Red*
  - *Blue*



Answers to Think About It...

Do you think that your energy budget is balanced? Why or why not? ***Responses vary, but a balanced budget would have enough energy coming from renewable energy sources to provide for all energy needs.***

How do you balance your energy budget in terms of energy income and energy spending? ***Use of nonrenewable sources (savings) would need to be reduced and renewable energy sources (income) would need to be increased. Spending habits may also need to be reduced.***

If energy spending is greater than energy income, what will eventually happen? ***We will run out of savings, meaning that nonrenewable sources will be depleted. If there are no new methods for creating or harnessing energy, then our technology-based world would face serious problems.***

Is there any way to save some of our energy income? ***Energy could be captured and stored from renewable energy sources for future use, like in a battery or fuel cell.***

Answers to Act On It...

What ways did your family discuss to lower their monthly energy spending (kWh)? ***Responses vary, but may include changes in lighting, insulation, and thermostat, as well as doing less laundry, unplugging electronics, driving less, or buying a car with better gas mileage.***

Can you or your family change the amount of energy income or energy savings in your budget? ***Responses vary.***

If you think you can, how could you? ***May include incorporating new technologies into their home such as solar panels on their roof or buying renewable energy credits from your utility company. In fact, some homes generate enough energy that the homeowner is able to sell back "extra" energy to some power companies.***

If not, why not? ***Responses vary, but may include they can't afford to install, or the utility company doesn't offer renewable energy credits.***

G I

Facilitating the Activity

Using both the Florida 4-H SAVE Web site, and other reliable sources, youth will find information about solar, wind, biomass, geothermal, hydro, and tidal energy. In addition to researching the topic, youth will also complete one energy activity from the Web site. More information about these activities is available in the SAVE Teacher's Edition. If youth complete this activity in small groups, allow time for groups to present their findings.

Answers to Think About It...

Which of the two renewable energy sources did you choose to learn about? ***Responses vary.***

What was the most challenging part of the activity you chose to complete from List 1?

How did you address those challenges?
Responses vary.

What are some advantages and disadvantages to the renewable energy sources, or energy income streams, that you studied? ***Responses vary.***

How could using multiple renewable energy sources provide a better energy portfolio? ***Responses vary, but may include that most renewable sources are not always available. So, using more than one resource at a time will help prevent a lapse in available energy.***

Answers to Act On It...

Think about the diversified energy income portfolio for the United States. Do some background research as an energy investment specialist.

Which alternative energy sources would be useful to explore in a state like Florida? ***Responses may include solar, hydro, biomass, and tidal.***

What about a state in the middle of the country like Kansas? ***Responses may include solar, biomass, and wind.***

What about a state in the northern part of the country like Washington state? ***Responses may include wind or tidal.***

Where might geothermal energy be a viable option? ***Responses may include areas with volcanic activity, such as Hawaii.***

More Info for *Did You Know?*

Net zero energy homes (ZEHs) and buildings (ZEBs) are "on-grid" structures that produce renewable energy onsite at a value equal to, or greater than, the building's total annual energy consumption. The "net" portion means the building may use energy from the utility grid (electricity and/or natural gas) during some times of the day (such as at night), but supplies the renewable energy back to the grid during other times in a balance that equals out over the course of a year.

Facilitating the Activity

This activity challenges youth to identify any patterns in the fourteen energy activities in their Energy Journal. Unlike in other lessons, youth will not be adding additional activities to their journal this lesson.

Answers to Think About It...

Are there any patterns occurring from the data in your journal? What are they? ***Responses vary.***

Is your energy budget balanced or unbalanced? How can you improve it? ***Responses vary.***

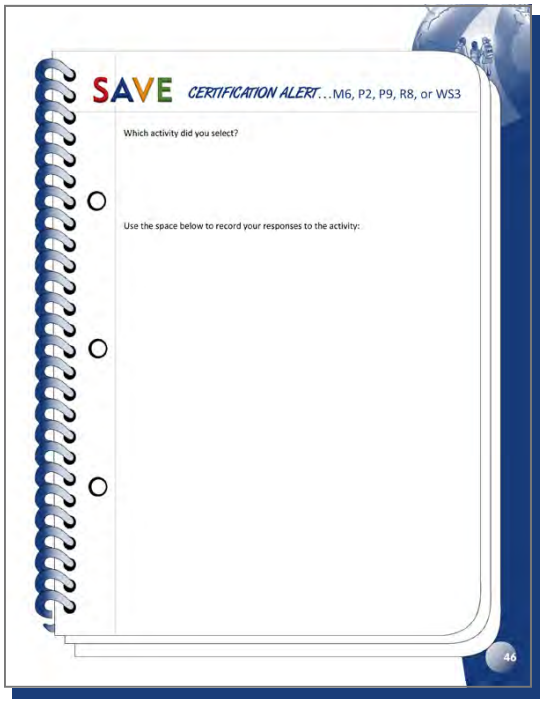
Has writing down your energy entries made you more aware of your energy use? ***Responses vary.***

Answers to Act On It...

Choose **THREE** of your fourteen activities. Describe how you could make these activities more balanced for your budget by either reducing energy spending or increasing energy income. ***Responses vary.***

SAVE Certification Alert...

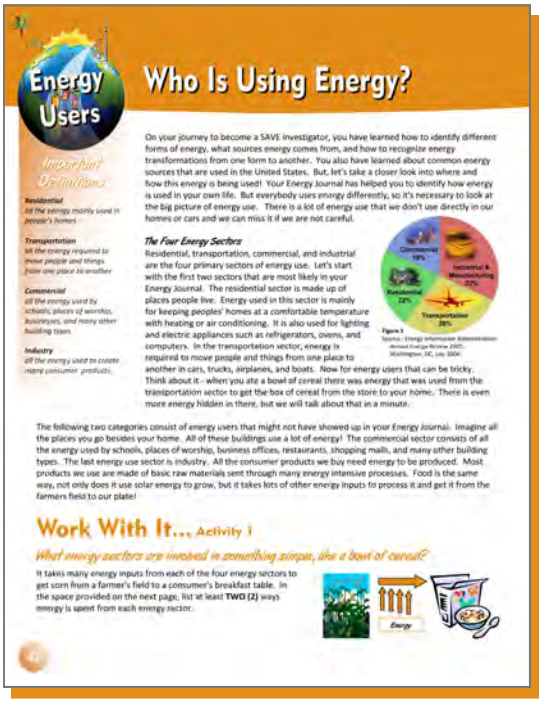
The activities for this lesson have been listed at the top of the first journal page. These activities can be found on page 91 and 92 in the youth book. This lesson does not have an Additional SAVE Certification Opportunity.



Chapter 3: Energy Users

Lesson 5: Who Is Using Energy?

Life Skills: Critical Thinking; Collecting & Recording Data; Analyzing Data


Energy Users

Who Is Using Energy?

On your journey to become a SAVE investigator, you have learned how to identify different forms of energy, what sources energy comes from, and how to recognize energy transformations from one form to another. You also have learned about common energy sources that are used in the United States. But, let's take a closer look into where and how this energy is being used! Your Energy Journal has helped you to identify how energy is used in your own life. But everybody uses energy differently, so it's necessary to look at the big picture of energy use. There is a lot of energy use that we don't use directly in our homes or cars and we can miss it if we are not careful.

The Four Energy Sectors

Residential, transportation, commercial, and industrial are the four primary sectors of energy use. Let's start with the first two sectors that are most likely in your Energy Journal. The residential sector is made up of places people live. Energy used in this sector is mainly for keeping peoples' homes at a comfortable temperature with heating or air conditioning. It is also used for lighting and electric appliances such as refrigerators, ovens, and computers. In the transportation sector, energy is required to move people and things from one place to another in cars, trucks, airplanes, and boats. Now for energy users that can be tricky. Think about it - when you ate a bowl of cereal there was energy that was used from the transportation sector to get the box of cereal from the store to your home. There is even more energy hidden in there, but we will talk about that in a minute.

The following two categories consist of energy users that might not have showed up in your Energy Journal. Imagine all the places you go besides your home. All of these buildings use a lot of energy! The commercial sector consists of all the energy used by schools, places of worship, business offices, restaurants, shopping malls, and many other building types. The last energy use sector is industry. All the consumer products we buy need energy to be produced. Most products we use are made of basic raw materials sent through many energy intensive processes. Food is the same way, not only does it use solar energy to grow, but it takes lots of other energy inputs to process it and get it from the farmers field to our plate!

Work With It... Activity 1

What energy sectors are involved in something simple, like a bowl of cereal?

It takes many energy inputs from each of the four energy sectors to get corn from a farmer's field to a consumer's breakfast table. In the space provided on the next page, list at least TWO (2) ways energy is spent from each energy sector.

Background Basics

On your journey to become a SAVE investigator, you have learned how to identify different forms of energy, what sources provide energy, and how to recognize energy transformations from one form to another. You also have learned about common energy sources that are used in the United States. But, let's take a closer look into where and how this energy is being used! Your Energy Journal has helped you to identify how energy is used in your own life. But everybody uses energy differently, so it's necessary to look at the big picture of energy use. There are many energy transformations taking place to meet our needs beyond those in our homes and cars. We can miss them if we are not careful.

The Four Energy Sectors

Residential, transportation, commercial, and industrial are the four primary sectors of energy use. Let's start with the first two sectors that are most likely in your Energy Journal. The residential sector is made up of places people live. Energy used in this sector is mainly for keeping peoples' homes at a comfortable temperature with heating or air conditioning. It is also used for heating water, lighting and electric appliances such as refrigerators, ovens, and computers. In the transportation sector, energy is required to move people and things from one place to another in cars, trucks, airplanes, and boats. Now for energy sectors that can be tricky.

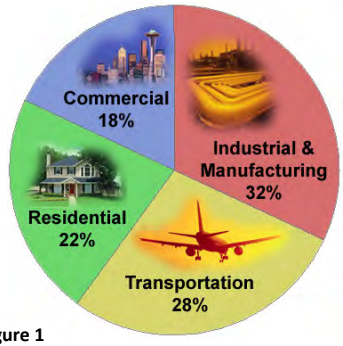


Figure 1
End-use sector shares of total consumption - 2005
Source : Energy Information Administration
Annual Energy Review 2005, Washington, DC, July 2006

The following two energy sectors consist of energy users that might not have showed up in your Energy Journal. Imagine all the places you go besides your home. All of these buildings use a lot of energy! The commercial sector consists of all the energy used by schools, places of worship, business offices, restaurants, shopping malls, and many other building types. The last, and largest, energy use sector is industrial. All the consumer products we buy need energy to be produced. Most products we use are made of basic raw materials sent through many energy intensive processes. Food is the same way, not only does it use solar energy to grow, but it takes lots of other energy inputs to process it and get it from the farmers' fields to our plate!

