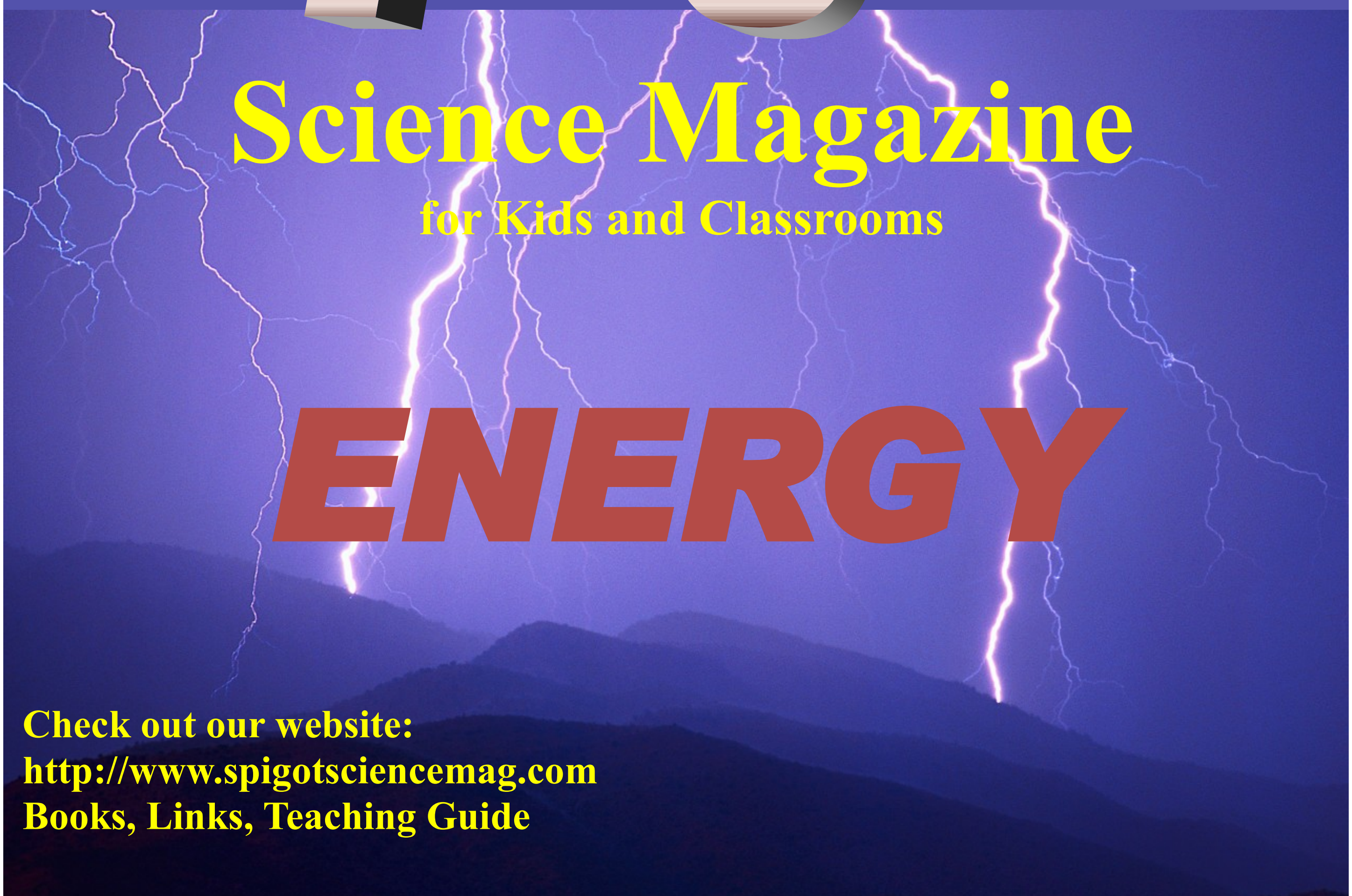
Tap into Learning

Volume 2: Number 1
January/February 2009

Spigot



Science Magazine

for Kids and Classrooms

ENERGY

Check out our website:
http://www.spigotsciencemag.com
Books, Links, Teaching Guide

In this Issue:

*Energy: Invisible Power *Renewable Energy
*Transforming Energy *NASA Ares Project
* Energy Inside Us *Energy Art *and much more!

Our Mission

The mission of Spigot Science Magazine is to help children understand how and why the world works and to inspire young minds to be curious and thoughtful stewards of the world that will be theirs one day.

Spigot Science Magazine Important Legal Information

Spigot Science Magazine is owned and operated by
Daval Publications, LLC
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Blawenburg, NJ 08504

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Publication Schedule
Spigot Science Magazine is published online five times per year in September, November, January, March, and May. It is a free magazine.

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From the Publishers

Dear Readers,

It takes a lot of energy to write about energy. It's a good thing we have energy from our cereal and fruit, our salad and vegetables, our chicken and chops, our milk and tea, our vitamins and, of course, a lot of water. Now we can move and grow and work and communicate (see p. 20). It's also a good thing we have energy from oil for our furnace, electricity for our lights, gas for our stove, batteries for our computer, and gasoline for our car. Now we can be warm and comfortable, at home and away. We can write all about energy (see p. 5-6). Thank you, Energy.

What is energy anyway? Energy is mass multiplied by the speed of light squared. Thank you, Albert Einstein (see p.19).

And where does all this energy come from? From Nature, of course. Scientists, inventors, and engineers know how to harness energy from the forces of Nature (see p. 7). They have even found enough energy to defy gravity and fly to the Moon (see p.17-18).Thank you, scientists, inventors, and engineers. Thank you, Nature.

Are you feeling like you need a little energy right now? Go have an apple with some peanut butter on it (see p. 20). When you're all energized, do a little garbage energy dance (see #6, p.22).

We hope you enjoy this issue and feel energized after reading it.

Pondering,
Valeria B. Girandola
David Cochran

Flensted Mobiles, Denmark , Wikipedia
Combining energy and art

Spigot

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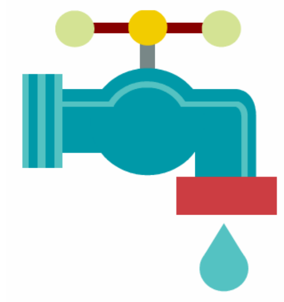

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Look for **BOLD** words throughout Spigot. These are vocabulary words you should learn. If you don't know them, look them up online or in a dictionary.

When you see a picture of Ponder in Spigot, you'll know it's time to think about what he's saying.

Think Like a Scientist

Scientists are always designing experiments to do to learn more about how the world works. They observe, measure, ask good questions, and decide how to set up a **fair test** so that what they learn is **reliable.** In an experiment or test, scientists use **constants and variables.** A constant is a value that does not change. Numbers are constants, like 12, or 3.5, or 1/2. The value of ***pi*** is also a constant.

Variables are factors that change. They take on different values while being observed. Many times they are represented by the letters x, y, or z.

For instance, to find how tall you are, measure your height in feet and inches. The measuring tape is a constant—one foot always equals 12 inches. Height is a variable.

Our lives are filled with variables and constants. Take my dog Star. She is a constant. Her real name is Stars and Stripes. That's a constant. That's not going to change. She is a bearded collie. That's not going to change either. And neither is her color. Her hair will always be black and white.

Her **nickname**? That's definitely a variable. I call her Star most of the time. But sometimes I call her Starbaby, or Starlight. Her birthday is October 7, 2004. Right now she is four years old.

Sometimes in the summer, the groomer cuts her long, silky hair short. That's a real variable. She looks like a completely different dog. (See her pictures on p.10.) But I always know she is my beautiful Stars and Stripes, and that we love each other—that will never change. And that's why I know that Star is a constant.

To think like a scientist it's necessary to know and use constants and variables in experiments and tests. Einstein, one of the greatest scientists in the history of the world, reasoned that the speed of light is a constant. It is **instantaneous** and the speed of light is always the same. Light always travels at a speed of 186,282.4 miles per second. To find out how this discovery changed the world, read **Scientists Are People Too,** p.19.

