

Lesson 5: How Electricity is Saved and Using Electricity Safely

OBJECTIVE

Students become stewards of energy by demonstrating ways of consuming and using energy efficiently.

KEY CONCEPTS

- Phantom Load
- Energy Demand
- Watt (W)
- Using Electricity Safely
- Circuit Overload

LESSON RESOURCES

- Green Link..... 3
- Overload!..... 7-8
- Career Connections..... 9-10

LIMITED ENGLISH PROFICIENT, AT GRADE, AND ADVANCED

In this lesson, there are three versions provided for the Overload! activity. Each version is designed for a particular ability level. The color-coded outlet in the upper right-hand corner indicates the ability level.



**LIMITED ENGLISH
PROFICIENT LEVEL**



AT GRADE LEVEL



**ADVANCED
GRADE LEVEL**



LESSON 5:

How Electricity is Saved and Using Electricity Safely

After reading through the first four lessons of this program, you may understand a lot more about electricity than before. You know how electricity is made and how it is measured. You know the types of resources needed to make electricity. You also know the creative ways people use to generate energy from renewable resources.

When people work together to save electricity, building new power plants can be delayed or even reduced. Practicing load shifting helps make sure you are using less electricity during on-peak hours. Small changes like these make a big difference. Now, we'll take a look at a way to save energy that is used in your home invisibly.



LESSON 5 ENRICHMENT

Interactive Links

[Switched on Kids](#)

This link, originating in the United Kingdom, allows students to plug in items on an interactive power strip. The wattage meter registers power use and overloads. Click on “Teachers and Parents” for additional knowledge.

[Eco Kids](#)

This link offers a colorful, engaging home designed to teach energy efficiency. An interactive quiz moves students through the home and immediate feedback is provided for student learning.

[Texas Cares](#)

Middle school is a good time to offer early glances into the realities of the world of work. By exploring career options, students will make better connections between school and their futures.

Invisible power? It may sound strange, but it exists. Another phrase for invisible power is standby power. This kind of power is fairly new to some of us because this wasn't even a problem until the 1970s. Before the 70s, when an appliance was turned off, it was really off. In today's world, when we push the off button, it may not truly be off. It was during the decade of the 1970s that the first remote controls for televisions and stereos became available.

Before this time, when you turned on the television set or changed the channel, you got up out of your chair and flipped a switch on the set. Many times people would watch several programs in a row on the same channel, just because they didn't feel like getting up to change the station. It also took a minute for televisions to warm up before they were ready to be watched. The same was true for stereos and other electrical appliances in the home.

Then came the first television remote. No longer did folks wait around for the television to be ready to watch. Pushing the "on" button meant the television came right on. The station could be changed with the push of a button without ever leaving the couch! The remote changed how we watched television. Instead of getting a bit of exercise every time people wanted to change a channel, they could stay in their chairs for hours. This is when the term "couch potato" was heard for the first time.

People did not know that there was a small price to pay for the convenience of having appliances turn on so easily. Televisions and other appliances needed to be ready

to turn on in seconds. To be able to do this, they never really turned off. A tiny amount of power was always flowing to the appliance; this is what it means to have standby power.

Soon, most appliances had clocks, timers or remotes, and were using energy even when they were turned off. People began to learn about this energy use and wanted to do something about it. There are ways to reduce or stop wasting energy in this way. There is even a phrase for this invisible power; it is called **Phantom Load**.

Phantom Load describes the electricity that is being used when an appliance or device is not doing its main job and is either turned off or in standby mode. A good example of this is the microwave. Microwaves are always on so the clock can keep running, even when you are not cooking food. These phantom loads hide in game consoles, DVD players, printers, computers, cordless appliances, and many other devices.

The easiest way to spot a phantom load is to look for devices with clocks on them, or those that have a small white or black box between the plug and the appliance. For any single appliance, the load is never very large; however, when you add up the many phantom loads in a typical home, it can equal up to 10% of the electricity your home uses.

So how can you help shut down these phantoms? The only sure way to eliminate a phantom load is to unplug the appliance or device. As you might have guessed, this

Green Link

Click on the green word “unplugging” in the student lesson to have students take a quiz to find out how wisely they use electricity. “What’s My Electric Personality?” is the activity provided. Students may begin by clicking on their first answer and then selecting the “next” arrow.

Spotting Phantom Load Devices



is not always possible; a certain amount of phantom load may always exist. For example, it would be difficult to unplug the stove every night. However, there is a lot you can do. Here are a few easy suggestions:

- Unplug all battery chargers when they are not in use.
- Unplug all appliances in the home that you only use now and then, especially those in rooms you do not use often.
- When you are leaving for several days, unplug as many gadgets or appliances as possible.
- When you buy new products, buy ones with low standby energy demand.
- Use a power strip designed to switch off clusters of electronic products.

