

# SAY WATT?!

DISCOVER THE AMAZING WORLD OF ELECTRICITY



Touchstone Energy<sup>®</sup>  
Cooperatives

## I'M HERE TO TELL YOU ALL ABOUT ELECTRICITY!

I'm Wali Watt. I live in the fascinating world of electricity, and my friends at your local Touchstone Energy® Cooperative asked if I would tell you all about it. When we're done chatting, you're going to know cool things like circuits, conductors and what my last name Watt means. Now let's dive in!



# GETTING DOWN TO BASICS

## WHAT IS ELECTRICITY?

Electricity is a type of energy. There are two types of electricity: static and current.

**STATIC ELECTRICITY** stays in one place, like when you rub a balloon on your head and it sticks to your hair. That's static electricity!

**CURRENT ELECTRICITY** travels from one place to another. It's what lights me up so I can help you see in the dark.

Electricity is everywhere! You use electricity at school and at home. It is what lets you surf the Internet, watch your favorite TV show, keep ice cream cold, make some toast and more. Can you imagine life without it? Think how hard it would be to do your homework at night. And what would you do for entertainment?!

## SO, WHERE DOES ELECTRICITY COME FROM?

The electricity we use every day comes from many sources. Some of it is made by burning coal or using natural gas. These are nonrenewable energy sources. That means once they are used, they are gone. Electricity can also be made from the sun, wind, water or heat coming off the Earth. These are called renewable energy sources because we can use them again and again.

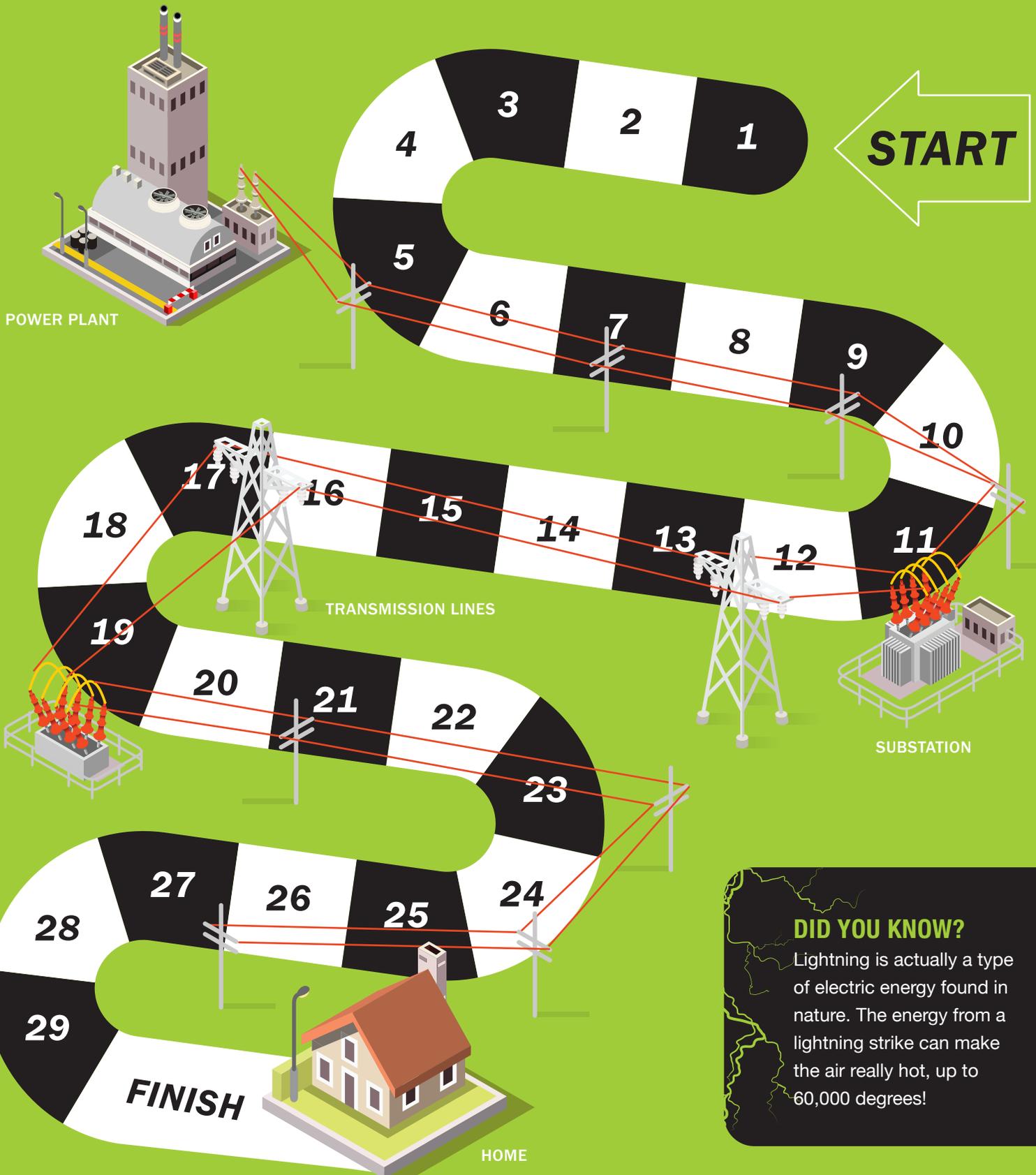
## BUT HOW DOES ELECTRICITY TRAVEL?

