NSTA - AHEEC Curriculum Guide - Elementary - Grades 3-5

The **America's Home Energy Education Challenge (AHEEC)** is designed to help educators:

- educate students across the United States in grades 3-5 about energy and the benefits of energy conservation and efficiency;
- teach students to recognize that lowering their home energy use saves money;
- engage schools, students, and their families in a **Save Energy, Save Money** initiative.

Sponsored by the U.S. Department of Energy, this curriculum guide supports educators in meeting state and national standards for teaching energy concepts, while enabling students to earn Energy Fitness Awards by improving their knowledge of energy use and conservation. In addition, students earn points for their school in the AHEEC by completing class assignments and optional Quests.

Objectives

Students will:

- participate in class activities which investigate energy and how it is produced, transmitted, conserved, and managed.
- evaluate their personal use of energy and develop a plan for conservation.
- analyze energy resources and empower their communities (home, school, and local) to adopt energy and money-saving practices.
- engage in STEM activities with real-world applications for their daily behaviors.

Standards

The AHEEC curriculum is aligned with the **Next Generation Science Standards** for grades 3-5 *(note: NGSS Standards will be finalized and updated in April 2013)*. Students who demonstrate understanding can:

- **3-LS4-d.** Analyze and interpret data about changes in the environment of different areas and describe how the changes may affect the organisms that live in the areas. *Environmental changes should include changes to landforms, distribution of water, temperature, or availability of resources.*
- **4-PS3-b.** Make observations and collect data to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- **4-PS3-d.** Use information from texts and and diagrams to communicate that scientists and engineers from diverse backgrounds have applied scientific discoveries to invent technologies to enable humans to transport and store energy for practical use in daily life. *Examples of technology that allows humans to transport and store energy could include batteries in electrical devices, power grids, and gasoline stations.*
- **4-ESS3-a.** Construct a model using abstract representations and examples to describe differences between renewable and nonrenewable sources of energy.
- **5-ESS3-a.** Design and evaluate a solution to an environmental problem that decreases risks, increases benefits, or better meets societal demands for new or improved technologies. *Examples could include conducting an energy audit and developing a plan to reduce energy use.*

Materials and Suggested Timeframe

- The Next Generation Science Standards above are detailed according to grade levels 3-5; state requirements for energy-related education will vary somewhat from grade to grade, but are consistent with the content of this curriculum. The following lesson plans may be differentiated for learners across the span of the three grades. Third graders will most likely require more guided instruction through the material than 5th graders, who may have greater experience with the content as well as more highly developed independent learning skills. As the educator and expert in your classroom, you determine the best methods for exploring this content, engaging in these activities, and evaluating its effectiveness with your students.

- Prior to beginning this lesson series, check to be sure that your school has access to EIA Kids (http://www.eia.gov/kids/), or make the necessary photocopies to replicate the website's information. You will want to familiarize yourself with the EIA Kids website in order to present the information to your students (3-4th grades), or lead them through their own exploration (4-5th grades), in an organized manner.

- Determine which activities your students are going to complete in each lesson and prepare additional materials as needed for labs. Secure computer lab time if necessary. Copy the lesson worksheets and required materials from EIA Kids well in advance of implementing the lessons. Take a look at the associated links, personal energy audit, stories, and Quest activities. With a strong sense of the content and objectives for the lessons, you can help your students make meaningful connections between activities as they explore them one by one.

- Items to photocopy per student:

Lesson #	Item to Copy	Where to Find It
1	EIA Kids Scavenger Hunt Worksheet	Curriculum Guide pg. 5-6
2	Field Trip Worksheet (option 1 or 2)	Curriculum Guide pg. 8-9 or 10
	Online Field Trips (if using copies)	http://www.eia.gov/kids/energy.cfm?page=Trips
	Energy Source Posters	http://www.eia.gov/kids/resources/teachers/pdfs/submitted_lessons/source_roll_elem_lesson.pdf
	Chocolate Chip Cookie Mining Lab Worksheet	Curriculum Guide pg. 11-12
3	Lesson 3 Worksheet and Home Audit	Curriculum Guide pg. 15-16
	Short Circuit Story	http://www.eia.gov/kids/resources/teachers/pdfs/ShortCircuitElementary.pdf
	Light Bulb Comparison Lab Worksheet	Curriculum Guide pg. 17-18
4	Lesson 4 Worksheet	Curriculum Guide pg. 20-21
5	Lesson 5 Worksheet	Curriculum Guide pg. 23
Assessment	Energy Fitness Award Quiz	Curriculum Guide pg. 24-25
	Energy Fitness Award Rubric	Curriculum Guide pg. 29

- Activity worksheets, lab responses, terms and definitions, and procedures are provided for each lesson. An optional multiple choice quiz follows the lesson plans, focusing on vocabulary. You may adapt the plans as needed to differentiate instruction for your students, fit your schedule of classes, account for prior learning of the content, or work within technological constraints.

- The basic lessons and activities are designed to be five of the ten class periods suggested for implementing the *America's Home Energy Education Challenge.* Some activities, such as labs, are intended to reinforce the energy concepts in the basic lessons through immersion in a hands-on experience. Some of these labs may require an additional class period.

SUGGESTED 5-LESSON TIMEFRAME				
Day	**Topic**	**Time**	**Objectives**	**Tasks**
1	What is energy? (Energy Basics)	60 minutes (10 discussion, 50 for information gathering)	Students learn/review the basic foundations of energy, activating and enhancing their background knowledge.	* Complete a guided Energy Kids Scavenger Hunt web-quest and worksheet.
2	What sources provide us with energy? (Electricity Production)	60+ minutes (60+ for field trip OR (30 for in-class field trip experience, 30+ for lab)	Students explore energy sources and locations, comparing and contrasting renewable and nonrenewable options.	* Take an energy field trip (in or out of class). * Complete experiment and lab sheet.
3	How do I use energy? (Energy Transmission)	60+ minutes (30 for audit, 30+ for lab)	Students analyze their everyday energy usage and examine lighting choices.	* Complete home audit. * Conduct light bulb lab.
4	How can I save energy? (Energy Conservation)	60+ minutes (30 for graph, 15 for group discussion, 15+ for plan and goals)	After review of their audits, students develop a goal-oriented plan to reduce personal energy usage.	* Graph audit. * Write plan for change and make predictions of possible outcomes.
5	How can I share what I've learned? (Energy Management)	60+ minutes (30 for letter, 30+ for slogans)	Students reflect on their increased energy knowledge and report on their experiences to their family and school.	* Write letter to parents. * Write slogan for energy conservation and display them in the school building.

