

Colorado Reader

AG IN THE CLASSROOM—HELPING THE NEXT GENERATION UNDERSTAND THEIR CONNECTION TO AGRICULTURE

COLORADO FOUNDATION FOR AGRICULTURE ~ WWW.GROWINGYOURFUTURE.COM

All About Renewable Energy

Renewable energy is power that is generated by renewable resources, such as solar energy, wind energy, hydropower, geothermal energy and biomass. Renewable resources are replaced—or *renewed*—naturally on an on-going basis. **Nonrenewable** resources, which include oil, coal and natural gas, are replaced very slowly or not at all. In the United States, 8% of the energy we use comes from renewable resources.

Solar energy is generated when the sun's rays beam through tiny cells on a solar panel. Wind energy is created through the movement of a spinning wind turbine. Hydropower is produced when the movement of falling water causes blades inside special turbines to spin. Geothermal energy is generated from the earth's heat. Biomass is energy that comes from living organisms, such as wood, animal manure and crops.

Get ready to learn lots of fun and interesting facts about renewable energy!



Electricity And Me

Electricity is a form of energy. It makes the way we live our lives possible. It keeps our homes warm, our lights on, our computers and cell phones charged, our ice cream frozen—it touches our lives in almost every way!

Energy is created from both nonrenewable and renewable natural resources. The electricity we use in school, at home and other places is a secondary energy resource. It comes from the burning of coal or natural gas, the turning of wind turbines, the sun in solar panels and from other sources. It takes people to make the electricity we use. Many skilled men and women in hundreds of different career fields work to take the energy from the earth's natural resources, turn it into electricity and deliver it to you to make your electronic video games and your household appliances run.

Electricity is a valuable part of our lives. It's important to use it wisely, because not wasting electricity means we are not wasting the earth's natural resources.

TRY IT!

In the picture below, circle all the ways electricity is being used. Next, find a partner. For three minutes, list all the different ways you use electricity every day. Share and compare your list with your partner.

Below are the average amounts a typical American household spends on energy each year to run specific items. What is the total yearly energy cost for these items?

Computer and monitor -	\$ 22
TV, DVR, DVD -	\$ 35
Dishwasher -	\$ 47
Refrigerator -	\$ 87
Clothes washer & dryer -	\$107
Lighting -	\$184
Other -	\$239
Water heater -	\$245
Cooling -	\$257
Heating -	\$688

Total _____



Solar Energy

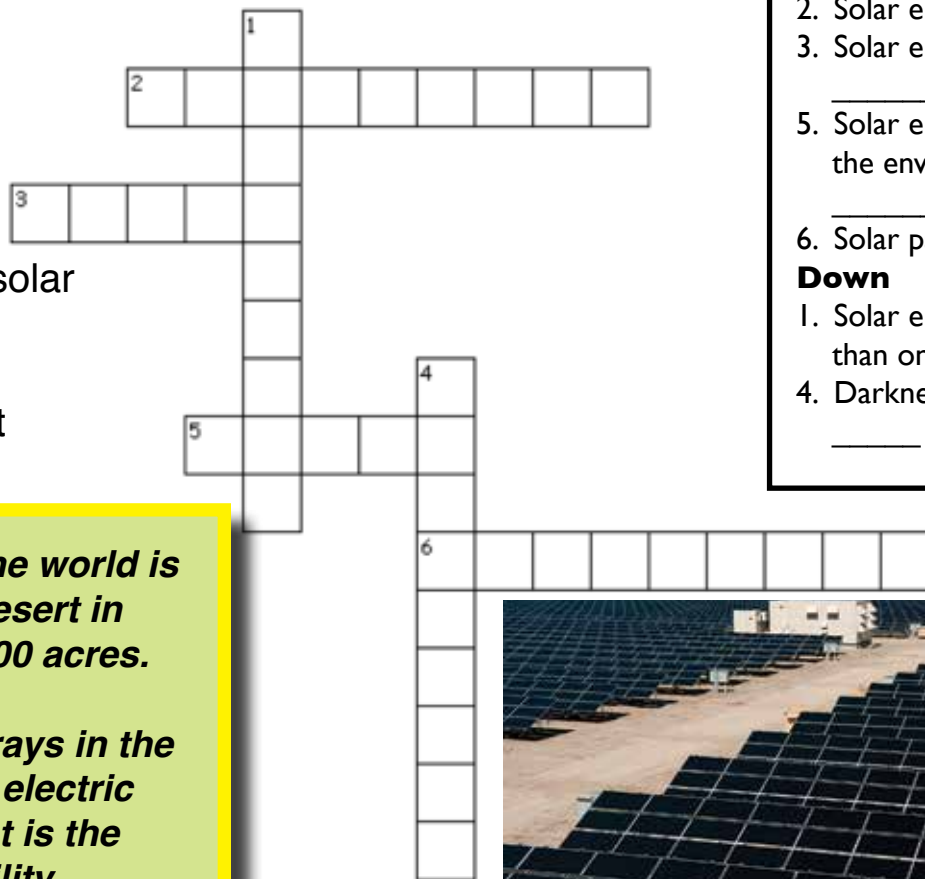
The sun has produced energy for billions of years. Solar energy, which is plentiful, is gathered from the sun's rays that reach the earth. In 1954, three American scientists developed a way to convert the sun's energy into other forms of energy, such as heat and electricity. The energy can be converted in two different ways:

