4H EGM 50

Youth Book

SAVE

Steps in Achieving Viable Energy

UF | IFAS Extension
UNIVERSITY of FLORIDA

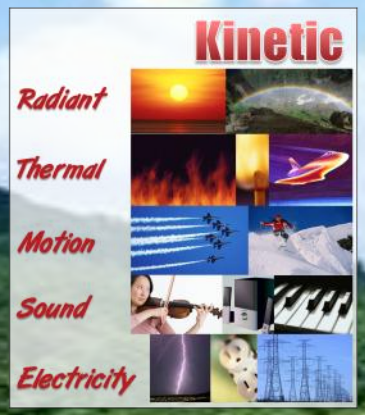
Engineering

ENERGY

Basic Forms

Potential

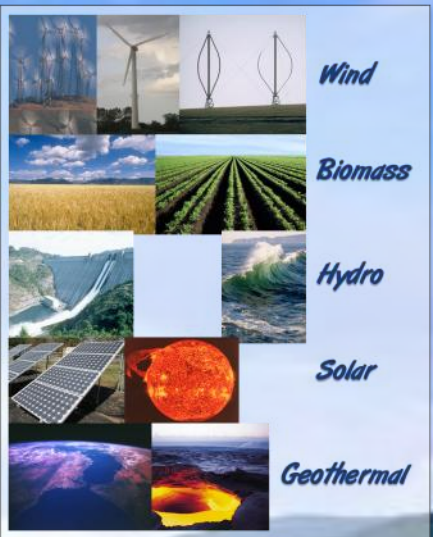
Kinetic



Sources

Nonrenewable Energy

Renewable Energy



Impacts

Negative Choices

Positive Choices

Users

Energy Sectors

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4-H

GATOR Engineering

Welcome to SAVE

This project takes you on a journey through the exciting world of energy. 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 of 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!

You start your journey by learning about what energy is, the various forms in which energy can exist, and how it can transform from one form into another. Once you have mastered the forms in which energy can exist, you will search out where that energy comes from by investigating the wide variety of energy sources. Your journey continues as you investigate the different ways, or sectors, in which energy is used, both through natural and man-made processes. Finally, your journey will conclude with a closer look into the ways the world you live in is impacted as you explore both the positive and negative impacts of our energy use.

Once you complete this project book, you will be part of a very special group; you will be SAVE certified. This means you will have taken Steps in Achieving Viable Energy (SAVE). You will not only know about alternative sources for energy, but you will also have discovered several ways that you and your family can make a difference and have a more positive impact on our world.

Table of Contents

Get Ready for Your Journey

Like any wise traveler it is important to know where you are going before you begin. The steps below will help you become familiar with the project book.

Step 1:

Flip through your project book. You will see **FOUR** major chapters. Each chapter has a specific color to help you quickly identify which section you are working on. The title for each chapter is found on the first page of every lesson in the top corner - just look for the **SAVE** globe! Also in that area are any ***Important Definitions*** that you will need to know throughout that lesson.

List the titles for each of the chapters in **SAVE:**

Chapter 1:

Chapter 2:

Chapter 3:

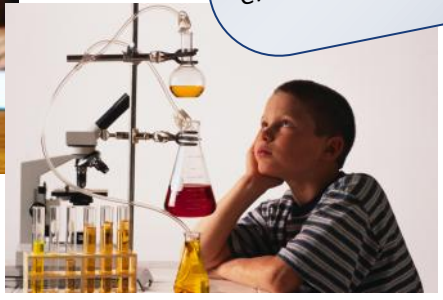
Chapter 4:

Step 2:

Now, take a closer look at the **Work With It** activities in each lesson of the book. This section describes the different activities that you will complete for each lesson. There is a checklist of the materials you will need to collect before you begin the activity.

Step 3:

Following each **Work With It** activity, you will also find questions to answer in the sections **Think About It** and **Act On It**. This will help you reflect on what you did and think about how you can apply those ideas and skills to other situations as steps to achieving viable energy now and in the future.



Step 4:

In addition to the **Work With It** activities, there are several projects for you to complete in order to receive your Certificate of Completion. Each lesson has a **SAVE** *Certification Alert* identifying activities you can choose from for that specific lesson. Turn to **page 91** to see all the activities listed.

Some projects are easier than others, so try to balance your choices. Choose one that seems easy and one that seems more difficult (rather than choosing two easy ones or two hard ones). Discuss your selections with your adult helper, especially if you are not sure which you would like to complete.

Planning and determining your final destination is an important step in any journey. For each chapter, list one SAVE Certification Activity you plan to do as part of this project for the year.

Chapter 1:

Chapter 2:

Chapter 3:

Chapter 4:

Step 5:

Finally, there may be some topics that you will want to explore more. Special projects, called *Additional* **SAVE** *Certification Opportunities*, have bee included in each chapter to help you do just that. Talk to your helper about your selection before you begin these activities since many of these projects are more challenging than the others in the project book.

List one Additional **SAVE** Certification Opportunity *you might want to complete:*

Now that you have explored the project book, let's look at what you have to accomplish to become SAVE *Certified.*

Did You Know?

This project book has been designed for use over multiple years. Each level has increasingly more activities that you need to complete for **SAVE** Certification.

FIRST year:

- Complete all the **Work With It** activities.
- Complete **ONE SAVE** ***Certification Alert*** project in each chapter (four total).

SECOND year:

In addition to the requirements for FIRST year:

- Complete **BOTH SAVE** ***Certification Alert*** projects for each chapter (nine total).
- Complete **ONE** ***Additional*** **SAVE** ***Certification Opportunity*** project from any chapter.

THIRD year:

In addition to the requirements for FIRST and SECOND year:

- Complete the ***Additional*** **SAVE** ***Certification Opportunity*** projects from any remaining chapter (five total - one from SECOND year, four from THIRD year).
- Present the information learned from this project to a group of peers or members of your community.

FIRST Year: *Activity Record*

Now you know where you are going, but it's also important to record where you have been. Use the space below to record the date you finish each chapter. After you complete each chapter, ask your helper to review your work and initial in the space provided.

Chapter 1: Energy Forms

Date Completed: _____

Which **SAVE** ***Certification Alert*** project did you complete? _____

Helper's initials: _____

Chapter 2: Energy Sources

Date Completed: _____

Which **SAVE** ***Certification Alert*** project did you complete? _____

Helper's initials: _____

Chapter 3: Energy Users

Date Completed: _____

Which **SAVE** ***Certification Alert*** project did you complete? _____

Helper's initials: _____

Chapter 4: Energy Impacts

Date Completed: _____

Which **SAVE** ***Certification Alert*** project did you complete? _____

Helper's initials: _____

SECOND Year: *Activity Record*

After you complete each project, ask your helper to review your work and initial in the space provided.

Which **SAVE** *Certification Alert* projects did you complete?	Date Completed:	Helper's initials:
Chapter 1: Energy Forms		
Chapter 2: Energy Sources		
Chapter 3: Energy Users		
Chapter 4: Energy Impacts		
Which *Additional* **SAVE** *Certification Opportunity* projects did you complete?	Date Completed:	Helper's initials:

THIRD Year: *Activity Record*

After you complete each project, ask your helper to review your work and initial in the space provided.

Which *Additional* **SAVE** *Certification Opportunity* projects did you complete?	Date Completed:	Helper's initials:
Presented **SAVE** project to a group from your community:	Date Completed:	Helper's initials:

Let's do a quick science review before we begin . . .

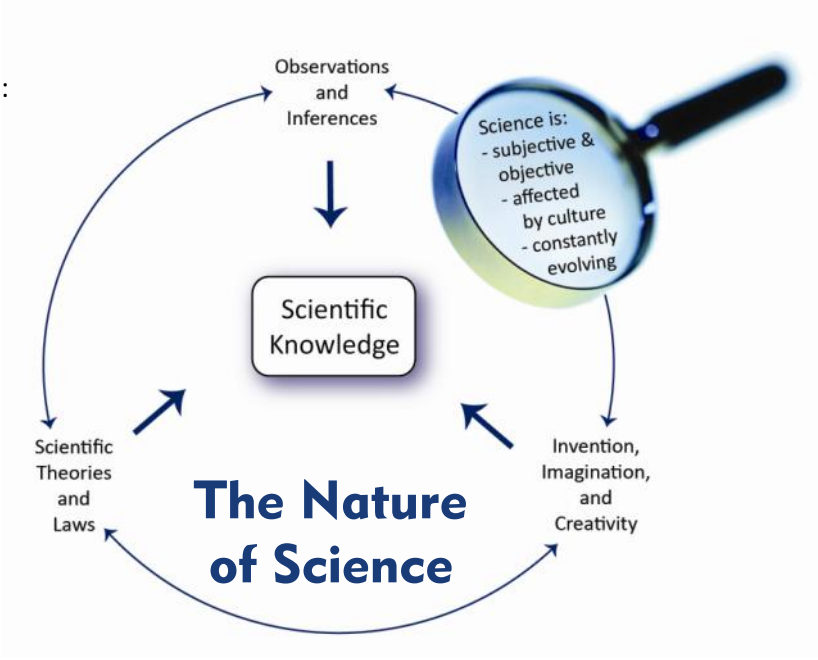
SAVE Science Review

This project book uses many terms and processes you may already know, but in case your science skills are a little rusty, let's do a quick review.

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 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)

The Toolbox

Observation
a statement that describes natural phenomena - observations must be based on information from your senses and confirmed by other observers with ease.

Research Question
the main question that drives and guides the investigation.

Hypothesis (*pl.* ***Hypotheses)***
a possible explanation for some observation, phenomenon, or scientific problem that can be tested.

Test (*or* ***Experiment)***
a particular process or method used to investigate answers to the questions posed in the research.

Data
facts, collected from observations, and from which conclusions can be made.

Assumption
something that is taken for granted before or during the scientific process that may or may not be true.

Inference
a logical conclusion based on the observations made.

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.

Certificate of Completion

I certify that _____ has successfully completed the requirements of the

SAVE Steps in Achieving Viable Energy Project Book

Year 1	Year 2	Year 3
Date Completed:	Date Completed:	Date Completed:
Helper's initials:	Helper's initials:	Helper's initials:

So, 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.