Procedures

Lesson 1: **Energy Basics (60 minutes)**

Lesson 1: What is energy?	
Objective: Students learn/review the basic foundations of energy, activating and enhancing their background knowledge.	
Vocabulary	biomass: Any organic (plant or animal) material which is renewable, including agricultural crops, wastes, and residues; wood, animal and municipal wastes; and aquatic plants. DOE: U.S. Department of Energy carbon dioxide: a colorless, odorless gas that is present in the atmosphere. energy: the ability to do work or the ability to move an object. potential energy: stored energy, or the energy of position. kinetic energy: the energy of motion. power**:** the rate at which energy is transferred. watt: a metric unit of power, usually used in electric measurements, which gives the rate at which work is done or energy used. renewable energy sources: fuels that can be easily made or renewed in our lifetime, such as water, solar, wind, geothermal, and biomass. nonrenewable energy sources: fuels that cannot be easily made or renewed, such as oil, natural gas, and coal.
Procedures	* Activate your students' prior knowledge with a brief discussion of what a day would be like without energy. Record student responses (board, screen, overhead). * Explain the overview of the five lessons and how they connect to each other; distribute worksheets for Lesson 1, introduce today's terms, and preview the EIA Kids Scavenger Hunt questions. * If you are using individual computers as a web-quest or projecting the website on a shared screen, direct students to the EIA Kids Scavenger Hunt. Explain that you will work as a class to find the answers to the worksheet questions. * Complete the worksheet together, reading over the Scavenger Hunt categories on the website, finding the answers, and assisting students with transferring answers on their worksheets. * Collect worksheets or have students file them in an Energy Folder or Science folder/section, to be collected at the end of the five lessons. * Encourage students to visit the EIA Kids site at home for review and further information. The URL is on their worksheet.
Links	* Energy Kids (EIA) Scavenger Hunt -- http://www.eia.gov/kids/resources/teachers/pdfs/EIAScavengerHunt.pdf

Lesson 1 - What Is Energy?
NAME: _____ **DATE:** _____

Terms to know:

- biomass: Any organic (plant or animal) material which is renewable, including agricultural crops, wastes, and residues; wood, animal and municipal wastes; and aquatic plants.
- DOE: U.S. Department of Energy
- carbon dioxide: a colorless, odorless gas that is present in the atmosphere.
- energy: the ability to do work or the ability to move an object.
- potential energy: stored energy, or the energy of position.
- kinetic energy: the energy of motion.

* power**:** the rate at which energy is transferred.
* watt: a metric unit of power, usually used in electric measurements, which gives the rate at which work is done or energy used.
* renewable energy sources: fuels that can be easily made or renewed in our lifetime, such as water, solar, wind, geothermal, and biomass.
* nonrenewable energy sources: fuels that cannot be easily made or renewed, such as oil, natural gas, and coal.

Part 1: EIA Kids Scavenger Hunt Questions
http://www.eia.gov/kids/resources/teachers/pdfs/EIAScavengerHunt.pdf
Answer these questions as your educator guides you through the EIA Kids Website.

13.The two categories for all energy are _____ and _____.

14.Petroleum is used to make many everyday products -- name five: _____
_____.

15.How is natural gas transported? _____.

16.How is coal transported? _____.

17.What are two methods used to mine coal out of the ground? _____ and
_____.

18.Nuclear _____ is the process of splitting uranium atoms into smaller atoms to release heat energy.

19.A _____cell converts solar energy into electricity.

20.The “ring” of geothermal resources is known as _____.

21. We use corn to make the transportation fuel known as _____.

22. The biomass resource most often used is _____.

23. Energy from moving water is called _____.

24. Everything in the universe is made of tiny, tiny things called _____. They are made of tiny parts called neutrons, protons, and electrons. Electricity is moving electrons.

25. How is electricity measured? _____.

26. What is the number one use of energy in homes? _____.

27. What is energy conservation? _____
_____.

16. Define "renewable resources."	17. List the five examples.

18. Define "nonrenewable resources."	19. List the four examples.

20. Does most of the energy used in the U.S. come from renewable or nonrenewable sources?
_____.

BONUS: If your goal is to save energy, why is it a good idea to recycle? _____
_____
_____.

Lesson 2: Energy Production (60+ minutes)

Lesson 2: What sources provide us with energy?	
Objective: Students explore energy sources and locations, and compare and contrast renewable and nonrenewable options.	
Vocabulary	chemical energy: energy stored in a substance and released during a chemical reaction, such as burning wood or coal. coal: a fossil fuel formed by the breakdown of vegetable material trapped underground without access to air. fossil fuels: fuels (coal, oil, natural gas) that result from the compression of ancient plant and animal life formed over millions of years. geothermal energy: heat energy produced by natural processes inside the earth; it can be taken from hot springs or by breaking open the rock itself. hydropower: energy that comes from moving water. land reclamation: returning land to the way it was or better than before mining. mechanical energy: the energy of motion used to perform work; the total energy of motion and position of an object. solar cell: an electric cell which changes radiant energy from the sun into electrical energy. wind turbine: device powered by the wind that produces mechanical or electrical power.
Procedures	1. Lesson 2 can be presented in class or as a field trip. If you have the resources to take students to an energy source location to interview professionals and gather evidence, use the Field Trip worksheet (pages 1-2), and omit the lab activity or schedule it for another day. If you opt for an in-class experience, following steps 2-6. 2. Using the link below (disregarding page 1), print the ten Energy Source posters and post renewable sources on one side of the room, nonrenewable on the other. Review the list of renewable and nonrenewable sources from the Lesson 1 worksheet with your students. 3. Distribute Lesson 2 Virtual Field Trip worksheets to students. 4. Assign students in pairs to each of the EIA Kids online field trips. Have them read the entry for their trip (either online or photocopied) and write a summary report (three to five sentences) to present to the class about their energy location. 5. Have students (in established pairs) go to the poster/side of the room that describes the place they visited -- see who else arrives there and discuss briefly the connections between the stories and locations. As time permits, have the two large groups verbally compare and contrast their locations' benefits. 6. Today or during the next class period, conduct the Chocolate Chip Cookie Mining lab with your students. The lab sheet and teacher instructions are found on pages 10-12 of this guide.
Links	* Energy Source Posters (10): http://www.eia.gov/kids/resources/teachers/pdfs/submitted_lessons/source_roll_elem_lesson.pdf (posters begin on the second page of the site) 1. EIA online field trips: http://www.eia.gov/kids/energy.cfm?page=Trips (click on energy sites listed for each journal entry/field trip)

Lesson 2 - Field Trip Option, page 1 - What Sources Provide Us WIth Energy?

NAME: _____ DATE: _____

You flip on a switch and all of a sudden your bedroom is full of light. This can seem like magic, but it is not! The electricity that is powering so many things in your life is generated somewhere — usually pretty far away from where you are actually using it. The energy source used to generate your electricity might be coal, hydropower, wind, or any one of a number of other sources. Do you remember the nine sources of energy from Lesson 1 (renewable and nonrenewable)? The source could even be a combination of many of these sources.

Your educator has arranged for you to visit a place in your community where electricity is being produced, fuels are being processed or transferred, or energy technology is being developed. This should be a place where you have something new to learn. Some examples of energy locations are:

* a local utility company
* a hydro-power dam
* a wind farm
* an alternative fueling station
* an electrical substation
* a geothermal power station
* a local home that has its own wind or solar power

You are going to visit: _____!

