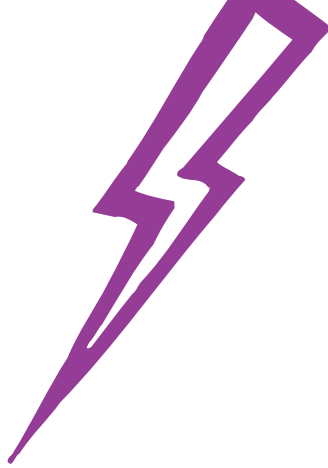


# Energy

## G.A.C. Pack



Here are some energetic ways  
for you and your partner  
to get all charged up about energy!



A national collaboration to encourage  
family involvement in girls' science learning

Developed for Girls at the Center, funded in part by the National  
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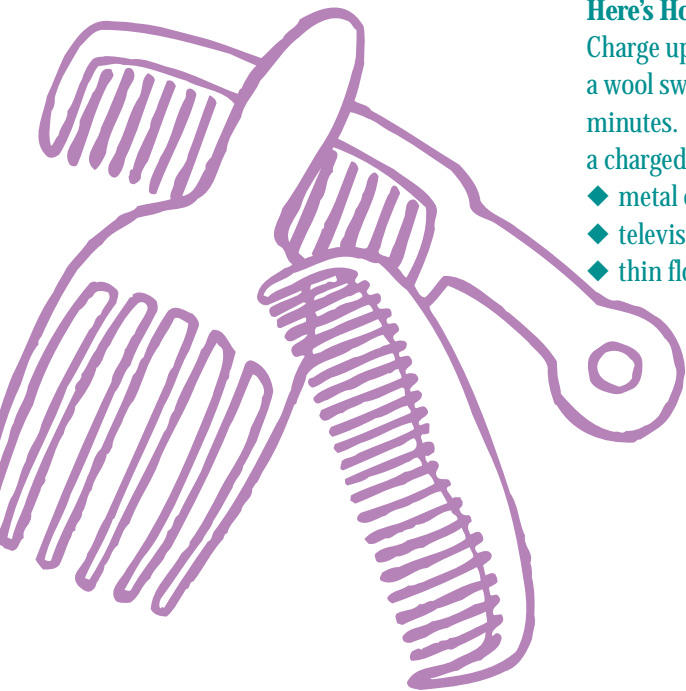
Alcoa Foundation

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# Electrify Your Friends with Comb Tricks



## Here's How

Charge up a comb by rubbing it against a wool sweater or the carpet for several minutes. What happens when you hold a charged comb near a

- ◆ metal door knob?
- ◆ television screen?
- ◆ thin flow of cold water?

## Spark Your Curiosity About Static Electricity

You will need:

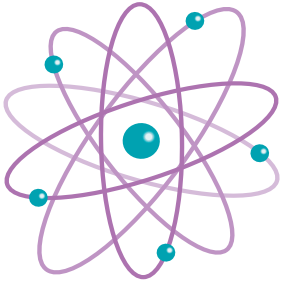
- ◆ Two small clear plastic containers with lids (Make sure each is clean and dry.)
- ◆ A small pile of salt and pepper
- ◆ Small bits of aluminum foil
- ◆ Puffed cereal
- ◆ Small bits of paper
- ◆ Glitter

What to do:

1. Choose a substance from the list above and place it inside a plastic container.
2. Rub the container against your clothes or carpeting.

Repeat steps 1 and 2 for each of the substances listed above. What do you notice? Compare what happens with the different substances. What happens when you run your finger along the container?

# ALL ABOUT ENERGY



**Did you know that**

**everything in the world is made up of small particles known as atoms. Each atom has a nucleus (center) that contains smaller particles (protons and neutrons)? Other particles, called electrons circle around the nucleus.**

**electrons have negative (-) charges? Electrons are attracted to positive (+) charges but repelled by the negative charges of other electrons.**