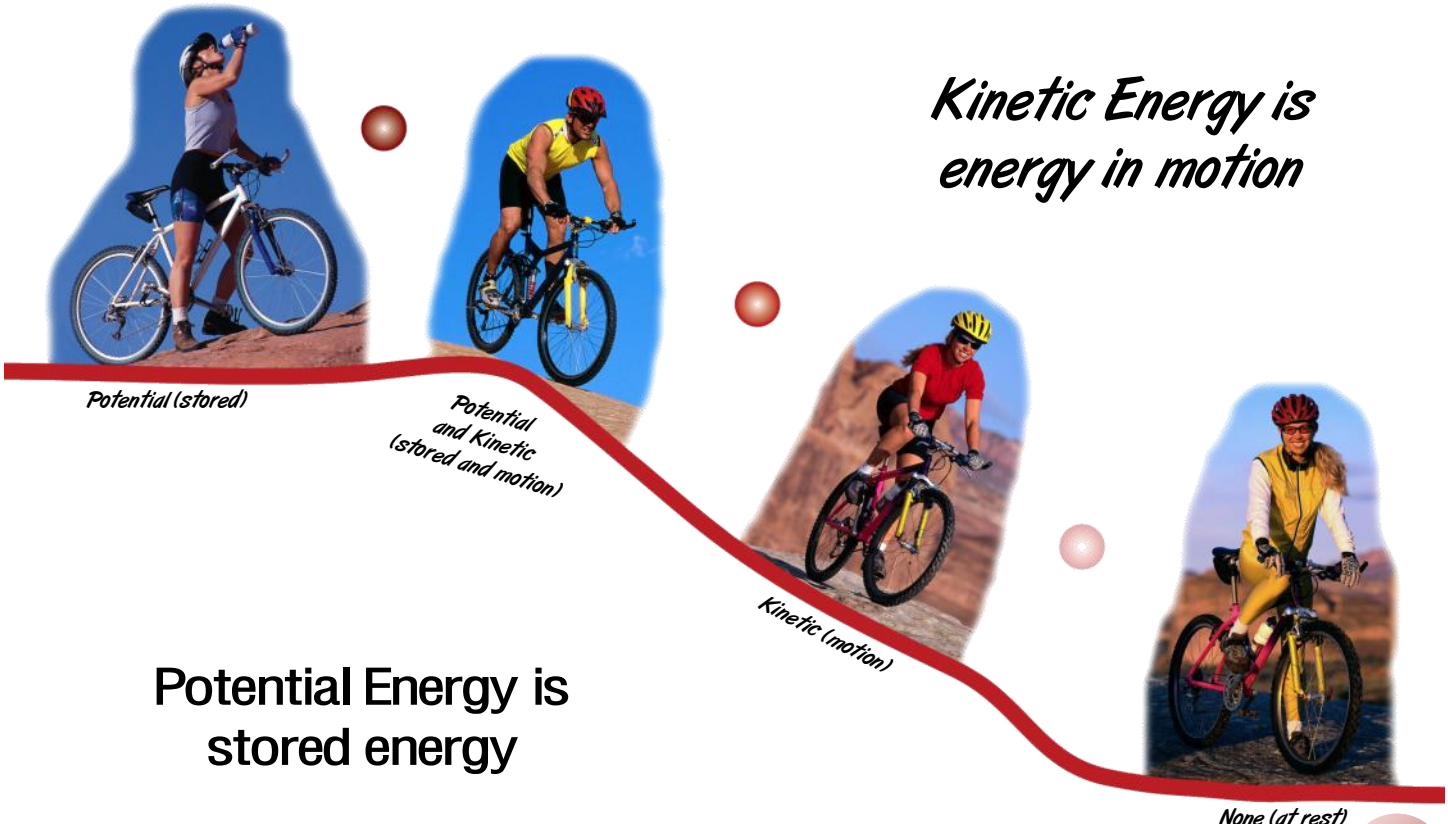
Important Definitions

Energy Forms
scientific terms used to classify energy

Potential Energy
stored energy

Kinetic Energy
energy in motion

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.



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 category 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?

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 Facts

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.

SAVE Work With It... Activity 2

What are the different types of energy?

Test how well you are understanding where to find some of the different energy forms. Label each picture below with the correct form and category. Remember to use the *Important Definitions* on the next page if you need help.

Form:

Category:

Form:

Category:

Form:

Category:

Form:

Category:

Form:

Category:

Form:

Category:

Form:

Category:

Form:

Category:

Think About It...

What are some similarities between potential and kinetic energy forms?

What are some of the differences?

Act On It...

Think back to your walk. Describe a time when you were using kinetic energy.

Now, describe a time when you had just potential energy.

Finally, describe a time when you were experiencing both kinetic and potential energy.

Important Definitions

Thermal
a form of kinetic energy; occurs as molecules in a substance vibrate back and forth; measured by the temperature of the object.

Radiant
a form of kinetic energy; this occurs when a warm or hot object gives off infrared electromagnetic radiation

Sound
a form of kinetic energy; sound waves move through a material such as air

Electrical
a form of kinetic energy; occurs when negatively charged electrons flow through an electrical circuit.

Motion
a form of kinetic energy; occurs when there is a change in the position or location of something.

Chemical
a form of potential energy; energy is stored within molecular bonds.

Mechanical
a form of potential energy; it is the potential energy that an object has because of its position.

Gravitational
a form of potential energy; this energy comes from the position of an object and the force of gravity acting on it.

Energy Facts — Common Energy Forms

Electricity and **liquid chemical fuels** are two common forms of energy that we use. They can come from both renewable sources and nonrenewable sources. We also use the radiant energy from the sun which is transformed into thermal energy when it hits the Earth, keeping us warm. Radiant energy also causes all our food crops to grow when it is absorbed by the earth's atmosphere and surface.

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.

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 documenting this kind of information helps people?

SAVE CERTIFICATION ALERT…R1 or W3

Look at the Certification Activities under the ***Forms*** section on page 91. Read the requirements for each of the activities suggested above and then choose which one you would like to complete.

Which activity did you select?

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

Does Energy Always Stay the Same?

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 one energy form is transformed into the next energy form

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!

*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

How does radiant energy transform?

Checklist

Part 1

For this activity you will need:
- 1 plastic container *(clear and identical short/chubby works best)*
- Water
- Thermometer
- 1 metal cookie sheet
- Camera (optional)

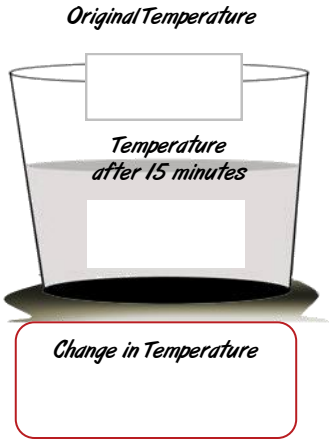
Directions for PART 1:

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

Step 2: Place the container on the cookie sheet.

Step 3: Choose a sunny area where it will not be disturbed. Try to make sure that the sun is directly on the container throughout the activity.

Step 4: After 15 minutes, record the new temperature in the container.



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 the container. These areas should also feel warm to the touch, since the radiant energy from the sun was absorbed by them and the water at the same time. Not all the radiant energy was absorbed. Did you see any being reflected?

What can affect radiant energy transformations?

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 the temperature change for each container. Use the blanks marked *Hypothesis* on pages 19 and 20 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.

Checklist

Part 2

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)

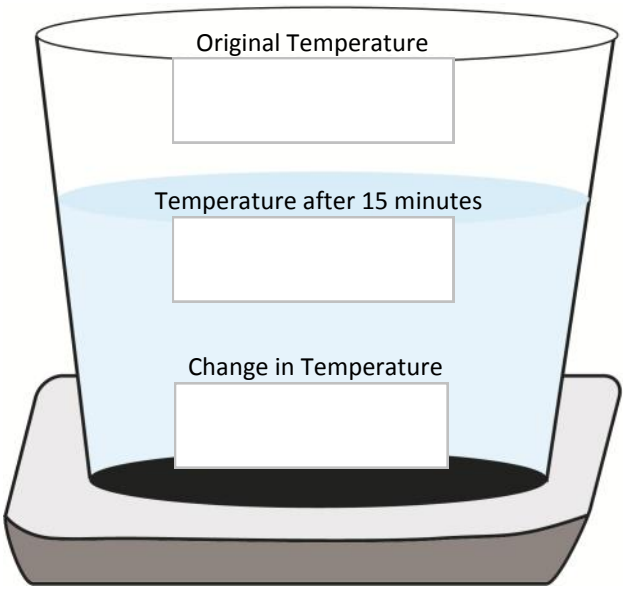
Energy Facts — Heat Transfers From One Object to Another

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.

SAVE

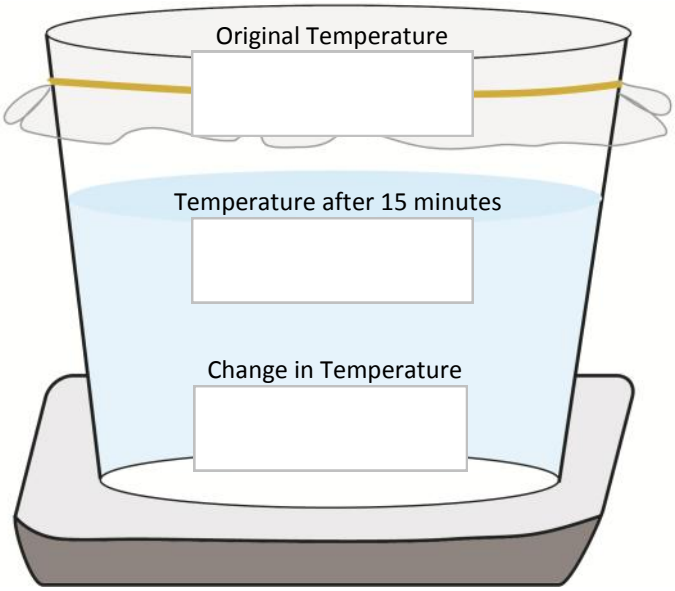
Record Your Observations...

Hypothesis 1:



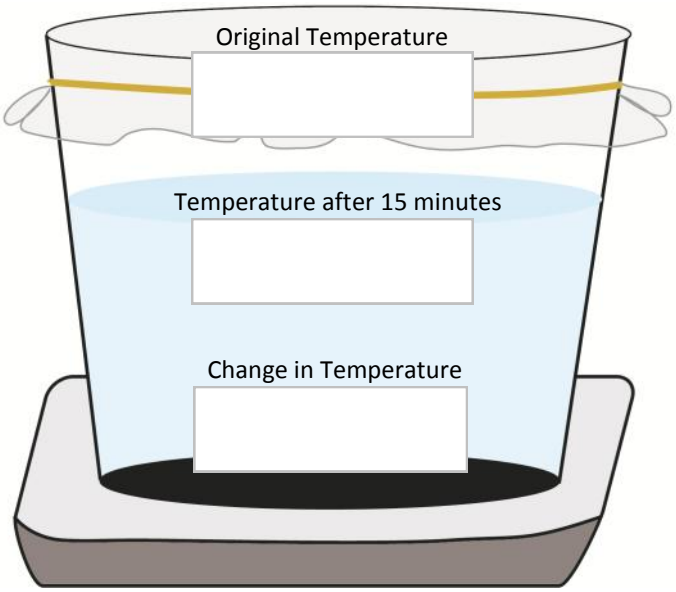
How Did Your Observations Compare to Your Hypothesis?