On the field trip, you must gather evidence of your visit. For example, you may take pictures or short video clips, collect informational brochures, request business cards of the professionals you speak with, take notes, or ask questions and record the answers. Use the back of this sheet for your questions, answers, and note-taking.

This field trip will help you understand more about where your energy comes from and how it gets to you. That light coming on in your bedroom is not magic! We have a big energy system designed to make things like that possible!

Terms	Definitions
chemical energy	Energy stored in a substance and released during a chemical reaction, such as burning wood or coal.
coal	A fossil fuel formed by the breakdown of vegetable material trapped underground without air.
fossil fuels	Fuels (coal, oil, natural gas) that result from the compression of ancient plant and animal life formed over millions of years.
geothermal energy	Heat energy produced by natural processes inside the earth; it can be taken from hot springs or by breaking open the rock itself.
hydropower	Energy that comes from moving water.
land reclamation	Returning land to the way it was or better than before mining.
mechanical energy	The energy of motion used to perform work; total energy of motion and position of an object.
solar cell	An electric cell which changes radiant energy from the sun into electrical energy.
wind turbine	Device powered by the wind that produces mechanical or electrical power.

Lesson 2 - Field Trip Option, page 2 - What Sources Provide Us With Energy?
NAME: _____DATE: _____

Field trip location: _____

This is a place for you to record the information you receive from the professionals at the location you are visiting today -- listen carefully to all the speakers, including any classmates who ask questions. If you have a question, write it down here. That way you'll remember it when the speaker asks if there are any questions! (They usually ask this at the end of their talk.)

Notes:

What items did you collect from the field trip? What does this evidence teach you and others about the energy source or service provided here? Remember to write your answer in complete sentences.

Lesson 2 - Virtual Field Trip Option - What Sources Provide Us With Energy?
NAME: _____ DATE: _____

Terms to know:

1. chemical energy: energy stored in a substance and released during a chemical reaction, such as burning wood or coal.

2. coal: a fossil fuel formed by the breakdown of vegetable material trapped underground without access to air.

3. fossil fuels: fuels (coal, oil, natural gas) that result from the compression of ancient plant and animal life formed over millions of years.

4. geothermal energy: heat energy produced by natural processes inside the earth; it can be taken from hot springs or by breaking open the rock itself.

5. hydropower: energy that comes from moving water.

6. land reclamation: returning land to the way it was or better than before mining.

7. mechanical energy: the energy of motion used to perform work; the total energy of motion and position of an object.

8. solar cell: an electric cell which changes radiant energy from the sun into electrical energy.

9. wind turbine: device powered by the wind that produce mechanical or electrical power.

Part 1: Virtual Field Trip Activity
You will be assigned to a partner and will visit an energy source location either online or on paper. Write your location and your partner's name here: _____
_____.

Read your assigned Field Trip journal entry now. With your partner, write a three to five sentence summary of your virtual trip on a separate sheet of paper. You will report to the class (read your summary) in a few minutes. Staple your summary to this worksheet.

Part 2: Energy Source Comparisons
Look around the room at the Energy Source Posters. Which one fits best with your Field Trip? Go stand next to it. Is your source renewable or nonrenewable? _____
Compare and contrast the benefits of your source with your classmates - take turns!

Part 3: Chocolate Chip Cookie Mining Lab
Your educator will hand out a lab response sheet for this activity. When you're finished with the lab, staple the response sheet to this worksheet.

Lesson 2: Chocolate Chip Cookie Mining Lab
NAME: _____DATE: _____

(Adapted from The NEED Project)

In this lab, you are going on a mining expedition! Your educator will provide you with the necessary equipment. Follow the step by step directions, and work carefully for the best results. Before you start, your class is going to discuss a few facts about coal. Take some notes here during the discussion:

1. Coal is...

2. We use coal for....

3. Why is coal nonrenewable?

4. Land reclamation is....

Mining Equipment:

1. 2 land locations (cookie A and cookie B)
2. 2 mining tools (toothpicks)
3. 2 regions (napkins)
4. 1 mine map (piece of paper)

Step 1: Once you have your equipment in hand, label one of the regions A and one B. Your educator will give you a piece of land for each (cookie A and cookie B) -- be sure to put the correct land on the corresponding map (example: cookie A goes on napkin A). DO NOT eat your cookies! Coal can't be mined from land that isn't there.

Step 2: Trace the outline of cookie A on your mine map/piece of paper. Draw the location of the chocolate chips you can see on the top of the cookie.

Step 3: Count the number of chips you can see on the top and sides of the cookie. Record this number on the chart on the back of this page.

Step 4: Using the toothpick, carefully mine as many chocolate chips as you can from the cookie. Set the chips aside in a pile.

Step 5: Count the number of chips mined from the cookie. Record the number on the chart on the back of this page.

Step 6: Put the cookie back together without the chocolate chips. Compare it to your drawing of the cookie and make it as similar to the whole cookie as possible.

Step 7: Repeat the procedure for cookie B.

My Cookie Chart

Cookie	# of surface chips	# of chips mined
A		
B		

When your mining is complete, report to your educator with your totals. Then get started with these questions. Write your answer to questions 1-4 in complete sentences. You will discuss these with your class in a few minutes. While you're working on your answers, you can eat your cookies.

- Which cookie was easier to mine and why? _____
  _____
  _____.

- Which cookie had the most chips? _____.

- Was it easier to mine chips on the surface of the cookie or inside the cookie? Why? _____
  _____
  _____.

- The chocolate chips are like coal that is used for energy. Do some areas of land have coal that is easier to mine? Do some areas have more coal to mine in the first place? _____
  _____
  _____
  _____.

- Does your "reclaimed" cookie look like it did before it was mined? Why or why not? _____
  _____
  _____.

- Why is land reclamation important? _____
  _____
  _____
  _____.

Lesson 2: Chocolate Chip Cookie Mining Lab

Educator Guide -- (Adapted from The NEED Project - http://www.need.org/)
http://www.eia.gov/kids/resources/teachers/pdfs/CookieMining_PriElem.pdf

Concepts:

a. Coal is a nonrenewable energy resource that is mined from the earth.
b. Some places have more coal than others.
c. Some places have coal that is easier to mine than others.
d. Coal on the surface is easier to mine than coal that is underground.

Time: approximately 45 minutes

Materials (per student)

a. 2 different kinds of chocolate chip cookies (land)
b. 2 toothpicks (mining tools)
c. 2 napkins (regions)
d. 1 piece of paper (mine map)

Procedures

1. Explain to your students that coal was formed from plants and animals that lived millions of years ago before the dinosaurs were around. When the plants died, they were buried under sand and silt. Over time, the sand and silt built up, putting heat and pressure on the thick layer of dead plants, and changing it into coal.

2. Ask your students how we use coal; add to their responses and discuss the ways which we use coal every day. Remind students that coal is a nonrenewable energy source. Once we use it, we cannot make more of it in a short period of time.

3. Explain that coal is buried underground and it is harvested through the process of mining. When coal is mined, the land that the coal came from must be reclaimed so that people can use the land again.