- 1.) **Photovoltaic or "solar cells"** change sunlight directly into electricity. These cells are grouped into panels and arrays of panels that can be used in many different ways.
- 2.) **Solar thermal/electric power plants** generate electricity by concentrating solar energy to heat a fluid and produce steam that is used to power a generator.

The main benefit of solar energy is that it is clean—it does not create air pollution or carbon dioxide, and when solar panels are placed on buildings, they have a very small effect on the environment.

TRY IT-SOLAR ENERGY REVIEW

Solar power also has limitations. The sun's energy can only be gathered when it is shining—night time, clouds and bad weather can interrupt the sun's rays. Also, solar panels can be expensive and it takes a very large area of the earth's surface to collect the energy at a useful rate.



Across

2. Solar energy is _____.
3. Solar energy requires a _____ area of space.
5. Solar energy does not pollute the environment because it is _____.
6. Solar panels can be _____.

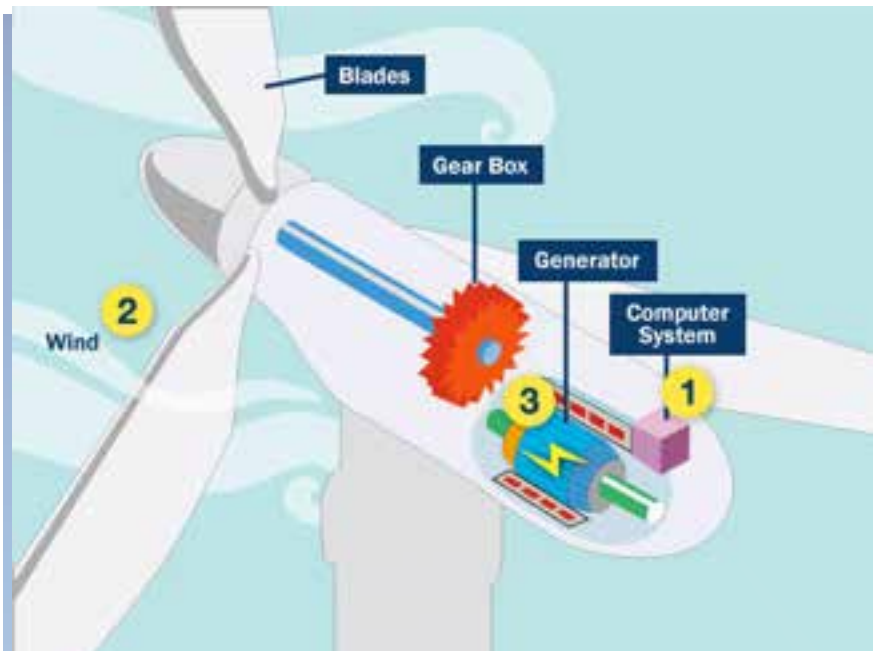
Down

1. Solar energy can be used more than once, it is _____.
4. Darkness and bad weather _____ the supply of sunlight.

The largest solar plant in the world is located in the Mojave Desert in California and covers 3,500 acres.

One of the largest solar arrays in the region that powers rural electric cooperatives in the west is the Cimarron Solar Facility in New Mexico (pictured at right).





Before a wind farm is built, it takes careful planning to understand how fast and how much the wind blows at the site. Usually, wind speed increases at higher altitudes and over open areas.