Hypothesis 2:



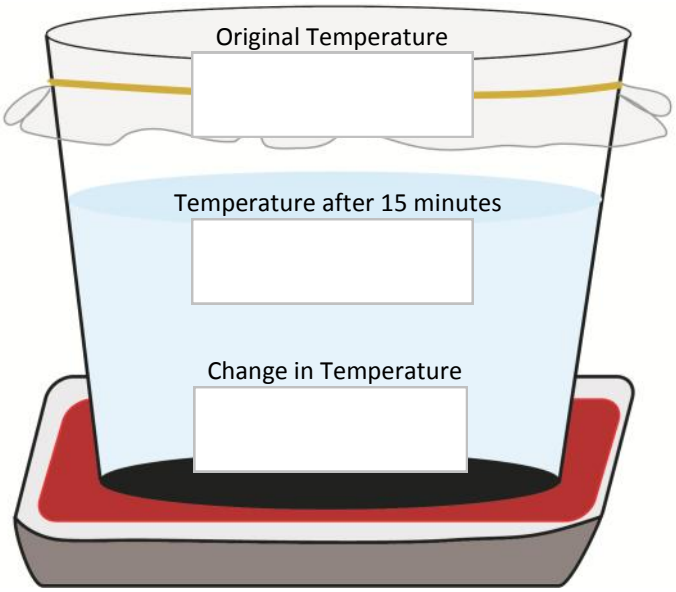
How Did Your Observations Compare to Your Hypothesis?

Hypothesis 3:



How Did Your Observations Compare to Your Hypothesis?

Hypothesis 4:



How Did Your Observations Compare to Your Hypothesis?

SAVE

Do You Know About...

Insulators

Much of the radiant energy that comes from the sun is transformed into thermal (heat) energy. Heat naturally flows from warmer spaces to cooler spaces in an attempt to balance the temperature of both (this is called **equilibrium**). During the summer, heat flows from outdoors to indoors since the higher temperature is outside your home. In the winter the opposite occurs, with the heat travelling from the inside of your home to the outdoors. Large amounts of this energy transfer are not a good thing since you want to keep the heat out during the summer and in during the winter.

In order to guard our homes from too much of this heat flow, builders use materials that help **insulate** our homes. These materials naturally resist the flow of heat, thereby decreasing the amount of energy transferred.

Think About It...

What generalizations can you make about what you saw in this activity?

Which container had the most thermal energy? How do you know?

Which had the least thermal energy?

What do you think made the temperatures in these two containers so different?

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?

Do hypotheses (predictions) always have to be right? Explain your answer.

Act On It...

Now, think bigger than this activity. Why is the radiant energy from the sun so important for Earth?

What do you think would happen if the amount of radiant energy from the sun changed (either increased or decreased)?

How is the Earth like one of the containers?

Work With It... Activity 2

How efficient is the transformation?

Understanding how energy can transform from one form to another is an important skill for any energy investigator! But, it is important to also know that not all energy transformations are equal; some are more efficient than others. ***Efficiency*** is a measure of how well an input energy form is transformed into the desired output energy form. Every energy transformation has a certain level of efficiency. Every machine that transforms energy has a certain level of efficiency, too. The better a machine transforms one energy form into another, the more efficient it is.

To measure efficiency, use the equation:

$$\frac{\text{Energy Out}}{\text{Energy In}} \times 100\% = \text{Energy Efficiency!}$$

This activity lets you explore the efficiency of one of these transformations through a unique machine - the light bulb. A light bulb is a simple machine that transforms energy. It takes electrical energy and transforms it into two different forms of energy: thermal and radiant. However, this energy is not divided equally; sometimes more radiant energy is produced, sometimes more thermal. Since light, radiant energy, is the desired energy from a light bulb, we would want to choose a light bulb that produces more radiant energy and less thermal.

Checklist

For this activity you will need:

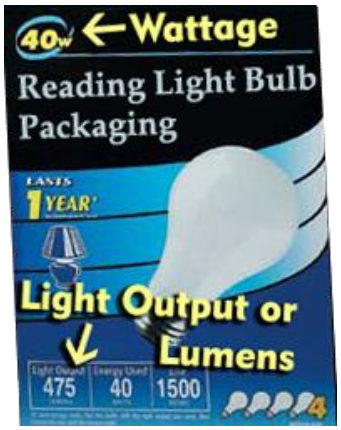
- Lamp
- Thermometer
- Incandescent bulbs (*60-watt)*
- Fluorescent bulbs (*Use bulbs that have the same lumens as above; try the compact fluorescent lamp (CFL) bulbs available at most discount stores)**
- Camera (optional)
- Power meter (optional)

* You may also experiment with LED's (light emitting diodes). Be sure to compare bulbs with similar light output (lumens).

Directions:

Use the materials in the *Checklist*, as well as what you have learned from the activities you have completed so far, to design an experiment to test which light bulb type is more efficient at producing radiant energy. Use the space on the next page to write out the steps for your experiment. Also be sure to record your findings.

Do You Know About...



Energy Facts — *Energy Consumption*

The Law of Energy Conservation states that energy can never be created or destroyed; it can only change from one form to another. Energy use is actually a transformation of energy from one form to another. We call this **energy consumption**. It is called consumption since it is transformed from a usable form to a less usable form. Think about dumping a bucket of water down the drain, the water still exists but it is not usable anymore. In the same way, the energy still exists, just in a less usable form.

SAVE

My Experimental Plan…

What is your research question?

(What are you testing for?)

What is your hypothesis?

(What do you think will happen?)

What steps will you take to test your hypothesis?

(What are you going to do?)

Include an Illustration or Picture of Your Experiment Here

What were your results?

(What happened?)

What are your conclusions?

(What does it all mean?)

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 10 incandescent light bulbs (60 Watts each) with 10 more efficient compact fluorescent light bulbs (13 Watts each)?

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?

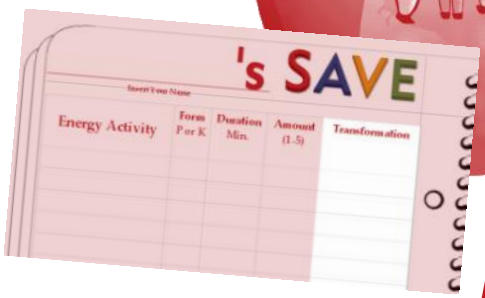
Think about your home.

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

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

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 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?

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 CERTIFICATION ALERT…R5 or P1

Look at the Certification Activities under the ***Forms*** section on page 91. Read the requirements for each of the activities suggested above and then choose which one you would like to complete.

Which activity did you select?

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

Additional SAVE Certification Opportunity

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!

Where Does Energy Come From?

Important Definitions

Renewable Energy Sources
sources of energy which naturally keep providing energy because they are continually replenishing; they usually do not contribute to pollution and global warming

Viable
feasible; capable of being developed with current circumstances

Nonrenewable Energy Sources
sources of energy that are limited because they do not replenish quickly enough; they are often highly concentrated and, therefore, easy to collect and use; most contribute to pollution and global warming

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 it 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.

Work With It... Activity 1

Where can energy come from?

Humans have long used energy 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! A solar oven is a type of machine that 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

Checklist

For this activity you 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)

Directions for Part 1:

Step 1: Draw an 8½ inch by 11 inch rectangle in the lid of the pizza box.

Step 2: Cut out three sides of the rectangle. Fold back the flap along the uncut edge.

Step 3: Create a sun reflector to capture more radiant energy for your oven by covering the inside of the flap with aluminum foil (use tape to secure).

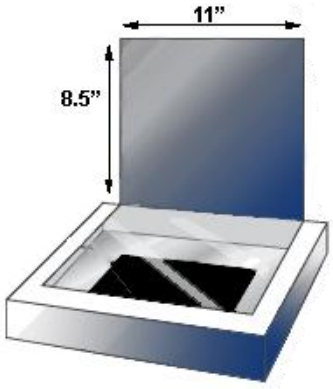
Step 4: Keep heat you capture from getting away by creating insulation for your oven. Crumple up the newspaper (about 1½ inches thick) and secure it around the inside edges of your box with tape.

Step 5: Line the inside of the box with aluminum foil. Make sure to smooth out the foil as much as possible.

Step 6: Line the inside bottom of the box with black construction paper to better absorb the radiant energy. Use tape to secure.

Step 7: Secure a piece of plastic wrap to the underside of the pizza lid (over the opening). Make sure it is stretched tightly and taped well so that heat will not escape easily. Then repeat this process over the top of the lid opening. This keeps heat from escaping through the opening.

Step 8: Place your food into the oven and close the box lid. Choose an area that will get direct sunlight. Move the box around to get the maximum amount of sun into your oven.



3” x 5” Photo
(optional)

SAVE

How can using different designs change the results?

Checklist

For this activity you 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)

Directions for Part 2:

Step 1: Take one slice of bread and cut it in half. Place 1 tablespoon of shredded cheese on each piece of bread. Be sure to make both slices as equal as possible. Set them to the side.

Step 2: Line a large bowl with aluminum foil.

Step 3: Place one piece of "cheese bread" in the middle of the bowl. Then cover the top of the bowl with plastic (cling) wrap.

Step 4: Place the other piece of "cheese bread" into the pizza box oven and close the box lid.

Step 5: Now, setup both the pizza box oven and the bowl oven. Choose an area that will get direct sunlight. Move the box and bowl around to get the maximum amount of sun on both ovens. You may need to tilt the bowl to catch as much solar energy in the bowl as possible. Use small stones or twigs to prop the bowl into the desired position.

Step 6: Let the ovens work for about 15 minutes.

While you are waiting for the cheese bread to cook, make a hypothesis about which design you think will do the best job and why you think that.

HYPOTHESIS:

Step 7: Check the ovens after 15 minutes. If the cheese does not look melted on either one, wait another 15 minutes.

Step 8: After 30 minutes, check to see which one has done the best job of cooking your "cheese bread".

3" x 5" Photo
(optional)

Record Your Observations . . .

What were your results?

Pizza Box Solar Oven	Kitchen Bowl Solar Oven

Compare your hypothesis to what you observed:

SAVE

So, what do you think?

Is using energy from a renewable source (like from the sun) really practical? Defend your answer.

Think About It...

What are some of the advantages of using solar energy to cook with?

What are the disadvantages of using solar energy?

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?

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.

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

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?

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? You can build and test it out if you wish!

Work With It... Activity 2

What sources do we use most?

Below are the estimated percentages of energy sources used in the U.S. in 2007. Use these percentages to make a pie graph in the circle below. Figure out how to display the amount of renewable and nonrenewable energy sources used in the United States. Shade the renewable sources **GREEN** and the nonrenewable sources **RED**. Then, use your compass or large, round container and poster paper to create a larger version of your pie chart that you could use for a demonstration or poster presentation for your next 4-H Club meeting.