4. Explain to the students that they will be comparing two different land sites containing coal. They will mine the coal from each piece of land.

5. Show the students their “land” (cookies) and “mining equipment” (toothpicks). Emphasize that the cookies are not to be eaten during the mining, but may be at the end. Make sure all students know which cookie is A and which is B.

6. Explain the mining process to the students, using the directions on the worksheet. Have students mine their cookies.

7. Make a chart on the board with class totals from cookies A and B, and compare the results. Then, eat the cookies!

8. Ask the students which type of cookie was easier to mine and which type contained the most coal (chips). Discuss with the students how this compares with coal resources. Do some areas have coal that is easier to mine than others? Do some areas have more coal than others?

9. Ask if it was easier to mine chips on the surface of the cookie or chips inside the cookie. Discuss with the students the differences between surface and underground mining.

10. Ask the students if their reclaimed cookies looked like the original cookies. Discuss once more the concept of land reclamation and why it is important.

Lesson 3: Energy Transmission (60+ minutes)

Lesson 3: How do I use energy?	
Objective: Students analyze their everyday energy usage and examine lighting choices.	
Vocabulary	appliance: a piece of equipment, commonly powered by electricity, used to perform a particular energy-driven function. Examples: refrigerator, washer, oven, microwave, toaster, radio, television. audit: a careful and detailed review of a condition or situation. circuit: a closed loop through which electric currents continuously move. conductor: a material, such as metal or water, that electricity can easily flow through. generator: a device that turns mechanical energy into electric energy by using an engine or turbine. incandescent light bulb: a glass bulb in which light is produced by a thin wire heated by an electric current. compact fluorescent light bulb: (CFL) small fluorescent bulb which uses up to 75% less energy and lasts about eight times longer than incandescent bulbs. kilowatt-hour: A unit of work or energy used to measure electricity. LED light bulb: "light emitting diode" - a light bulb which produces less heat by directing its light in a specific direction; use at least 75% less energy and last 25 times longer than incandescent bulbs. load: the power and energy requirements of users on the electric power system in a certain area or the amount of power delivered to a certain point. power plant: a facility where power, especially electricity, is generated. thermostat: a device that adjusts the amount of heating or cooling produced and/or distributed by automatically responding to the temperature of the environment.
Procedures	1. Review the content of the two previous lessons: energy basics, and the many ways and places in which electricity is produced (going from primary source to secondary source). Explain that today is when you take this knowledge to a personal level. 2. Explain to students that they will be conducting a simple home energy audit based on their daily energy use. Define "audit", and distribute the worksheet for Lesson 3. Go over the audit directions together, demonstrating how to circle the Energy Bucks and total them at the bottom. 3. Instruct students to complete their audits and add up each section. When they are finished, tell them to read the Short Circuit story to learn about power outages. 4. When all audits are complete, conduct the Light Bulb Comparison lab and have students complete the lab sheet. The lab is designed to test all three bulbs, but can be done using just a CFL and incandescent if LEDs are not available. ***Additional materials needed for the lab (per group of students): lamp, bulbs, thermometer.*** Suggested bulbs from Lowe's: - ***LED (item #338931)*** *- 13.5 W(60 W equivalent), $19.98 per bulb, Energy Star Rated, bulb life 25,000 hours, 800 lumens, 3000 K Warm White Light, dimmable* - ***Incandescent (item #220054)*** *- 60 W, $0.32 per bulb, Bulb life 1,000 hours, 760 lumens of brightness, 2700 K Soft White Light, dimmable* - ***CFL (item #82382)*** *- 15 W (60 W equivalent), $4.00 per bulb, Energy Star Rated, bulb life 8,000 hours, 800 lumens, 2700 K Soft White Light.* 5. Discuss answers to questions after you conduct the lab.
Links	• Short Circuit story: http://www.eia.gov/kids/resources/teachers/pdfs/ShortCircuitElementary.pdf • Reference to CFLs, mercury, recycling and disposal: http://www2.epa.gov/cfl

Lesson 3 - How Do I Use Energy?
NAME: _____ DATE: _____

Terms to know:

- appliance: a piece of equipment, commonly powered by electricity, used to perform a particular energy-driven function. Examples include: refrigerators, washers, dryers, ovens, microwaves, toasters, radios, and televisions.
- audit: a careful and detailed review of a condition or situation.
- circuit: a closed loop through which electric currents continuously move.
- conductor: a material, such as metal or water, that electricity can easily flow through.
- generator: a device that turns mechanical energy into electric energy by using an engine or turbine.
- incandescent light bulb: a glass bulb in which light is produced by a thin wire heated by an electric current.
- compact fluorescent light bulb: (CFL) small fluorescent bulb which uses up to 75% less energy and lasts about eight times longer than incandescent bulbs.
- kilowatt-hour: A unit of work or energy used to measure electricity.
- LED light bulb: “light emitting diode” - a light bulb which produces less heat by directing its light in a specific direction; use at least 75% less energy and last 25 times longer than incandescent bulbs.
- load: the power and energy requirements of users on the electric power system in a certain area or the amount of power delivered to a certain point.
- power plant: a facility where power, especially electricity, is generated.
- thermostat: a device that adjusts the amount of heating or cooling produced and/or distributed by automatically responding to the temperature of the environment.

Part 1: Home Energy Audit

Now that you’ve reviewed the basics of energy, and the many ways and places in which electricity is produced, it’s time to consider how you use it every day! Using the Home Energy Audit on the back of this sheet, mark the items you use in a typical day. An estimation of the number of Energy Bucks it costs for that usage is listed after each item. For each item you mark, circle the Energy Bucks number beside it, and total them at the bottom of the Energy Bucks column.

Part 2: What’s a Short Circuit?

When you have finished your Home Energy Audit, read the article “What’s a Short Circuit?” and learn how power outages happen.

Home Energy Audit

NAME: _____ **DATE:** _____

Put an X in the second column (Items Used by My Family) for every item you use in your home. Then circle the Energy Bucks in the last column for every item you gave an X. Add the circled Energy Bucks to find your total monthly cost of electricity used in your home.

Items Using Electricity	Items Used by my Family	Estimated kWh usage per month	Energy Bucks (monthly kWh X $.10)
Kitchen Items			
Microwave		20 kWh	$2
Oven/Stove		60 kWh	$6
Toaster		10 kWh	$1
Refrigerator		200 kWh	$20
Dishwasher		30 kWh	$3
Bathroom Items			
Water heater (for family of 4)		300 kWh	$30
Hair Dryer		10 kWh	$1
Hair Straightener/Curling Iron		10 kWh	$1
Other Appliances			
Heating system, fan		90 kWh	$9
Air Conditioner (central)		850 kWh	$85
Alarm Clock, Radio or Stereo		10 kWh	$1
TV/VCR/DVD		30 kWh	$3
Video Game System		20 kWh	$2
Computer		30 kWh	$3
Lighting			
Lighting, 4-5 rooms		50 kWh	$5
Lighting, 6-8 rooms		60 kWh	$6
Total Monthly Energy Bucks			

** Average cost for electricity is $0.10 per kWh; last updated 2013.*

Part 3: Light Bulb Comparison Lab
NAME: _____ DATE: _____

In this lab, you will be comparing three light bulbs using the following chart and experiment outlined below. Some of the information is provided; you are to complete the last two rows of the table during the experiment. Read over all the steps before you begin the experiment.