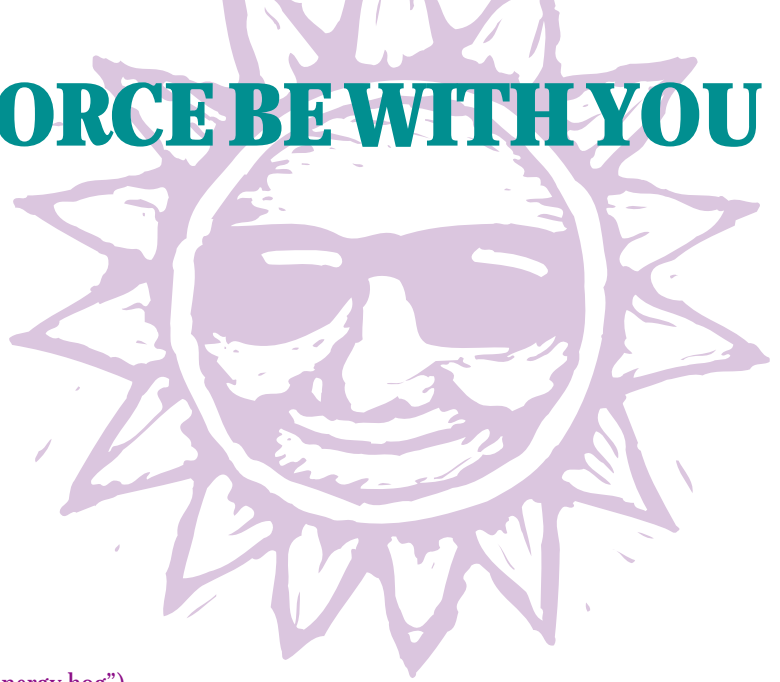
**the crackle you hear or the spark you see when two things rub together, like a comb against your hair, is static electricity?**

**It is easier to make static electricity on cold, dry days rather than on humid days? Why do you think this is so?**

# MAY THE FORCE BE WITH YOU

**Take a “power” walk with your partner around your home or neighborhood and see how many of the following energy items you can find!**

- Something that measures electrical use
- A television cable line or satellite dish
- Something that’s battery-powered
- A light that’s on a timer
- Something that makes steam
- A source of electrical power
- Something that burns wood or coal
- Something that uses lots of energy (an “energy hog”)
- Something that uses wind power
- An energy saver
- Something that runs on fossil fuel
- An example of static electricity
- Something that uses solar power





# ELECTRIC BOOGIE

Feel the beat of those dancing feet...

## You will need:

Tissue paper  
Scissors  
A small box with a plastic top  
Feet pattern card (enclosed)

## What to do:

1. Make several pairs of feet using tissue paper to trace the patterns of the other side of this card.
2. Cut out each individual foot.
3. Place the cutouts in a small box with a plastic top.
4. Charge the top of the box by rubbing it on your clothes, a blown-up balloon, or a carpet.

What happens?





# Crack the Energy Code

Take turns unraveling the hidden, energy-related messages below by using this decoder:

P	A	C	I	T	U	M	W	H	E	V	R	F	O	L	D	S	N
☀	♠	♦	★	✱	☆	♣	♥	✂	✕	☞	✍	✌	➡	👉	👈	◯	↗

1. \_\_\_\_\_ energy can be used to cook food. Heat homes, and run electric cars.



2. You \_\_\_\_\_ energy when you turn off lights in an empty room.



3. Electricity is the \_\_\_\_\_ of \_\_\_\_\_.



4. Electrical \_\_\_\_\_ in your heart make it \_\_\_\_\_.



Answers : 1) solar; 2)  
conserves; 3) flow,  
electrons; 4) impulses;  
pump

# WORD SEARCH

Focus your energy on finding the hidden words in the puzzle below. Words go up and down, across, at an angle, forward, or backward.

ATOM  
GENERATOR  
CHARGE  
KILOWATTS  
CONDUCTOR  
LIGHTNING  
CURRENT  
NEUTRONS

ELECTRICITY  
POWER  
ELECTRONS  
PROTONS  
ENERGY  
STATIC  
FORCE



## Girl Scout Program Links

*For Brownie Girl Scouts:*

Experiment with static electricity with the **Science Wonders Try-It. Science in Action** is a “bright” way to learn about energy conservation.