Checklist

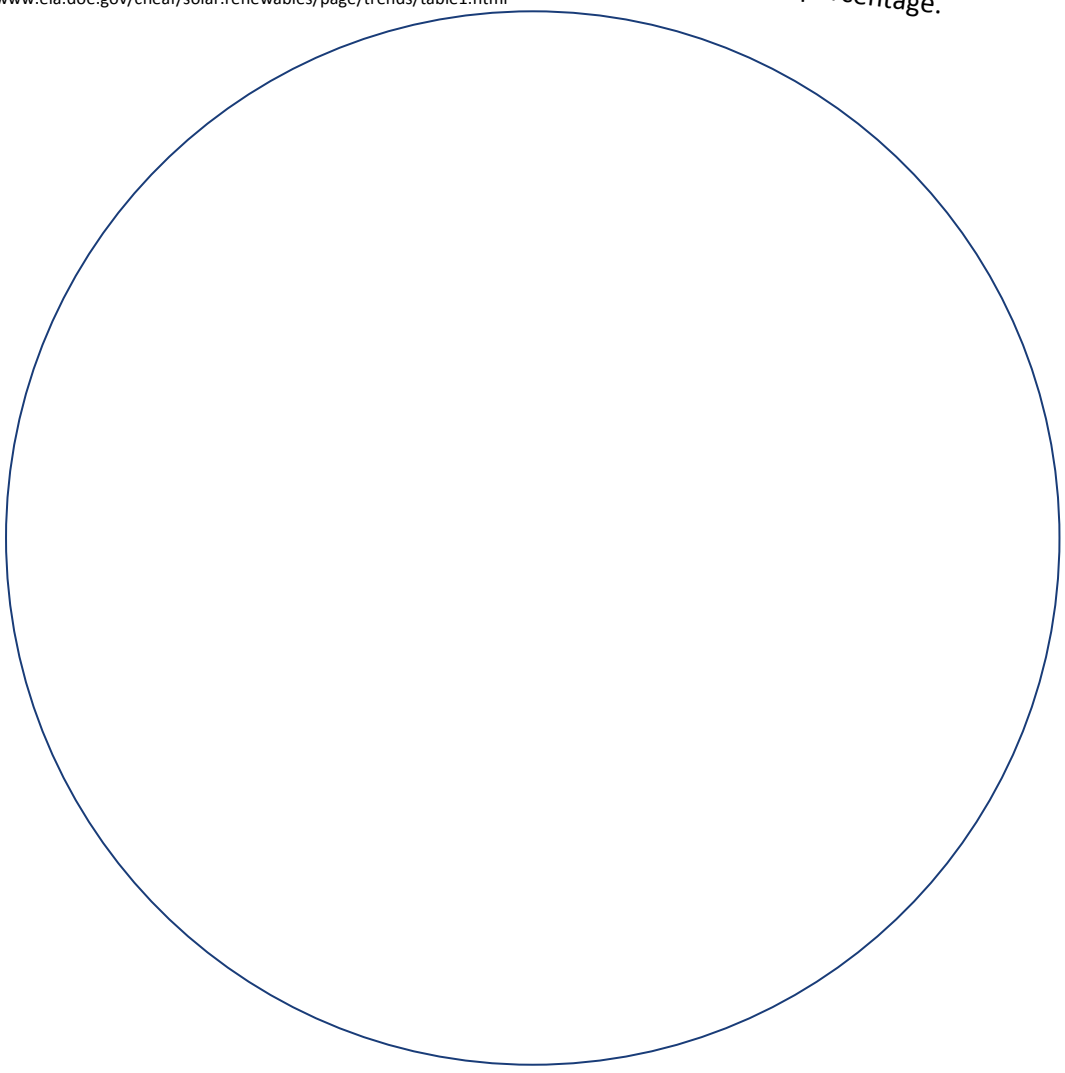
For this activity you will need:

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

Biomass	3.5%
Petroleum	39.4%
Hydropower	2.4%
Natural Gas	23.3%
Geothermal	0.3%
Coal	22.4%
Wind	0.3%
Uranium (Nuclear)	8.3%
Solar and Other	0.1%

Source: U.S. Energy Consumption by Energy Source, 2007
http://www.eia.doe.gov/cneaf/solar.renewables/page/trends/table1.html

For a greater challenge, create ***TWO*** pie charts. Follow the directions above to create a Renewable/Nonrenewable Comparison Chart. Then, create another chart that graphs each category separately. The areas of the new pie charts will have to be recalculated based on the new ratios of each percentage to the total percentage.



SAVE

Think About It...

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

NONRENEWABLE **RENEWABLE**

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

Did You Know?

Most electricity is generated in power plants that burn coal.

Gasoline comes from petroleum resources pumped from deep in the ground.

Energy Facts

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. For what other things could you use a pie chart to communicate information?

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.

Name of Your Power Company:

Do they offer electricity generated from renewable energy sources? If yes, what renewable sources do they use?

Is there a program your family can participate in to get some or all of their electricity from renewable sources?

What would you have to do to participate?

Work With It... Activity 3

What sources provide the energy I use?

Return to your Energy Journal. You should have **TWELVE (12)** energy actions documented so far. Write in the sources for each action and whether or not the energy used is renewable. Remember, electricity is a form, not a source, of energy. Instead, think about what source your electricity comes from. You might need to do some investigation! Also, add **TWO (2)** more activities to the end of your list. Be sure to fill out all the information on forms, transformations and sources.

Think About It...

What was the most common source of energy that you have recorded in your journal?

You have now made several visits to your Energy Journal.

Have your thoughts about energy changed? How have they changed?

Is it becoming easier or harder to complete the Energy Journal? Why?

Act On It...

Think about the many sources that energy can come from. Why does so much of our energy come from nonrenewable sources?

What do you think is the most viable renewable energy source for the area where you live?

Explain how a different location might have a different renewable energy source that would be more viable. Try to use a specific example.

SAVE *CERTIFICATION ALERT*…P5, WS2, WS5, or W4

Look at the Certification Activities under the ***Sources*** section on page 91 and 92. Read the requirements for each of the activities suggested above and then choose which one you would like to complete.

Which activity did you select?

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

Additional SAVE Certification Opportunity

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 you would use and how you would use them.

Does Energy Last Forever?

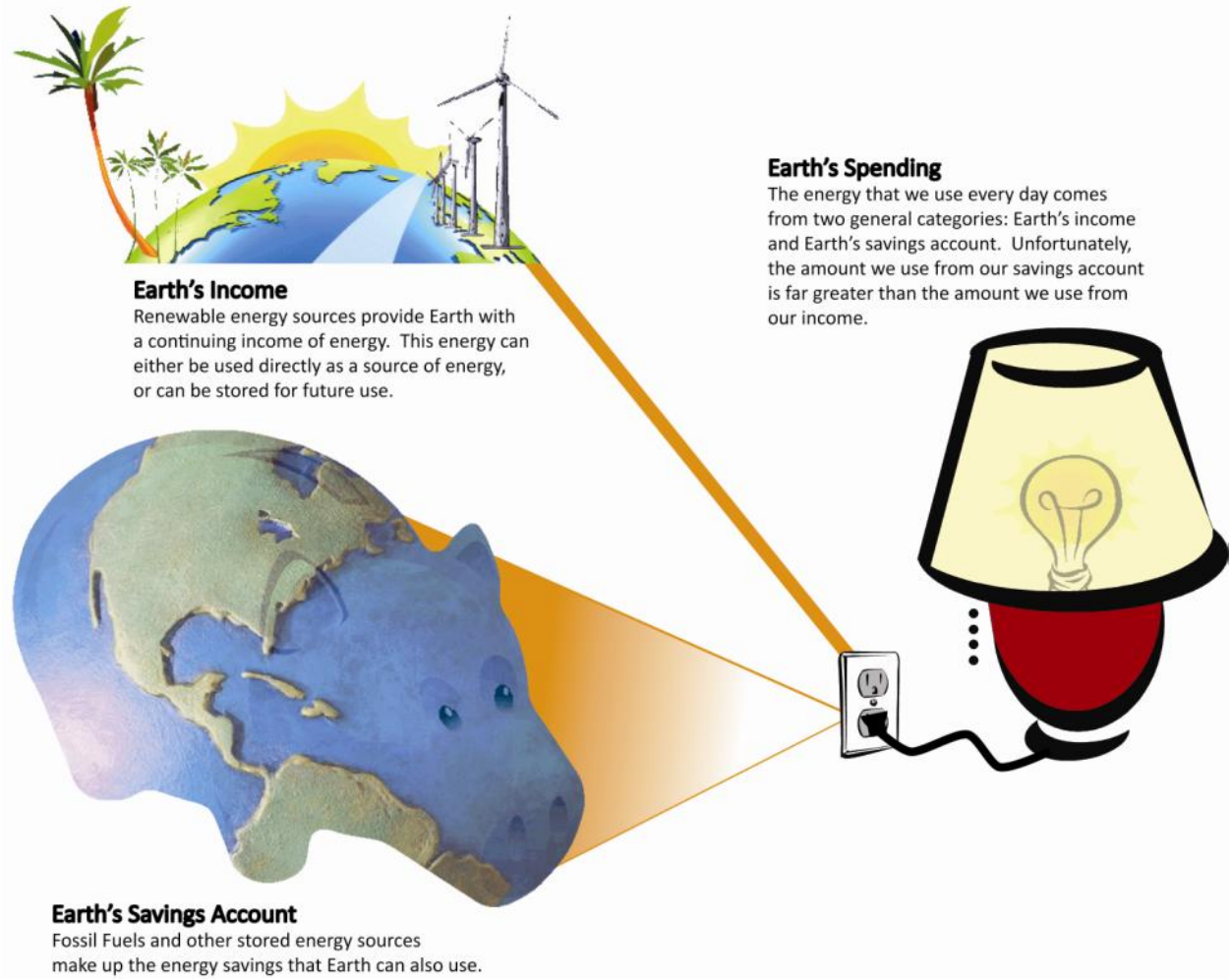
Important Definitions

Budget
a list of all planned income and expenses

Portfolio
a list of assets held by an individual

In the last couple of lessons, you 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.



Work With It... Activity 1

Do we have a balanced energy budget?

Checklist

For this activity you will need:
- Black marker
- Ruler
- Recent utility bill
- Colored pencils or markers
  - *Green*
  - *Yellow*
  - *Red*
  - *Blue*

According to the U.S. Department of Energy, the average monthly residential electricity consumption in the United States was 920 kilowatt hours (kWh) in 2008. Use the percentages from the 2007 U.S. energy data in Lesson 3, Activity 2 to create an Estimated Energy Budget for one household. Remember that **renewable sources** are the **income** for this budget, while **nonrenewable** sources are the **savings account** of the Earth.