Activity

Make up a fair test. Decide what the constants are and what the variables are. Here are two suggestions:

a) Find the difference between the shortest and the tallest student in your class. What are the variables and constants?

b) Find the average temperature outside for one week. What are the variables and

Discussion

Is Star's birthday a constant or a variable?

Is her age a constant or a variable?

Look at the pictures of Star on page 9.

What other things about Star are a constant? A variable?

What things about you are a constant? A variable?

ENERGY: INVISIBLE POWER

Energy is everywhere - in the air we breathe, in the wind that blows the leaves in trees, and even in the food we eat. The strange thing about energy is that while it is everywhere, we can't see it. It's invisible.

"Hmm," you wonder. "I see the lights on in the house, I feel the wind on my back, and I see the cars moving in the street. Isn't that energy?"

Well, no, it isn't. We only see what energy does, the result of its power. We don't see energy itself.

Energy is the ability to do work or move objects. So when we ride a bicycle, energy from our muscles causes us to push the pedals and move the bike forward. We can't see the energy that causes our muscles to move, we can only see what that movement does.

Stored and Working Energy

There are two types of energy – **stored energy** (also called **potential energy**) and **working energy** (also called **kinetic energy**). Stored energy is energy that is just waiting to be used. It has potential to do something, but nothing is happening yet. An example of stored energy is a battery. If you hold a battery in your hand, it does nothing, but that doesn't mean it isn't powerful. If you put it in a flashlight and press the button, the light goes on. Working energy, on the other hand, is energy that has been released. It causes something to happen, to move. When the button on the flashlight is pressed, the stored energy is released and the light bulb turns on. The energy is changed from stored to working energy. The energy has changed from one form to another.

Albert Einstein, a famous physicist (see p. 4 and 19), figured out that matter and energy are both forms of the same thing. Matter can become energy and all energy can become matter. This is like the idea of stored and working energy. Stored energy is matter that is waiting to release its energy.

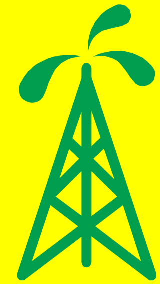
There are many examples of this change from stored to working energy.

- When we eat food, the energy is stored in the food. When it is digested and sent to our body, the stored energy is released. We use that working energy to move and do work.
- When gasoline is put in a car, it is stored energy. When it is ignited in the engine, it explodes, causing the pistons to move up and down and the car to move.
- When a seed is inside a seed packet, it has lots of stored energy. When it is planted and water and Sunlight are added, the stored energy inside the seed becomes working energy and the plant grows.

In the table below list some other examples of stored energy that becomes working energy.

Stored energy	Working energy

Renewable and Non-Renewable Energy



Renewable Energy

We know that energy never disappears, it only changes form. But it has to come from somewhere. Some energy sources are easily replaced and can be used over and over again. These are called **renewable** energy sources. The Sun, wind, and water are renewable sources. Just as in the library, when we want to keep a book longer, we renew it. We have all of these renewable energy sources in plentiful supply. As we use them, there are more for us to use.

Solar Energy — Renewable

Solar energy is an example of a renewable source because the Sun shines all the time. Solar collector panels constantly capture and store or transfer the Sun's energy. Since solar energy is everywhere, solar panels can be anywhere that there is direct sunlight. The Sun shines on the solar panels. The panels absorb the Sun's energy and change it to heat or electricity

Non-Renewable Energy

A lot of the energy we use to heat our homes and drive our cars comes from energy sources that are hard to replace once they are used. It takes millions of years to replace oil, coal, and gas— **non-renewable** energy sources. To get these sources we have to do some work. We have to locate them underground, get them out of the Earth, and transport them to where they can be used. Sometimes we have to process them to make them usable.

Gasoline – Non-renewable

Gasoline is an example of a non-renewable fuel that takes a lot of work to use. It is also non-renewable because once it is used, there is no more.

- Gasoline starts as oil.
- Oil isn't everywhere, so we need to find it. Some places where large deposits of oil have been found are: the Middle East, Alaska, and off the shore in the Gulf of Mexico.
- Oil is deep underground, so we need to drill a very deep well.
- The oil is then put in a ship or in a very long pipeline and transported to a refinery.
- At the refinery, the oil is processed to become gasoline.
- The gasoline is then trucked to gas stations for use in our cars and lawn mowers.

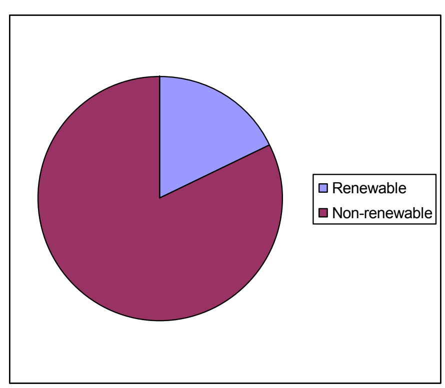
Discussion: Which energy source is easier to get? Why do we use more gasoline than solar energy?

Research: Which energy source is less expensive to get? Why?

Which Energy Type Does the World Use Most?

Look at the pie chart below. Which type of energy does the world use most—renewable or non-renewable? About how much more? Estimate the ratio of use between renewable and non-renewable energy. Why do you think the world relies so heavily on one kind of energy? Talk about this with friends, decide on your answer, and create a list to support your answer.

World Energy Use by Type of Energy



Source: Renewables 2007 Global Status Report, Renewable Energy Policy Network for the 21st Century

Energy for the World

Have you ever wondered where all the electric power we use for our lighting, TVs, and appliances comes from? People around the world use huge amounts of electricity, and it takes a lot of power plants to create and distribute electricity to everyone who needs it.

There are over 4,000 power plants supplying electricity to homes, buildings, and factories all over the world. All of them convert some kind of energy—fossil fuel, water, nuclear, solar, underground steam, wind, agricultural wastes, and ocean waves into electricity.

While the power plants operate in different ways, they all take an energy source and convert it into electricity. Let's look at how several power plants do this.

Power plant fueled by coal

KINDS OF POWER PLANTS

Fossil Fuel Power Plants

Conventional steam-electric power plants burn coal, oil, or natural gas. These are fossil fuels that come from plants and animals that lived 300 million years ago. They contain stored sunlight (potential energy) that was changed into chemical energy in ancient burying grounds and swamps. The deposits are now far underground and are non-renewable.

General Electric

Three Gorges hydroelectric plant in China

Hydroelectric Power Plants

Hydroelectric power plants convert water power into electricity. The kinetic energy in falling, rushing water turns **turbines** that produce electricity. These plants are built near water—on lakes and rivers. Dams hold back the water and release it into powerful waterfalls. This turns the turbines and **generates** electricity.

Nuclear Power Plants

Nuclear power plants use **nuclear fission** to heat water into steam. The steam drives a turbine generator to create electricity. Nuclear fission happens when one atom splits in two and produces a burst of energy. There are more than 430 nuclear power plants in the world. http://www.insc.anl.gov/pwrmaps/map/world_map.php

Why do you think the nuclear plants are mainly in the United States and Europe?

Nuclear power plant

Solar panels capture the sun's rays at a solar power plant.

Solar Power Plants

Solar energy is made from the Sun's rays that reach the Earth. Solar cells change sunlight directly into electricity. They are used in calculators, road signs, and watches. Solar power plants collect heat from the Sun. The heat then turns water into steam that powers a generator, producing electrical energy.

Geothermal Power Plants

Underneath the Earth's crust there are accumulations of water as hot as 350 F degrees. **Geothermal** power plants drill deep wells, pumping up this hot water. They use the steam and **brine** to power turbines that generate electrical energy. Geothermal makes up three percent of the nation's renewable energy. To see how one works go to: http://www1.eere.energy.gov/geothermal/gpp_animation.html

The wind spins the blades at a wind power plant.