Wind Power

What causes the wind to blow? The earth's daily wind cycle is created by air above land heating up faster than the air over water. The warm air expands and rises and the heavier, cooler air rushes in to take its place—which creates wind.

Giant wind turbines can be used to collect the wind's **kinetic energy, or energy of motion**. The wind flows over the blades of the turbine, which causes them to lift and turn. The blades are connected to a drive shaft inside the turbine that turns an electric generator to produce electricity.

Like solar energy, wind power has both benefits and limits. It's a clean source of energy and doesn't produce air pollution. One turbine can power hundreds of homes throughout the year.

However, wind turbines change the view of a landscape and can be a hazard to birds. They also can't provide power all the time—only when the wind is blowing. Sometimes the wind blows too hard and the turbines need to be shut off. Back-up power plants that are fueled by resources such as coal, oil and natural gas work along with wind power to ensure electricity is always available, every second of every day.

TRY IT! How windy is it outside your school? Make a class anemometer and find out!

Supplies & Tools:

- 4 small paper drinking cups
- scissors
- a marker
- 2 strips of stiff, corrugated cardboard about 18 inches x 3 inches
- stapler
- push pin
- sharpened pencil with an eraser on the end
- modeling clay

Directions

1. Make the paper cups lighter by cutting the rolled edges off the tops.
2. Color the outside of one cup with the marker.
3. Cross the cardboard strips so they make a plus sign. Staple them together.
4. Find and mark the exact center of the cardboard strips.
5. Staple the cups to the ends of the cardboard strips, making sure the cups all face the same direction.
6. Push the pin through the center of the cardboard and attach the cardboard cross with the cups on it to the eraser point of the pencil. Blow on the cups to make sure the cardboard spins around freely on the pin.
7. Place the modeling clay on a surface outdoors. Stick the sharpened end of the pencil into the clay so it stands up straight.

Using a watch with a second hand, count the number of times the marked cup spins around in one minute. You are measuring the wind speed in revolutions (turns) per minute. Weather forecasters' anemometers convert the revolutions per minutes into miles per hour.

Hydropower

Hydropower is one of the oldest sources of energy. Thousands of years ago in ancient Egypt, it was used to turn paddle wheels to grind grain. In the United States, hydropower has been in use since the late 1800s. The first U.S. hydroelectric power plant opened in 1882 on the Fox River in Wisconsin. Today more than half of the renewable energy we use in America comes from hydropower.