*For Junior Girl Scouts:*

Discover ways in which you can make your home more energy-efficient with the **Do-It-Yourself** badge. Become an expert on electricity in your home with the **Ms. Fix-It** badge.

*For Cadette and Senior Girl Scouts:*

Explore alternative sources of energy with the **Eco-Action** interest project award. The **Planet Power** interest project is a “powerful” way to learn about energy and energy conservation.

# HOT LINKS

**What does it feel like to be struck by lightning?** Read the “shocking” stories of girls who experienced nature’s static electricity at <http://www.azstarnet.com/anubis/zaphome.htm>

**Learn about hydroelectricity**—the power of water- by visiting a national historic landmark at <http://www.hooverdam.com/educate/edpack4.html>



Find out **what life was like before electrical appliances**. Check out <http://www.pbs.org/wgbh/aso/tryit/tech/> for activities and information on home technology.

**Get energized!** Log on to <http://www.enerby.ca.gov/education/index.html> for some electrifying activities and an energy game show.

# BOOKS ABOUT ENERGY



*The Magic School Bus and the Electric Trip*, by Joanna Cole and Bruce Degen. Scholastic Inc., 1997. Miss Frizzle is electrifying as she teaches her class about the wonders of electricity. (Ages 4 — 8)

*Turn on the Lights—from Bed: Inventions, Contraptions, and Gadgets Kids Can Build*, by Robert S. Carrow. McGraw-Hill, 1996. With just your creativity and some simple household items, you can invent any number of electrical devices. (Ages 9-12)

*Ben Franklin's Adventures with Electricity*, by Beverley Birch and Robin Bell Corfield. Barrons Juveniles, 1996. Jolting stories about the discoveries that led to the use of electrical energy. (Ages 9 — 12)

*The New Way Things Work*, by David MacAulay. Houghton Mifflin, 1998. Discover the mechanics behind everything from toasters to televisions. (Ages 9 and up)

*Janice VanCleave's Electricity: Mind-Boggling Experiments You Can Turn into Science Fair Projects*, by Janice Pratt VanCleave. John Wiley & Sons, 1994. Fun and exciting experiments to spark your curiosity. (Ages 7—12)



# Enlightening Facts

Did you know that lightning is static electricity?

Air, water droplets, and even ice crystals rub violently against each other inside a thundercloud, creating negative and positive charges. Lightning occurs when the attraction between charges is so strong that they push through the air towards each other. You can see lightning in action inside clouds, going between clouds, and traveling from earth to clouds.

Can you imagine being able to glow in the dark or shoot electricity out of your body—ZAP!

Some creatures can actually do that. **Bioluminescent** creatures give off light and **bioelectric** ones emit electricity.

# Let There Be Light

Some organisms produce their own light by changing chemical energy into light energy. Others depend on light-producing bacteria that live in their bodies.

**Bioluminescent** organisms can produce light that is green, yellow, blue, or even red.

Organisms produce light to attract a mate, lure animals closer so that they can eat them, or see in the dark.

Most of the organisms that produce light can be found in the oceans.

**Bioelectric** animals use electricity to kill the animals they eat, sense where they are going in the dark, escape predators, or communicate with each other.

The electric eel of South America can give you a jolt of up to 600 volts—OUCH! In the United States, the electric ray is a real shocker.

# G.A.C. ENERGY SURVEY



Do this energy survey with your partner.  
Plan to share your results at the next G.A.C. event!

1. How many of each of the following bulbs is used in your home?

- |               |                                |
|---------------|--------------------------------|
| _____ 25 watt | _____ 100 watt                 |
| _____ 40 watt | _____ other (indicate wattage) |
| _____ 60 watt |                                |

2. List all the electrical appliances you have in your home.

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3. How many kilowatt-hours of electricity did you use in your home last month? How much did the electricity cost? (Look at last month's electric bill.)