Wind Power Plants

Wind energy is converted into electrical energy by turning the blades of a turbine, spinning a shaft. Rotating copper coils generate electric current as they pass by magnets. Wind energy plants generate about 1% of U.S. power.

Biomass Power Plants

Biomass energy includes wood, logging **residue**, manure, mill wastes, yard wastes, rice hulls, grasses and even garbage. Biomass power plants burn these wastes to generate electrical energy.

Waves release energy that can be converted to electricity.

Wave and Tidal Power Plants

At wave and **tidal** hydroelectric power plants scientists are working to develop wave-power devices. Waves are caused by the wind blowing over the surface of the ocean. There is much kinetic energy in ocean waves. At the web site below, see a demonstration of ocean waves making energy. The ocean buoy is constantly rocked by the waves. The upward movement of the waves starts a generator using 150 kilowatts. http://www.swellfuel.com/?gclid=CL_Ootjfn5cCFQxzHgodzgnz_w

Activity

Visit Power Plants Around the World-Photo Gallery at: http://www.industcards.com/ppworld.htm

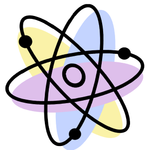
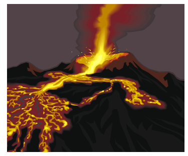
Group Discussion:

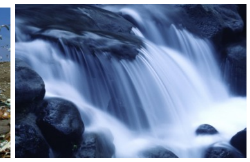
1. After you find pictures of each of the eight power plants in the gallery, discuss locations, numbers, energy sources in the pictures.

2. Scroll down to the bottom of the home page. Click on the link to "Power Plants on Postage Stamps". In which country is each of the 12 power plants located? Find them on a world map. What kind of energy does each plant use to make electricity?

Renewable Energy Quest





Mission Possible

Mission

The world is using fossil fuels (oil, gas, coal) at a very fast rate. These fuels are hard to get and they often pollute the atmosphere. Your mission is to research a renewable energy source (solar, wind, nuclear, geothermal, biomass, hydroelectric) and show your class why your fuel offers the greatest hope for the future. The purpose of the project is for you to teach others about your energy source and to persuade them that it is the best choice.

Research

Pick a type of renewable energy you'd like to learn more about. Go to the **Links for the Renewable Energy Quest** below and see what these sites have to say about the energy source you are researching. Take notes on key points that will help you when you present your report.

Be sure you know at least the following things about your energy source:

1. Where is it found?
2. How is the energy captured and transferred?
3. What are the benefits of this energy?
4. What problems may be connected with its use?

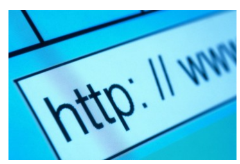
Project and Presentation

Present your project in a clear and logical way. Here are a few ideas:

1. Make a large poster to demonstrate how your energy source works.
2. Record a podcast (sound/video recording) that presents your ideas.
3. Create a power point presentation
4. Interview an energy scientist. Include the interview (sound and/or video) in your presentation.

Evaluation

Work with your teacher to determine how your project will be evaluated.



Links for the Renewable Energy Quest

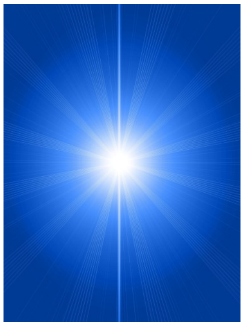
In addition to these locations you may find other information in books and by searching on the Internet using the name of the energy source.

US Department of Energy—tells about all the types of energy
http://www.energy.gov/energysources/bioenergy.htm

US Department of Energy—Energy Kid's Page. This describes each type of energy plus some not mentioned.
http://www.eia.doe.gov/kids/energyfacts/

The Energy Story—this site has a lot of material on every area in this project. Scroll down on the home page to the Table of Contents and you'll find your energy source.
http://www.energyquest.ca.gov/story/index.html

This site links to many sites about energy. It's powerful!
http://www.suelebeau.com/energy.htm



How Did the Sun Turn on My TV?

So how did the Sun turn on my TV? Well, it all started in ancient times. Large trees, plants, and bushes on the Earth died and decayed. More grew, died, and decayed. Weather, erosion, and shifting plates of the Earth made the underground change.

Decayed plants were pushed deeper and deeper. Far down under the weight of the dirt and rocks, the decayed matter became **fossilized**. It changed into large deposits of coal. Inside the coal was the stored energy of the plants. The plants had collected this energy from the Sun through **photosynthesis** while they were still growing on the Earth.

Hundreds of thousands of years later, people found that they could dig up hard, shiny, black chunks of coal and burn them for heat. The plants' stored chemical energy now became heat energy.

People then discovered that heat could warm up water enough to make it boil and become steam. Engineers built power plants where this steam would turn a turbine, transforming heat energy into kinetic energy. They found that kinetic energy would change into electrical energy in a generator. Electrical energy moves long distances through wires connected to your house. You plug your TV into an electrically wired outlet. Then you push the "on" button. The Sun just turned on your TV!

Activity — Energy Chain

Create a graphic organizer linking the energy of the sun to turning on the TV. Use pictures, diagrams, and words.

Star in Two Seasons

V. Girandola

Star in Winter

V. Girandola

Star in Summer

Why is Star's hair longer in one picture than the other? Is her hair length a constant or a variable? Use these pictures for the discussion questions in *Think Like a Scientist*, p. 4.

Energetic Humor

Alana: My car battery died. Do you know how to charge it?
Phyllis: Sure, just give me your credit card!

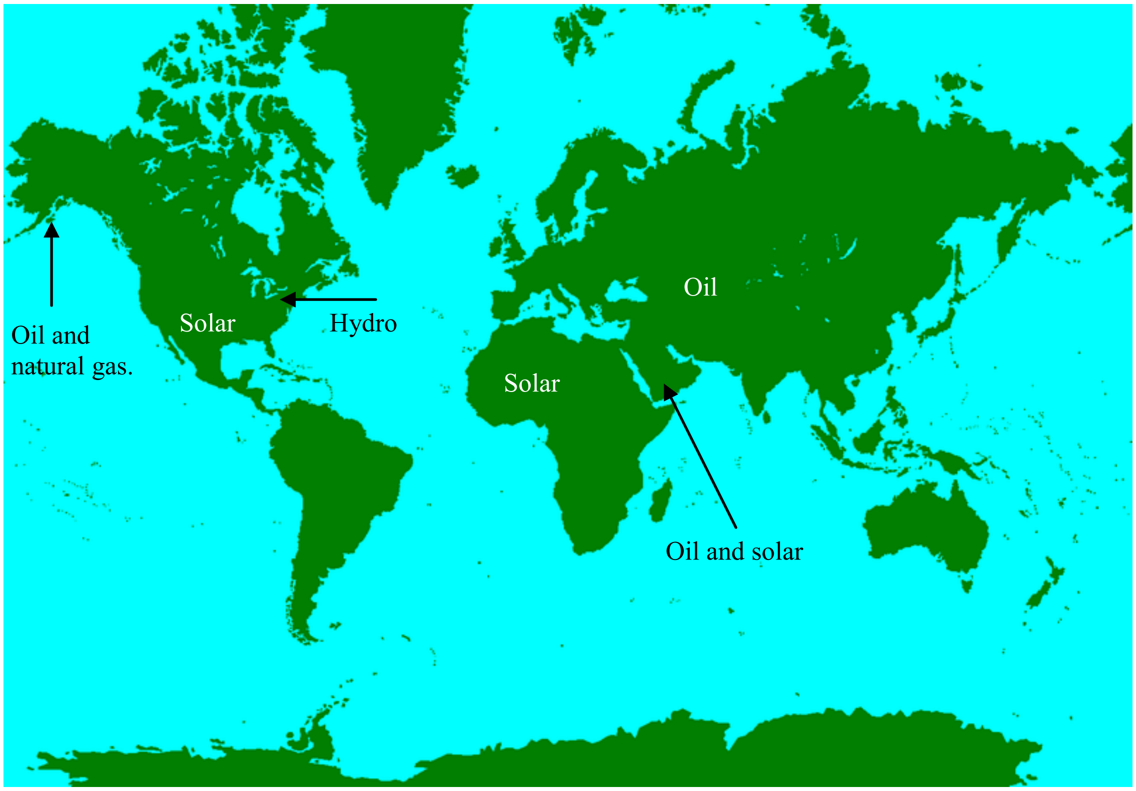
~ ~ ~

Bruce: Hey, Mary, I can solve the energy crisis.
Mary: Right, Bruce, and I'm going to fly to the moon.
Bruce: I'm going to plant a garden.
Mary (laughing): What are you going to plant, oil wells?
Bruce: No. Power plants!