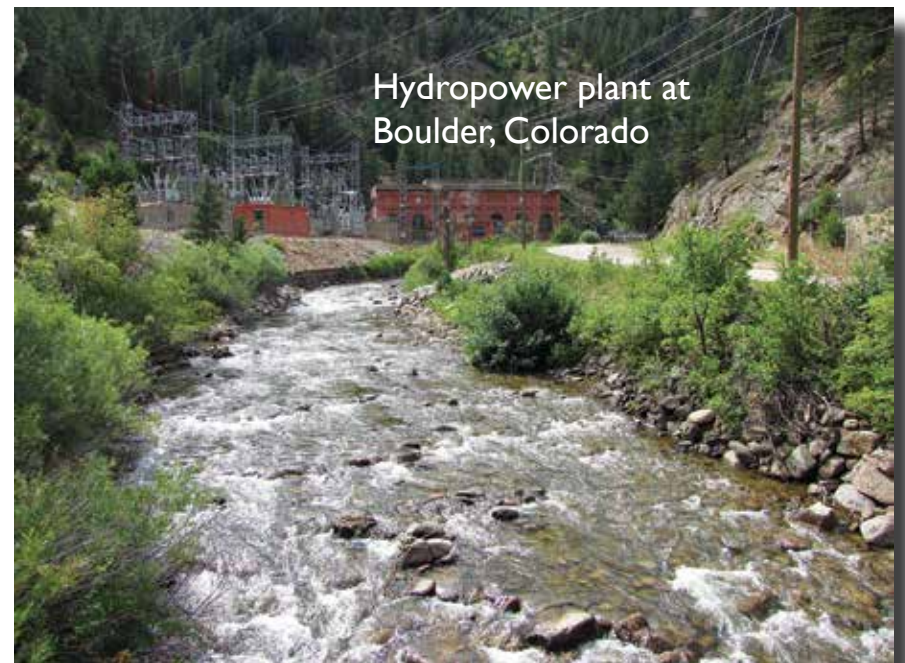
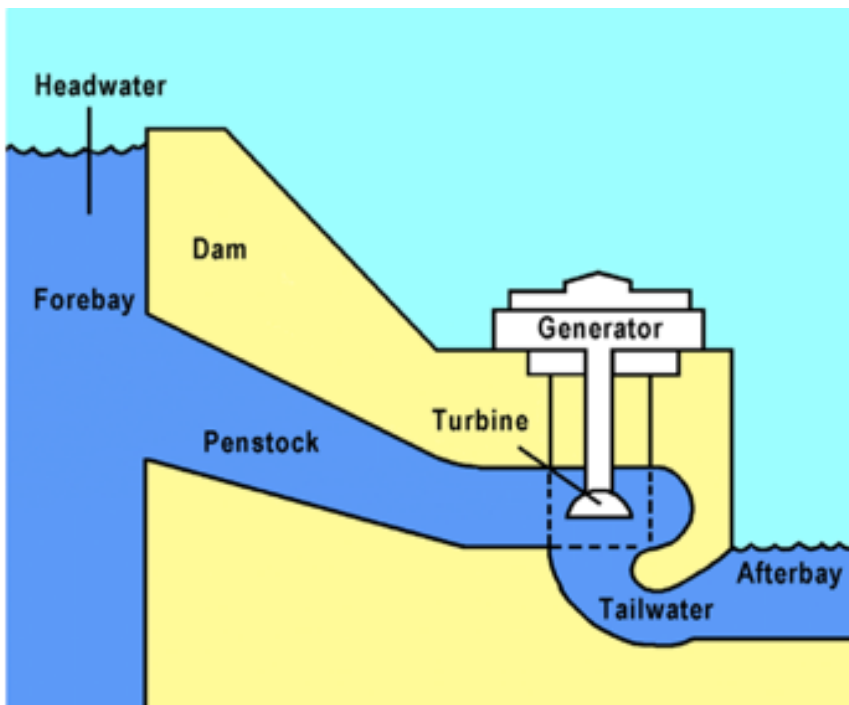
Moving water carries **mechanical energy, which is the sum of potential energy (stored energy) and kinetic energy (energy in motion)**. Using the mechanical energy found in a large flowing river or waterfall created by a dam allows electricity to be produced. Power is created when the water flows through a pipe, or penstock, then pushes against blades that turn in a turbine to spin a generator to produce electricity.

TRY IT!

On a warm day, try making your own water turbine with help from an adult:

Materials: String, tape, plastic one-liter empty soda bottle, hammer/nail, water

Carefully punch four holes into the empty soda bottle using scissors or a nail and hammer. The holes should be on the bottom corners equal distance apart. Tape the holes so they are plugged. Cut enough string to wrap around the neck of the bottle. Choose to hold the bottle off the ground or find an object that will hold it off the ground, like a tree branch, and tie it to that object. Pour water into the bottle, filling it at least half full of water. Unplug the tape from the holes and the water will come out of the bottle. The bottle will spin faster and faster as the water is pushed out of the holes. The water pushes against the bottle with equal and opposite force, demonstrating Newton's third law of motion. This law says that for every action (force) there is an equal and opposite reaction (force).