Facilitating the Activity

G I

Using critical thinking skills, youth think through the energy needed to put a bowl of cereal in front of them in the morning. There is no "right" answer for this activity. However, some possible responses have been listed below.

Energy Usage	*Energy Sector*
Harvesting the cereal grains	Industrial (Agriculture)
Trucking grains to processing plant	Transportation
Processing the grains into cereal	Industrial
Trucking cereal to grocery store	Transportation
Lights for the grocery store	Commercial
Electricity for the cash register	Commercial
Refrigeration for milk (for cereal)	Residential
Energy for washing dishes (clean dishes for putting cereal in)	Residential

G For use in small groups, have each group come up with as many examples as possible in an allotted amount of time (3 minutes). Once time is up, have one group start reading off their list. As they read each of their examples, have the other groups cross it off their own lists (if they came up with the same example). Once the first group finishes, repeat the process with another group, until all the possible examples have been read.

Answers to Think About It...

Had you ever thought about how you can categorize energy transformations according to sectors? Was it helpful? ***Responses vary.***

Were there any sectors that were difficult to figure out? How did you work through that? ***Responses vary.***

Answers to Act On It...

How have your thoughts about energy changed since you started SAVE? ***Responses vary.***

What are some ways you could reduce the amount of energy that goes into your family's food? Think about each energy sector related to food. ***Responses may include growing their own garden to cut down on the energy needed to go to the grocer. They may also purchase food from farmer's markets since these locally produced fruits and veggies don't require as much energy from the industry, commercial, and transportation sectors.***

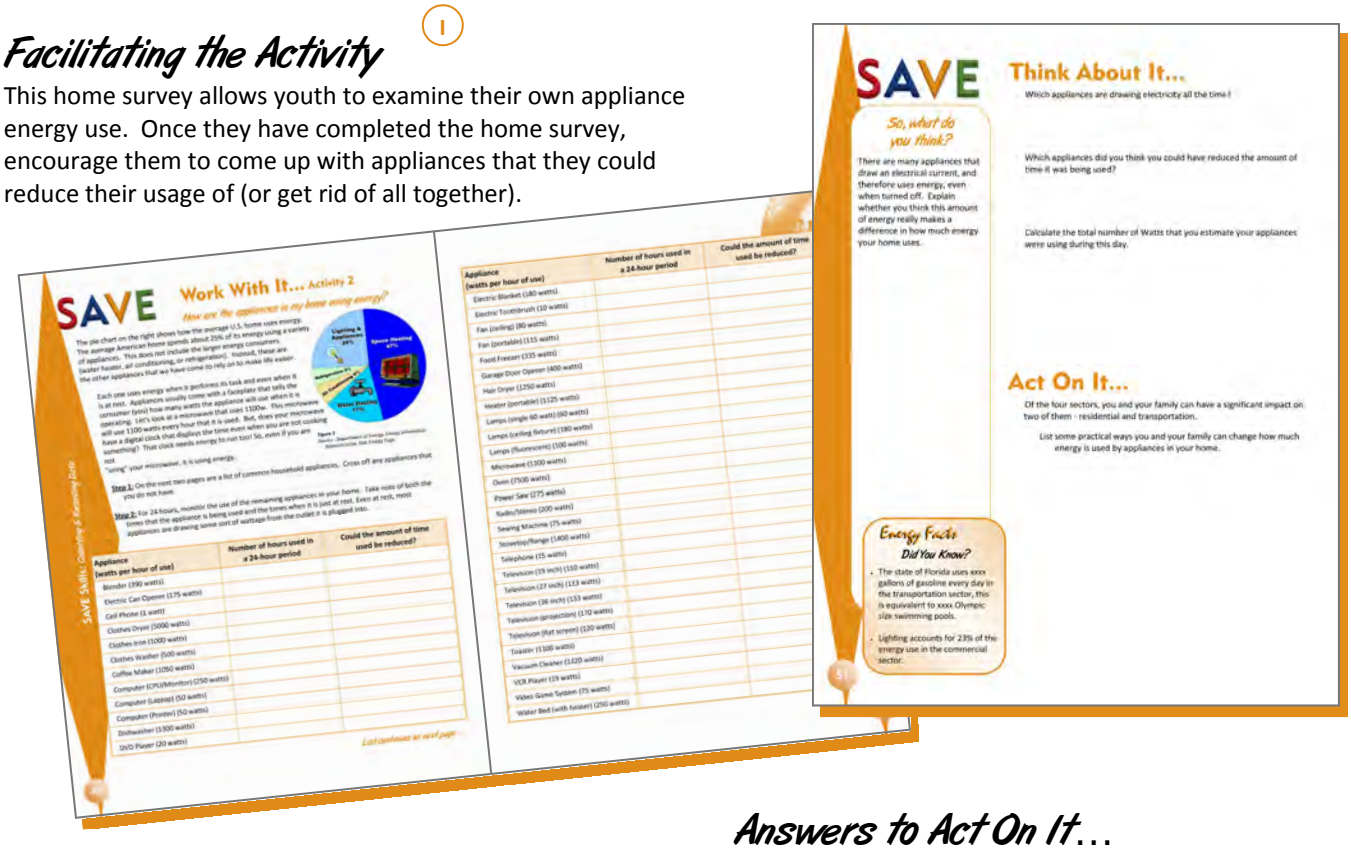
Concept Check Questions

Use the following prompts and questions to check comprehension of important ideas throughout the lesson:

- ? Who uses energy?
- ? What energy sectors are involved in something simple, like a bowl of cereal?
- ? How are the appliances in my home using energy?
- ? What sectors have been involved in our daily energy use?
- ? What types of energy transformations tend to be "behind the scenes?"

Facilitating the Activity

This home survey allows youth to examine their own appliance energy use. Once they have completed the home survey, encourage them to come up with appliances that they could reduce their usage of (or get rid of all together).



Answers to Think About It...

Which appliances are drawing electricity all the time? How do you know? ***Responses may include the refrigerator as well as any digital clocks on an appliance or entertainment equipment.***

Which appliances did you think you could have reduced the amount of time it was being used? ***Responses vary. Encourage youth to describe how it could be reduced, such as reducing loads of laundry.***

Calculate the total number of kilowatt hours that you estimate your appliances were using during this day. ***Responses vary based on what appliances are reduced.***

More Information...

Let youth know that the wattage listed on an appliance is the MAXIMUM power that is drawn by the appliance. If the wattage is not listed on the appliance, they can estimate it by finding the current draw using a clamp-on ammeter (which is available at most electronics stores) and multiplying that by the voltage used by the appliance. Most appliances in the U.S. use 120 volts although large appliances (such as clothes dryers and electric ranges) usually use 240 volts.

Answers to Act On It...

Of the four sectors, you and your family can have a direct impact on two of them - residential and transportation. List some practical ways you and your family can reduce energy spending in these sectors. ***Responses vary.***

You can also have an indirect impact on commercial and industrial sectors. What are some ways you can help reduce energy spending or increase energy income in these sectors? ***Responses vary.***

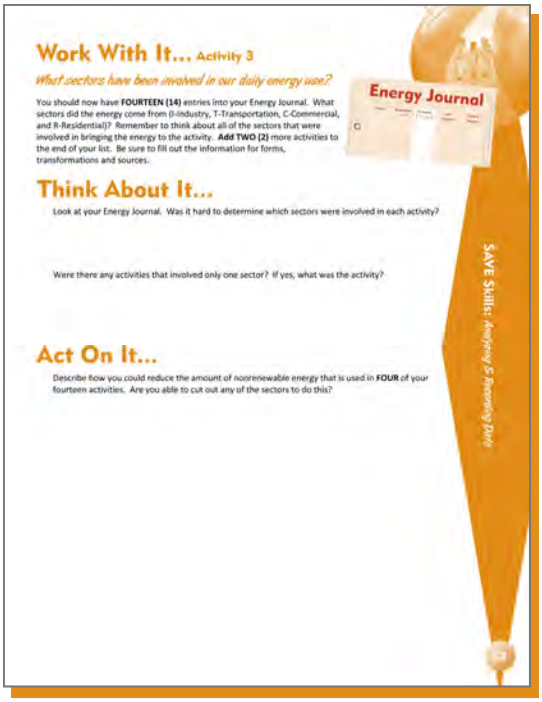
To generate additional discussion or debate, have youth explore their thoughts on this lesson's So What Do You Think? question: ***There are many appliances that draw an electrical current, and therefore use energy, even when turned off. Explain whether you think this amount of energy really makes a difference in how much energy your home uses.***

Did You Know?

- The state of Florida uses approximately 23,030,685 gallons of gasoline every day in the transportation sector, this is equivalent to almost **35** Olympic size swimming pools.
- Lighting accounts for approximately 23% of the energy use in the commercial sector.

Facilitating the Activity

This activity challenges youth to identify the energy sectors throughout their Energy Journal. Specifically, youth need to determine the sectors used in the fourteen (14) energy activities they have already recorded. In addition to these, they also need to add on two (2) more activities, filling in all the information to date (forms, transformations, sources, and sectors).



Answers to Think About It...

Look at your Energy Journal. Was it hard to determine which sectors were involved in each activity? ***Responses vary.***

Were there any activities that involved all the energy sectors? If yes, what was the activity? ***Responses vary.***

Answers to Act On It...

Describe how you could reduce the amount of nonrenewable energy that is used in **FOUR** of your fourteen activities. Are you able to reduce any of the sectors to do this? For example, growing food in a garden reduces the energy from the transportation and commercial sectors. ***Responses vary.***

SAVE Certification Alert...

The activities for this lesson have been listed at the top of the first journal page. These activities can be found on page 92 in the youth book. For youth in their second or third year, the Additional SAVE Certification Opportunity for this lesson is: ***Use the following suggestions to create a list of survey items. Then, interview at least five people who are not related to you or in your class. Be sure you ask permission to interview them and to use their answers for your activity.***

- ***What is the difference between renewable and nonrenewable energy sources?***
- ***Can you name some renewable energy sources?***
- ***Can you name some nonrenewable ones?***
- ***How would you describe your level of energy use?***

Chapter 3: Energy Users

Lesson 6: Is All Energy Seen?