You know those poles and wires you see along the road? That is how electricity travels from where it is made to your home. Here is how it works:

1. Electricity is made at a power plant.
2. Once made, it goes to a transformer that boosts it to travel long distances. Electricity usually has to travel hundreds of miles!
3. It then travels through transmission lines (the wires you see along the road).
4. The electricity then arrives at a substation. At a substation, the electricity is slowed down so it can safely travel to your home.
5. It then goes through smaller wires called distribution lines, which are connected to your home.
6. Then it goes through a meter on your home and into small wires throughout your home so it is ready for use when you plug in an electronic or flip on the lights.
7. Play the game on the next page to learn more about this.

# FLIP THE SWITCH

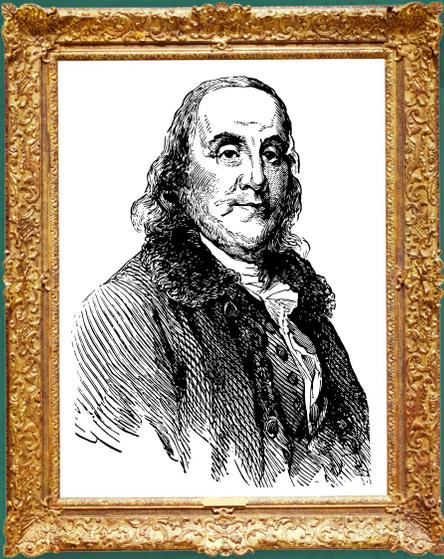
Play this game with family or friends to see how electricity travels. You will need one dice and markers (like a penny or button) for each player. Start at the power plant and take turns rolling the dice. Move the number of spaces that you roll. Whoever reaches the house first wins!



## DID YOU KNOW?

Lightning is actually a type of electric energy found in nature. The energy from a lightning strike can make the air really hot, up to 60,000 degrees!

# THE SHOCKING HISTORY OF ELECTRICITY

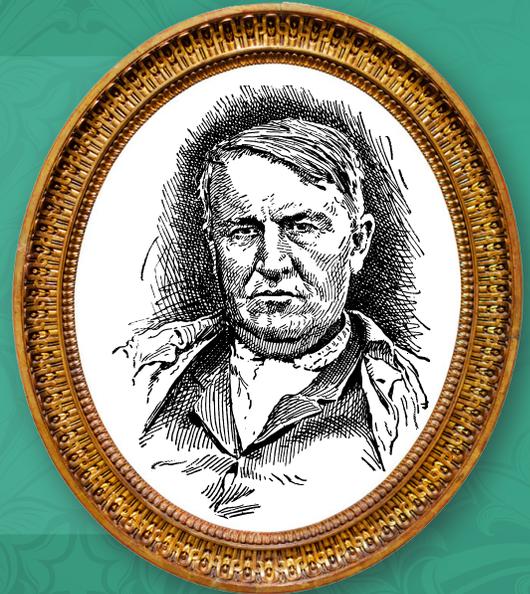


## *Benjamin Franklin*

Benjamin Franklin was a man with a lot of talents and one of our country's Founding Fathers. He did many experiments in his lifetime to learn about electricity. Franklin discovered that lightning is electricity. Some of his experiments led him to get shocked. Ouch!