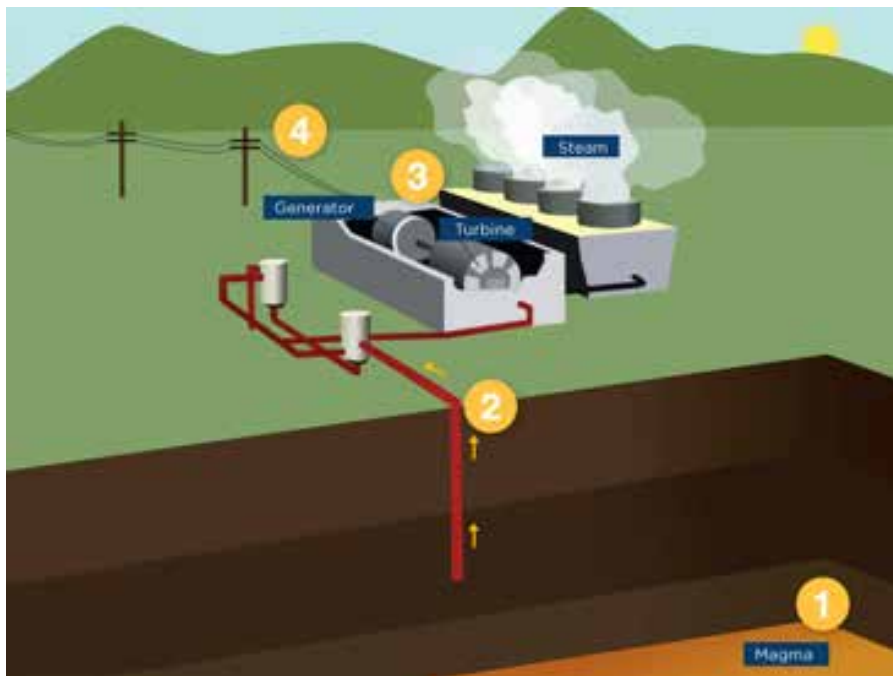


More Renewable Energy Sources

Solar, wind and hydropower are familiar sources of renewable energy, but the earth offers us even more ways to generate electricity from its renewable resources.

Geothermal energy uses the Earth's internal heat to help heat and cool buildings and make electricity. It's the same energy that causes volcanoes and geysers to erupt.

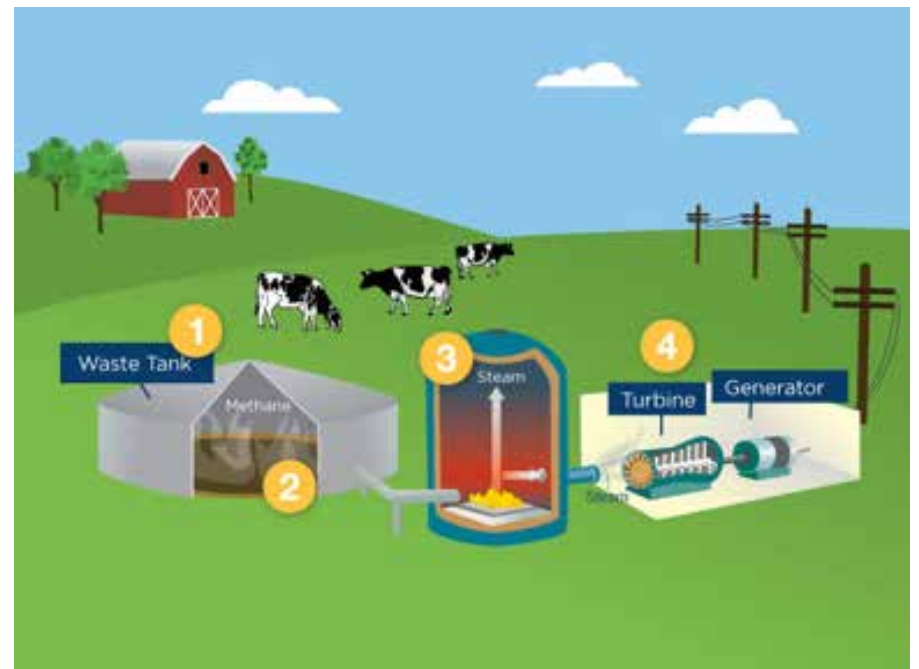
A geothermal system for a home or building uses pipes buried four to six feet underground, where the temperature remains about 50-55 degrees all year long. A geothermal system pumps a liquid through the pipes to absorb the warmth and bring it back indoors. In the summer, it works in reverse to cool the temperature of hot buildings.



Geothermal power plants work by tapping into steam or hot water reservoirs underground. The heat is used to drive a generator that produces electricity.

Biomass energy uses natural materials like wood, paper, plants and even garbage to make electricity. Chemical energy is released from biomass as heat when it is burned. The wood you burn in a fireplace or campfire is a biomass fuel. Wood and waste materials made from wood and garbage are burned to produce steam for making electricity.

Burning biomass is not the only way to release its energy. Biomass can be converted to other useable forms of energy like methane gas, or fuels like ethanol and biodiesel that can power cars and trucks.



Renewable energy resources can provide us with the energy we need, but they can't do it alone. In order for us to be able to rely on electricity anytime we need it—like turning on a lamp in the middle of the night, turning on the air conditioner on a hot summer afternoon, or charging a cell phone early in the morning—a base load of energy is needed. Base load is the minimum amount of electricity delivered or required at a constant rate over a certain period of time.