Life Skills: Researching a Question; Predicting Using Numbers; Communicating Information

Background Basics

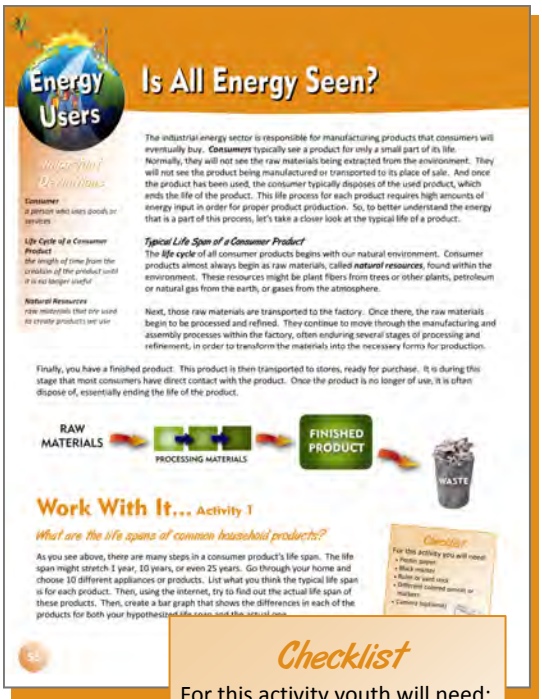
The industrial energy sector is responsible for manufacturing products that consumers will eventually buy. ***Consumers*** typically see a product for only a small part of its life. Normally, they will not see the raw materials being extracted from the environment. They will not see the product being manufactured or transported to its place of sale. Once the product has been used, the consumer eventually disposes of the used product. At this point, it continues to exist in a landfill or some other place. This life process, or life cycle, for each product requires high amounts of energy input in order for proper product production. So, to better understand the energy that is a part of this process, let's take a closer look at the typical life of a product.

Typical Life Span of a Consumer Product

The ***life cycle*** of all consumer products begins with our natural environment. Consumer products almost always begin as raw materials, called ***natural resources***, found within the environment. These resources might be plant fibers from trees or other plants, minerals, petroleum or natural gas from the Earth, or gases from the atmosphere.

Next, those raw materials are transported to the factory. Once there, the raw materials are processed and refined, and continue to move through the manufacturing and assembly processes. These materials often endure several stages of processing and refinement in order to transform the materials into the finished product.

Once you have a finished product, it is then transported to stores, ready for purchase. It is during this stage that most consumers have direct contact with the product. Once the product is no longer of use, it is often disposed of, essentially ending the useful life of the product as waste.



Checklist

For this activity youth will need:

- Poster paper
- Black marker
- Ruler or yard stick
- Different colored pencils or markers
- Camera (optional)

Concept Check Questions

Use the following prompts and questions to check comprehension of important ideas throughout the lesson:

- ? Is all energy visible (or able to be seen)?
- ? What are the life spans of common household products?
- ? How much energy is hidden in a building?

Facilitating the Activity

This activity asks youth to predict the typical life span of common household products. These predictions will most likely be based on their own usage patterns and not the actual life span for the product. Youth are then instructed to use the Internet to investigate the life span of the products. If you choose to have youth perform this activity in small groups, set aside some time for coming back together to discuss each group's findings.

Answers to Think About It...

What products were difficult to find an actual life span for? How did you work through that? ***Responses vary.***

Were there any products for which you correctly guessed the life cycle? Which ones? ***Responses vary.***

Which of the products you selected had the longest life span? The shortest? ***Responses vary based on items selected by youth.***

Are the items in your household lasting longer or shorter than their estimated life cycle? ***Responses vary.***

Answers to Act On It...

If a product has a short life span, then it is most likely to need to be replaced often. This means that there is a lot of energy that is constantly needed to make those new products. What ways can you think of to reduce the amount energy that this requires? Use one of your short life span products to explain your answer. ***Responses vary based on items selected by youth. However, the energy expended in the creation of short life span products can often be reduced by using the 4Rs (discussed in detail in Lesson 9). By reducing amounts, reusing parts, recycling products, or repairing items, we can reduce the amount of energy needed.***

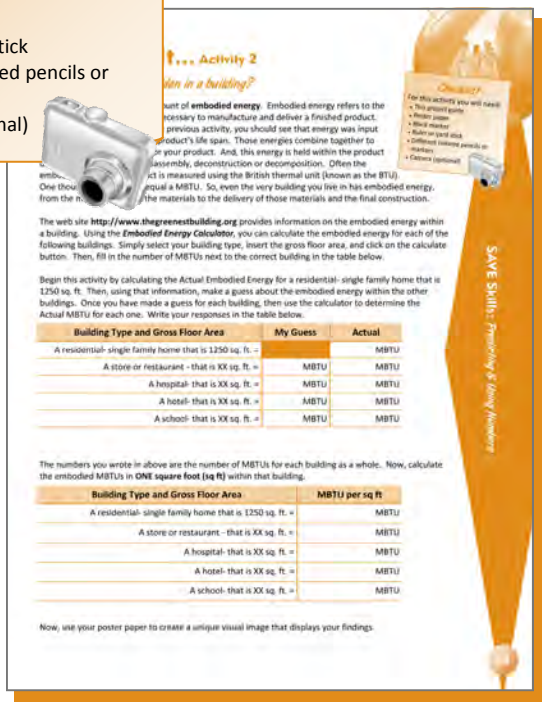
Facilitating the Activity

This activity leads youth through a discussion of the embodied energy found in products. ***Embodied energy*** refers to the total amount of energy that is necessary to manufacture and deliver a finished product. Every product has an amount of embodied energy. Youth will look at the embodied energy of buildings in order to better understand this topic. One Web site, www.thegreenestbuilding.org, provides an embodied energy calculator for determining the energy within the building itself.

Checklist

For this activity you will need:

- This project guide
- Poster paper
- Black marker
- Ruler or yard stick
- Different colored pencils or markers
- Camera (optional)



Answers to Think About It...

Which building did you think had the most embodied energy? Why did you think that? ***Responses vary.***

Which building did you think had the least amount of embodied energy? Why? ***Responses vary.***

Which building ACTUALLY has the most embodied energy per square foot? Which has the least? ***The 120,500 sq ft school has the most, the 1250 sq ft residential home has the least.***

What makes the embodied energy of those buildings so different? ***Size and types of materials used to create the buildings.***

Answers to Act On It...

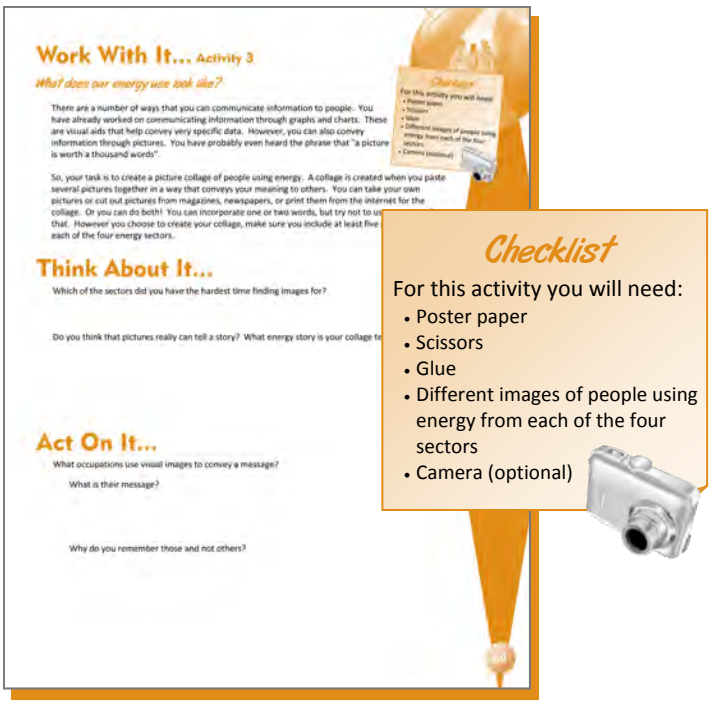
Do you have any ideas about how to reduce the embodied energy of a new building being built? ***Responses vary.***

Explain how the last two lessons have changed your perception of the energy that every product has (from an MP3 player to your home to a piece of toast). Does this change your actions in regards to using or purchasing those products? What might you do differently? ***Responses vary.***

To generate additional discussion or debate, have youth explore their thoughts on this lesson's So What Do You Think? question: ***There has been a recent movement for using less packaging when selling products. These new packages may use recycled materials or simply less materials overall. Explain if you think this change in packaging impacts the embodied energy of that product.***

Facilitating the Activity

This activity asks youth to create a collage about energy use. They will need to create an overall image that uses at least five pictures from each of the four sectors in order to create a picture of people using energy. This activity can also be completed in pairs or small groups. Allow time for groups to share their collage.



Answers to Think About It...

Which of the sectors did you have the hardest time finding images for? ***Responses vary.***

Do you think that pictures really can tell a story? What energy story is your collage telling? ***Responses vary, but look for: relationship among different energy sectors, ways that energy decisions impact the environment, or the common energy transformations in our lives***

Answers to Act On It...

What occupations use visual images to convey a message?

What is their message? ***Responses vary.***

Some people remember things better when they can see them. Do you remember visual things well or do you remember things better some other way (like through hearing or touching the object)? ***Responses vary based on youth learning styles and memory techniques.***

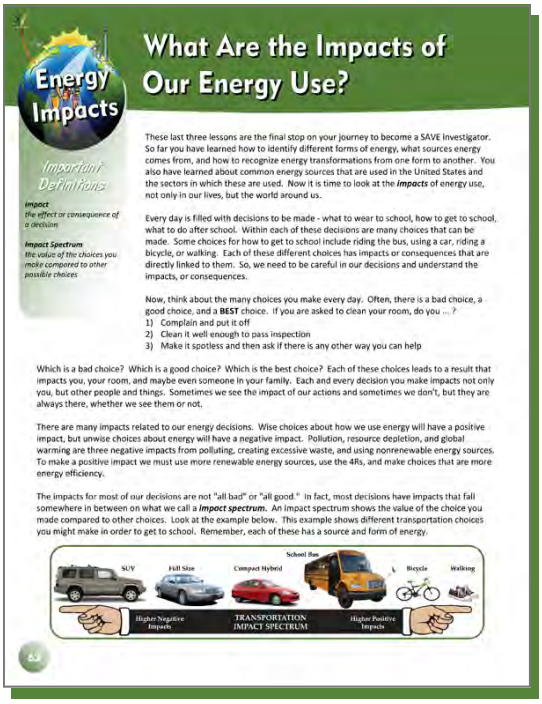
SAVE Certification Alert...