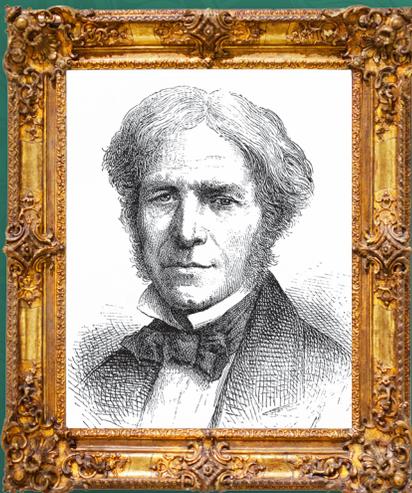
## *Thomas Edison*

Then there is my favorite inventor, Thomas Edison. He invented me—the light bulb! Before I was invented, people used candles to see at night. But candles can be dangerous and messy. The light bulb is a simple principle: Electricity flows into the filament and when it heats up, it starts to glow and we have light! Edison worked hard to create a safe version of the light bulb that would last a long time.

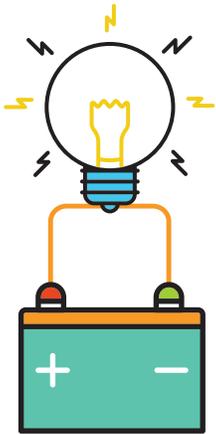


## *Michael Faraday*

Michael Faraday helped create modern-day electricity. He discovered that if you move a magnet inside of a wire coil, it created an electric current. This discovery led to him building the first transformer, generator and electric motor!



# CIRCUIT POWER



Thomas Edison did many experiments to perfect light bulbs. Now, let's do one of our own! Ask a parent to help you gather:

- 1 D Battery
- 2 Flashlight Bulb
- 3 Copper Wire Stripped

Using these materials, see how many ways you can get the bulb to light. If the bulb lights, you've made a circuit. This is a closed path along which electricity can travel. We'll learn more about circuits on the next page.

SAFETY with WALI



Don't do what Benjamin Franklin did! When you hear a thunderstorm approaching, it's time to put your kite away and take shelter inside.

Draw a diagram showing one of your **successful circuits**.

Draw a diagram showing an **unsuccessful circuit**.

What do you need to do for the bulb to turn on?

# LIVING IN A WIRED WORLD

Now that we know the basics of electricity, how it travels and who is behind the invention of it, let's learn more about how electricity works in your everyday life. Let's jump back into circuits.

The word circuit means circle. Electricity can only move in a closed circuit. If the circuit is open, electricity can't flow. When you flip on a light switch, you close a circuit. The electricity flows from a wire, through the light bulb and back out another wire. When you flip the light off, you open the circuit so no electricity can flow to the light.