Materials needed (per group):
- lamp
- thermometer
- ruler
- light bulbs (equivalent to 60w): incandescent, CFL, and LED

Light Bulb Options for Home Use

	LED	CFL	Incandescent
Watts (light output) per bulb - equivalent to 60w	13.5 watts	15 watts	60 watts
Projected lifespan	25,000 hours	8,000 hours	1,000 hours
Lumens rating	800 lumens	800 lumens	760 lumens
Hazardous materials	none	5mg of mercury/bulb	none
# of bulbs needed (for 25,000 hours)	1	3	25
Cost per bulb (approximate)	$20	$4	$0.50
Cost of electricity used over 25,000 hours ($0.10 per KWh)	$25	$36	$150
Energy Star Rated	yes	yes	no
TOTAL Cost for 25,000 hours of light	$45	$48	$162.50
Heat emitted or given off: temperature reached after two minutes (indicate either °C or °F)			
Observation of light (color, brightness, reach, etc.)			

- ***Cost of light bulbs and electricity will vary somewhat from state to state. These figures are not exact and are used for comparison purposes.***

Step 1: Take the LED light bulb, place it in a lamp with the lightbulb pointed toward the ceiling, and turn the lamp on. Hold a thermometer six inches above the light bulb for two minutes. At the end of the allotted time, turn off the light bulb and read the thermometer. Record the temperature in the row labeled “heat emitted” in the table above.

Step 2: During the two minutes of heating, observe the light coming from the bulb. Is it white or yellow? Bright or soft? How far does it reach in the room? Could you see well enough to read by its light across the room? Write your observations in the last row of the table above.

Step 3: Repeat the process for the CFL and the incandescent bulbs. Be sure you have the last two rows of the chart completed before answering the following questions.

Questions:

Why do you think you're told to hold the thermometer six inches away from the lamp? _____
_____
_____.

Do you think there is supposed to be heat coming from the bulb? _____ Why or why not?
_____
_____.

Is there more heat or more light coming from the bulbs? _____
_____
_____.

Using the information in the chart and from the experiment, which light bulb do you feel uses the least energy? Explain your answer in a sentence or two, using data from the chart as evidence.
_____
_____
_____
_____.

Using the information in the chart, which light bulb costs the least amount, looking at the cost of the bulb and the cost of energy to light it over a span of time? _____
_____
_____.

Comparing LEDs and CFLs, what is one reason a family might choose to buy LEDs instead of CFLs?
_____
_____
_____.

How do you recycle or dispose of CFL bulbs in order to limit your contact with mercury or its release into the environment? _____
_____
_____.

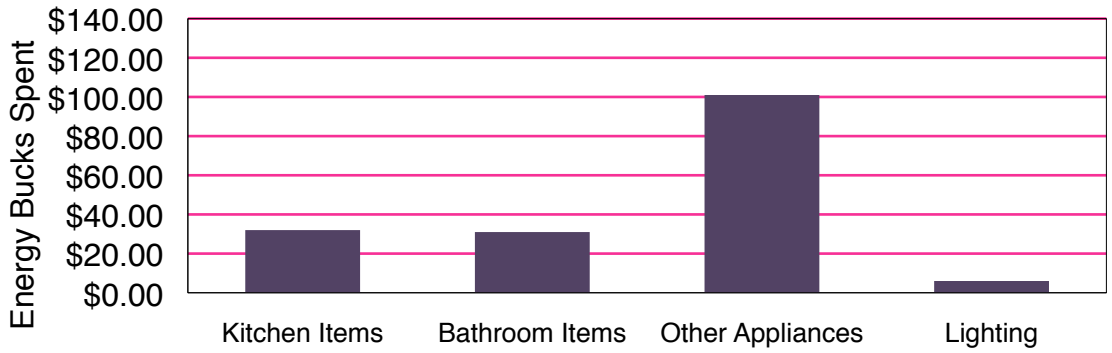
Step 4: Discuss the questions below with your classmates:

10. Do you think that future generations will use incandescent light bulbs? Why or why not?
11. What will you do with this new information about light bulbs?

Lesson 4: Energy Conservation (60+ minutes)

Lesson 4: How can I save energy?	
Objective: After reviewing their audits, students develop a goal-oriented plan to reduce personal energy usage.	
Vocabulary	energy conservation: the act of using less energy or saving energy. energy star rating: a label given to a product or appliance that shows it meets strict government standards for energy efficiency.
Procedures	• Have students take out their Home Energy Audits. Distribute graph paper and tell students that they will be creating a bar graph of their results (example below). For younger students who may not have much previous instruction in bar-graphing, review the parts of a bar graph: X and Y axis, labels, scale, and how to create a bar for each set of data. • Model how to label the axis of the graph -- Y axis as "Energy Bucks", and X axis as the categories of items from the audit. Scale suggestion is by $20 increments. Display the sample graph and demonstrate how to do a bar for each section of the audit - you might model your own personal audit results for them. Then have students fill in their personal graphs. • Distribute the Lesson 4 Worksheet and look at Part 1: Graph Analysis. Tell students to fill in their category with the greatest energy use; then have them fill in their category with their lowest energy use. • As your time permits, compare and contrast student results in a cooperative group setting; starting with pairs, have students discover whether they share similar categories with greater or less energy usage? Join the pairs into groups of four, and after comparing results, have students discuss why might this be true or why it might be different. Have a spokesperson from each group of four share one point from their group discussion. *(Omit this step if you only have sixty minutes or less.)* • As a class, brainstorm some ways students can use less energy throughout the day, and record suggestions on the board or projector where students can see them for the next step. Have students list these in Part 2 of their worksheets. • In Part 3 of the worksheet, have them write a minimum of three goals to lower their areas of greatest energy usage (using ideas from the list they just made) • Wrap up with a prediction (Part 4) of how many Energy Bucks they think they will save. Show your students how you can take each goal and estimate the money they will save each month by cutting back on their usage - you can model with a goal of your own, breaking down the monthly cost into percentages for days or particular uses. For example, if students make a goal to turn off lights when not in use, they might save $1 a month on lighting. • Finish the lesson by collecting student plans and graphs.

SAMPLE GRAPH



Lesson 4 - How Can I Save Energy?
NAME: _____ DATE: _____

Terms to know:

- energy conservation: the act of using less energy or saving energy.

- energy star rating: a label given to a product or appliance that shows it meets strict government standards for energy efficiency.

Part 1: Graph Analysis
Using the bar graph of your Home Energy Audit results, answer the following questions by stating the time of day for each category.

1. What category on your graph shows the most energy usage (which bar is the highest)?
   _____.

2. What category on your graph shows the least energy usage (which bar is the lowest)?
   _____.

3. After comparing your graph results with a group of classmates, what reasons can you give for why your graphs are similar or different?
   _____
   _____
   _____.