The activities for this lesson have been listed at the top of the first journal page. These activities can be found on page 92 in the youth book. For youth in their second or third year, the Additional SAVE Certification Opportunity for this lesson is a "Free for All!" **At this point, you've learned a lot of great information about energy. Come up with you own project idea and ask your helper if you can do it for your SAVE Project Certification. Design your project to be used as a 4-H fair exhibit, a demonstration for your class or club, or an upcoming 4-H county event.**

Chapter 4: Energy Impacts

Lesson 7: What Are the Impacts of Our Energy Use?

Life Skills: Critical Thinking; Collecting & Recording Data; Comparing Data; Analyzing Data & Critical Thinking



Background Basics

These last three lessons are the final stop on your journey to become a SAVE investigator. So far you have learned how to identify different forms of energy, what sources energy comes from, and how to recognize energy transformations from one form to another. You also have learned about common energy sources that are used in the United States and the sectors in which these are used. Now it is time to look at the ***impacts*** of energy use, not only in our lives, but in the world around us.

Every day is filled with decisions to be made - what to wear to school, how to get to school, what to do after school. Within each of these decisions are many choices that can be made. Some choices for how to get to school include riding the bus, using a car, riding a bicycle, or walking. Each of these different choices has impacts or consequences that are directly linked to them. So, we need to be careful in our decisions and understand the impacts, or consequences.

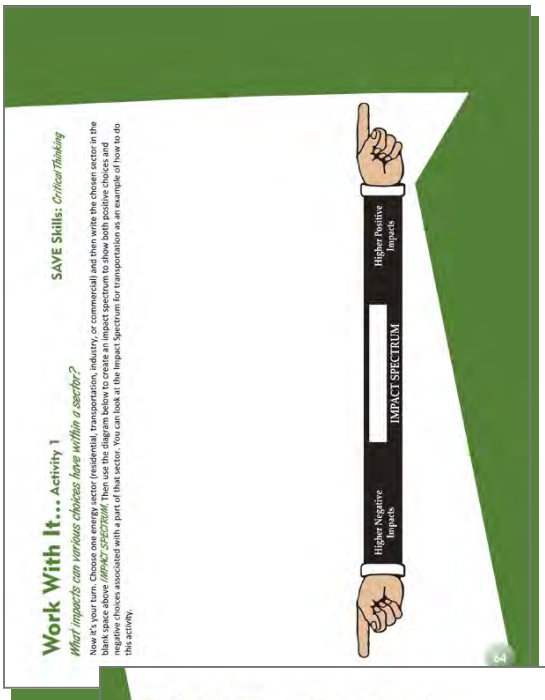
Now, think about the many choices you make every day. Often, there is a bad choice, a good choice, and a **BEST** choice. If you are asked to clean your room, do you ... ?

1) Complain and put it off
2) Clean it well enough to pass inspection
3) Make it spotless and then ask if there is any other way you can help

Which is a bad choice? Which is a good choice? Which is the best choice? Each of these choices leads to a result that impacts you, your room, and maybe even someone in your family. Each and every decision you make impacts not only you, but other people and things. Sometimes we see the impact of our actions and sometimes we don't, but they are always there, whether we see them or not.

There are many impacts related to our energy decisions. Wise choices about how we use energy will have a positive impact, but unwise choices about energy will have a negative impact. Pollution, resource depletion, and global warming are three negative impacts from polluting, creating excessive waste, and using nonrenewable energy sources. To make a positive impact we must use more renewable energy sources, use the 4Rs (Reduce, Reuse, Repair and Recycle), and make choices that are more energy efficient.

The impacts for most of our decisions are not "all bad" or "all good." In fact, most decisions have impacts that fall somewhere in between on what we call an ***impact spectrum***. An impact spectrum shows the value of the choice you made compared to other choices. Look at the example below. This example shows different transportation choices you might make in order to get to school. Remember, each of these requires a source of energy and involves various energy forms undergoing transformations.



To generate additional discussion or debate, have youth explore their thoughts on this lesson's So What Do You Think? question: ***Is it important to realize both the positive and negative choices that exist for decisions you make? Explain your answer.***

Facilitating the Activity

G I

Youth are asked to create their own Impact Spectrum for one of the four sectors. If youth are having difficulty with this concept, youth may complete this in pairs or small groups. Once complete, have youth explain their spectrum and why they placed the choices in the positions that they did.

Answers to Think About It...

Which sector did you choose to use? ***Responses vary.***

How many choices were you able to include? ***Responses vary, but encourage youth to include at least five choices.***

Which choice did you think had the most positive impact? Why? ***Responses may include choices that limit waste production and promote clean energy use, reduce nonrenewable energy consumption, or increase renewable energy use.***

Which choice did you think had the most negative impact? Why? ***Responses may include choices that are bad for the environment, increase pollution, or increase energy consumption.***

Is there ever a perfect choice? Explain your answer. ***There is never a "perfect choice." Every choice has some consequence. Our job is to minimize the negative impacts and maximize the positive impacts that we might have on the world around us.***

Answers to Act On It...

Think about your lifestyle. Where do your choices usually fall on your spectrum? ***Responses vary.***

How could you apply this type of thinking to other areas of your life? ***Responses vary.***

Concept Check Questions

Use the following prompts and questions to check comprehension of important ideas throughout the lesson:

- ? What are the impacts of our energy use choices?
- ? What impacts can various choices have within a sector?
- ? Where and how is my home using energy?
- ? Is there energy that is forgotten?
- ? How do my daily energy choices rate on the impact spectrum?

Checklist

For this activity youth will need:

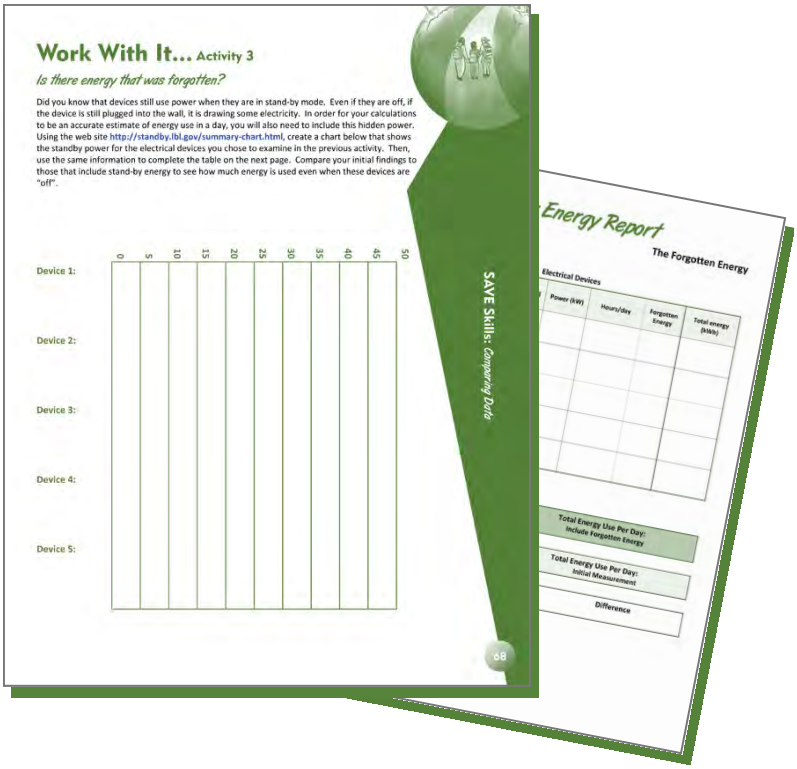
- This project guide
- Energy meter *(available online)*
- Measuring tape
- Information about the light bulbs being used in your home
- Camera (optional)

Facilitating the Activity

G I

Lesson 5 Activity 2 had youth perform a home survey to examine their own appliance energy use. The next two activities (Activity 2 and Activity 3) continue this exploration of energy use in their home, moving from appliances to other electrical devices, lighting, and air conditioning.

In Activity 2, youth will use an energy meter to measure the amount of energy drawn by electrical devices. Youth can use any device that is able to be plugged into the meter (television, DVD player, lamp, refrigerator), and will measure the equipment in each of its different modes such as "on" and "standby". They will then examine major electricity users - lighting and air conditioning.



Activity 3 introduces youth to the concept of forgotten energy. Often called “phantom energy”, electrical devices continue to pull even when they are in standby mode or even shut off. In order for the daily calculations to be as accurate as possible, youth will investigate the amount of energy drawn by these devices when in standby. The Web site http://standby.lbl.gov/summary-chart.html allows youth to examine the average standby energy drawn by these types of devices to give them a better idea of the hidden energy that their home is using.

Suggestions for Group Work

G Lesson 9 in the SAVE Teacher's Edition has an additional activity that you could incorporate into this lesson as a group activity in order to reinforce the use of energy in a common location. CLASSROOM CONSERVATION QUESTION - allows youth to explore the energy being used in a common location - such as a classroom. This activity is available on the SAVE Web site at www.florida4h.org/SAVE/TeacherEdition.shtml.

Answers to Think About It...

Were there devices that were difficult to measure? ***Responses vary, but may include equipment with different modes of operation or where the plug was difficult to get to.***

How would the results have been different if you had chosen another room to measure? ***Responses depend on the room that has been chosen, but may include that the devices in a kitchen (oven, stove, refrigerator) would draw more electricity than in a bedroom.***

Explain some of the reasons that utility bills often vary from month to month. What are some of the factors that contribute to that variability? ***Responses may include that since air conditioners use so much electricity, utility bills in summer months would naturally be higher because they are being used more often to keep the home at a comfortable temperature. The same is true for heating units during the winter months. Other reasons may include that lights or other devices were left on when they could have been shut off and/or unplugged.***

Answers to Act On It...

Remember, of the four sectors, you and your family can have a direct impact on two of them - residential and transportation.

Offer to use your energy meter to collect energy measurements for a neighbor or where one of your parents work. ***Ask youth to share their findings.***

Ask a parent to show you the electric bill. Ask them how to read the monthly consumption (kWh) and the total cost ($). Collect bills from the last several months if they are available and create a graph of how energy consumption has changed over the months. ***Ask youth to share their findings.***


SAVE Work With It... Activity 4

How do my daily energy choices rate?