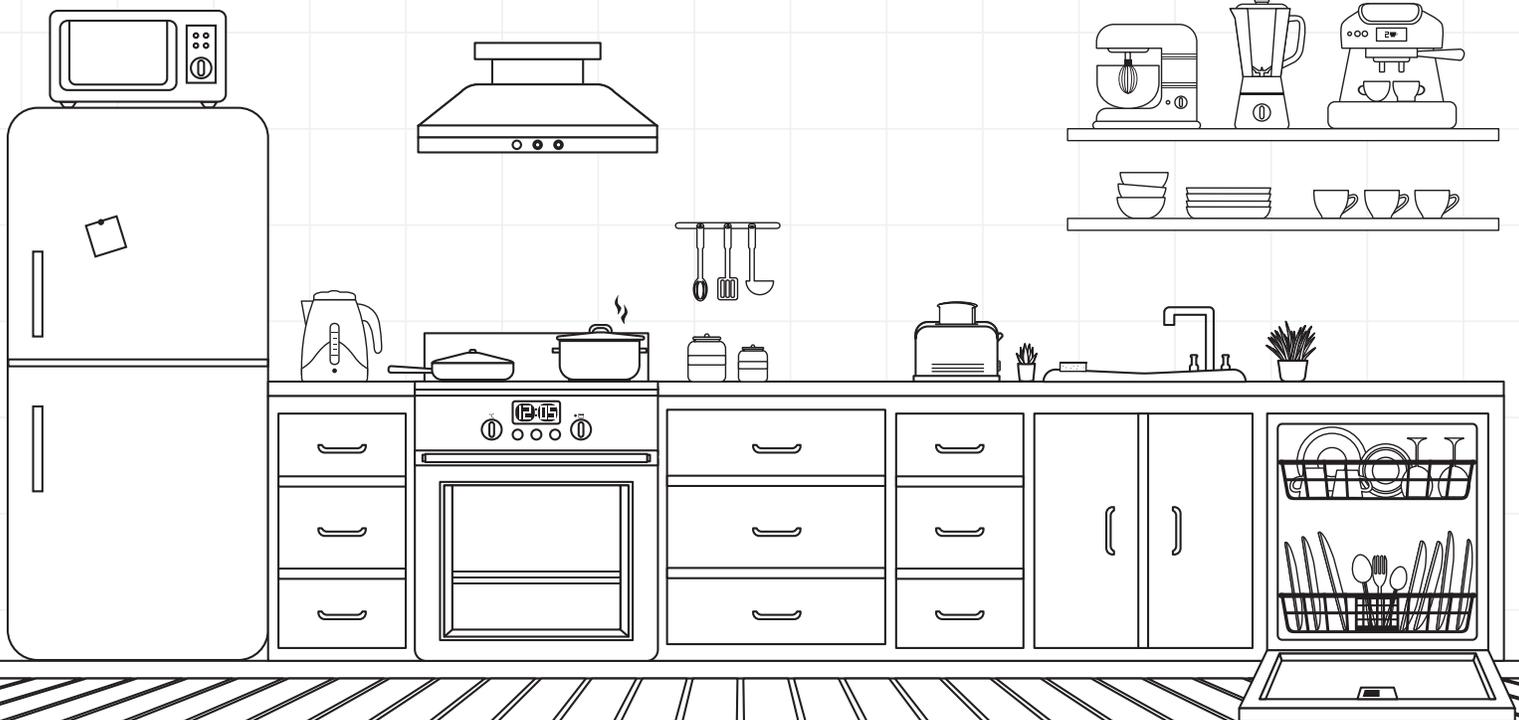
## ELECTRICITY IN YOUR HOME AND SCHOOL

So thanks to circuits, you are able to draw electricity all the way from a power plant to a light bulb with the flip of a switch. Isn't that cool! Think about everything you do at school and home that requires electricity.

**What are some of the things you first think of?** \_\_\_\_\_  
\_\_\_\_\_

## IT'S ELECTRIC!

Can you circle all of the products that use electricity in the kitchen?



## HOW DOES YOUR FAMILY GET ELECTRICITY?

Do some research! You may have to ask an adult for help on these.