Power plants that burn coal and natural gas, which are fossil fuels, are able to guarantee a base load of electricity. Because the sun doesn't always shine and the wind doesn't always blow, power plants that use fossil fuels to generate power are also needed to support renewable energy, making sure electricity is available at all times.

The Earth's Resources All Work Together

Coal being loaded into a truck...

DID YOU KNOW?

Mining is an important part of creating electricity. Millions of tons of coal are mined in the U.S. every year and nearly all of it is used to generate electricity. Mining is also needed for renewable energy. It takes 16 different metals and minerals that are mined all over the world to make a single solar panel. Wind turbines are made from 13 different mined mineral products and metals. Not all of these materials are mined in the United States. We depend on the resources of many other countries throughout the world such as Peru, South Africa, India, Germany, Mexico and Sweden to manufacture solar panels and wind turbines.

The Colorado Reader publication and Ag in the Classroom are projects of the Colorado Foundation for Agriculture. Educational projects are produced in cooperation with the Colorado Department of Agriculture, other state and federal agencies, Colorado commodity groups, Colorado agricultural associations, state universities and colleges and interested individuals. Colorado Readers are provided free to educators requesting them. For more information contact: Bette Blinde, Colorado Foundation for Agriculture, P.O. Box 10, Livermore, CO 80536 or phone 970 881.2902 or e-mail bblinde@growingyourfuture.com. Financial support for this reader has been provided by: Tri-State Generation and Transmission Association, www.tristategt.org. Written by Mary Peck.



Knowledge is POWER

* More people use electrical energy than any other form of energy.

* The amount of energy that Americans consume doubles every 20 years.

* Compact fluorescent light (CFL) bulbs use about 80% less electricity than conventional (incandescent) light bulbs and last up to 12 times as long.

* In the average home, 75% of the electricity used to power home electronics is consumed while the products are turned off but still plugged in—this is known as **vampire power**.

Inefficient appliances, drafty windows and doors, poor insulation, and other fixable energy wasters cost Americans an estimated \$300 billion a year.

TALK ABOUT IT

Find a partner and together list 10 smart ways you can each help to conserve electricity.



CHECK IT OUT

“Power Up” is a fun new online game where players try to choose the right amount and right type of power to keep the lights on. Visit www.myamericanfarm.com to play.



Say hello to “Power!” He helps members of rural electric cooperatives use energy wisely. Meet him at www.powerworksforyou.coop

REVIEW

1. Which of the following energy resources is not renewable:

- Wind
- Water
- Natural gas
- Sunshine

2. Giant wind turbines collect the wind’s energy of motion. Energy of motion is known as:

- Mechanical energy
- Potential energy
- Kinetic energy
- Renewable energy

3. Mechanical energy is the sum of what two other types of energy?

- Kinetic energy and hydro energy
- Potential energy and kinetic energy
- Renewable energy and potential energy
- Biomass and electric energy

4. Geothermal energy works by using energy from:

- Oceans
- Landfills
- Gravity
- Earth

5. Nonrenewable energy sources are also called:

- Fossil fuels
- Nature’s sources
- Fast fuels
- Power resources

6. A base load of energy is:

- The energy created when a light is switched on
- The minimum amount of electricity delivered or required at a constant rate over a set period of time
- The weight of a set amount of electricity over a one-hour period
- A nickname for renewable energy

7. Mining is important to both:

- The earth and the oceans
- Renewable and nonrenewable energy resources
- Reliability and access
- Hydropower and mechanics

Teacher's Guide

Ag in the Classroom - Helping the Next Generation Understand Their Connection to Agriculture

Renewable Energy

Additional Resources

Power Up Game:

www.myamericanfarm.com/games/power_up/

The following YouTube videos have more information on energy:

Kinetic Energy

www.youtube.com/watch?v=ASZv3tIK56k

Force and Gravity

www.youtube.com/watch?v=LEs9J2IQIZY

Where does energy come from?