You should now have **SIXTEEN (16)** entries into your Energy Journal. Look at these activities and rate each activity on the level of their choices. Use a scale of 1 to 5 with 1 being a more negative choice and 5 being a more positive choice.

Energy Journal

Think About It...

How many positive choices do you think you've made? How many negative ones?

Look at when you made these choices. Have you made more positive choices as you've moved through the project book? Why do you think that is?

Act On It...

What other areas of your life do you have to weigh your personal choices?

Why is it important to think about how your choices might affect not only you, but those around you?

Describe a time when you made either a more positive choice or a more negative choice and how that impacted your life and how it impacted others around you.

SAVE Skills: *Analyzing Data & Critical Thinking*

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SAVE *CERTIFICATION ALERT*...M1, R2, R7, P3, P4, or W1

Additional SAVE *Certification Opportunity*

Write a letter to a county, state, or federal representative. Explain something you have learned about viable energy. Express to them how energy must be used wisely and how everybody must work together to make it happen. Tell them why renewable energy sources need to become our primary energy sources. Then, find the appropriate address for your representative and send the letter to them!

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Facilitating the Activity

This activity challenges youth to rate their energy choices throughout their Energy Journal. Specifically, youth need to determine the sectors used in the sixteen (16) energy activities they have already recorded.

Answers to Think About It...

How many positive choices do you think you've made? How many negative ones? ***Responses vary.***

Explain the possible impacts of one positive choice and one negative choice. Have you made more positive choices as you've moved through the project book? Why do you think that is? ***Responses vary.***

Answers to Act On It...

What other areas of your life do you have to weigh your personal choices? ***Responses may include deciding between doing what I want to do and what I need to do, or between deciding what are wants and what are needs when shopping.***

Why is it important to think about how your choices might affect not only you, but those around you? ***Keeping others in mind when I make choices is important because the impacts affect other people, too.***

Describe a time when you made either a more positive choice or a more negative choice and how that impacted your life and how it impacted others around you. ***Responses vary.***

SAVE Certification Alert...

The activities for this lesson have been listed at the top of the first journal page. These activities can be found on page 92 and 93 in the youth book. For youth in their second or third year, the Additional SAVE Certification Opportunity for this lesson is: ***Write a letter to a county, state, or federal representative. Explain something you have learned about viable energy. Express to them how energy must be used wisely and how everybody must work together to make it happen. Tell them that we need an energy efficient economy and that renewable energy sources need to become our primary energy sources. Then, find the appropriate address for your representative and send the letter to them! Share with them how this will help our state or country be a leader in the energy industry and create more jobs.***

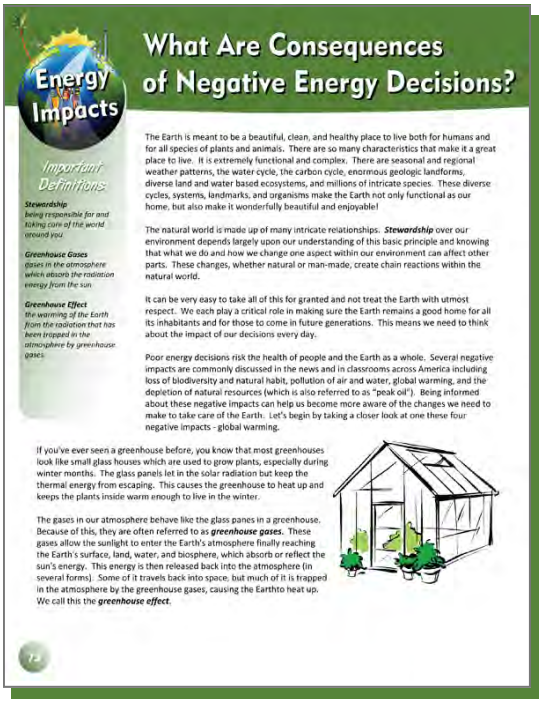
Chapter 4: Energy Impacts

Lesson 8: What Are the Consequences of Negative Energy Decisions?

Life Skills: Collecting & Comparing Data; Researching an Issue & Communicating Information; Collecting Data & Creating a Survey

Background Basics

The Earth is meant to be a beautiful, clean, and healthy place to live both for humans and for all species of plants and animals. There are so many characteristics that make it a great place to live. It is extremely functional and complex. There are seasonal and regional weather patterns, the water cycle, the carbon cycle, enormous geologic landforms, diverse land and water based ecosystems, and millions of intricate species. These diverse cycles, systems, landmarks, and organisms make the Earth not only functional as our home, but also make it wonderfully beautiful and enjoyable!



The natural world is made up of many intricate relationships. ***Stewardship*** over our environment depends largely upon our understanding of this basic principle and knowing that what we do and how we change one aspect within our environment can affect other parts. These changes, whether natural or man-made, create chain reactions within the natural world.

It can be very easy to take all of this for granted and not treat the Earth with utmost respect. We each play a critical role in making sure the Earth remains a good home for all its inhabitants and for those to come in future generations. This means we need to think about the impact of our decisions every day.

Poor energy decisions risk the health of people and the Earth as a whole. Several negative impacts are commonly discussed in the news and in classrooms across America including loss of biodiversity and natural habit, pollution of air and water, global warming, and the depletion of natural resources. Being informed about these negative impacts can help us become more aware of the changes we need to make to take care of the Earth. Let's begin by taking a closer look at one these four negative impacts - global warming.

If you've ever seen a greenhouse before, you know that most greenhouses look like small glass houses which are used to grow plants, especially during winter months. The glass panels let in the solar radiation but keep the thermal energy from escaping. This causes the greenhouse to heat up and keeps the plants inside warm enough to live in the winter.

The gases in our atmosphere behave like the glass panes in a greenhouse. Because of this, they are often referred to as ***greenhouse gases***. The most common greenhouse gases are water vapor, carbon dioxide, and methane, but there are many others. These gases absorb a portion of the solar radiation as it enters the Earth's atmosphere finally reaching the Earth's surface, land, water, and biosphere, which absorb or reflect the remaining portion. Some of this reflected energy travels back into space, but much of it is trapped in the atmosphere by the greenhouse gases. This process causes the Earth to heat up and it is called the ***greenhouse effect***.

Background Basics (continued)

The greenhouse effect is important. Without it, the Earth would not be warm enough for humans to live. But if the greenhouse effect continues to intensify, it will make the Earth warmer than it is suppose to be. This warming process is called ***global warming*** and is caused both by natural causes and human activities. In fact, the global average air temperature near the Earth's surface rose between 1.00 ˚F and 1.65 ˚F during the last hundred years (ending in 2005). And, while 1˚F may not sound like a huge increase, even a little extra warming can cause major problems for the Earth and its many inhabitants and plant species. So, let's take a closer look at this warming process.

Climate Change - A Result of Global Warming

Global warming describes the fact that the average temperature of the Earth is increasing. This alone may not seem like a big deal, especially when the average temperature is only changing by a degree over 100 years. After all, don't most people like warm weather? The real problem with the global warming caused by human activities such as burning fossil fuels is that it can accelerate ***climate change***. It only requires a small temperature change to bring on significant changes in climate. Climate is critical because it determines, directly or indirectly, rainfall accumulation, droughts, storms, wind patterns, ocean current patterns, habitats of both land and aquatic species, and agricultural conditions for growing food. Try to imagine a natural ecosystem or society that is not highly impacted by the climate!

Climate change is a naturally occurring process that has taken place over the history of the Earth. Scientists can use several methods to show how climate has changed over the course of history, and they can also use ***climate models*** to predict how it will change in the future. These models account for ***climate forcings*** which are factors that affect the overall climate. There are natural climate forcings (such as the amount of radiation from the sun, variations in the ocean current, and volcanic eruptions) and there are human-caused or ***anthropogenic forcings*** *(*activities such as emission of greenhouse gases and aerosols, deforestation, and ozone depletion). It is important that conclusions made about climate change come from rigorous scientific analysis. So far, climate scientists from around the world are highly confident that anthropogenic forcings play a large role in climate change.

The Earth's natural systems are so highly tuned that even very small changes in climate can have major impacts on natural systems and human society. For example, consider the difference between water at 0 degrees Celsius and 0.5 degrees Celsius; it is the difference between a solid ice cube and a liquid puddle. Considering that about 70% of the Earth is covered in water, this is an important fact! Or think about a particular species of fish upon which an entire fishing village is dependent for their livelihood. What if that fish would now prefer to dwell one hundred miles north of the village because of only fractions of a degree difference in the region's average water temperature? Finally, consider that water expands as it warms up. What would happen to the shorelines of Florida if all the water in the ocean expanded causing sea levels to rise by several feet?

Concept Check Questions

Use the following prompts and questions to check comprehension of important ideas throughout the lesson:

- ? What are the consequences of negative energy decisions?
- ? How do greenhouse gases affect temperature?
- ? How does climate change affect different countries?
- ? What are some current energy-related environmental issues you hear about in the news? Are the opinions positive or negative?

Facilitating the Activity

G I

Youth are asked to set up an experiment to explore the effects of greenhouse gases on the temperature inside various containers.

Answers to Think About It...

Which container had the highest temperature? The lowest?
Responses vary.

What do you think caused these differences?
Responses vary.

How do these findings relate to what you know about climate change? ***Responses vary.***

Answers to Act On It...

What are some of the ways that your daily lifestyle might contribute to climate change? ***Responses vary.***

Is there anything you can do to limit these impacts? If so, what are they? ***Responses vary.***

To generate additional discussion or debate, have youth explore their thoughts on this lesson's So What Do You Think? question: ***How are you affected by climate change now and how might you be affected in the future? Explain your answer.***

Checklist

For this activity youth will need:

- Poster board
- Items necessary for constructing your display
- Access to the Internet or the library

Facilitating the Activity

G I

Throughout the unit, youth have been asked to give their opinions on a series of questions (So What Do You Think?). These questions often had the potential to generate solid debates on both sides of the issues provided.

This activity asks youth to choose one topic from a list of potentially controversial conservation topics to research and then present as an illustrated talk. These topics may be considered controversial since there are people who believe that these are prime issues to be discussed, while there are others who believe that these are just figments of the imagination, thought up to allow conservationists to play researcher. It is important that youth be encouraged to use reliable and accurate sources for the information they collect, rather than using opinion pieces from a general search engine.

Work With It... Activity 2

What are some current conservation issues?