**Where is the closest power plant?** \_\_\_\_\_

**What kind of energy source does it utilize?** \_\_\_\_\_

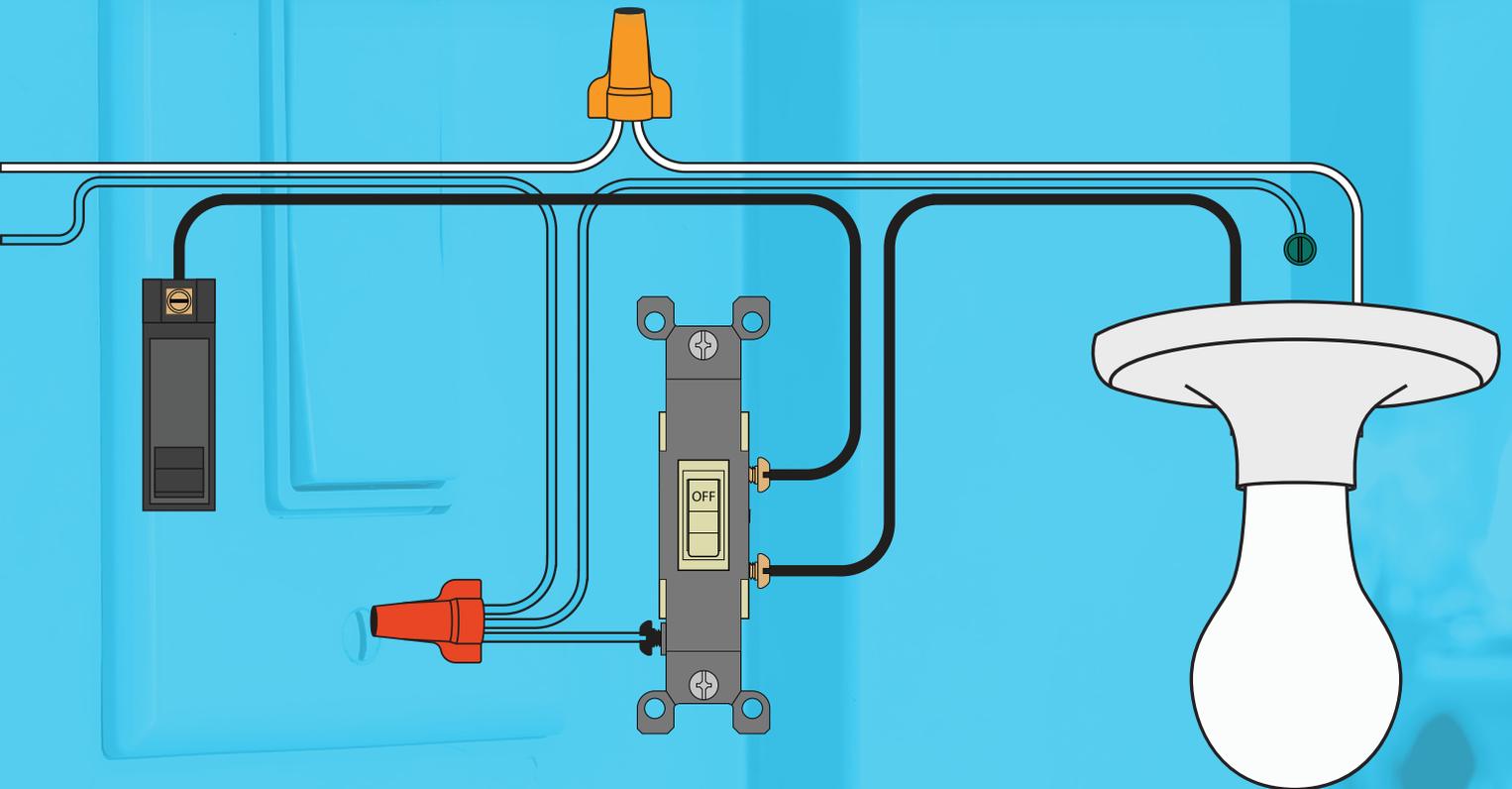
**How far does electricity travel before it gets to you?** \_\_\_\_\_

**What is the name of your electric utility?** (Hint: Check the front cover of your service panel.)

\_\_\_\_\_

## WHAT LURKS BEHIND THE WALLS?

Someone designed the electric circuits in your home so that your family could put lights and appliances where you want them without overloading the circuit. Skip to page 10 to learn how circuits can become overloaded.



# SAVING ELECTRICITY

Did you know your family pays for the electricity you use at home? Here are some ways you can help save money:



## PLAY OUTSIDE.

When it's nice out, turn off your electronics and get outdoors. Not only is it fun to enjoy the sunshine, but you'll use less electricity simply by not powering on your electronics.