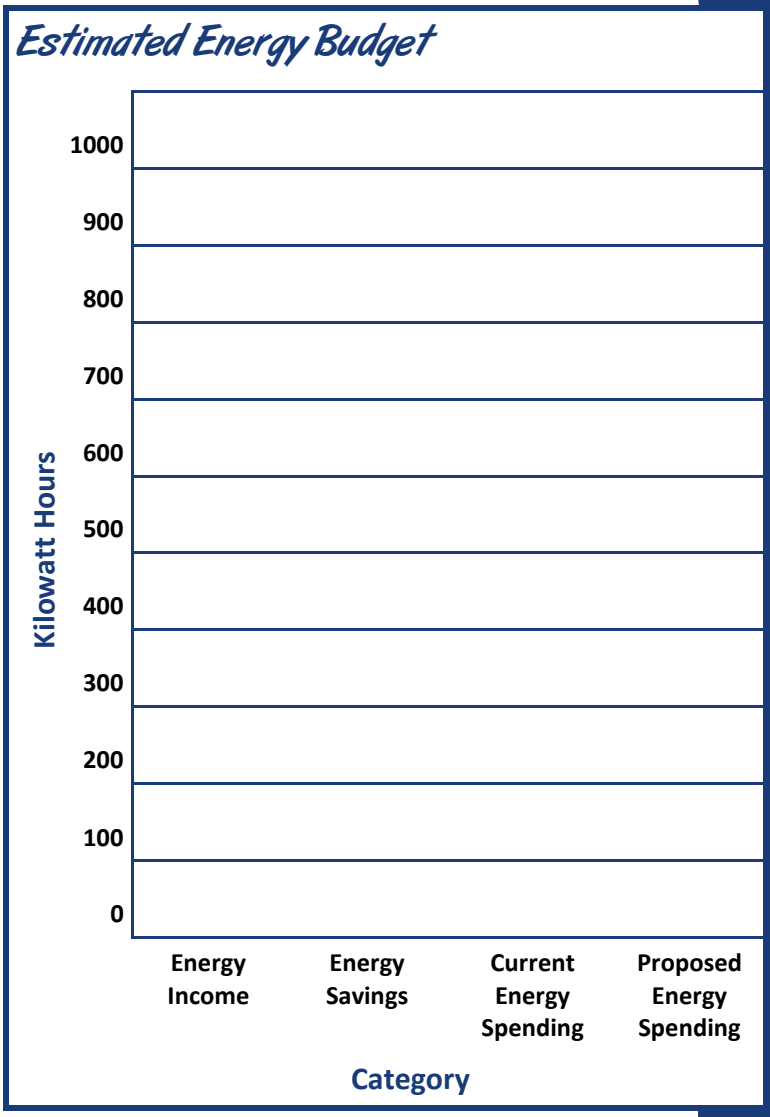
Directions:

Step 1: From Lesson 3, Activity 2 write down the amount of energy spending in the U.S. that comes from income, or renewable sources (percentage): _____. Multiply this by the average household energy spending of 920 kWh per month, then divide by 100. This gives the average amount of energy income for each household in kWh. Mark this value in **green** on the chart.

Step 2: Now write down the amount of energy spending in the U.S. that comes from savings, or non-renewable sources (percentage): _____. Multiply this by the average household energy spending of 920 kWh per month, then divide by 100. This gives the average amount of energy savings used for each household. Mark in **red** to indicate the savings used.

Step 3: Now, ask your parents if you can see your family's last monthly electricity bill. Look for the number of actual kilowatt hours (abbreviated kWh) that your family used. Mark that under Spending 1 in **yellow**. This column might go over the top line, since the 920 kWh mentioned above is only an average. If it does, be sure to write down the actual kWh used somewhere on the column.

Step 4: Talk to your parents about the energy bill. Figure out how, as a family, you would like to try to lower the amount of kWh you use every month. Mark a goal level of kWh that you and your parents agree on for Spending 2. Mark that under Spending 2 in **blue** to indicate the level you would like to achieve.



SAVE

So, what do you think?

Where can individuals have the greatest impact on their energy budget - changes in income, savings, or in spending? Why?

Think About It...

Do you think that your energy budget is balanced? Why or why not?

How do you balance your energy budget in terms of energy income and energy spending?

If energy spending is greater than energy income, what will eventually happen?

Is there any way to save some of our energy income?

Act On It...

What ways did your family discuss to lower their monthly energy spending (kWh)?

Can you or your family change the amount of energy income or energy savings in your budget?

If you think you can, how could you?

If not, why not?

Work With It... Activity 2

How do we diversify our energy portfolios?

Checklist

For this activity you will need to use the material list for whichever project you choose to complete.

Be sure you snap a couple pics If you do something cool in one of the activities.

Along with having a balanced budget to manage our money, we also need to invest our money so it is safe and can earn interest. Financial investors put their money in many different stocks, bonds, and money markets and this is called their portfolio. This portfolio should include many different investments to minimize risk so that in case something happens to one investment the entire portfolio is not affected too much. This is called having a ***diversified portfolio***, a combination of many different investments to minimize risk and maximize benefit. These same principles apply to the combination of our energy sources.

Choose one type of renewable energy from each list. Begin this activity by visiting the Florida 4-H website for this project book. There you will read about your chosen renewable energy source, and then will complete the related activity at the end of the unit. Then find a reliable energy information site to investigate the second energy source you have chosen. One great site for this would be **http://www.energyquest.ca.gov/story/index.html**.

List 1 - Florida 4-H Website

- Solar Energy and Photovoltaic Cells - Solar Cars
  http://florida4h.org/projects/SAVE/Solar.shtml
- Biomass Energy - Press Activity
  http://florida4h.org/projects/SAVE/Biomass.shtml

List 2 - Other Websites

- Geothermal Energy
- Hydroelectric Energy
- Tidal Energy

Notes from List 1 Activity...

Which activity did you select?

What were some of the key energy concepts you learned from completing this activity?

SAVE

Notes from List 2 Activity…

Which activity did you select?

What were some of the key energy concepts you learned from completing this activity?

Write a paragraph that summarizes the information you found out about your topic from your research.

Think About It...

Which of the two renewable energy sources did you choose to learn about?

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

How did you address those challenges?

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

How could using multiple renewable energy sources provide a better energy portfolio?

Did You Know?

A balanced energy budget where spending is equal to income can also be called "net-zero." For instance, a net-zero building is a highly efficient building with a renewable energy system. Over the course of a year, it earns as much energy income as it spends!

Energy Facts

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?

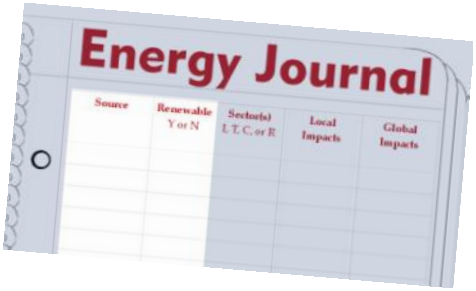
What about a state in the middle of the country like Kansas?

What about a state in the north-western part of the country like Washington?

Where might geothermal energy be a viable option?

SAVE Work With It... Activity 3

What patterns exist in my daily energy use?



You should now have **FOURTEEN (14)** entries into your Energy Journal. Answer the following questions by looking back at what you have already written in your journal.

Think About It...

Are there any patterns occurring from the data in your journal? What are they?

Is your energy budget balanced or unbalanced? How can you improve it?

Has writing down your energy entries made you more aware of your energy use?

Act On It...

Choose any **THREE** of your fourteen activities. These are essentially line items in your energy budget. Describe how you could make these activities more balanced for your budget by either reducing energy spending, or increasing energy income.

Activity 1:

Activity 2:

Activity 3:

SAVE CERTIFICATION ALERT…M4, P2, P9, R8, or WS3

Look at the Certification Activities under the ***Sources*** section on page 91 and 92. Read the requirements for each of the activities suggested above and then choose which one you would like to complete.

Which activity did you select?

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

Who Is Using Energy?

Important Definitions

Residential
all the energy used in homes

Transportation
the energy required to move people and things from one place to another

Commercial
the energy used by schools, places of worship, businesses, and many other building types

Industrial
the energy used to create many consumer products

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, boats, etc. Now for energy sectors that can be tricky.

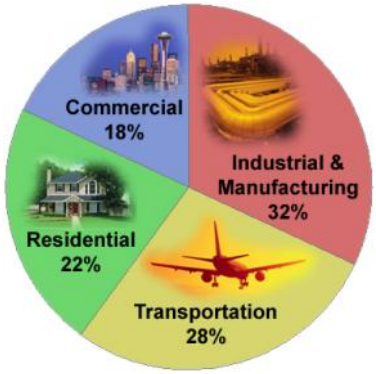


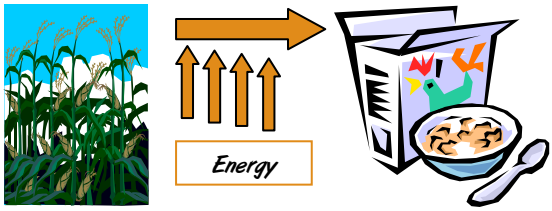
Figure 1
End-use sector shares of total consumption - 2005
Source : Energy Information Administration *Annual Energy Review 2005*, Washington, DC, July 2006

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!

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)** energy transformations from each energy sector.



Cereal Sector Search

Energy Transformation	*Energy Sector*
Example: Trucking cereal from distribution center to grocery store	Transportation

Think About It...

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

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

Act On It...

How have your thoughts about energy changed since you started SAVE?

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.

Work With It... Activity 2

How are the appliances in my home using energy?

The pie chart on the right shows how the average U.S. home uses, or transforms, energy. The average American home spends about 25% of its energy for lighting and appliances. This does not include the larger energy consumers (water heater, air conditioning, or refrigeration). Instead, these are the other appliances that we have come to rely on to make life easier.

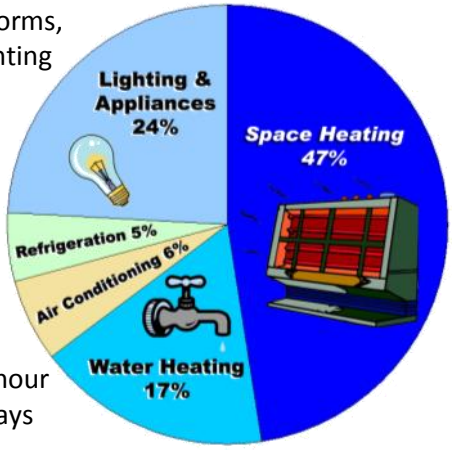


Figure 2
Source : Department of Energy, Energy Information Administration, Kids Energy Page

Each appliance uses energy when it performs its task and sometimes even when it is at rest. Appliances usually come with a faceplate that tells the consumer (you) how many Watts the appliance will use when it is at maximum operating power. Let's look at a microwave that uses 1100 Watts. This microwave will use a maximum of 1100 Watts every hour that it is used. But, does your microwave have a digital clock that displays the time even when you are not cooking something? That clock needs energy to run, too! So, even if you are not "using" your microwave, it is still using a small amount of energy.