Checklist
For this activity you will need:
- Poster board
- Items necessary for constructing your display
- Access to the internet or the library

Use either the internet or your local library to find books and articles that talk about one of the current energy topics listed below. Read these articles and create an illustrated talk about the material you read for your club or a local community venue. People often have strong opinions about these topics, but may not be using facts to support their point of view. So, make sure you use wise researching skills to find reliable and accurate sources for this information, such as the U.S. Department of Energy.

- global warming and climate change
- pollution
- loss of biodiversity and natural habitats
- depletion of natural resources and peak oil

Think About It...

Which topic did you choose for your illustrated talk?

What resources did you use? Did they provide conflicting viewpoints?

What were your general conclusions about this topic?

Act On It...

What choices do you make that cause the issues for your topic to be worse?

What choices can you change to lessen the negative impact you have?

Put together an issue debate for your next 4-H club meeting. You can use the topics from this activity or any of the questions from the *So What Do You Think* boxes as prompts for a debate.

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SAVE Skills: *Researching an Issue & Communicating Information*

Answers to Think About It...

Which topic did you choose for your illustrated talk? ***Responses vary.***

What resources did you use? Did they provide conflicting viewpoints? ***Responses vary.***

What were your general conclusions about this topic? ***Responses vary.***

Answers to Act On It...

What choices do you make that would have a negative impact on this conservation issue? ***Responses vary.***

What choices can you change to lessen the negative impact you have? ***Responses vary.***

Suggestions for Group Work

G This activity can be completed as a small group project, with each group being assigned one of the four topics. In addition to this, youth could prepare an Issues Debate session. Separate youth into small groups with an even number of members. Assign topics to each group. Then, separate each group in half, making one half "for" the issue, while the others debate "against" the issue.

SAVE Work With It... Activity 3

What do people think about these conservation issues?

Use what you have learned about these negative consequences to create a basic survey about common beliefs people hold about these impacts. Include these questions plus some of your own:

1. Do you think topics, such as global warming or pollution, are important for scientists to study? Why?
2. Are you affected by climate change?
3. Do you think they are important for you to learn about? Why or why not?
4. Do you think it is important for people to conserve energy? Why?
5. What are simple things everybody can do to conserve energy?
6. What are some primary sources of renewable energy that we could be using instead of fossil fuels?

Ask at least 20 different people to respond to your survey questions. Then, read through all your responses. Discuss your findings with your adult helper.

Think About It...

What would you say was the most common response for questions 1 and 2? Did people seem to think it was someone else's responsibility more than their own?

Were there any surprising responses? If yes, what were they?

Act On It...

You may have noticed that some people are very opinionated when it comes to this topic. This is true in many aspects of life. How did you deal with other people's opinion?

Did you worry about offending people?

How did you keep from doing that?

Were they able to change your thoughts about the issue?

SAVE Skills: *Collecting Data & Creating Surveys*

iv

SAVE *CERTIFICATION ALERT*...P6, P7, P8, R3, R4, or R6

Additional SAVE *Certification Opportunity*

Write a skit which models how someone could effectively communicate the importance of achieving viable energy. Use facts and arguments to make your case convincing, but do not be rude. The skit can be acted out in class to practice how this might be done in real life.

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Facilitating the Activity

G I

Now that the youth have become more familiar with some hot energy topics, this activity challenges youth to create and implement a survey to determine what others think about these controversial issue or topics.

Answers to Think About It...

What would you say was the most common response for questions 1 and 2? What was one thing you learned about opinions on these topics? ***Responses vary.***

Were there any surprising responses? If yes, what were they? ***Responses vary.***

Answers to Act On It...

You may have noticed that some people are very opinionated when it comes to this topic. This is true in many aspects of life. How did you deal with the opinions of others? ***Responses vary.***

Did you worry about offending people? ***Responses vary.***

How did you keep from doing that? ***Responses vary.***

Were others able to change your thoughts about the issue? ***Responses vary.***

SAVE Certification Alert...

I

The activities for this lesson have been listed at the top of the first journal page. These activities can be found on page 92 and 93 in the youth book. For youth in their second or third year, the Additional SAVE Certification Opportunity for this lesson is: **Write a skit which models how someone could effectively communicate the importance of achieving viable energy. Use facts and arguments to make your case convincing, but do not be rude. The skit can be acted out in class to practice how this might be done in real life.**

Chapter 4: Energy Impacts

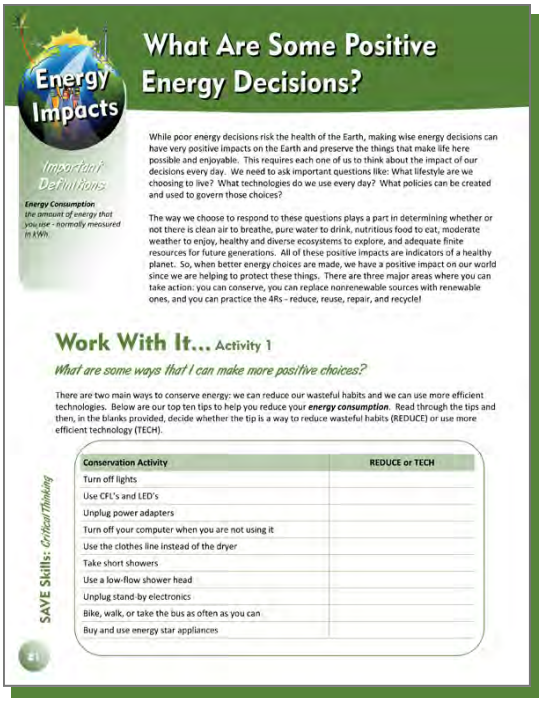
Lesson 9: What Are the Consequences of Positive Energy Decisions?

Life Skills: Critical Thinking; Collecting & Recording Data, Building/Constructing; Implementing Solutions

Background Basics

While poor energy decisions risk the health of the Earth, making wise energy decisions can have very positive impacts on the Earth and preserve the things that make life here possible and enjoyable. This requires each one of us to think about the impact of our decisions every day. We need to ask important questions like: What lifestyle are we choosing to live? What technologies do we use every day? What policies can be created and used to govern those choices?

The way we choose to respond to these questions plays a part in determining whether or not there is clean air to breathe, pure water to drink, nutritious food to eat, moderate weather to enjoy, healthy and diverse ecosystems to explore, and adequate finite resources for future generations. All of these positive impacts are indicators of a healthy planet. So, when better energy choices are made, we have a positive impact on our world since we are helping to protect these things. There are three major areas where you can take action: 1. reduce wasteful habits, 2. use energy efficient technologies, and 3. replace non-renewable energy sources with renewable sources.



Energy Impacts

What Are Some Positive Energy Decisions?

Important Definitions:

Energy Consumption: *the amount of energy that you use - normally measured in kWh.*

While poor energy decisions risk the health of the Earth, making wise energy decisions can have very positive impacts on the Earth and preserve the things that make life here possible and enjoyable. This requires each one of us to think about the impact of our decisions every day. We need to ask important questions like: What lifestyle are we choosing to live? What technologies do we use every day? What policies can be created and used to govern those choices?

The way we choose to respond to these questions plays a part in determining whether or not there is clean air to breathe, pure water to drink, nutritious food to eat, moderate weather to enjoy, healthy and diverse ecosystems to explore, and adequate finite resources for future generations. All of these positive impacts are indicators of a healthy planet. So, when better energy choices are made, we have a positive impact on our world since we are helping to protect these things. There are three major areas where you can take action: you can conserve, you can replace nonrenewable sources with renewable ones, and you can practice the 4Rs – reduce, reuse, repair, and recycle!

Work With It... Activity 1

What are some ways that I can make more positive choices?

There are two main ways to conserve energy: we can reduce our wasteful habits and we can use more efficient technologies. Below are our top ten tips to help you reduce your ***energy consumption***. Read through the tips and then, in the blanks provided, decide whether the tip is a way to reduce wasteful habits (REDUCE) or use more efficient technology (TECH).

Conservation Activity	REDUCE or TECH
Turn off lights	
Use CFL's and LED's	
Unplug power adapters	
Turn off your computer when you are not using it	
Use the clothes line instead of the dryer	
Take short showers	
Use a low-flow shower head	
Unplug stand-by electronics	
Bike, walk, or take the bus as often as you can	
Buy and use energy star appliances	

SAVE Skills: *Critical Thinking*

Facilitating the Activity

Youth begin the final lesson of this unit by learning to identify multiple ways to make positive energy choices through reducing wasteful habits and using more efficient technology.

Concept Check Questions

Use the following prompts and questions to check comprehension of important ideas throughout the lesson:

- ? What are some positive energy decisions?
- ? What are some ways that I can make more positive choices?
- ? What are some practical ways to practice the 4Rs?
- ? Can electricity be made from the motion of air?

Suggestions for Group Work

G This activity can be turned into a small group project. Once youth have completed this activity, have the small groups spend time collecting images, either with digital cameras (if available) or from magazines. Once they have collected each of these images, have them put together a poster or display to educate others on simple ways to reduce the amount of energy they are wasting each day.

Answers to Think About It...

How many activities asked you to reduce wasteful habits? ***There are five ways to reduce wasteful habits - turn off lights, unplug power adapters, turn off your computer, take short showers, and unplug stand-by electronics.***

How many used more efficient technology? ***There are five ways to use more efficient technologies - use CFLs and LEDs; use the clothes line instead of dryer; use a low-flow showerhead; bike, walk, or take the bus; and buy and use ENERGY STAR appliances.***

What are some other activities not listed? ***Responses vary but may include recycling products to cut down on energy needed for processing or making sure water faucets are completely turned off.***

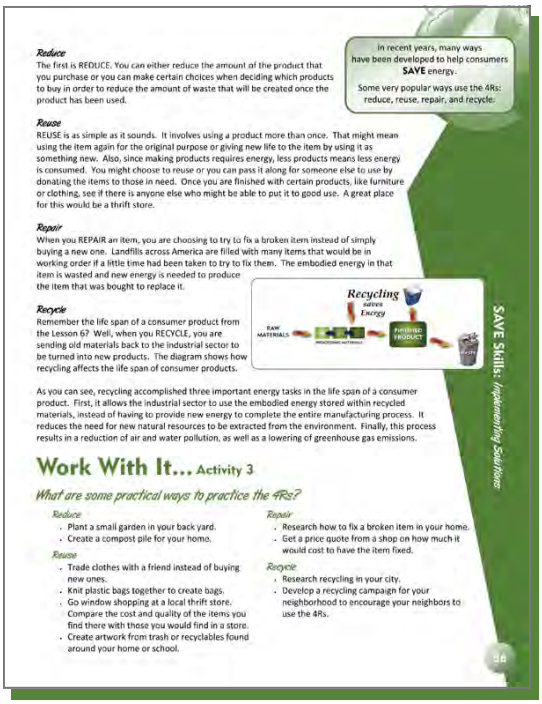
By following these tips, one positive impact you will have on the Earth is that you will be using fewer natural resources. What other impacts might you have? ***Responses vary but may include decreasing the amount of resources that are needed, such as wood or fossil fuels, which in turn would decrease the deforestation and loss of habitat that is taking place in many places around the world. Also, reducing the amount of unclean fuel sources being burned would also decrease the amount of pollution (particulates) being released into the air. Other impacts include reducing pollution of air, water, and ecosystems, preserving natural resources, and reducing the speed and impact of climate change.***

Answers to Act On It...