## TURN IT OFF.

If you leave a room, turn whatever you were using off. Switch the lights off, power down the TV, shut your game off. Leaving lights and electronics on uses a lot of electricity.



## SHUT THE DOOR.

Don't leave the fridge door open. This saves more energy than you think!

## WASH WITH COLD WATER.

Remind your family to use cold water when washing clothes. It uses a lot less energy than hot water. **And, if you can, hang your clothes outside to dry!**



## USE LED LIGHT BULBS.

Ask an adult what kind of light bulbs you use at home. LED bulbs make more light with less electricity and last longer.

## PLANT A TREE.

Help your family plant a tree that will shade your house on hot summer days.



# CONDUCTORS & INSULATORS

All the things in the world can be divided into conductors and insulators. Conductors are materials that allow electricity to flow easily through them. Insulators are materials through which electricity does not flow easily.



Metal is a really good conductor. That's why you should NEVER stick a fork into a plugged-in toaster. The fork would conduct electricity from the wires to you. That would SERIOUSLY hurt you!

## WORD SCRAMBLE

Unscramble the letters to reveal the names of common insulators and conductors.

### INSULATORS

REBUBR \_\_\_\_\_

LGSAS \_\_\_\_\_

SIPALTC \_\_\_\_\_

### CONDUCTORS

LATME \_\_\_\_\_

TERWA \_\_\_\_\_

SRETE \_\_\_\_\_

## HOW IS ELECTRICITY MEASURED?

Watts (my last name!), volts and amps measure electricity. To understand each, think of water in a hose. You use water that comes out fast to wash a muddy car. And you use water that comes out slower to water a garden.

Turning on the faucet supplies the force, which is like the voltage. The amount of water moving through the hose is like the amperage. And you need different combinations of volts and amps to do different kinds of jobs. The work that electricity does in a job is measured in watts.

$$1 \text{ WATT} = 1 \text{ AMP} \times 1 \text{ VOLTS}$$

OR

$$1 \text{ AMP} = 1 \text{ WATT} \div 1 \text{ VOLT}$$



Touching as little as 60 milliamps of electricity can be fatal. That's why you should never play with a wall socket or hit the electric lines that feed your house.

# LIVING IN A WIRED WORLD

## AMP IT UP

The circuit breaker in your living room has tripped, cutting off the electricity. The living room is served by 120 volts and the circuit can carry 15 amps. Can you figure out why the circuit overloaded? I helped you solve the first one!

DEVICES	WATTS	WATTS ÷ VOLTS	=	AMPS
Ceiling Lamp	150	$150 \div 120$		1.25
Table Lamp	100			
Vacuum Cleaner	900			
Color Television	170			
Answering Machine	6			
Space Heater	1200			
Ceiling Fan	20			
Computer	7			

If everything were on at once, how many amps would you need? \_\_\_\_\_

\_\_\_\_\_

If you turn on the space heater, can you leave on all the lights? \_\_\_\_\_

\_\_\_\_\_

What can't you use in the room when you're vacuuming? \_\_\_\_\_

\_\_\_\_\_

# PLAY IT SAFE

Electricity is amazing, but it can also be very dangerous. I've shared some safety tips along the way that I hope you've paid attention to. Let's learn some more so you can avoid accidents and injuries.

## WHY IS ELECTRICITY DANGEROUS?

As we just learned, there are conductors and insulators. Your body is a conductor, which means electricity could easily flow through you. **This is why you must be careful around electricity!**

Tiny electrochemical nerve pulses of .001 amp are what causes your heart to beat in rhythm. If an electric current as small as .01 amp runs through your body, it can interrupt your heart, cause muscle spasms and put your life at risk. That would be an electric shock.

## WHAT CAN YOU DO IF SOMEONE GETS AN ELECTRIC SHOCK?

If someone is shocked, you can help by:

- 1 **Not touching them.** The electricity can flow to you.
- 2 **Alert an adult.** Tell the adult to turn off the power at the main service panel.
- 3 **Call 911 and tell them someone** has been shocked.
- 4 **Make sure they see a doctor** even if they seem okay. There may be injuries you can't see.