~ ~ ~

Teacher: How do we know that wind power is popular?
Akim: Because it has so many fans!

Where in the World is Energy?



Energy can be found all over the world. We've noted just a few places on the map where solar, hydro and fossil fuels can be found. Look at the map of the world in an atlas or online. Find the names of the continents and countries on this map where energy sources are located.

Some other things to ponder...

- Why is it hard to find a place on the map for: bioenergy, geothermal, nuclear, and wind?
- What is the most common energy source where you live? Where does your electricity come from?
- About 87.5% or 7/8 of the Earth is covered by water. The ocean is always moving and can be a source of energy. How could we harness the power of the ocean to make energy?

Who Uses the Most Energy?

Look at the table below. On graph paper, make a bar graph comparing populations and energy used.

Wealth, Population, and Energy Use by Countries

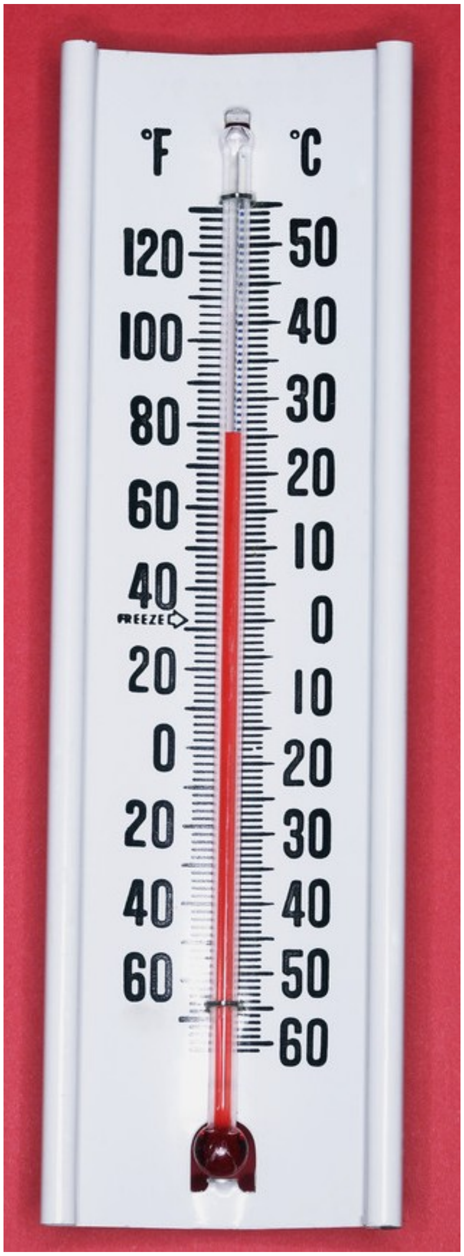
Nations	Wealth	Population*	Energy Used**
USA	High	306,000,000	2,326
China	Medium	1,325,000,000	1698
India	Med/Low	1,148,000,000	423
Bangladesh	Low	154,000,000	19

Use the chart to answers these questions.

1. Which countries use the most energy? Which use the least?
2. Which countries have the largest population? The least?
3. Does population size have anything to do with energy use?
4. The countries are ranked from wealthiest to poorest. What do you think wealth has to do with energy use?

* Population data from www.census.gov, 12/15/08
** Energy used is in metric tons.

Some Measures of Energy



Fahrenheit and Celsius thermometer. The red liquid in the thermometer is mercury. As mercury gets warm, it expands and moves up the thermometer. As it gets colder, it contracts and moves down the thermometer.

Measuring the amount of energy in something is tricky because energy is not something we can see. Here are some ways of measuring.

Temperature

Temperature is the measure of heat energy. The element Mercury is the silver liquid inside a thermometer that rises to show warmth and lowers to show cooling. On the Fahrenheit scale, water freezes at 32 degrees and boils at 212 degrees. On the centigrade scale, water freezes at 0 degrees and boils at 100 degrees. What is the temperature in the room where you are?

Learn more about temperature at: http://www.nyu.edu/pages/mathmol/textbook/measureenergy.html

Calories

The energy stored in food is measured in **calories**. The calories measure how much heat the food produces. You can learn more about calories and our bodies in the Health article on page 20. To see how many calories your body needs at various ages, go to: http://www.childrensheartinstitute.org/educate/nutritio/intake.htm

Luminosity

Luminosity is a measure of light energy. It can be the amount of light coming from a light bulb or how much energy is coming from a star or galaxy per second. The units of measurement of luminosity are watts (W). Scientists measure the brightness of a star by comparing it to the luminosity of the Sun. The luminosity of the Sun is $L_{\{sun\}} = 3.9$ X 10 to the 26th power W.

The brightness of a star is called its **magnitude**. Our Sun is the only star we can see in the daytime. At night we can see many other stars. Find out what stars have the greatest magnitude in our evening sky by going to: http://astronomyspace.suite101.com/article.cfm/the_brightest_stars

Measuring Electricity Use

We can measure how much electricity we use in our house or apartment by using the electric meter located on the outside of the building. Go outside and look at the meter where you live. It probably looks like the one in the picture below.

On the meter itself there is: Kh, which stands for kilowatt hour. The disc turns as the watts of electricity are used. Every thousand watts equals one Kilowatt. Our electric bill is based on how many kilowatts we use each month.

Electric meter

Spigot Theater

WHO WILL START THE CAMPFIRE?

A Play

By David W. Cochran

Dr. Albert Einstein and the world energy leaders are gathered at a conference to solve the world's energy problems. They are about to have a cookout.

Characters and Props

Narrator: firewood
Professor Einstein —wild hair and glasses
Ollie Oil—an oil can
Sally Solar—all in yellow with sunglasses
Winnie Wind—a fan
Norris Nuclear—E=MC2 on his shirt and a cell phone
Gary Gas—a Bunsen burner
Tommy Tidal—a bottle of water
Kenny Kilowatt—a battery

SETTING: All the leaders are sitting on the ground in a semi-circle outside in a wooded area at night. There are hotdogs, rolls, and other cookout food on a table nearby.

NARRATOR: *(Placing firewood in the middle of the circle)* The world energy leaders led by Professor Albert Einstein are at the International Energy Conference. They are huddled around a campfire looking at unlit logs.

PROFESSOR EINSTEIN: (*Going through his pockets, looking for matches*) Vell, my friends, ve are here at zee Energy Conference and ve hov a problem. *(He looks down at the logs ready to be ignited.)*

OLLIE OIL: Problem? What problem?

SALLY SOLAR: The fire, Ollie. The professor wants the fire lit. If we don't light it, the campfire will just be a camp.

WINNIE WIND: Huh? Oh, I get it. You can't have a campfire without fire, right?

NORRIS NUCLEAR: I think I could light the fire, but I'm afraid, I might overdo it with my nuclear power. *(He points to the formula on his shirt.)*

PROFESSOR EINSTEIN: (*Scratching his head*) All zees brilliant forms of power, surely von of you must be able to light the fire.

GARY GAS: My cousin is a "pro" at this, but he's also a "pane." (*He waves his gas burner.)*

SALLY SOLAR: You're a real gas, Gary. I think you should use my power. Get a magnifying glass, shine some of my solar rays through it and poof, the fire will start right up. *(She twirls around.)*

PROFESSOR EINSTEIN: Zat would be great tomorrow morning, Sally. But, if you notice, zere is no Sun now. It's night time.