Kilowatt-hours used

Cost

4. What "bright" ideas can you think of that might help your family reduce the amount of electricity used each month?

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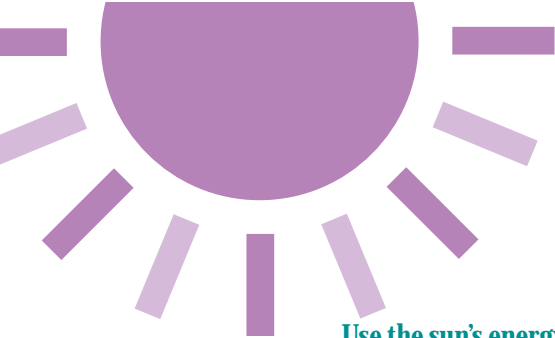
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5. Try these ideas for one month.

What effect did it have on your electric bill?

Kilowatt-hours used

Cost



**Use the sun's energy to cook a treat for yourself and your partner!**

**You will need:**

- ◆ Aluminum foil
- ◆ One sheet of flexible cardboard (12 by 18 inches)
- ◆ One yard of string
- ◆ Tape
- ◆ A long, clean stick
- ◆ Marshmallows
- ◆ A hot sunny day

# SOLAR ENERGY CHALLENGE

**What to do:**

1. Cover one side of the cardboard with aluminum foil, shiny side out. Try to keep the foil as smooth as possible. Secure the foil with the tape.
2. Bend the cardboard so that the foil is on the inside of the curve. Wrap the string twice around the middle of the bent cardboard and knot the string at the back.
3. Place your cooker in a sunny place so that the foil catches the sun's rays. With your hand, find your cooker's "hot spot." That's the spot where the sun's rays are most concentrated. This is the spot where you'll want to cook your marshmallows. Can you think of another way to measure the temperatures in different places?
4. Put two marshmallows on the end of your stick. Then hold them in the cooker's hot spot until they are golden and gooey!

Enjoy your solar energy treat.

# Wired for Success



Can you and your partner connect the description of the job to the career?

## Career

1. Electrical engineer
2. Medical technician
3. Air traffic controller
4. Electrician
5. Electronic repair person
6. Line installer
7. Broadcast technician
8. High energy physicist
9. Meteorologist
10. Environmental biologist



## Job Description

- A. Fixes electronic equipment
- B. Wires buildings
- C. Studies the effect of energy choices on air quality and weather patterns
- D. Designs equipment, machines, and systems that generate and use electricity
- E. Connects work and home environment to a power source
- F. Reads radar
- G. Applies electrical impulses to restart a stopped heart
- H. Monitors the impact of power sources on the environment
- I. Studies matter and forces
- J. Sets up, operates, and maintains electronic equipment used in radio and TV broadcasts

Answers: (1) D; (2) G; (3) F; (4) B; (5) A; (6) E; (7) J; (8) I; (9) C; (10) H

# WOMEN IN SCIENCE

Meet K'Andrea Bickerstaff, engineer, graduate student, and mentor. K'Andrea designs memories, adders, and transistor level circuits for chips used in personal computers and Internet sound players. For her doctoral dissertation, she is developing high-speed multipliers and other arithmetic circuits used to create the special 3-D sound and visual effects that make movies and other attractions so exciting.

In fact, it was curiosity about movie special effects and space missions that led to K'Andrea's interest in engineering. She always wanted to know "how'd they do that?!" As an electrical engineer K'Andrea now knows how to do it and spends a great deal of her time sharing her knowledge of



and enthusiasm for engineering with girls and young women.

As an active member of the Society of Women Engineers (SWE), K'Andrea has led Girl Scouts through hands-on projects, coached an all-girls team for a state-wide math and science competition and coordinated a program that sends girls to Space Academy each summer.

K'Andrea loves the challenges of her job as an electrical engineer and is "proud to be a part of a group (SWE) whose #1 goal is to encourage young women to pursue careers in engineering."

## What Is an Electrical Engineer?

When you think of an electrical engineer, do you think of power stations or appliances? Think again! Electrical engineers are the power behind some very exciting happenings, including 3-D sound and visual effects for movies, photo displays in shopping malls, laser shows at theme parks, and the electrical systems for space flight.

Electrical engineers do plan and design power stations and develop products such as electric motors and appliances. They also design signaling devices for road, rail, and air traffic and telecommunications equipment and networks. Many use computer assisted design (CAD) to assist in the drawing of complicated electrical systems, including those in cameras, strobe lights, sound systems, computers, rockets, and, of course, movie special effects!