Part 2: Ways to Conserve Energy in Your Home
With your class, make a list of actions you can take to lower your greatest energy usage.

Record the list of ideas here:

Part 3: Goals for Personal Energy Conservation
Your class has brainstormed a list of ways you can lower your energy usage on a daily basis. Write goals using at least three methods that would help you lower your greatest usage bars. You may set as many additional goals as you like and think you can meet. Be specific and state what you will do differently in your actions to save energy.

2. Goal #1: I will lower my energy usage by _____
_____
_____.

2. Goal #2: I will lower my energy usage by _____
_____
_____.

3. Goal #3: I will lower my energy usage by _____
_____
_____.

Part 4: Making a Prediction for Energy and Cost Savings
Everyone sets goals in order to improve behavior. By estimating how much energy you can save based on your goals, you can predict how much money your family can save each month if you all work together! Look at your audit and goals one more time, and estimate how many Energy Bucks you can save each month by making those three changes.

Prediction: My family can save _____ each month by these actions _____
_____
_____
_____.

Be sure to staple your graph to the back of this worksheet.

Good luck getting your plan started and meeting your goals!

Lesson 5: Energy Management (60+ minutes)

Lesson 5: How can I share what I've learned?	
Objective: Students review and reflect on their increased energy knowledge, then report on that knowledge to their home and school communities to enable further energy conservation.	
Vocabulary	emission: releases of gases into the air as a result of some type of human activity, such as cooking or driving a car. climate change: significant change in the Earth's climate. The Earth is currently getting warmer because people are adding heat-trapping greenhouse gases to the atmosphere. The term "global warming" refers to warmer temperatures, while "climate change" refers to the broader set of changes that go along with warmer temperatures, including changes in weather patterns, the oceans, ice and snow, and ecosystems around the world. greenhouse effect: the effect of the Earth's atmosphere, due to certain gases, in trapping heat from the sun -- the atmosphere acts like a greenhouse. recycling: the process of converting materials which are no longer useful as designed or intended into a new product. Part of the three R's (reduce, reuse, recycle) that help preserve natural resources and prevent greenhouse gas emissions.
Procedures	1. Explain to students that this is the last lesson for the Energy Fitness Award. Review the content of the previous four lessons: energy basics, energy sources, energy usage, and energy conservation. 2. Tell students that today's lesson is about sharing their knowledge in order to encourage change. Hand out the worksheet for Lesson 5 and read over the vocabulary together. Connect these terms to their home energy audits, reinforcing that by using less energy, they not only save money for their families, but they also reduce their impact on the environment. Energy Fitness benefits everyone! 3. Spend a moment reviewing the three R's (three principles of "reduce -- reuse -- recycle") and reminding students that these practices slow climate change by people buying and throwing away less stuff, so less energy is used for manufacturing new items and disposing of the old ones. Write Reduce, Reuse, and Recycle on the board or screen and brainstorm some examples for each. 4. For Part 1, have students take out a piece of paper and tell them they will be writing a personal letter to their parents. They should include their three energy-saving goals from the previous lesson and explain the importance of those goals in lowering their family's bills as well as using less energy. They can ask their parents to support their plan by making the same changes in their energy behavior. They should consider what their family is doing to reduce, reuse, and recycle. Overall, student letters should try to show enthusiasm for energy conservation! 5. When the letters are finished, collect them, or note in a grade book or on a checklist that they are finished and send them home to the parents. 6. For Part 2, either in small groups, or on their own, have students write a slogan advertising energy conservation, like a mini-billboard. Display the slogans on a bulletin board or in a hallway of the school building. If you are short on time, schedule this activity for an additional class period -- allowing students to share what they have learned regarding energy conservation is a highlight of the curriculum. 7. Lastly, connect the students goals to the school's participation in the AHEEC contest - remind them that they will be collecting data for the next several months from real utility bills and will be able to track their personal progress with their goals. 8. Remind students of the optional Quests found in the Energy Lab of the AHEEC website and that completing these is fun, interesting, and earns points for their school in the AHEEC Contest!

Lesson 5 - How Can I Share What I've Learned?
NAME: _____ DATE: _____

Terms to know:

- emission: releases of gases into the air as a result of some type of human activity, such as cooking or driving a car.

- climate change: A significant change in the Earth's climate. The Earth is currently getting warmer because people are adding heat-trapping greenhouse gases to the atmosphere. The term "global warming" refers to warmer temperatures, while "climate change" refers to the broader set of changes that go along with warmer temperatures, including changes in weather patterns, the oceans, ice and snow, and ecosystems around the world.

- greenhouse effect: The effect of the Earth's atmosphere, due to certain gases, in trapping heat from the sun -- the atmosphere acts like a greenhouse.

- recycling: the process of converting materials which are no longer useful as designed or intended into a new product. Part of the three R's (reduce, reuse, recycle) that help preserve natural resources and prevent greenhouse gas emissions.

Part 1: Parent Letter
Now that you know so much more about energy use and conservation, it's time to share what you've learned with the people around you. On a separate sheet of paper, write a letter to your parents or adults in your home sharing the three goals that you set to lower your energy usage in your home. Explain to them how they can help you meet those goals by changing their energy-using behaviors along with you. Consider what your family is doing to Reduce -- Reuse -- Recycle. Show your excitement in saving money and saving energy through your everyday actions! Finally, thank your parents and family members for caring about the future of energy and our planet.

Part 2: Slogan
Every good campaign for change needs a catchy slogan, like you see on billboards around town. For example, ***"It Makes Good "Cents" to save Energy Bucks!"*** On your own or with a group, write a slogan that will encourage people to lower their energy usage. Make a small poster/billboard with your slogan and post it in your school.

Write your slogan here before you make your poster:
_____
_____
_____
_____.

Display your slogan with energy symbols or drawings that show energy conservation in action!

Energy Fitness Award Quiz
NAME: _____ DATE: _____

Part 1: Answer the following questions by circling the letter of the correct answer.

1. The ability to do work is:

    a. biomass
    b. energy
    c. watt
    d. circuit

2. Energy of motion is:

    a. potential energy
    b. kinetic energy
    c. chemical energy
    d. solar energy

3. Stored energy, or the energy of position is:

    a. potential energy
    b. kinetic energy
    c. chemical energy
    d. wind energy

4. A fossil fuel formed by the breakdown of vegetable materials trapped underground without access to air:

    a. petroleum
    b. coal
    c. natural gas
    a. wood

5. Electricity that comes from moving water is referred to as:

    a. kinetic energy
    b. solar energy
    c. hydropower
    d. chemical energy

6. A closed loop through which electric currents continuously move is called a:

    a. circuit
    b. generator
    c. thermostat
    d. light bulb

7. A device that turns mechanical energy into electric energy is known as a:

    a. circuit
    b. generator
    c. thermostat
    d. light bulb

8. The gases released into the air through some kind of human activity are known as:

a. fossil fuels
b. emissions
c. petroleum
a. ethanol

9. A piece of equipment, commonly powered by electricity, used to perform a particular energy-driven function:

a. light bulb
b. load
c. circuit
d. appliance

10. The rate at which energy is transferred is called:

a. power
b. watt
c. load
a. carbon dioxide

Part 2: Answer the questions by filling in the blank with the word or words which best completes the sentence.