WINNIE WIND: (*Fanning herself)* Yeah, Sally. Even I knew that. I could tell it was dark when I couldn't see without my flashlight.

TOMMY TIDAL: *(Shaking his bottle of water)* Well, I could churn up some power if I were out in the ocean. I could use the water to spin a generator and make electrical power.

KENNY KILOWATT: (*Juggling his batteries)* Hey! I could take some of my stored energy in a battery and start the fire with a spark.

PROFESSOR EINSTEIN: *(Clapping his hands)* Zat's good, Kenny. Now, ve're thinking.

OLLIE OIL: Man, if you could get a spark going, I could put some gasoline on that fire. (*He pretends to pour gasoline onto the fire.*) ... and we'd really have those hot dogs cooking.

(*They all turn and look at Ollie.)*

OLLIE OIL: We'll, it WOULD get the fire going.

NORRIS NUCLEAR: (*He jumps up and down.)* That's it. I'm calling my cousin, Fannie Friction. She'll know what to do.

(*He flips open his cell phone and calls Fannie.)*

Hello, Fannie? Cousin Norris here. How are you? Yeah, I'm having a blast. I have a question for you. No, I'm not on a quiz show. How would you start a fire if you didn't have anything to start it with? You have 30 seconds…no, just kidding. What would you do? *(Pause).* Ok. Uh, huh. Good. Thanks, and I'll see you soon.

OLLIE OIL: What'd she say? What'd she say?

(They lean closer to Norris Nuclear to hear what he has to say.)

NORRIS NUCLEAR: (*Slowly and dramatically*) Well... Fannie suggests... that we get ...two sticks and rub them together!

(They groan and grumble.)

SALLY SOLAR: (*Looking hopeful)* By the time we get the fire going that way, it will be sunrise and we could use my solar power.

TOMMY TIDAL: *(Jumping up and down)* I know, I know. We could go find some matches in the conference center. We could put some kindling on the fire and it will be blazing in no time.

WINNIE WIND: Cool. Actually, it would be hot, but it's still cool. And I could add my wind and have a real bonfire.(*Fanning everyone*)

PROFESSOR EINSTEIN: Now zat's thinking! It's simple and easy. You vin, Tommy. Vinny, you're runner up, but I'm afraid you'll burn zee camp down. How 'bout if you just go find zee matches. *(He shakes Tommy's and Winnie's hands.)*

NARRATOR: How would you solve this problem? Pretend that matches were not available. What would you do to get the campfire going? Brainstorm some ideas to outsmart the world energy leaders.

~ END ~

Renewable Energy Diamante

By David Cochran

oil
slick, deep
drilling, flowing, polluting
darkness, lipid, ray, light
radiating, shining, warming
plentiful, clean
Sun

Transforming Energy

The Law of Conservation of Energy states that energy cannot be created or destroyed. It only changes from one form to another. However, energy can be collected, absorbed, harnessed, soaked up, trapped, reflected, stored, saved, changed, converted, transferred, used, released, measured, and wasted. Here are some common types of energy with their descriptions.

- **Kinetic energy**: motion, the energy in the movement of an object
- **Potential energy**: energy stored, kept for use at a later time
- **Heat energy**: the driving force of life on Earth, the energy of vibrating particles in a substance, hot water, steam.
- **Chemical energy**: contained in food, wood and other fuels.
- **Mechanical energy**: energy stored in a machine, the wind, or water.
- **Sound energy**: carried by waves of vibrating particles that travel to the ear
- **Light energy**: light, solar, x-rays

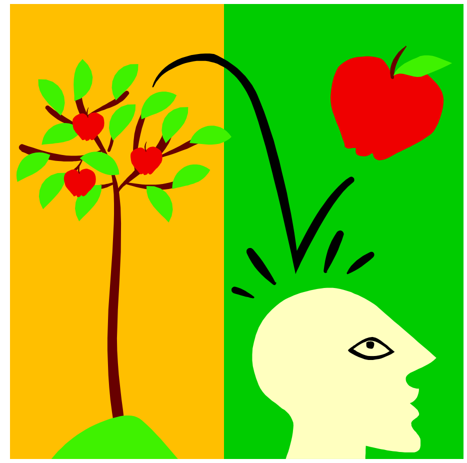
Answers On Page 23

For each example of a transfer (change) of energy below, fill in the energy type from the list above. Some energy types are used more than once. (The letters in the puzzle give you hints.)

Hammering a nail into a piece of wood	_ _ t _ _ _ _ _ _ energy into _ _ _ _ t _ _ energy
Popping popcorn	_ _ _ t energy into _ _ _ _ t _ _ energy
Starting the motor of a car	_ _ _ m _ _ _ _ energy into m _ _ _ _ _ _ _ _ _ _ energy
Ringing wind chimes	_ _ n _ _ _ _ energy into _ _ _ n _ energy
Kicking a soccer ball	_ _ t _ _ _ _ _ _ energy into _ _ _ _ t _ _ energy
Rubbing hands to warm hands	_ _ _ _ t _ _ energy into _ _ _ t energy
Turning on a flashlight	_ _ _ _ _ _ i _ _ _ energy into _ i _ _ _ energy

Drop It

A Word Game You Can Play Anywhere



Drop It First read the word clue. Guess the word. Read the Drop It clue. Guess the shorter word. Do both words make sense? Example: A four-letter word meaning to get bigger. Drop it and it means something you do with an oar. Answer: **GROW**, **ROW**
Take turns finding the answers and then make up some of your own.

Word Clues	First Word	Drop It Clue	Shorter word
1. A four-letter word meaning to be on fire		Drop it and it means a large vase.	
2. A four-letter word meaning the opposite of cool		Drop it and it is an upper limb.	
3. A four-letter word meaning heaviness of burden		Drop it and it is a long-eared beast of burden.	
4. A five-letter word meaning to begin		Drop it and it is a small pastry.	
5. A five-letter word meaning small hard seeds		Drop it and it is a form of precipitation.	
6. A four-letter word meaning to lie in water		Drop it and it is a tall, stately tree.	
7. A four-letter word meaning a feeling of warmth		Drop it and it means to chew and swallow food.	
8. A six-letter word meaning luminous		Drop it and it is the opposite of left.	
9. A five-letter word meaning a location		Drop it and it means a shoe string	
10. A four-letter word meaning frigid		Drop it and means the opposite of young.	

Answers are on p. 23

The Great Escape

How NASA's New Moon Rocket Will Escape Earth's Gravity

By Tracy McMahan,
Historian/Writer
NASA Ares Project

NASA/MAFC
"NASA's next-generation launch vehicle systems standing side-by-side. Ares I, left, is the crew launch vehicle that will carry the Orion crew exploration vehicle to space. Ares V is the cargo launch vehicle that will deliver large-scale hardware, including the lunar lander, to space."
(From http://www.nasa.gov/mission_pages/constellation/multimedia/ares_collage2.html)

Take a NASA Poll

Space Travel

If you could travel to any place in the solar system, where would you go?

Go to http://www.nasa.gov/mission_pages/constellation/ares/ares_education.html. **Look for *What do YOU Think?* and take the poll.**

While you're at the site, you can learn more about the Constellation Program and the Ares rockets.

To escape Earth, rockets produce and release tremendous energy. As they lift off from the Earth's surface, they must overcome the **resistance** of the atmosphere and reach a speed fast enough to **defy** gravity's downward pull. Two new NASA launch vehicles—the Ares I and Ares V—will leave Earth and send people and cargo to the Moon and other places in our universe.