Step 1: On the next two pages are a list of common household appliances with some approximate power ratings. Cross off any appliances that you do not have.

Step 2: For 24 hours, monitor the use of the remaining appliances in your home. Take note of both the times that the appliance is being used and the times when it is just at rest. Even at rest, most appliances are drawing some sort of wattage from the outlet it is plugged into.

Appliance (Watts)	Number of hours used in a 24-hour period	Could the amount of time used be reduced?
Clothes Dryer (5000 Watts)		
Clothes Iron (1000 Watts)		
Clothes Washer (500 Watts)		
Coffee Maker (1050 Watts)		
Computer (CPU/Monitor) (250 Watts)		
Computer (Laptop) (50 Watts)		
Computer (Printer) (50 Watts)		

List continues on next page...

Appliance (Watts)	Number of hours used in a 24-hour period	Could the amount of time used be reduced?
Dishwasher (1300 Watts)		
DVD Player (20 Watts)		
Electric Blanket (100 Watts)		
Fan (ceiling) (80 Watts)		
Fan (window) (115 Watts)		
Hair Dryer (1250 Watts)		
Heater (portable) (1125 Watts)		
Lamps (single 60 watt) (60 Watts)		
Lamps (ceiling fixture) (180 Watts)		
Microwave (1100 Watts)		
Oven (7500 Watts)		
Radio/Stereo (200 Watts)		
Television (19 inch) (110 Watts)		
Television (27 inch) (113 Watts)		
Television (36 inch) (133 Watts)		
Television (projection) (170 Watts)		
Television (flat screen) (120 Watts)		
Toaster (1100 Watts)		
Vacuum Cleaner (1220 Watts)		
VCR Player (19 Watts)		
Water Bed (with heater) (250 Watts)		

NOTE Use this formula to estimate an appliance's energy use:

Wattage × Hours Used Per Day ÷ 1000 = Daily Kilowatt-hour (kWh) Consumption

Approximate Wattage values found at http://www.energysavers.gov.

SAVE

So, what do you think?

Many appliances continue to use energy even when they are turned off. Explain whether you think this amount of energy really makes a difference in how much energy your home uses.

Think About It...

Which appliances are drawing electricity all the time? How do you know?

Which appliances did you think you could have reduced the amount of time it was being used?

Calculate the total maximum number of Watts your appliances were using at any moment during the day.

Act On It...

Of the four sectors, you and your family can have a significant impact on two of them—residential and transportation.

List some practical ways in which you and your family can change how much energy is used by appliances in your home.

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?

Energy Facts

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.

Work With It... Activity 3

What sectors have been involved in our daily energy use?

You should now have **FOURTEEN (14)** entries into your Energy Journal. In what sectors did these energy transformation take place (I-Industry, T-Transportation, C-Commercial, or R-Residential)? Remember to think about all of the sectors that were involved in bringing the energy to the activity. **Add TWO (2)** more activities to the end of your list. Be sure to fill out the information for forms, transformations, and sources.

Think About It...

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

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

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.

SAVE CERTIFICATION ALERT…M2, M3, WS4, or W5

Look at the Certification Activities under the ***Users*** section on page 92. Read the requirements for each of the activities suggested above, and then choose which one you would like to complete.

Which activity did you select?

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

Additional SAVE Certification Opportunity

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?
- Can you name any energy efficient technologies?
- How would you describe your level of energy use?

Is All Energy Seen?

Important Definitions

Consumer
a person who uses goods or services

Life Cycle of a Consumer Product
the length of time from the creation of the product until it is no longer useful

Natural Resources
raw materials that can be used to create products or provide services

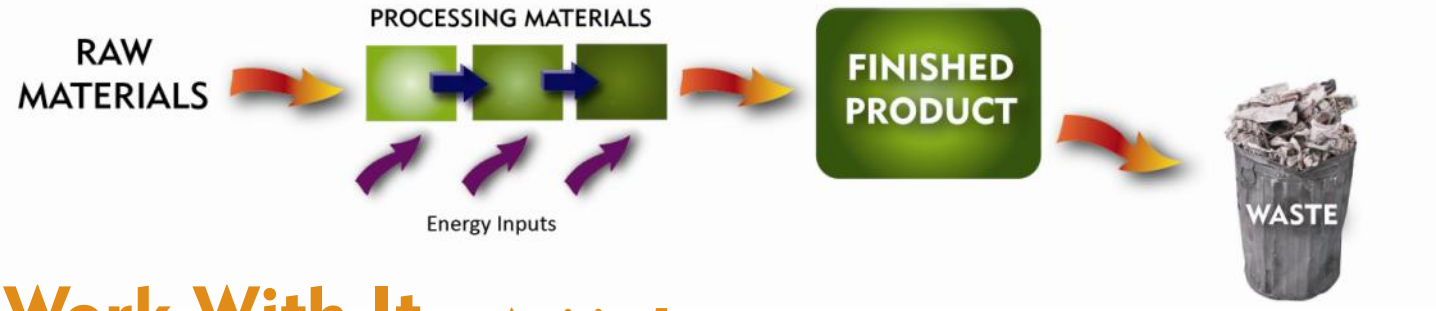
The industrial energy sector is responsible for manufacturing products that consumers will eventually buy. ***Consumers*** typically see a product for only a small part of its life. Normally, they will not see the raw materials being extracted from the environment. They will not see the product being 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 Cycle 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.



Work With It... Activity 1

What are the life cycles of common household products?

As you see above, there are many steps in a consumer product's life cycle. The life cycle might stretch 1 year, 10 years, or even 25 years. Go through your home and choose 10 different appliances or products. List what you think the typical life cycle is for each product. Then, using the Internet, try to find out the estimated life cycle of these products. Then, create a bar graph that shows the differences in each of the products for both your hypothesized life span and the actual one.

Checklist

For this activity you will need:
- Poster paper
- Black marker
- Ruler or yard stick
- Different colored pencils or markers
- Camera (optional)

Life Span	Product 1	Product 2	Product 3	Product 4	Product 5
Product or Appliance					
My Guess (months or years)					
Estimated (months or years)					

Life Span	Product 6	Product 7	Product 8	Product 9	Product 10
Product or Appliance					
My Guess (months or years)					
Estimated (months or years)					

SAVE

Energy Facts

When we "use" energy we are actually transforming energy from one form to another less useable form. People normally call this **energy usage** or **consumption**.

Remember, the Law of Energy Conservation states that energy can never be created or destroyed; it can only change from one form to another.

Think About It...

What products were difficult to find an actual lifespan for? How did you work through that?

Were there any products for which you correctly guessed the life cycle? Which ones?

Which of the products that you selected had the longest life cycle? The shortest?

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

Act On It...

If a product has a short life cycle, 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.

Work With It... Activity 2

How much energy is hidden in a building?

Every product has a specific amount of **embodied energy**. Embodied energy refers to the total amount of energy that is necessary to manufacture and deliver a finished product. Often, the embodied energy of a product is measured using the British thermal unit (known as the BTU). One thousand (1000) BTUs equals 1 MBTU. So, even the very building you live in has embodied energy—from the manufacturing of the materials, to the delivery of those materials and the final construction.

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)

Use an online calculator such as **http://www.thegreenestbuilding.org**, to calculate the embodied energy within a building. Using the ***Embodied Energy Calculator,*** you can calculate the embodied energy for each of the following buildings. Simply select your building type, insert the gross floor area, and click on the calculate button. Then, fill in the number of MBTUs next to the correct building in the table below.

Begin this activity by calculating the Actual Embodied Energy for a residential, single-family home that is 1250 square feet. Then, using that information, make a guess about the embodied energy within the other buildings. Once you have made a guess for each building, use the calculator to determine the Actual MBTU for each one. Write your responses in the table below.

Building Type and Gross Floor Area	My Guess	Actual
A residential, single family home that is 1250 sq. ft. =		MBTU
A store or restaurant that is 10,350 sq. ft. =	MBTU	MBTU
A hospital that is 75,400 sq. ft. =	MBTU	MBTU
A hotel that is 120,500 sq. ft. =	MBTU	MBTU
A school that is 120,500 sq. ft. =	MBTU	MBTU

The numbers you wrote in above are the number of MBTUs for each building as a whole. Now, calculate the embodied MBTUs in **ONE square foot (sq ft)** within each building.

Building Type and Gross Floor Area	MBTU per sq ft
A residential, single-family home that is 1250 sq. ft. =	MBTU
A store or restaurant that is 10,350 sq. ft. =	MBTU
A hospital that is 75,400 sq. ft. =	MBTU
A hotel that is 120,500 sq. ft. =	MBTU
A school that is 120,500 sq. ft. =	MBTU

Now, use your poster paper to create a unique visual image that displays your findings.

SAVE

So, what do you think?

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 any given product.

Think About It...

Which building did you think had the most embodied energy? Why did you think that?

Which building did you think had the least amount of embodied energy? Why?

Which building ACTUALLY has the most embodied energy per square foot? Which has the least?

What makes the embodied energy of those buildings so different?

Act On It...

Do you have any ideas as to how to reduce the embodied energy of a new building being built?

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?

Work With It... Activity 3

What does our energy use look like?

Checklist

For this activity you will need:

- Poster paper
- Scissors
- Glue
- Different images of people using energy from each of the four sectors
- Camera (optional)

There are a number of ways to communicate information to people. You have already worked on communicating information through graphs and charts. These are visual aids that help convey very specific data. However, you can also convey information through pictures. You have probably even heard the phrase "a picture is worth a thousand words."

So, your task is to create a picture collage of people using energy. A collage is created when you paste several pictures together in a way that conveys your meaning to others. You can take your own pictures or cut out pictures from magazines, newspapers, or print them from the Internet for the collage. Or you can do both! You can incorporate one or two words, but try not to use any more than that. However you choose to create your collage, make sure you include at least five pictures from each of the four energy sectors.

Think About It...

Which of the sectors did you have the hardest time finding images for?

Do you think that pictures really can tell a story? What energy story is your collage telling?

Act On It...

What occupations use visual images to convey a message?

What is their message?

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)?

SAVE CERTIFICATION ALERT…R9, WS1, WS6 or W6

Look at the Certification Activities under the ***Users*** section on page 92. Read the requirements for each of the activities suggested above, and then choose which one you would like to complete.

Which activity did you select?

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

Additional SAVE Certification Opportunity

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 club, or an upcoming 4-H county event. Use this space for brainstorming or keeping notes about your project.

What Are the Impacts of Our Energy Use?

Important Definitions

Impact
the effect or consequence of a decision

Impact Spectrum
the value of the choices you make compared to other possible choices

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.