## SAFETY AT HOME

Here is a list of things you can do to stay safe at home. If you need help with something that uses electricity, ask an adult!



Don't plug too many cords into an outlet, and keep them organized.

Don't stick an object into an outlet.



Check cords for cracks or other damage.

Don't staple or nail cords to the wall. Use tape or twist ties instead.



Keep all electronics and small appliances away from liquids.



## FIRE ALERT!



Sometimes electricity can cause a fire. This may be due to faulty wiring, old appliances, overloaded outlets or space heaters being too close to bedding. If there is an electrical fire:



**DO NOT** use water.



Tell an adult right away. If the fire can be put out safely, the adult should use a fire extinguisher. If the fire can't be put out **LEAVE THE HOUSE.**



**CALL 911** to get help.



# SAFETY OUTSIDE



It is also important to be safe around electricity outside your home. Here are some things to keep in mind:



Stay away from power lines and substations.



Obey signs like 'High Voltage' or 'Danger' and stay away.



DO NOT climb a tree, fly a kite or play near power lines and electrical equipment.



Going for a swim? Not if there is stormy weather! Get out of water if you hear thunder and go inside.



Don't go by downed power lines. If your car comes in contact with a downed wire, stay inside and do not exit. Call 911.

## CALL 811 BEFORE YOU DIG!

**STOP! DON'T DIG JUST YET.**

Call 811 before digging so that you don't unintentionally dig into an underground utility line.



START

## DOWNED POWER LINES

**UH OH! WATCH OUT.**

Looks like a storm moved through and downed some power lines.

Can you safely get home without touching any?



# ELECTRICAL SAFETY CHECKLIST

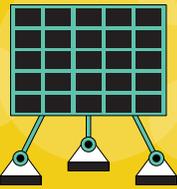
Now that you know how to be safe around electricity, have an adult help you fill in this checklist.

OK	NEEDS WORK	COMPLETED	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check for damaged appliance cords and plugs. Make sure outlets are not overloaded.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Move electronic devices away from water.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Make sure extension cords are rated to carry the current needed for appliances they serve.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Talk with an adult about the dangers of ladders, tree climbing and kites around electric lines.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Practice what to do if someone has an electrical accident.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Practice what to do if there is an electrical fire.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Make sure your home has working smoke and carbon monoxide detectors.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Make sure your home has a fire extinguisher and learn where it is.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Practice what to do if you are in a car with a power line on it.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Practice how to communicate information to an emergency operator.

# THE FUTURE OF ENERGY

As we talked about on page 2, electricity comes from two energy sources: renewable and nonrenewable. We're now going to learn more about renewable energy sources. These sources are present in nature, can be used limitlessly and are good for the environment. Let's explore some!

## RENEWABLE ENERGY SOURCES



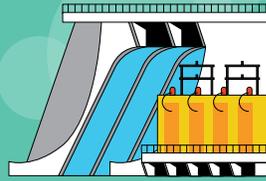
### SOLAR ENERGY

Solar energy comes from the sun, and is harvested with several technologies, including solar panels.



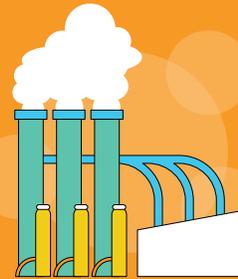
### WIND ENERGY

Wind turbines capture the wind's power as they spin and convert it to electricity.



### HYDROELECTRICITY

Hydropower turbines rotate as water flows through them, generating electricity.



### GEOTHERMAL

Heat energy from within the Earth can be harnessed to generate electricity.

Our friends at your local Touchstone Energy Cooperative want to give us reliable electricity that is also affordable. That is why they use a mix of energy sources, including renewables.

**From the list of renewable energy sources above, what two sources do you think your electric cooperative uses?**



SCAN QR CODE

## IT'S A BREEZE!

Scan the QR code to see how you can **make a wind turbine** using just a few household items.







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