www.youtube.com/watch?v=aUa717D_myU

Using Energy

www.youtube.com/watch?v=z1xFrYkQwik

General Energy Resources

The Energy Story

www.energyquest.ca.gov/story/

EIA Energy Kids

www.eia.gov/kids/

Science Daily: Matter & Energy

www.sciencedaily.com/news/matter_energy/

Other links

www.need.org

www.energyquest.ca.gov/games/index.html (online energy games)

www.epa.gov/students/teachers.html

www.myenergygateway.org

www.partselect.com/JustForFun/Electric-Math-Numbers-Behind-Appliances.aspx/

www.kidsenergyzone.com

Additional resources on renewable and non renewable energy:

www.kids.esdb.bg/basic.html

www.education.nationalgeographic.com/education/encyclopedia/non-renewable-energy/?ar_a=1

www.greenmountain.com/resources/enviro-kids/renewable-energy-101

Other Resources

www.agclassroom.org is the national website for Ag in the Classroom programs from across the nation. A site search will bring up a variety of lessons, books, videos and links.

www.growingyourfuture.com - connects you to Colorado's Ag in the Classroom program. A variety of resources are available at this site including past *Colorado Readers*.

Comments, questions, suggestions and feedback about the Reader are welcome. Contacts:

Bette Blinde

Colorado Foundation for Agriculture

PO Box 10 Livermore, CO 80536

970-881-2902

bblinde@growingyourfuture.com

www.growingyourfuture.com

Jessie Dafoe

Wyoming Agriculture in the Classroom

P.O. Box 347

Cheyenne, WY 82003

307.369.1749

jdafoe@wyaitc.org

Traci Curry

New Mexico Agriculture in

the Classroom

2220 N Telshor

Las Cruces, NM 88011

575.532.4714

agclass@nmflb.org

Deanna Karmazin

Nebraska Agriculture in the Classroom

5225 South 16th Street

Lincoln, NE 68512-1275

402.421.4408

DeannaK@nefb.org

Page 2: Electricity and Me

The total annual utility bill for an average American household is \$1911

Page 3: Solar Energy

Crossword answers:

Across

2. Solar energy is available all over the world; it is **plentiful**.

3. Solar energy requires a **large** area of space.

5. Solar energy does not pollute the environment because it is **clean**.

6. Solar panels can be **expensive**.

Down

1. Solar energy can be used more than once; it is **renewable**.

4. Darkness and bad weather **interrupt** the supply of sunlight.

Page 5: Hydropower

Using a block of wood, a hammer and a nail, help your students understand the process of mechanical energy:

'Work' is done when a force acts on an object to cause it to move, change shape, displace, or do something physical. For example, if I push the classroom door open for a student to walk in, work is done on the door (by causing it to open). But what kind of force caused the door to open? That's where mechanical energy comes in.

Mechanical energy is the sum of kinetic and potential energy in an object that is used to do work. I have an iron hammer, which on its own, has no kinetic energy, but it has some potential energy because of its weight. Now, if I want to drive a nail into this piece of wood (which is work), I need to lift the iron hammer up, which increases its potential energy because of its high position...then, force it to move at great speed downward (it now has kinetic energy) to hit the nail.

The sum of the potential and kinetic energy that the hammer needed to drive in the nail is called mechanical energy, which resulted in the work being done. Again, it's the mechanical energy within moving water that allows us to use it to create power.

View an animated hydropower slide at <http://energy.gov/eere/water/how-hydropower-works>

Watch a video about hydropower at <http://energy.gov/eere/water/hydropower-basics>

Page 8: Knowledge is POWER!

Discussion ideas for ways to conserve energy:

- *Set your home's thermostat a few degrees lower for heat or higher for cooling.
- *Turn off lights and all electronics (like computers, televisions, stereos, and video games) when you leave a room.
- *Use the microwave instead of the oven for cooking your meals.
- *Use machines like washers, dryers, and dishwashers after 8 p.m.
- *Open your blinds or curtains on sunny winter days to let the sun shine into your home.
- *Save hot water by taking short showers instead of baths.
- *Seal leaky cracks around the house.
- *Use compact florescent light bulbs (CFLs) instead of incandescent bulbs.
- *Don't leave the refrigerator door open.