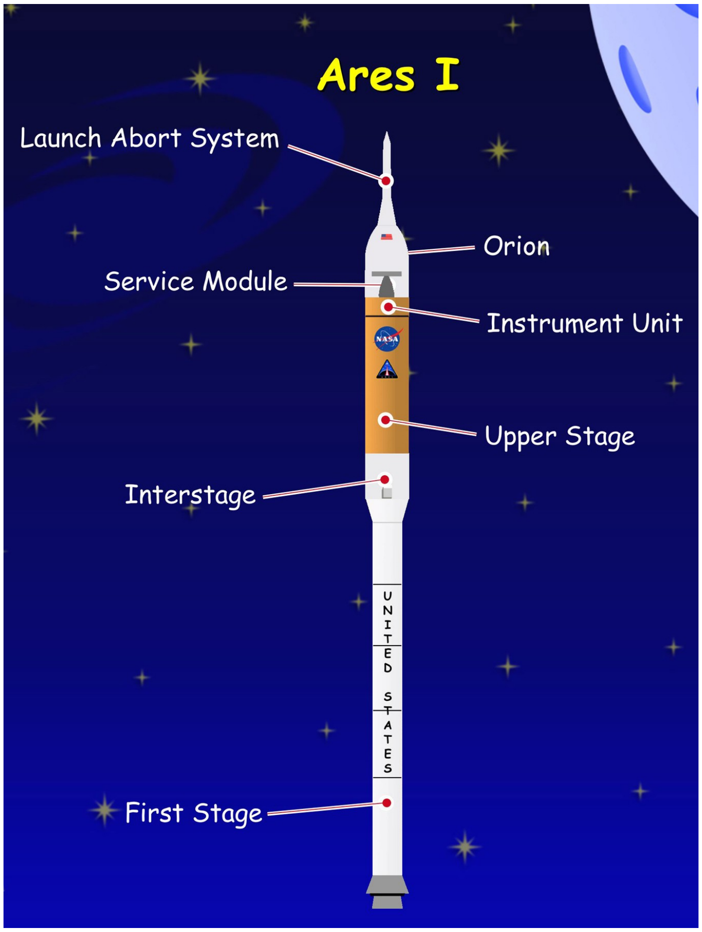
At 325 feet (99-meters) tall, Ares I will be taller than a 32-story building, weigh more than 2 million pounds (0.9 million kilograms), and **hoist** up to 56,500 pounds (25,628 kilograms)—enough to fill about 24 one-ton (0.9-metric ton) pickup trucks. The rocket's job is to carry the Orion spacecraft, which holds a crew of four to six people, water, air, and other supplies.

How Does It Escape?

How does a rocket escape Earth? It has to be light and burn **propellant** (fuel and **oxidizer**) as efficiently as possible. The launch vehicle has parts or **stages** that are dropped as fuel is turned into energy. Imagine you are hiking up a mountain while carrying a backpack full of food. As you eat the food, it provides energy to your body. The more you eat, the lighter your backpack gets and you can walk faster. If you remove the backpack, you can move even faster.

Ares I works the same way:

- Its first stage burns solid propellant for a little over two minutes and then separates and falls away.
- Next, the second, or upper stage, has a J-2X engine that burns liquid propellant for a little over eight minutes, using up 217 gallons (821 liters) of propellant per second.
- When its tanks are empty, the upper stage separates and falls away. At this point, Ares I has sent Orion and the crew thousands of miles downrange from the



NASA

Ares I rocket stages

launch pad and in an orbit about 80.5 miles (129.6 kilometers) above Earth.

- Ares I burns roughly 1.6 million pounds (0.7 million kilograms) of solid and liquid fuel. By comparison, a stock car uses 137.5 pounds (62.4 kilograms) of gasoline or 111 gallons (420 liters) for a 500-mile (805-kilometer) race.

To reach its destination, Orion fires its small rocket engine that places the spacecraft into the desired orbit to reach the International Space Station, a laboratory orbiting around 250 miles (400 kilometers) above Earth. Orion circles Earth at about 17,500 miles per hour (28,000 kilometers per hour).

Ares V Carries Cargo

For lunar missions Orion will dock with the Altair lunar lander carried to space by Ares V. This will be the largest NASA launch vehicle ever built. Ares V needs even more energy because it carries heavy cargos and provides enough energy to send Orion and Altair all the way to the Moon. To lift off, it will use six liquid rocket engines and two solid rocket boosters. If the energy produced by the boosters' fuel were converted to electric power, they would produce 2.3 million kilowatt hours of power, enough to supply the power for more than 92,000 homes for a full day.

Together, Ares I and Ares V can deliver 156,700 pounds (71,078 kilograms)—over 78 one-ton pickup trucks worth of crew and cargo—to the Moon. These rockets, along with the fleet of vehicles being developed by NASA's Constellation Program, will make it possible to take enough people and equipment to set up lunar outposts. From here, people can explore locations on the Moon that humans have never visited and practice living away from Earth for months. These are skills they will need before heading to Mars and beyond.

Activities

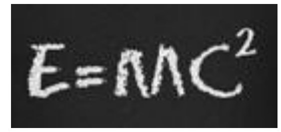
1. Make a timeline or graph to show when the parts of the Ares I rocket use their fuel and drop off.

2. Using photos from the NASA Ares web site, make a photo story to show the parts of the rockets and what they will do. See more Ares pictures at: http://www.nasa.gov/mission_pages/constellation/multimedia/const_images_search_agent_archive_3.html

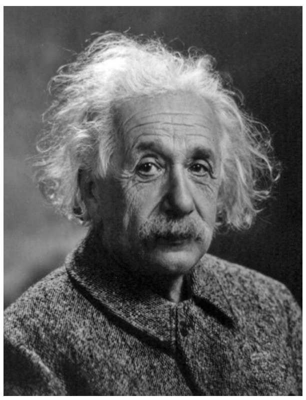
3. Imagine that you are an astronaut sitting in the Orion going from the Earth to the Moon. How would you feel? What would you say as you take off, as each stage of the rocket drops off, as you dock with the Altair lunar lander? Write a story or a script for a play showing how you feel.

Ponder
The Ares rockets are designed to help us get to the Moon and possibly to other planets in the future. What would it be like to be part of an astronaut team that goes far into space?

Scientists Are People Too



Albert Einstein



Oren Jack Turner, 1947, Library of Congress

Albert Einstein

Einstein, the Inventor

In 1930, Einstein invented a refrigerator that used no electricity, had no moving parts, and used no harmful gases. The refrigerator used only ammonia, butane, and water. Scientists are looking into Einstein's technology to see if it can be used today to make our world a greener place.

Albert Einstein, one of the greatest scientists the world has ever known, was born in Germany in 1879. His sense of mystery started with a magnetic compass that his father gave him when he was five. He watched the needle turn to magnetic north, pulled by a force he could not see, hear, or feel. It made him curious about "something behind things, something deeply hidden." His curiosity and imagination led him to ask questions. At 16, he became fascinated with what would happen if you raced alongside a light beam.

After excelling in math and physics in polytechnic school, he studied the equations of the nature of light. Einstein discovered that the speed of light remained the same no matter how fast one moved. The speed of light was a constant. This discovery led him to define the most renowned formula in science: $E=mc^2$. Energy equals mass times the speed of light squared.

In 1932, Einstein left Germany to work at the Institute for Advanced Study, in Princeton, New Jersey, where he lived until his death in 1955. His legacy is monumental.

Because of $E=mc^2$ scientists have developed television, lasers, global positioning systems, automation systems, space travel, fuel for the Mars Rover on Mars, nuclear plants, even the atom bomb.

Because of $E=mc^2$ scientists can explain the energy of the Sun and the stars, watch the universe expand, and study the creation of the universe, black holes, and wormholes in space.

Because of $E=mc^2$ scientists are looking into the future to study dark energy, higher dimensions, time travel, and Einstein's last quest—a Master Theory of Everything that would "read the mind of God."

V. Girandola

The house where Einstein lived in Princeton , NJ

Energy Inside Us

The human body is an amazing and **complex** machine. Just like a car, it requires energy to run. The source of that energy for our bodies is the food we eat and the liquids we drink. These food sources are just like the stored energy in batteries. They don't do anything outside our bodies, but when we eat or drink them, they cause chemical reactions that release energy.