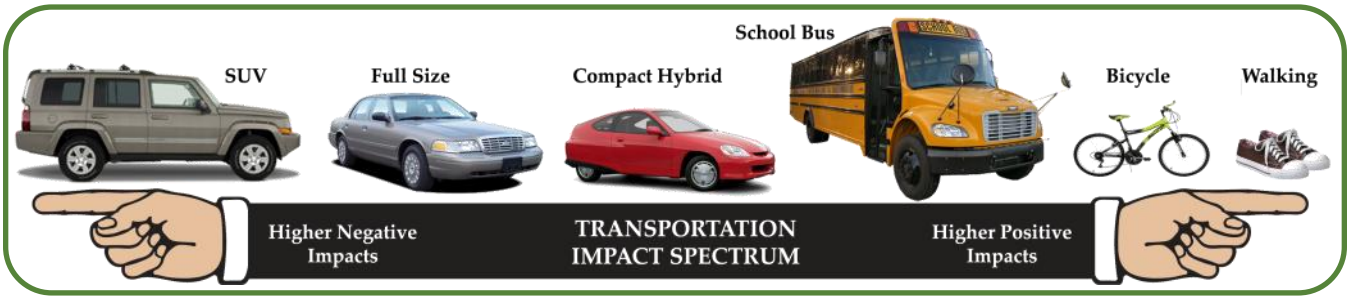
Now, think about the many choices you make every day. Often, there is a bad choice, a good choice, and a **BEST** choice. If you are asked to clean your room, do you ... ?

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.



Work With It... Activity 1

SAVE Skills: *Critical Thinking*

What impacts can various choices have within a sector?

Now it's your turn. Choose one energy sector (residential, transportation, industry, or commercial) and write your chosen sector in the blank space in the *IMPACT SPECTRUM* bar below. Then show where both positive choices and negative choices associated with a part of that sector fall in the spectrum. You can look at the Impact Spectrum for transportation as an example of how to do this activity.

SAVE

So, what do you think?

Is it important to realize both the positive and negative choices that exist for decisions you make? Explain your answer.

Think About It...

Which sector did you choose to use?

How many choices were you able to include?

Which choice did you think had the most positive impact? Why?

Which choice did you think had the most negative impact? Why?

Is there ever a perfect choice? Explain your answer.

Act On It...

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

How could you apply this type of thinking to other areas of your life?

Work With It... Activity 2

Where is my home using energy?

One of the previous activities asked you to use average wattages to analyze some common household appliances in your home. Now, let's take it a step further by taking a closer look at how energy is actually being used in your home.

Using a device called an Energy Meter, you can quickly and easily see how much energy is being used throughout your home. Let's start small. Choose one room in your home like your bedroom or living room. Following the directions below, calculate the amount of energy being used in that room.

Checklist

For this activity you will need:

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

SAVE Skills: *Collecting & Recording Data*

Electrical Devices

Step 1: Use the energy meter to measure how much electrical power each device uses when it is on (in Watts) and write the value in the table on page 67.

Step 2: Repeat until you have measured each device in the room.

Step 3: Record how many hours per day on average that device is using electricity.

Unfortunately, we cannot use the energy meter to measure the electricity used by the ceiling lights and the air conditioning. For the lights, we must use previously measured values given by the manufacturer.

Lighting

Step 4: Count all the bulbs which are lit and record this number in the lighting section of the table on page 67.

Step 5: Find out how many Watts each bulb uses by looking on the light bulb package or asking your parent to see a replacement bulb. The wattage should be written on the bulb. Record this data.

Step 6: Record how many hours per day on average the lights are kept on.

Air Conditioning

Step 7: To find out how much energy the air conditioner may require, we need to first calculate the area of the room in square feet. Measure the length and width of the room with a tape measure (Area = length x width).

Step 8: For a room in Florida, each 300 square feet of area requires approximately one ton of cooling. Calculate how many tons of cooling are needed for your room.

Step 9: The amount of electricity needed to provide cooling is based on the efficiency of the air conditioning equipment. With a standard Effective Efficiency Rating (EER) of 12, one ton of cooling requires 1 kilowatt (kW) of electricity power input. Calculate how many kilowatts of electricity are needed to meet the required cooling load. Assume that the air conditioning runs for approximately 12 hours on a hot day.

Step 10: Multiply the power (kilowatts) by the amount of time (hours) per day to calculate the amount of energy use (kWh) for each category in one day. Add these together to get the total energy use in your room in one average hot day.

Cooling Loads

The cooling load of a building depends on many things. The various numbers used to predict the cooling energy consumption in this exercise are approximations based on a hot day in Florida with an average building. Local climate, season, and the efficiency of the building and air conditioning equipment all play a large role in the energy required for cooling.

Remember that most climates also require energy for heating during parts of the year!

SAVE My Energy Report

Room You Chose:

Electrical Devices

Device	Number of Devices	Power (W)	Power (kW)	Hours/day	Total energy (kWh)

Lighting

Bulb Type	Number of Bulbs	Power (W)	Power (kW)	Hours/day	Total energy (kWh)

Air Conditioning

Length	Width	Number of Devices	Power (tons)	*Power (kW)	**Hours/day	Total energy (kWh)

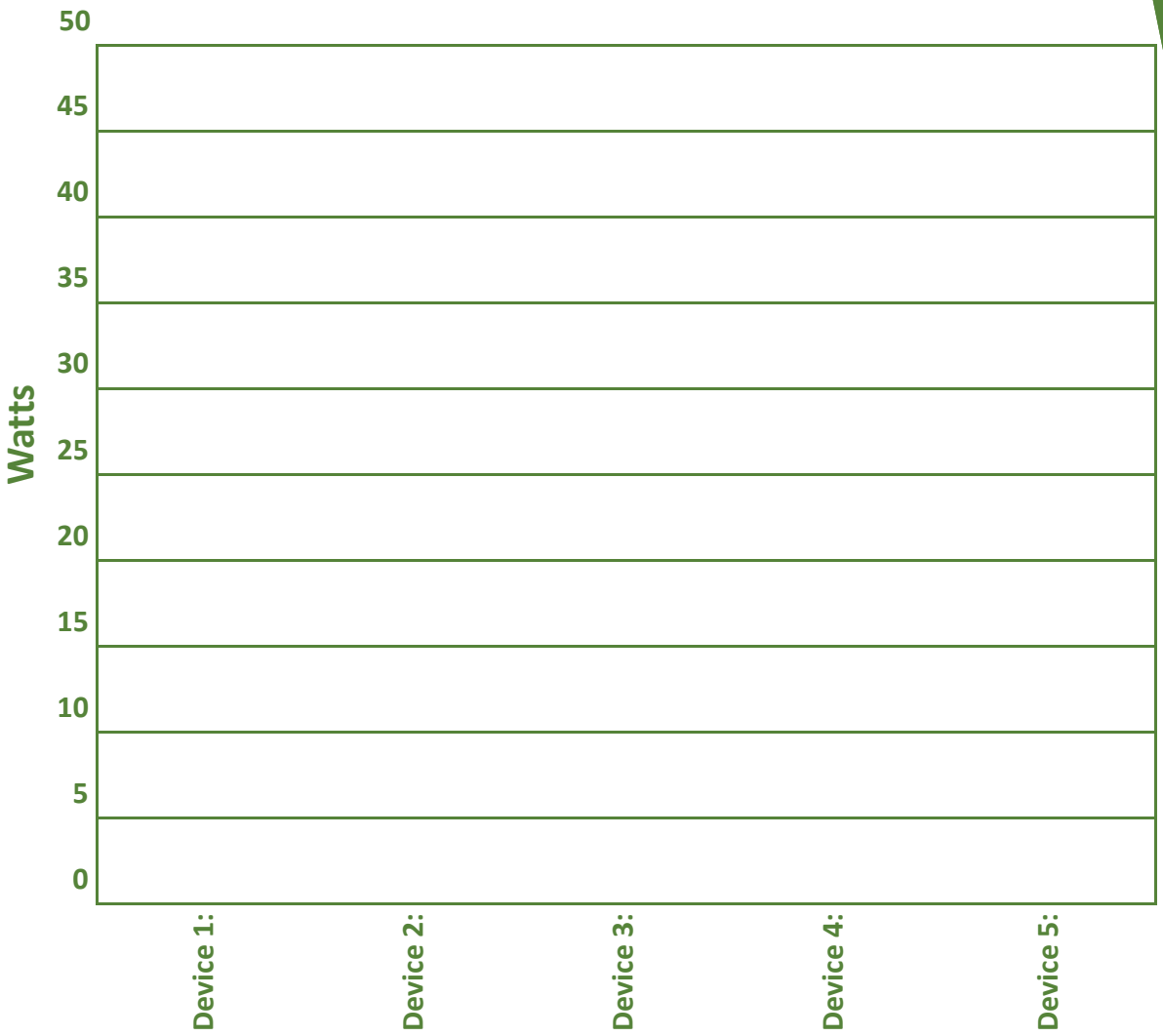
*assume EER = 12
**assume 12 hours per day

Total Energy Use Per Day:

Work With It... Activity 3

Is there energy that was forgotten?

Did you know that devices still use power when they are in standby mode. Even if they are off, if the device is still plugged into the wall, it is drawing some electricity. In order for your calculations to be an accurate estimate of energy use in a day, you will also need to include this hidden power. Using the website **http://standby.lbl.gov/summary-chart.html**, create a bar graph below that shows the standby power (in Watts) for the electrical devices you chose to examine in the previous activity. Then, use the same information to complete the table on the next page. Compare your initial findings to those that include standby energy to see how much energy is used even when these devices are "off".



SAVE *My Energy Report*

The Forgotten Energy

Room You Chose:

Electrical Devices

Device	Number of Devices	Power (W)	Power (kW)	Hours/day	Forgotten Energy	Total energy (kWh)

*assume EER = 12
**assume 12 hours per day

Total Energy Use Per Day:
Include Forgotten Energy

Total Energy Use Per Day:
Initial Measurement

Difference:

Think About It...

Were there devices that were difficult to measure?

How would the results have been different if you had chosen another room to measure?

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?

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 at one of your parent's workplace.

Ask a parent to show you the electric bill. Ask them how to read the monthly consumption (kWh) and the total cost ($). If available, collect bills from the last several months and create a graph of how energy consumption has changed over time.

Energy Facts

Did You Know?

- During the summer it is recommended that you set your thermostat at 78°F or higher and then use fans to increase the comfort level. In fact, your utility bill can increase as much as 4% for every degree you lower your thermostat below 78°F.
- Placing lamps and TV sets near a thermostat can cause the air conditioner to run longer than necessary since it detects the heat from those devices.
- Washing and drying clothes can be a real drain on electricity. A large amount of the energy for washing your clothes comes from heating the water. To reduce the energy needed for a load of laundry, reduce the amount of water you use and use cooler water.