11. A facility where power, especially electricity, is generated is called a _____.

12. An _____ is a careful and detailed review of a certain condition or situation.

13. _____ means “light emitting diode” and is the name of the type of lightbulb which produces less heat and directs its light in a specific direction.

14. The act of using less energy or saving energy is called _____.

15. The label given to appliances that meet strict government standards for energy efficiency is known as the _____ Rating.

16. Warmer temperatures and changes in weather patterns, the oceans, ice, snow, and ecosystems are examples of _____.

17. Water, solar, geothermal, wind, and biomass are examples of _____sources of energy.

18. A _____ cell changes radiant energy from the sun into electrical energy.

19. Fuels that cannot be easily made or renewed in our lifetime are called _____.

20. The DOE stands for _____.

Assessment

- A recommended scoring rubric for the Energy Fitness Award is provided at the end of this plan and includes all five lessons. Total points earned determine the level of the award each student receives:

  13-15 points: Megajoule Award
  9-12 points: Kilojoule Award
  5-8 points: Joule Award

- Individual assignments are designed to also provide educators with grades for the activities completed that meet requirements across the curriculum. For example:

  a. EIA Kids scavenger hunt worksheet (Science and Technology)
  b. Lab sheets (Science)
  c. Energy Bucks graph (Math)
  d. Personal letter to parents (Language Arts)
  e. Slogan (Art/Social Science)
  f. Quiz (Test-taking skills)

Resources

- An alphabetical, all-inclusive term and definition sheet can be found on the EIA Kids website: GLOSSARY »

- Educators should familiarize themselves with the EIA Kids website prior to starting this lesson unit. There are many alternate activities on the EIA Kids website for experiments and in-class activities; the ones here have been chosen to fit the category for each lesson and be adaptable to one class period or block; if educators have more time, they may prefer to search for one of the additional experiments or activities that would best suit their student group and time availability. The options are extensive!

- The NEED Project - National Energy Education Development Project (http://www.need.org/Educators) hosts an abundance of lessons and activities. Some are used here; many others can be found in the "Educators" section of the home page, listed by topic and grade level.

- Other lesson plans can be found at: the U.S. Department of Energy Education and Workforce Development (http://www1.eere.energy.gov/education/lessonplans/default.aspx) and CLEAN (http://cleanet.org/index.html).

Quests

Quests are designed as optional extended activities to be completed at home to earn extra points for the AHEEC Contest, for extra credit, or for personal enjoyment. Students access these Quests in the Energy Lab section of the AHEEC website. In order to earn points for their school, students will need to verify Quest completion with their educators as noted for each Quest. Educators may record Quest points on each student's scoring rubric. Each Quest completed earns one point toward the school's AHEEC contest total.

Quest #1: Energy Slang
http://www.eia.gov/kids/energy.cfm?page=energy_slang
Go to the Energy Slang activity in the Energy Lab. You should see a grid of pictures with captions. Using five of these slang terms, write a short humorous story with characters misunderstanding what they mean. Be sure your story shows the correct meaning of the terms by the end. Be creative! Return your story to your educator.

Quest #2: Energy Tales
http://www.eia.gov/kids/resources/teachers/pdfs/Activitybook_web.pdf Read the Energy Tales in the Energy Lab: Johnny Energy Seed, Fern Fossil, Annie Soakley, and Little Big Fuel. Choose your favorite and identify the source(s) of energy it describes. Complete the activity for the tale of your choice, and return it to your educator.

Quest #3: Energy Hog Scavenger Hunt
ScavEngEr Hunt - Energy Hog
Find the online Energy Hog Scavenger Hunt in the Energy Lab. You will need input from a parent or adult at home for some of the questions. Print the hunt, follow the directions, and bring your completed hunt to your educator. Let's see who our biggest Energy Hogs are!

Quest #4: Interview
For this quest, you are to conduct an interview with an adult who was born prior to 1950 about their energy use in the past and present. Suggested questions are found below, but you can ask anything related to what you've studied in class this week. Record your answers on a sheet of paper and return it to your educator.

Suggested Interview Questions *(adapted from TVAkids.com)*

1. What kind of lights did you use in your home when you were a kid?
2. How was your home heated and cooled?
3. What kind of washing machine did you have?
4. How was laundry dried?
5. What kind of stove and/or what fuel did your family use for cooking?
6. Did you have a refrigerator? If not, how did you keep your food fresh?
7. How was food packaged when it came from the store?
8. Did your family grow much of its own food?
9. What sort of items did your family make for itself?
10. What did milk come in? Was it delivered?
11. What sort of soap did you use? Did it clean as well as the cleaners we use now?
12. How was your water heated for bathing, dishwashing, and laundry?
13. Did your family have a car? If not, how did you get to where you needed to go?
14. Did you have a radio? TV? What did they look like?
15. How is life more enjoyable now that we have so many more products? How were the "good old days" better?

Quest #5: School Survey
http://www.eia.gov/kids/resources/teachers/pdfs/SchoolSurveyPrimary.pdf
You have the opportunity to help your school save energy as well! Complete Quest #5 by completing the School Survey in the Energy Lab; make a list of some changes that would reduce your school's usage and present it to your principal after your educator reviews it.

Quest #6: Virtual Field Trips
http://www.eia.gov/kids/energy.cfm?page=field_trips
You may have visited one of the Virtual Field Trips to an energy source in class as part of Lesson 2. For this quest, visit the EIA Kids site and visit some of the other energy source locations and read all about them. What jobs or careers could you do at each location? Follow the link above to go on the field trips, and list possible jobs or careers you might consider at each place you visit. Return your list to your educator.

Quest #7: Energy From the Sun
http://www.eia.gov/kids/resources/teachers/pdfs/Activitybook_web.pdf
You may be the kind of student who loves to do experiments. Here's one that experiments with energy from the sun. If you have three thermometers, you can do this. Follow the link above, and go to page 5; print the page, and follow the directions. Write down your results and bring them to your educator.

Quest #8: Transportation
How does energy (and energy-related costs) affect your choices about how you get to and from school as well as the places you want or need to go? Do you ride the bus to school? Walk? Get a ride from your parent or another adult? Ride a bike? How do these different transportation methods impact the environment? Do some research on transportation & the environment. Write up what you learn in a report or make a visual presentation and bring it to your educator.