Rural Electric Cooperatives

"Power" is a mascot whose mission is to help members of rural electric cooperatives use energy wisely. Rural electric co-ops were formed in the 1930s to bring electricity to the farms, ranches and smaller country communities of the U.S. Today, 42 million Americans receive electricity from more than 900 electric cooperatives – maybe you are one of them! Learn more at <http://www.nreca.coop/about-electric-cooperatives/co-op-facts-figures/>

Additional Resources Sites:

- www.alliantenergykids.com/FunandGames/CoolProjects/
- www.eia.gov/kids/index.cfm
- www.evergreenconservancy.org/environmental-education/hydro-power/
- www.dteenergy.com/kids/
- <http://fwee.org/nw-hydro-tours/walk-through-a-hydroelectric-project/>
- www.blackhillscorp.com
- www.energystar.gov/index.cfm?c=kids.kids_index
- www.greenmountainenergy.com/
- www.eschooltoday.com/energy/kinds-of-energy/what-is-mechanical-energy.html

www.tvakids.com

www.mineralseducationcoalition.org

Page 8 REVIEW Answers

1. Which of the following energy resources is not renewable:
 Natural gas
2. Giant wind turbines collect the wind's energy of motion. Energy of motion is known as:
 Kinetic energy
3. Mechanical energy is the sum of what two other types of energy?
 Potential energy and kinetic energy
4. Geothermal energy works by using energy from:
 Earth
5. Nonrenewable energy sources are also called:
 Fossil fuels
6. A base load of energy is:
 The minimum amount of electricity delivered or required at a constant rate over a set period of time
7. Mining is important to both:
 Renewable and nonrenewable energy resources

Here are Common Core Math and ELA-Literacy

CCSS.Math.Content.4.NBT.B.4

Fluently add and subtract multi-digit whole numbers using the standard algorithm.

CCSS.ELA-Literacy.CCRA.L.4

Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.

CCSS.ELA-Literacy.CCRA.L.6

Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.

NALO (National Ag Literacy Outcomes)

Science, Grades 3-5

Plants and Animals for Food, Fiber & Energy Outcomes
· Distinguish between renewable and non-renewable resources used in the production of food, feed, fuel, fiber (fabric or clothing) and shelter.

Renewable Energy

Evaluation ~ 2014

Colorado Reader ~ Agriculture in the Classroom

Please take a few minutes to evaluate your students' knowledge of this topic.

There is an area for additional comments.

Your comments help us improve future Colorado Reader issues. Thank you!

How many students used this reader? _____

How many or what percentage of your students can name one limitation for using wind power?

How many or what percentage of your students can describe the difference between renewable and nonrenewable energy sources? _____

How many or what percentage of your students can name three different renewable energy sources?

How many or what percentage of your students understand the difference between potential energy and kinetic energy?

Additional Comments _____

How many or what percentage of your students can name 5 ways they use electricity? _____

How many of your students can name one benefit of using solar energy? _____

How many or what percentage of your students can name one limitation to using solar energy? _____

How many or what percentage of your students can name one benefit of using wind power? _____

SUBMIT THIS EVALUATION FOR A CHANCE TO WIN A \$100 VISA CARD!

Please rate:	Good		Average		Poor
Student Activities Throughout Reader	5	4	3	2	1
Teacher's Guide	5	4	3	2	1
Reading Level	5	4	3	2	1

I would like to see more activities like: _____

School _____ Grade Level _____

Subject Area (s) _____

Name _____ Phone _____

Email _____



Order classroom resources on line! Visit

www.growingyourfuture.com

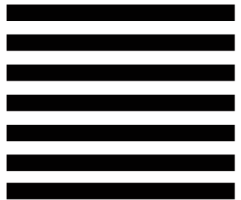
FREE

Teachers can sign up to receive resource materials

FOLD ON THE LINES, TAPE CLOSED AND DROP IN THE MAIL or GO ON LINE TO WWW.GROWINGYOURFUTURE.COM



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



BUSINESS REPLY MAIL
FIRST-CLASS MAIL PERMIT NO. 1 LIVERMORE, CO

POSTAGE WILL BE PAID BY ADDRESSEE

**COLORADO FOUNDATION FOR AGRICULTURE
PO BOX 10
LIVERMORE, CO 80536-9901**



EVALUATION

MARK YOUR CALENDAR!

**June 2015
San Luis
Valley**

**June
2015
Fort Collins**

Food, Fiber & More Summer Institute

Two continuing education credits
Five day course learning about Colorado agriculture and natural resource industries. The course includes classroom session, tours and a day walking in another person's boots!

See course description at www.growingyourfuture.com

Request electronic resources!



Colorado Foundation for Agriculture is converting resource materials and adding new materials in electronic format for use on I-Pads, notebooks and computers. We need some "testers" before we sign off on

unlimited release. Send an email to bblinde@growingyourfuture.com. Specify the technology your students will use and the grade level.
www.growingyourfuture.com