One of the things that this energy does is cause us to grow. All parts of us grow and change all the time that we have food. When we stop receiving stored energy, we stop growing, and stop living. We grow all over. Our bones, muscles, skin, hair and cells are always changing as we grow.

Our Food Processor

The digestive system is the food processor of the body. Food enters our mouth, travels though the esophagus to the stomach, and is mixed with chemicals that start the energy transfer from the food to the body. Once broken down, nutrients from food are absorbed into our bodies in the small intestine. The food we don't use moves on to the large intestine and is eliminated. Meanwhile the liquids are processed in the kidneys and pass on to the bladder. What isn't used is eliminated as urine.

Just as the type of fuel we put in our car determines how it runs, the kind of food we eat determines how well we function. If we put bad fuel in a car, it won't run. In humans, the body tries to run for as long as it can, but eventually a poor diet will lead to sickness or worse.

Our bodies break down food in a certain order. We burn the proteins (often found in meat and nuts). We then burn carbohydrates (sugars, breads). Finally, we burn off the fats we eat. If we eat a lot of fat in our diet and it is the last thing to be burned, there is often some left over. Any unused fuel is stored in our body. People who eat a lot more than they need, end up storing the extra fuel as fat.

The unit of measure for food energy is the calorie. This is the amount of heat it takes to raise the temperature of 1 kilogram of water 1 degree Celsius. We think of calories with food, but everything that has energy has calories – even gasoline.

Calories vary greatly in foods. Foods high in fat are high in calories. Compare these examples:
broccoli, raw – 34 calories
glazed donut – 417 calories
large hamburger with small fries – 790 calories
You can find a lot more about the amount of calories in types of food at: http://www.calorie-counter.net/nutrition-calories-in-food.htm

How many calories do we need to eat per day to keep our weight as it is? Go to a calorie counter on the Internet and put in your age, height, and weight. Here is one to try: http://www.shapefit.com/dailycalorie-calc.html

The more active we are, the more fuel we burn. If we watch TV all the time and never do any exercise, then we need fewer calories – less food.

Think about the fuel you put in your body. Is it enough? Too much? If you figure out what you should burn per day and what you eat per day, you'll have your answer.

Keep your human machine running well by eating good foods that give you energy, but not too much fat. And if you eat too much, go out and play. Run around and burn off those extra calories.

Activity

Keep track of the amount and type of food you eat in one day. Use a calorie chart to figure out how many calories you eat per day.

Be an Energy Artist

Jina Lee, Wikipedia

Wind chimes in a backyard

Have you ever thought of making energy art? It's really fun. Energy art can be any type of art such as music, dance, painting/drawing, or sculpture that uses or celebrates energy. Maybe you've already made some energy art and not called it that. Sometimes energy art tells us something about an energy source such as a painting that shows the Sun and its planets in our solar system.

Water moves in interesting ways in this fountain.

Other types of energy art actually use energy to create the art. For example, a set of wind chimes on a porch makes music when the wind blows. Fountains dance in artistic ways while they cool the air and filter the water.

Native Americans from many different tribes have danced to celebrate the Sun and other wonders of the Earth for centuries. They chant, dance, drum, and pray as part of the ceremony.

Architects are often energy artists. They design creative buildings that not only look interesting but also make good use of energy.

Native Americans dance in tribute to the Sun.

Art and energy go together in exciting ways to make life interesting and help us understand things in new and creative ways.

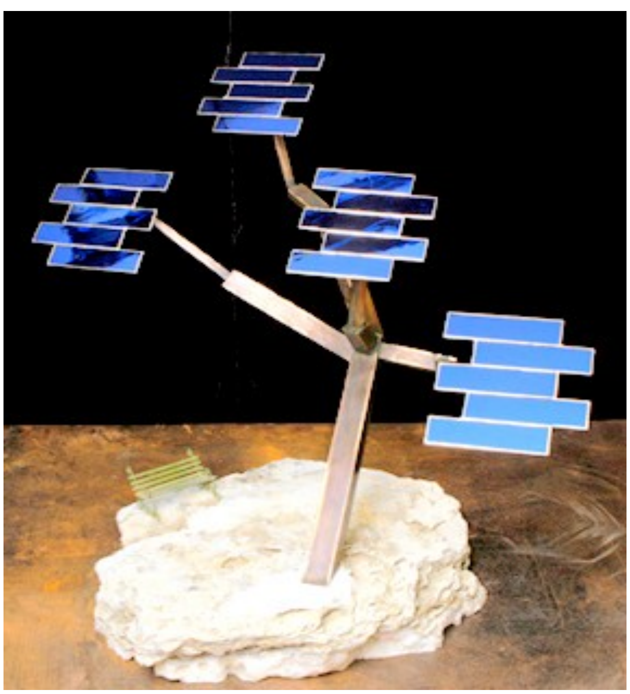
You Have What It Takes to Be an Energy Artist

The main ingredients needed to be an energy artist are understanding the energy source you are celebrating in your artwork and your imagination. Creative artists often have an idea, then they let their imagination loose to create something. They will sometimes plan their ideas or at other times they will just lift up the paint brush and start a painting.

Which type of art do you like to do? Check off all your favorite types in the box below.

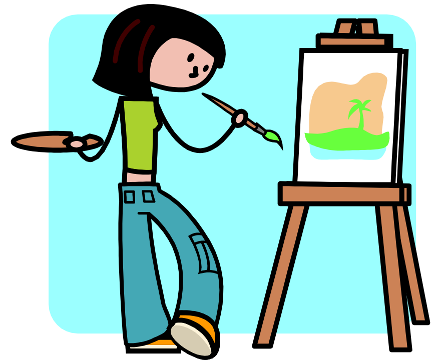
- ☐ painting
- ☐ drawing
- ☐ sculpting
- ☐ playwriting
- ☐ creative writing
- ☐ dancing
- ☐ building things
- ☐ writing poems
- ☐ writing music
- ☐ playing a musical instrument
- ☐ other: __________

Now that you've named some types of art you like, read the project ideas in the next column. Try one of them or make up something else. When you do, you will be an energy artist!



Cie Stroud

This is a model of a solar tree that will grow to 25 feet tall and will generate electricity from the Sun's energy. It will be built at an elementary school in California It was created by solar artist Rein Triefeldt at his studio in Hamilton, NJ. You can learn more about his work at: http://www.triefeldt.com.



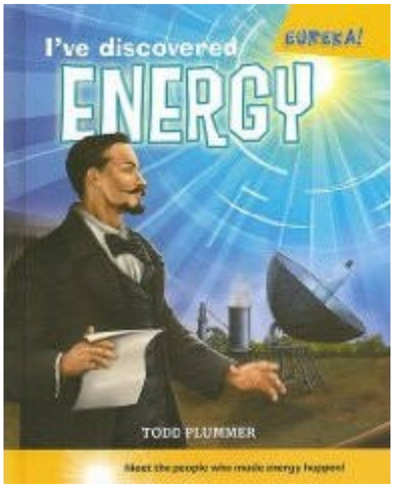
10 Ways You Can Be an Energy Artist

1. Make a painting or drawing that shows the beauty of the Sun as it strikes the Earth.
2. Imagine that you are an architect. Design a house or building that uses solar energy.
3. Using different lengths of copper pipe or other material, make a set of wind chimes and hang it outside.
4. Write a poem to compare fossil fuels and renewable energy. A diamante would be a perfect poem for this. (See the Spigot Patterns issue to learn how to write diamantes and other poems.)
5. Write or sing a song about the importance of energy in our lives. You might even want to perform it for others.
6. Create your own energy dance to celebrate one or more types of energy. For example, what do you think a garbage energy dance would look like?
7. Make an artistic mobile and place it where the wind will make it swirl.
8. Make a newspaper or magazine about the world energy crisis. Publish it online or print it for others to read.
9. Make an energy sculpture. Take one type of energy and build a three-dimensional sculpture that shows its power. You could make it from wood, metal, clay, or any other material you have available.
10. If you are really ambitious, write a short play about the importance of energy. You could include in it several of the projects above such as poems, songs, and music.