Which of these activities do you think you and your family could incorporate into your daily life? ***Responses vary.***

What are some of the barriers that have kept you from doing these activities? ***Responses vary but may include the time it takes to dry clothes on a clothesline versus in a dryer, costs of replacing appliances or efficient devices, or the convenience of not having to shut everything off every time you are not using them.***

Is there one that you are willing to agree to do every day for one month? If yes, then which one? ***Responses vary.***



Reduce
The first is REDUCE. You can either reduce the amount of the product that you purchase or you can make certain choices when deciding which products to buy in order to reduce the amount of waste that will be created once the product has been used.

In recent years, many ways have been developed to help consumers SAVE energy.

Some very popular ways use the 4Rs: reduce, reuse, repair, and recycle.

Reuse
REUSE is as simple as it sounds. It involves using a product more than once. That might mean using the item again for the original purpose or giving new life to the item by using it as something new. Also, since making products requires energy, less products means less energy is consumed. You might choose to reuse or you can pass it along for someone else to use by donating the items to those in need. Once you are finished with certain products, like furniture or clothing, see if there is anyone else who might be able to put it to good use. A great place for this would be a thrift store.

Repair
When you REPAIR an item, you are choosing to try to fix a broken item instead of simply buying a new one. Landfills across America are filled with many items that would be in working order if a little time had been taken to try to fix them. The embodied energy in that item is wasted and new energy is needed to produce the item that was bought to replace it.

Recycle
Remember the life span of a consumer product from the Lesson 6? Well, when you RECYCLE, you are sending old materials back to the industrial sector to be turned into new products. The diagram shows how recycling affects the life span of consumer products.

As you can see, recycling accomplished three important energy tasks in the life span of a consumer product. First, it allows the industrial sector to use the embodied energy stored within recycled materials, instead of having to provide new energy to complete the entire manufacturing process. It reduces the need for new natural resources to be extracted from the environment. Finally, this process results in a reduction of air and water pollution, as well as a lowering of greenhouse gas emissions.

SAVE Skills: Implementing Solutions

Work With It... Activity 3

What are some practical ways to practice the 4Rs?

Reduce
- Plant a small garden in your back yard.
- Create a compost pile for your home.

Reuse
- Trade clothes with a friend instead of buying new ones.
- Knit plastic bags together to create bags.
- Go window shopping at a local thrift store. Compare the cost and quality of the items you find there with those you would find in a store.
- Create artwork from trash or recyclables found around your home or school.

Repair
- Research how to fix a broken item in your home.
- Get a price quote from a shop on how much it would cost to have the item fixed.

Recycle
- Research recycling in your city.
- Develop a recycling campaign for your neighborhood to encourage your neighbors to use the 4Rs.

SAVE Energy Facts!

Think About It...

What two activities did you choose to complete?

Did you experience any difficulties in trying to do either of them?

If so, what were they? How did you overcome them?

Do you think that the activity you chose to complete was one that you could commit to doing as a part of your daily life?

If you said yes, why do you think you would be able to commit to this?

If you said no, why not? What would keep you from doing it?

Act On It...

Design another way that you could practice at least one of the 4Rs in your daily life that was not suggested in this activity. Try it out!

Explain which of the three positive choices categories (conserving, replacing nonrenewable energy sources, or the 4Rs) would be the easiest for you and your family to use in your daily lives.

Facilitating the Activity

G I

Many youth have heard about the 3Rs - reduce, reuse, recycle, and some may have also heard the 4th R - repair. Unfortunately, hearing is not always doing. This activity lets youth explore practical ways that they can use the 4Rs in their life, in addition to simply putting a soda can in the recycling bin. Youth can either do these activities individually or as small groups.

Answers to Think About It...

What two activities did you choose to complete? ***Responses vary.***

Did you experience any difficulties in trying to do either of them? If so, what were they? How did you overcome them? ***Responses vary.***

Do you think that the activity you chose to complete was one that you could commit to doing as a part of your daily life? ***Responses vary.***

If you said yes, why do you think you would be able to commit to this?
Responses vary but may include wanting to have a positive impact on the environment or reduce costs when buying used items.

If you said no, why not? What would keep you from doing it?
Responses vary but may include issues with time, convenience, or costs.

Answers to Act On It...

Design another way that you could practice at least one of the 4Rs in your daily life that was not suggested in this activity. Try it out! ***Ask youth to share their experiences.***

Explain which of the three positive choices categories (reducing wasteful habits, using energy efficient technologies, or replacing non-renewable energy sources with renewable sources) would be the easiest for you and your family to use in your daily lives. ***Responses vary.***

Checklist

For this activity youth will need:

- Access to the Internet or the library

Facilitating the Activity

G I

This activity allows youth to explore the energy within the wind as they research the history and current use of wind energy in the United States and across the globe.

Suggestions for Group Work

G Turn this into a design competition. Allow teams to design and create their own pinwheels based on blade designs that they found in their research. Once the pinwheels are completed, put them on display and discuss the pros and cons of each design.

Answers to Think About It...

Based on your research, is wind energy a viable energy source for your state? Explain why or why not. ***Responses vary.***

In your research you most likely saw several blade designs for capturing the power of the wind. Explain which one you think would do the best job (capture the most wind). Draw a sketch if it would help your explanation. ***Responses vary.***

Answers to Act On It...

Wind is a powerful renewable source for energy. But, most people can't install a large wind turbine in their backyard. So, what could you and your family do to replace nonrenewable energy with renewable energy sources? ***Check into local utility programs or state programs to purchase renewable energy credits. Some businesses sell them online but make sure they are legit and well qualified. Maybe get involved in a local community renewable energy project.***

To generate additional discussion or debate, have youth explore their thoughts on this lesson's So What Do You Think? question: ***Our energy use has significant impacts on the world around us. Describe how your personal energy use is connected to a global impact such as pollution, climate change, or loss of habitats.***

The Final Activity... I

The Final Activity asks youth to use their Energy Journal as inspiration to create their own energy concept map. Using images in magazines, newspapers, or from their own camera, youth will create their personal concept map to display their understanding of what energy is, where it comes from, how it is used, and the impacts that our energy use has on the world around them. If possible, encourage youth to use a camera to go on a photo scavenger hunt for these images, taking pictures of what energy means to them. If using a camera is not practical, images from magazines, newspapers or even hand-drawn sketches are fine. The object is to demonstrate a total understanding of the concepts covered throughout this unit.

SAVE Certification Activities

Forms

P1 - Make a poster: draw a timeline from the 1600's until today. Be sure to Include significant events, people, and sources of energy used.

R1 - Read a book or encyclopedia article about a famous inventor whose inventions help us use energy to accomplish things (Thomas Edison, John Vincent Atanasoff, Alexander Graham Bell, Nikola Tesla, Nikolaus August Otto, and many others!). Write a one paragraph summary about their invention and why it is helpful. Include the bibliographical information of the book.

R5 - Find a book or an article on the Internet, in a magazine, or in the newspaper that talks about a new technological invention that relates to using energy better. Read it and write a paragraph about how this invention will help people better use energy. Cut it out and use it to create a presentation, demonstration or exhibit for your 4-H Club.

W3 - Keep the energy journal you completed for homework #1 for two more days. At the end of each day write a paragraph about wise energy decisions you made and the unwise energy decisions you made.

Sources

M4 - Use the Internet to research a variety of nations throughout the world, comparing their use of renewable and nonrenewable energy sources. Create a bar chart to display which countries use more renewable sources than others.

P2 - Make a computer presentation on energy sources. Be sure to include: an introduction, types of nonrenewable energy sources, advantages and disadvantages of nonrenewable energy sources, types of renewable energy sources, advantages and disadvantages of renewable energy sources, and conclusion and personal statement about your beliefs.

P5 - Make your own advertisement video for a particular renewable energy source. Be creative in communicating to your viewers that it is an important subject. Give accurate information but don't be boring!

P9 - Make a picture collage of energy sources and energy technologies. Print them from the Internet or cut them out of newspapers and magazines.

R8 - Find a book or an article on the Internet, in a magazine, or in the newspaper that talks about energy from biomass (ethanol, biodiesel, solid waste). Read it and write a one paragraph summary of what it says. Cut it out and use it to create a presentation, demonstration or exhibit for your 4-H Club.

W2 - Creatively write a page about the following scenario: You and a friend are stranded on a deserted island. You not only need food but you need energy for staying warm, cooking food, making things, and possibly even escaping the island! Write about what sources of energy would you use and how would you use them?

W4 - Compare and contrast different energy sources, both nonrenewable and renewable. Talk about where they come from, how they are used, and whether or not they are reliable.

WS2 - Find out what geographical locations in the world are best for wind generation and what countries are actually using the most wind energy. Give Web site addresses of where you find the information and why you think the information is reliable.

Sources (continued)

WS3 - Where are the main hydroelectric power plants in the United States and what are their names? How do hydroelectric power plants work? Give Web site addresses of where you find the information and why you think the information is reliable.

WS5 - Search for national and international competitions in the area of renewable energy. Make a list of at least five and briefly describe the objective of each one. Give Web site addresses of where you find the information and why you think the information is reliable.

Users

M2 - Make a bar graph by hand or with a computer comparing the electricity usage of all the electronic devices and appliances in your home.

M3 - Compare fuel mileage. If you car is 25% efficient and goes 30 miles on one gallon of gasoline, how many miles could it go on one gallon of gasoline if it was 35% efficient (keeping all other conditions the same)? How far would it go on one gallon of ethanol? Why is it different?

W5 - Write one page about the current energy policy of the United States. What types of energy technologies are we trying to develop? What ways are the government using to encourage people to use energy wisely? Would you do anything different if you were in the government?