Energy Fitness Award

Recommended Scoring Rubric - Grades 3-5

NAME: _____ DATE: _____

EDUCATOR: _____ SCHOOL: _____

Activity	3 -Exceeds Expectations	2 Meets Expectations	1 Approaches Expectations	0 Does Not Meet Expectations
Lesson 1: Energy Basics	The EIA Kids Scavenger Hunt worksheet is completed, with no mistakes.	The worksheet is completed with a few mistakes.	Part of the worksheet is not complete and there are numerous mistakes throughout.	The worksheet is not completed or most of the answers are incorrect; or student did not participate.
Lesson 2: What sources provide energy?	Field trip evidence/summary is varied and shows new learning.	Field trip evidence/summary is present and shows some learning.	Field trip evidence/summary is there but doesn't show new learning.	Field trip evidence/summary is missing; or student did not participate.
Lesson 3: How do I use energy?	Student completed a thorough accounting of personal energy use with an accurate graph.	Student completed an accounting of personal energy use; graph has some errors.	Student completed an accounting of personal energy use, but no graph.	Student did not complete personal energy use sheet or graph, or both contain major mistakes; or student did not participate.
Lesson 4: How can I use less energy?	Student has written three energy goals and a prediction for saving money.	Student has written two goals and a prediction for saving money.	Student's goals are incomplete or the prediction is missing.	Student's goals and prediction are incomplete or missing, or student did not participate.
Lesson 5: How can I share what I've learned?	Student wrote an exceptional personal letter and created a slogan that shows understanding of energy.	Student wrote an acceptable personal letter and created a slogan that shows understanding of energy.	Student's personal letter or slogan is incomplete or shows a lack of understanding of energy.	Student did not complete a personal letter and slogan, or student did not participate.
TOTAL				

Final Score: _____ Award Received: _____

Award Categories: Megajoule (13-15 pts), Kilojoule (9-12 pts), and Joule (5-8 pts)

OPTIONAL QUEST POINTS EARNED: _____

Lesson 1: Worksheet

1. The two categories for all energy are potential and kinetic.
2. Petroleum is used to make: gasoline, propane fuel, ink, crayons, dishwashing liquids, deodorant, eyeglasses, CDs and DVDs, tires, ammonia, and heart valves.
3. Natural gas is transported by pipelines from the producing fields to consumers. From these pipelines it flows to smaller pipes or "mains" which lead directly to homes or buildings. It can also be chilled and transported or stored as a liquid (LNG or liquid natural gas).
4. About 71% of coal is transported by trains in the U.S. It can also be transported by truck, ship, barge or even pipeline.
5. Two methods used to mine coal out of the ground are surface mining and underground mining.
6. Nuclear fission is the process of splitting uranium atoms into smaller atoms to release heat energy.
7. A photovoltaic or solar cell converts solar energy into electricity.
8. The "ring" of geothermal resources is known as the ring of fire.
9. We use corn to make the transportation fuel known as ethanol.
10. The biomass resource most often used is wood.
11. Energy from moving water is called hydropower.
12. Everything in the universe is made of tiny, tiny things called atoms.
13. Electricity is measured in units of power called watts. One watt is a very small amount of power. A kilowatt is the same as 1,000 watts.
14. The number one use of energy in homes is for heating and cooling.
15. Energy conservation is any behavior that results in the use of less energy.
16. Renewable resources are are sources that can be replenished or made again.
17. Five examples of renewable resources are: biomass, geothermal, hydropower, solar and wind.
18. Nonrenewable resources are resources that cannot be replenished or made again in a short period of time.
19. Four examples of nonrenewable resources are: oil & petroleum products, natural gas, coal and uranium.
20. Most of the energy used in the U.S. comes from nonrenewable sources.

Bonus: It's a good idea to recycle because items get used again, and it takes less energy to make a product from recycled materials than from new materials. Recycling paper saves trees and water.

Lesson 2: Virtual Field Trip Worksheet

Answers will vary but should include location visited, partner's name, and whether the source for Part 2 is renewable or non renewable.

Lesson 2: Field Trip Worksheet

Answers will vary but should include notes and explanation of any evidence gathered.

Lesson 2: Chocolate Chip Cookie Mining Lab

- Coal is a nonrenewable energy resource that is mined from the earth; coal was formed from plants and animals that lived millions of years ago before the dinosaurs were around. When the plants died, they were buried under sand and silt. Over time, the sand and silt built up, putting heat and pressure on the thick layer of dead plants, and changing it into coal.
- We use coal for almost half the electricity in the U.S., for making plastics, tar, fertilizers, medicines, steel, concrete and paper.
- Coal is nonrenewable because once we use it, we can't make more of it in a short period of time.
- Land reclamation is returning the land as closely as possible to the way it was before being mined.
- Cookie chart data will vary.
  1. Answers will vary but should be explained.
  2. Answers will vary but should match cookie chart data.
  3. It is easier to mine chips on the surface; reasons will vary.
  4. Yes, some areas of land have coal that is easier to mine as well as more of it.
  5. Answers will vary.
  6. Land reclamation is important because people need to be able to use the land again, and to protect the surrounding areas from dust and water runoff.

Lesson 3: Home Energy Audit

Answers will vary but addition of Energy Bucks should be accurate.

Lesson 3: Lightbulb Comparison Lab

- For steps 1-3, students should record results in the lightbulb comparison chart, noting temperatures in units and observations of lighting for all three bulbs.
- Questions:
- Answers will vary.
- Heat emissions are part of energy transfer to the environment; no transfer is 100% efficient.
- More light is given off than heat (heat is the smaller percentage of loss).
- The bulb that uses the least energy is the LED. Students should point out the energy cost from the chart, the number of bulbs needed, and the lifespan of the bulb.
- The bulb that costs the least amount is the LED.
- A family might choose LEDs over CFLs due to the hazards involved with the mercury in CFLs.
- You recycle and dispose of CFLs by contacting your local waste collection agency, visiting local retailers like hardware stores, or watch for seasonal household hazardous material collections. Visit Earth911.com for a list of retailers. If your state or local environmental regulatory agency permits you to put used or broken CFLs in the regular household trash, seal the bulb in a plastic bag and put it into the outside trash for the next normal trash collection. If a bulb breaks, have all people clear the room for five to ten minutes and open a window or door. Shut off the heat or air conditioning. Do not vacuum until all other methods have been used: scoop up glass and powder using a piece of cardboard, and use sticky tape to pick up the powder and smaller fragment. Put all materials in a sealable container. Then take them to a recycling station or if permitted, in your trash.

Lesson 4: Worksheet

Part 1:

- Answered with student graph results.
- Answered with student graph results.
- Answers will vary but will likely include: technological differences, climate differences, type of dwelling, and number of people living in the home.

Part 2:

- List of ways to reduce energy use will likely include: turning lights off, changing to more efficient bulbs, eating a cold breakfast, letting hair air dry, only using the washers and dryers when full, turning the water heater temperature down, playing fewer video games or watching less television.
- Goals will vary but should state three different specific actions to reduce energy use.
- Predictions will vary but should include a dollar amount and specific actions to support that amount.

Lesson 5: Worksheet

Letters and slogans will vary.

Energy Fitness Award Quiz

1. b
2. b
3. a
4. b
5. c
6. a
7. b
8. b
9. d
10. a
11. power plant
12. audit
13. LED
14. energy conservation
15. Energy Star
16. climate change
17. renewable
18. solar
19. nonrenewable
20. Department of Energy