You may have an even better way to be an energy artist. Great! Go for it!

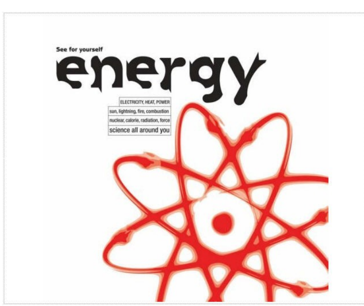
Energy Book Reviews

Dr. Patricia Richwine



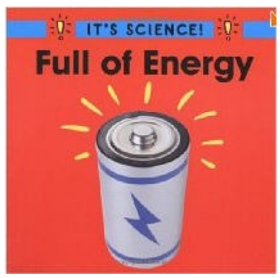
I've Discovered Energy by Todd Plummer, 2009, Marshall Cavendish Corp.

Meet the energy experts from Galileo to Einstein. Examine the timeline of energy history. Try your own energy experiments on the greenhouse effect, heat absorption, static electricity, and more. See step-by-step illustrated instructions for the experiments. Learn about kinetic, mechanical, potential, renewable, static, and thermal energy. Check out how energy is at work everywhere. You'll be energized!



Energy by Chris Woodford, 2007, DK Publishing.

Can cold things contain heat? What are fossil fuels? How does food act as fuel for our bodies? Where is the world's largest hydroelectric plant? From lightning to light bulbs energy is at work all around us. Find out how solar panels and surfing are related to energy. You'll be amazed with facts like these: "In a single second the Sun makes enough power to supply energy to the Earth for one million years" and "Switching off a computer screen overnight saves enough energy to print 800 pieces of paper."



Full of Energy by Sally Hewitt, 1997, Children's Press of Grolier Publishing.

Sometimes our bodies use only a little energy, as in reading. Sometimes our bodies use a lot of energy, as in running. When you feel hungry, your body needs fuel to give you more energy. Look at ways that you and other animals get and use energy. Find out if your energy needs change in different seasons. Try out some simple activities to help you learn more about you and energy.

Energy by John Woodruff, 1998, Raintree Steck-Vaughn.

Read about energy efficiency and do an investigation with insulators. Learn about biological energy and record how grass clippings make heat. Find out about electrical energy and make a battery. See how energy comes from water and use household materials to create a waterwheel. After you read about each type of energy, use your own energy to do the investigations for yourself.

These books are available through Amazon at our web site.

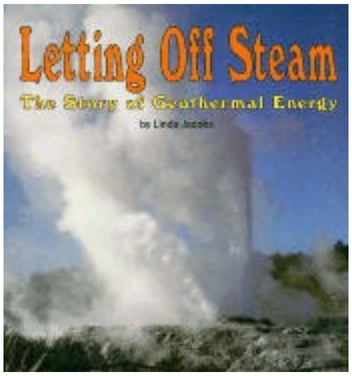
amazon.com

Answers for: Transforming Energy p.15

Potential energy to kinetic energy
Heat energy to kinetic energy
Chemical energy to mechanical energy
Kinetic energy to sound energy
Potential energy to kinetic energy
Kinetic energy to heat energy
Mechanical energy to light energy

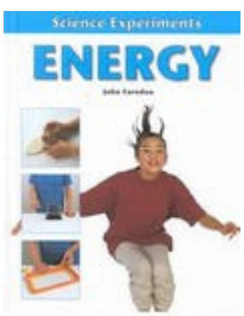
Answers to Drop It, p.16

1. Burn, urn 2. Warm, arm 3. Mass, ass
4. Start, tart 5. Grain, rain 6.Soak, oak
7. Heat, eat 8. Bright, right 9. Place, lace
10. Cold, old



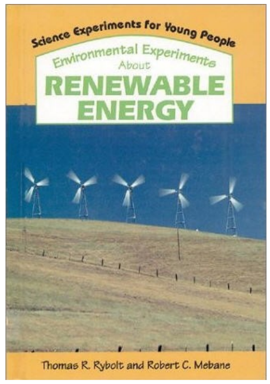
Letting off Steam: The Story of Geothermal Energy by Linda Jacobs, 1989, Carolrhoda Books.

You've seen steam come out of a boiling tea kettle or even out of a hot bowl of soup. Steam is water in the form of gas and can even come out of the Earth. The heat from the Earth's core makes geothermal energy. You can see the steam as it erupts out of geysers like Old Faithful in Wyoming's Yellowstone National Park. Learn more about the geothermal energy in hot springs, fumaroles, and mud pots. Think "green" to preserve this natural resource.



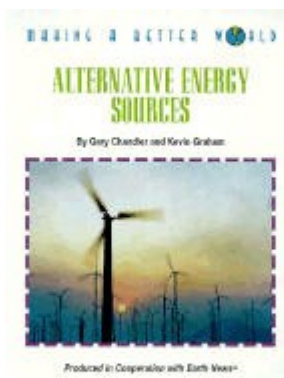
Energy by John Farndon, 2003, Marshall Cavendish Corp.

Did you ever hear someone say "It's so hot we can fry an egg on the sidewalk?" If you make the solar cooker shown in this book, you can cook an egg in the hot sunshine for yourself. See how energy from the Sun works through energy chains to power even your TV or computer.



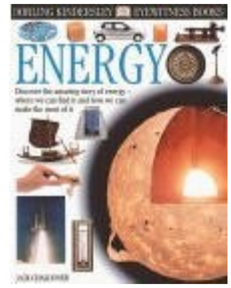
Environmental Experiments about Renewable Energy by Thomas R. Rybolt & Robert C. Mebane, 1994, Enslow Publishers.

When you burn wood in a fireplace, you are using biomass or energy from plants. Biomass, solar, wind, water, and geothermal are renewable sources of energy. They can help reduce pollution and can help prevent global warming. Try the 16 experiments in this book to learn more about all these forms of renewable energy.



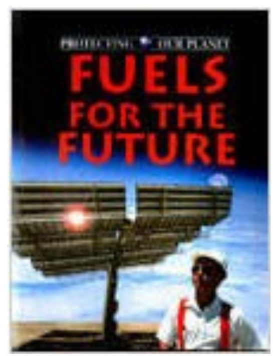
Alternative Energy Sources by Gary Chandler & Kevin Graham, 1996, Twenty-First Century Books.

Do you want to reduce pollution and protect the environment? If so, then you'll want to know more about alternative energy sources like the Sun and wind. One day you may even want to build a house from salt-treated wood to retain heat and use solar panels to provide your electricity. Maybe you'll even have a solar-powered lawn mower! Or, you may one day become a wind farmer with your own fields of wind turbines. Think about ways you might contribute to a cleaner, greener Earth.



Energy by Jack Challoner, 1993, DK Publishing.

From ancient times, people have used energy to do work. At first only muscle energy was used. Later, simple tools, then machines, natural resources, and even nuclear energy were used. Magnetism to muscle power, Faraday to Franklin, and aircraft to atomic bombs are all included in this extensive look at energy.



Fuels for the Future by Steve Parker, 1998, Raintree Steck-Vaughn.

Kilojoules (kj) are measurement units of fuels and the energy they provide. For a person, a two-mile walk would take 250 kj, and one banana would provide the fuel for that walk. There are many other kinds of fuel and lots of uses for them. Non-renewable fuels will eventually be depleted. In the future, we all need to find creative resources and ways to use fuels more efficiently.

Tap into Learning

Volume 2: Number 2
March/April 2009

Spigot

Science Magazine

for Kids and Classrooms

Ecosystems

Check out our website:
http://www.spigotsciencemag.com
Books, Links, Teaching Guide

In this Issue:

*Biomes around the World *Biodiversity
*Adaptation by Plants and Animals *Ecosystems
*Food Chains *and much more!