Try finding more of these tips for reducing your utility bill at your local power company's website or other reliable websites on energy conservation.

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.

Think About It...

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

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?

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 CERTIFICATION ALERT…M1, R2, R7, P3, P4, or W1

Look at the Certification Activities under the ***Impacts*** section on page 92 and 93. Read the requirements for each of the activities suggested above and then choose which one you would like to complete.

Which activity did you select?

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

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!

What Are Consequences of Negative Energy Decisions?

Important Definitions

Stewardship
being responsible for and taking care of the world around you

Greenhouse Gases
gases in the atmosphere which absorb the radiation energy from the sun

Greenhouse Effect
the warming of the Earth from the radiation that has been trapped in the atmosphere by greenhouse gases.

Peak Oil
Peak oil refers to the depletion of one of our most valuable natural resources - petroleum. It is technically defined by when petroleum production reaches its maximum and slowly begins to decline as the nonrenewable resource becomes harder and more expensive to extract from the ground.

The Earth is meant to be a beautiful, clean, and healthy place to live 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***.

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 near-surface 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 such activity 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 32°F and 33°F; 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?

SAVE Work With It... Activity 1

How do greenhouse gases affect temperature?

To get the best results, be sure to do this activity around **mid-day** (between 11:00 am and 2:00 pm). You are going to test the temperatures of three different containers to simulate the effects of three different variables.

Checklist

For this activity you will need:

- 3 small thermometers
- 3 canning jars *(make sure they are all the same)*
- Marking pen
- White paper
- Transparent tape
- 1 stopwatch
- A sunny spot (or lamp)
- Someone to help
- Camera (optional)

Directions:

Step 1: Place each of your thermometers carefully on the ground in the sunny spot you've chosen. Wait three minutes and then read the temperature from each of them (they should be about the same).

Step 2: Place a thermometer in each of the containers. Cover the ends of each thermometer with small pieces of white paper in order to measure the air temperature rather than the solar energy from the sun.

Step 3: Now, take a deep breath and exhale your breath into one of the jars. Put the lid on as quickly as you can to trap in the carbon dioxide that you just exhaled. Label this one **CO_2** and **WATER VAPOR**.

Step 4: Place the lid on one of the other jars (but do not exhale into it). This will trap in the normal air from the spot you have chosen. Label this one **TRAPPED AIR**.

Step 5: The third container will simply be set out with no lid. Label this one **NO LID**.

Step 6: Finally, place all three containers on their sides on a sheet of white paper on the ground. Space them out—not too far, but just so that no shadows are cast on any other thermometers.

Step 7: Take a reading from each of the containers. Have your helper assist you in collecting these temperatures. Repeat this measurement every 2 minutes for 20 minutes total.

Sketch Your Setup

Record Your Observations . . .

Observation:	CO_2 and WATER VAPOR	TRAPPED AIR	NO LID
Beginning Temperature			
Temp. at 2 minutes			
Temp. at 4 minutes			
Temp. at 6 minutes			
Temp. at 8 minutes			
Temp. at 10 minutes			
Temp. at 12 minutes			
Temp. at 14 minutes			
Temp. at 16 minutes			
Temp. at 18 minutes			
Temp. at 20 minutes			

SAVE

So, what do you think?

How are you affected by climate change now and how might you be affected in the future? Explain your answer.

Think About It...

Which container had the highest temperature? The lowest?

What do you think caused these differences?

How do these findings relate to what you know about climate change?

Act On It...

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

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

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.

Topics:

- 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 would have a negative impact on this conservation issue?

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.*

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 opinions people have on the impacts of their energy choices. 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? How?
3. Do you think these topics 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 10 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? What was one thing you learned about opinions on these topics?

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 the opinions of others?

Did you worry about offending people?

How did you keep from doing that?

Were others able to change your thoughts about the issue?

SAVE CERTIFICATION ALERT…P6, P7, P8, R3, R4, or R6

Look at the Certification Activities under the ***Impacts*** section on page 92 and 93. Read the requirements for each of the activities suggested above and then choose which one you would like to complete.

Which activity did you select?

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

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.

What Are Some Positive Energy Decisions?

Important Definitions

Energy Consumption
the amount of energy that you use or transform into a less usable state; normally measured in kWh for electricity and gallons for gasoline.

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.

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 CFLs and LEDs	
Unplug power adapters	
Adjust your thermostat	
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 showerhead	
Unplug stand-by electronics	
Bike, walk, or take the bus as often as you can	
Buy and use ENERGY STAR appliances	

Think About It...

How many activities asked you to reduce wasteful habits?

How many used more efficient technology?

What are some other activities not listed?

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?

Act On It...

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

What are some of the barriers that have kept you from doing these activities?

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

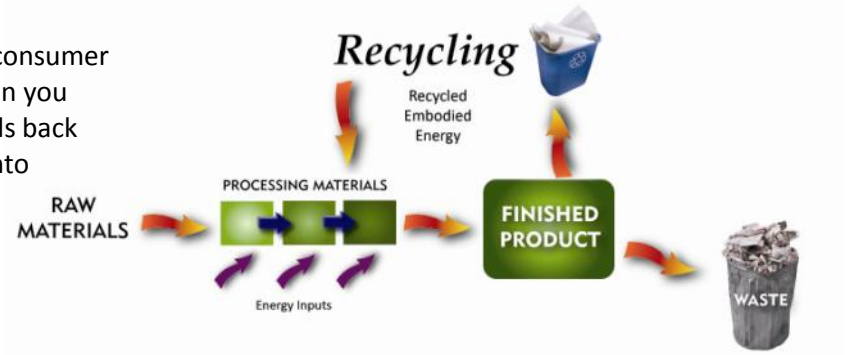
SAVE

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.

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 lifespan 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 cycle 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. Second, 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. Now, let's put the 4Rs to work! Choose **TWO** of the following activities to incorporate into your daily life.

Work With It... Activity 2

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.
- Only take the food you know you can eat instead of throwing some away.

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 with those in another 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.
- Find out if there are any items being thrown away at home that could be recycled.
- Develop a recycling campaign for your neighborhood to encourage your neighbors to use the 4Rs.

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 (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.

SAVE

You already know that many of our current energy needs are met using nonrenewable energy sources. These energy sources, such as gasoline, oil, and coal, are very concentrated and they are easier for us to collect and use than renewable sources. Unfortunately, these sources also contribute to environmental pollution and global warming. The solution is to replace as many nonrenewable energy sources with renewable ones as we can.

The activity on page 42 gave you an opportunity to explore several renewable energy sources. Remember, using renewable energy sources will not directly pollute the environment or contribute to global warming under normal circumstances. Renewable energy sources (such as wind, geothermal, solar, and biomass) are viable because they are usable, healthy, and able to be developed into our future energy sources. Let's look at the way wind energy is being used to create electricity.

Work With It... Activity 3

Can electricity be made from the motion of air?

Checklist

For this activity you will need:
- Access to the Internet or the library

People have been using wind to do work for a long time. Before electricity was so common, people often used wind to mill grain (chop grains, like wheat, into powder), lift water, and rotate saws to cut wood. These people were using the energy in the wind to rotate things. In the same way, we can use wind today to rotate magnets in the generator of a wind turbine. If you have ever played with a pinwheel, you know that blowing air into the pinwheel can rotate the shaft that the pinwheel sits on. If you place it into the wind it will rotate by itself. Since a wind turbine is essentially a very large pinwheel, so we could generate a lot of electricity, pump water, or even heat houses.

Directions:

Use your research skills to answer the questions about how wind energy has been harnessed to do work on page 86. One great website that can help you is from the U.S. Energy Information Administration. To find information about wind energy in the United States:

- Visit the site **http://www.eia.doe.gov/kids**
- Click on the ***Energy Sources*** link on the right hand side
- Select the ***Renewable*** link in the left column
- Select the ***Wind*** link in the left column
- Read the information on this page. Check out the maps, pictures and other links for additional information.

As you are reading the information, write down any interesting information that you find out about wind energy in the United States. Continue your research by investigating other places around the world that use wind power to generate electricity. Use caution when doing Internet research. You need to choose sources that are credible and accurate. Many people publish things on the Internet these days, and it is important to select sources with information that you can trust. Ask yourself the following questions about a website to help you decide if the information is trustworthy:

- Is the website personal or part of an organization or company?
- Does the website have a date? When was the information last updated? Who is responsible for updating the information?
- If the website is from a company, is it a commercial or a non-profit organization? Is there anything for sale on the website?
- Do the authors of this website provide a section of references or additional resources?

Wonderful World of Wind…

1. **Where does wind come from? Why is there wind?**

2. **How does a wind turbine work?**

3. **Is wind power viable for all states in America? Why or why not?**

4. **What states have the highest wind capacity?**

5. **What states have the lowest wind capacity?**

6. **Why does it take careful planning to figure out where to place a wind power plant?**

7. **What are some other places around the world that use wind power to generate electricity?**

SAVE

So, what do you think?

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.

Think About It...

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

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.

Act On It...

Wind is a powerful renewable source for energy, but most people can't install a large wind turbine in their backyard. In addition, not all locations are suitable for wind turbines. So, what could you and your family do to replace nonrenewable energy with renewable energy sources?

The Final Activity...

Use your Energy Journal to create your own concept map for your energy use. Use your camera to take pictures or find images in magazines or newspapers that capture what you have come to understand about energy using the four areas - forms, sources, users, and impacts. Then, create a concept map poster that you can share with others that captures your energy lifestyle.

SAVE Energy Journal

Energy Activity	Form	Potential or Kinetic	Duration in minutes	Energy Scale 1 - 5

Insert YEAR Here

Transformation(s)	Source	Renewable Y or N	Sector(s) I, T, C, or R	Impact Spectrum 1 - 5

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 website 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 website 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 website 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 website 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 website 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 website 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 website for more information:

www.florida4h.org/projects/SAVE.shmtl

The ***SAVE: Steps in Achieving Viable Energy Youth Guide*** **[4H EGM 50]** was developed by Nathan Mitten, Former Graduate Student and H.A. (Skip) Ingley, Associate Professor, Department of Mechanical and Aerospace Engineering, and Jessica Kochert, Former Graduate Student and Joy Jordan, 4-H Youth Development Curriculum Specialist, Department of Family, Youth and Community Sciences and Heather Kent, Regional Specialized Agent, UF/IFAS Extension. Reviewed January 2018.

Special thanks to Noorie Rajvanshi, Akiko Hiramatsu, and Paul Wassink for content contributions and to Neal Horstmeyer for SAVE graphics throughout the SAVE series.

Special thanks to the reviewers and pilot sites: Kathleen Ruppert, Extension Scientist Program for Resource Efficient Communities, Department of Agricultural and Biological Engineering; Julie Dillard, Washington County 4-H Agent; Suzanne Wilson, Walton County 4-H Agent; and the Jackson County 4-H Program pilot sites.

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