W6 - Choose a country besides the United States and learn about what sources of energy they use. Write one page about what sources they use, why they use them, and what advantages and disadvantages they have. Are they working to do anything differently?

WS1 - Compare fuel cell, electric, internal combustion engine, and hybrid vehicles. What are the main power system differences as well as their advantages and disadvantages? Give Web site addresses of where you find the information and why you think the information is reliable.

WS4 - Why should we use all our resources wisely? List 10 things you can do at school and at home that reduce wasted energy. List 5 things you can do at school and at home that reduce wasted water. Give Web site addresses of where you find the information and why you think the information is reliable.

WS6 - Search for companies that design machines and systems that utilize some type of alternative energy. Give the name, location and the main services and/or products that each company provides. Give Web site addresses of where you find the information and why you think the information is reliable.

Impacts

M1 - How many kilowatt-hours (kWh) of energy does your family use at home each day? List each activity, its power use in Watts and the number of hours it is used each day. Then calculate the number of kWh each activity uses per day and the total.

P3 - Invent and build a prototype of something that helps conserve energy at home (less heating and cooling, using heating and cooling more efficiently to reduce waste, less lighting needed, using lighting more efficiently).

P4 - Invent and build a prototype of something that conserves energy in transportation (less traveling by car, makes car more efficient, improves other modes of transportation like biking, walking, or taking the bus).

List continues on next page…

Impacts (continued)

P6 - Make a video documentary of a business or person around your hometown who is using energy or other resources wisely. Be sure to ask permission before videotaping in public!

P7 - Write song lyrics and/or compose music about energy. You may use a popular song and change the lyrics to your own. If you compose music instead of writing lyrics, explain what you are trying to communicate with your music.

P8 - Draw or paint a picture of a beautiful landscape where people live in harmony with the environment and where they do no damage to where they live.

R2 - Find a book or an article on the Internet, in a magazine, or in the newspaper that talks about energy conservation. Read it and write a one paragraph summary of what it says. Cut it out and use it to create a presentation, demonstration or exhibit for your 4-H Club.

R3 - Find a book or an article on the Internet, in a magazine, or in the newspaper that talks about climate change. Read it and write a one paragraph summary of what it says. Cut it out and use it to create a presentation, demonstration or exhibit for your 4-H Club.

R4 - Find a book or an article on the Internet, in a magazine, or in the newspaper that talks about current global energy policy. Read it and write a paragraph about how the United States is involved. Cut it out and use it to create a presentation, demonstration or exhibit for your 4-H Club.

R6 - Find a book or an article on the Internet, in a magazine, or in the newspaper that talks about global water shortage. Read it and write a one paragraph summary of what it says. Cut it out and use it to create a presentation, demonstration or exhibit for your 4-H Club.

R7 - Find a book or an article on the Internet, in a magazine, or in the newspaper that talks about recycling. Read it and write a one paragraph summary of what it says. Cut it out and use it to create a presentation, demonstration or exhibit for your 4-H Club.

R9 - Research the difference between using solar-powered landscape lighting and traditional lighting for a front yard. Look at the difference in product quality, amount of light produced, initial cost, and potential energy savings.

W1 - Creatively write a page about the following scenario:

All fossil fuels completely ran out! You are the scientist that has to decide what energy sources we are going to use and how we are going to use them. Write about how you come up with the best solution to meet everyone's needs. How do you get everyone to only use the energy they need and not waste it?

The Six Questions of Energy

What?

Energy keeps us warm, give us light, and helps us move. Energy is the ability to do work or to cause change and it plays a critical role in each of our lives and in the universe around us. It comes in many different forms. The two primary categories are **potential energy** and **kinetic energy**. Potential energy is stored energy waiting to be used. Kinetic energy is in motion and already being used. At the top of a hill you have potential energy due to gravity and while moving down the hill you have kinetic energy. One form of energy can be changed into another form of energy, which is called an **energy transformation**.

All energy forms come from energy sources. **Renewable energy sources** naturally renew themselves. They include wind, solar radiation, biomass (plants and other biological materials), geothermal, waves and tides, and hydro power. Renewable sources are all around us but their energy is spread out and hard to capture.

Because we need so much energy for the way we live, we use **non-renewable energy sources** whose energy is very concentrated and easier for us to capture and use. These include petroleum (gasoline and oil), coal, and uranium (nuclear). Non-renewable means they cannot replenish as fast as they are used.

Where?

Energy is all around us and even inside of our bodies! We feel energy everyday when our skin absorbs the sun's radiation or when the wind blows against us. Energy sources come from many places. For instance, a non-renewable energy source such as coal or petroleum is taken from deep within the ground. Solar radiation which is a renewable source comes from the sun, which is 93 million miles away. Energy is transformed and used by natural processes all over the universe. Humans, animals, and plants transform and use energy all over the Earth!

Who?

Everybody uses energy. Humans use it for their homes, businesses, cities, farms, cars, and to power their own bodies. Some people do not use very much energy because they either choose not to or they cannot afford it. The U.S. and other industrialized countries use much more energy than developing countries. Since non-renewable energy such as oil is found more in some places than others, certain countries have a much larger supply than others. For instance, the United States imports almost all its oil from other countries such as Canada and Saudi Arabia which costs a lot of money.

Animals also use energy primarily in the form of food, which they eat to nourish their bodies. Plants use energy in the form of solar radiation to perform photosynthesis in order to grow and reproduce.

Why?

Without energy the universe would not exist! Every natural process involves the transformation or use of energy. As humans, we need energy to stay warm, grow food, move from one place to another, and make things that we need. It is extremely important that we all know about energy and work towards making sure energy is available for the future. We must also use energy in a way that does not damage the Earth, since we also need clean water, air, and a healthy environment with beautiful plants and animals.

How?

Energy is never created, but is captured from an energy source. It is then transported and stored until it is needed. When needed, it is converted to kinetic energy with machines such as electric motors, engines, heaters, or air conditioners. A **machine** uses energy to do work or accomplish a task.

Electricity and liquid fuels are the two most common forms of energy that we use. The liquid fuel, gasoline, is distributed at gas stations along the road and is converted to kinetic energy by a gasoline engine. To distribute electricity, many countries have electric grids that deliver electrical energy many miles through power lines straight to each building. This electricity is generated at large power plants mostly using nonrenewable fuel sources like coal and oil. It can also come from renewable energy sources such as wind turbines, hydro power stations, or solar energy parks. Electricity can also be generated locally on a small scale from a variety of sources. Electricity is a form of energy that is very useful because many helpful electrical machines have been invented such as the electric motor, light bulb, and the computer.

Humans and animals store potential chemical energy from food as fat in their body and their muscles convert it to kinetic energy when they move. Many devices have been invented to use animal and human energy such as the horse carriage or the bicycle. Exercise makes your muscles better at converting the potential energy in food to kinetic energy for running, jumping, pedaling, and swimming.

Even though we often say that we use energy, in fact we only transform it to do work or accomplish something. Energy is never created or destroyed but it often changes from one form to another. This can happen by a chemical reaction, transfer of heat, or by moving an object. Some kinds of energy are more useful than others such as a charged battery is more useful than a bowl of hot water even though they both contain energy. When energy changes from one form to another some is always lost as heat, but energy never disappears or gets destroyed. This is called the **Law of Energy Conservation.**

When?

Energy has existed since the beginning of time and it will exist forever as far as we know. We could not live without it. Non-renewable energy sources are limited in supply and will therefore run out on Earth at some point if we continue to use them. Scientists disagree about when these sources will run out, but they agree that they will.

Renewable energy sources are unlimited in supply and will not run out if they are properly used. It is important that everyone achieves **viable energy** by only using the energy that they need and also working together to make renewable sources our primary sources of energy as soon as possible. Since renewable sources are normally more spread out and difficult to capture, they can be more expensive and also less reliable at times. For instance, solar radiation can only be captured and used during the day and the wind can only be captured and used when it's windy. But they never run out! Currently the United States uses only about 6% renewable energy (DOE), but there are some countries which use almost 100% renewable energy.

The 4-H Motto
To make the best better.

The 4-H Pledge
I pledge

my head to clearer thinking,

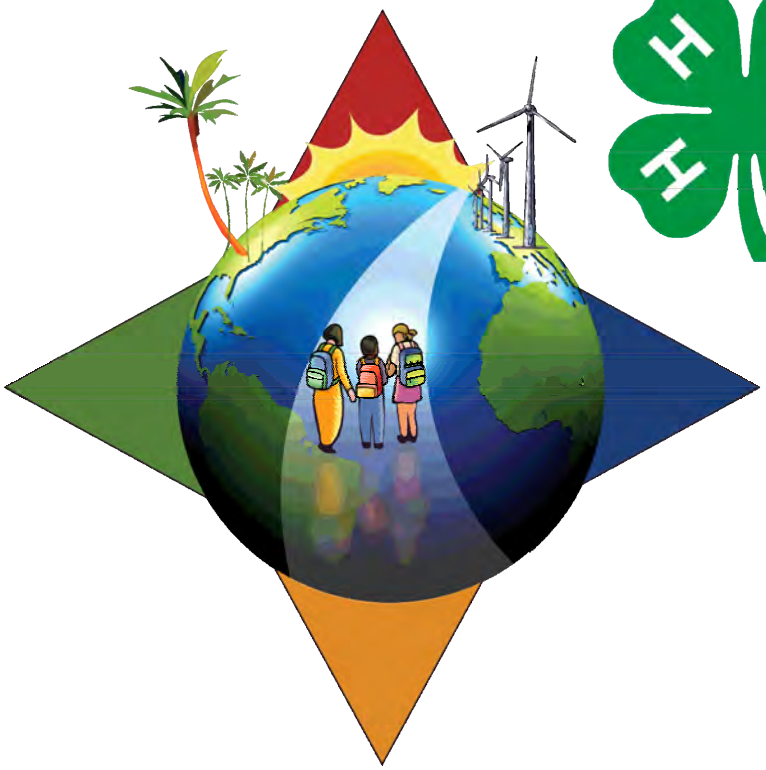
my heart to greater loyalty,

my hands to larger service, and

my health to better living,

for my club, my community,

my country and my world.



Visit the 4-H Web site for more information: http://www.florida4h.org

This document is 4H EGL 61, one of a series of the 4-H Youth Development Department, UF/IFAS Extension. Original publication date January 2011. Reviewed June 2014. Visit the EDIS website at http://edis.ifas.ufl.edu.

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