The chart on page shows how much different items will typically cost each year. Let’s see how much you can save by **unplugging** these items or plugging them into a smart strip. Read the questions carefully. See if you can “do the math” and save some money! The right-hand column shows how much the phantom load on each item in the left-hand column costs for one year.³³



NOTES:

TABLE 1

Cable Box with DVR	\$43.01
Video Recorder (DVR)	\$36.98
Window Fan	\$27.52
Cable Box (without DVR)	\$17.65
Satellite Cable Box	\$15.50
Laptop Computer	\$8.81
Fax	\$5.35
CD Player	\$4.99
VCR	\$4.38
Desktop Computer	\$3.96
Power Tool	\$3.96
Microwave Oven	\$3.05
Handheld Vacuum	\$2.97
Television	\$2.97
Answering Machine	\$1.99
Battery Charger	\$1.98
Printer	\$1.98
MP3 Player	\$1.98
Cordless Phone	\$1.98
Electric Toothbrush	\$1.98
DVD	\$1.53
Gas Range Oven	\$1.14
Coffee Maker	\$1.12
AM/FM Radio	\$1.11
Video Game Console	\$1.00
Cell Phone Charger (Unattached to Phone)	\$0.26

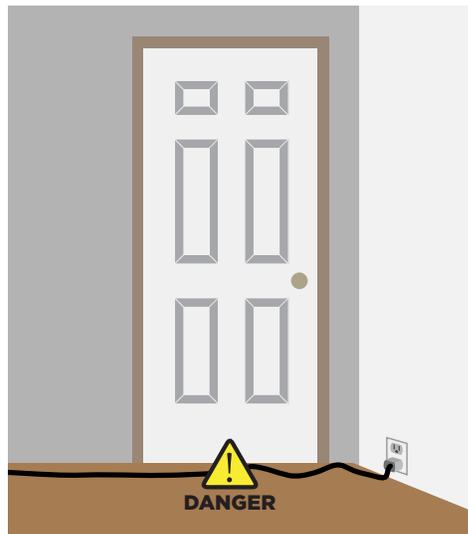
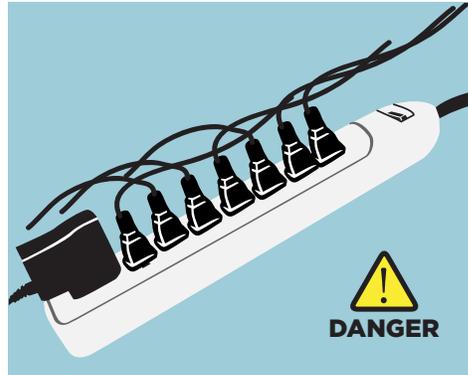
There is one more area of energy use that must be discussed: the topic of using energy safely.³⁴ As you have learned, electricity is all around you, so it is important to be careful. When using electricity think about these tips:

1. Never put your fingers, or anything other than an electrical plug, in a socket. Remember, just like water in a faucet, the electricity waits inside the socket until you plug something into it.
2. When unplugging an appliance, never yank the cord out of the socket. Pulling a cord out in this way can damage the appliance, the plug, or the outlet.
3. Don't use an electrical appliance, like a hairdryer, when you are either wet, have wet hands, or are standing in water. Many electrical accidents happen when people use electricity near water.
4. Don't plug too many appliances into a socket; this could lead to a fire. The more current that flows from a socket, the hotter it becomes. An overheated socket can start a fire.
5. Keep an eye out for damaged plugs and cords. Let an adult know about the problem.
6. It is impossible to tell if an electric wire is on or off simply by looking at it. Consider any electric wire to be "live," or on, and be careful when near it.
7. Make sure appliances, like the television, have a free flow of air around them so they do not overheat and start a fire.

8. Do not place electric cords so that they run through doorways or under carpets. There is a danger of electric shock if someone trips and the cord is yanked out or broken.
9. If you are outside flying a kite, watch out for power lines overhead. You can't always tell where a kite is going to land. Be sure your kite does not have any wire, metal, or foil on it. If your kite does get caught on a power line, let go immediately.
10. Never climb a tree with a power line running through it.

Now that you've finished the lessons in this program, you have new knowledge about electricity. The more you know about electricity, the easier it is to conserve it. Have you thought a little bit about your own electricity habits? Do you use electricity as if it were unlimited? Do you save electricity, but only sometimes? Or are you someone who likes to go the extra mile and save electricity whenever you can?

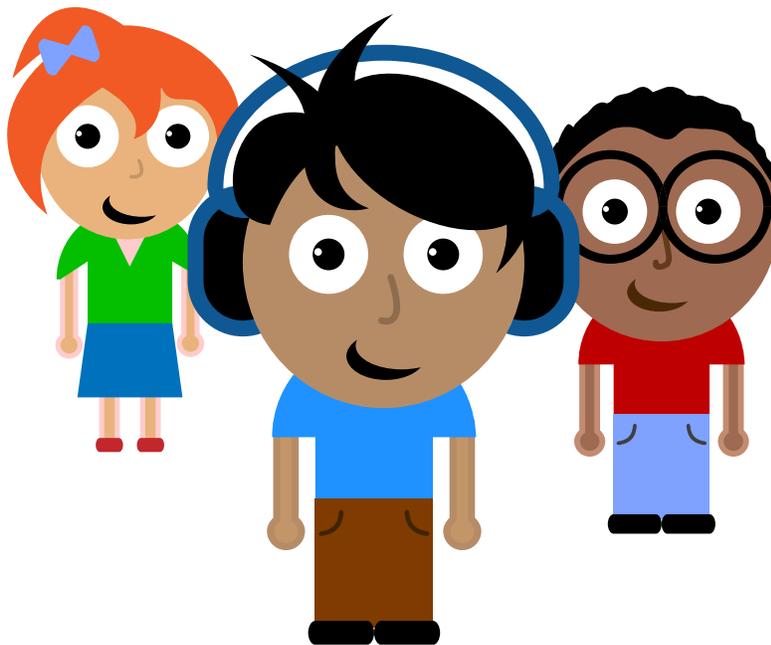
Saving electricity is everyone's job. But, you might think, "Hey, I'm just a kid!" Kids actually use as much or more energy than most adults. The clothes kids wear are usually washed more often, especially if they play on a team or spend a lot of time outside. Kids are at home a lot more often than most adults with jobs. When kids are home, most pass the time by playing electronic games or watching television.



Although everyone in the house uses the refrigerator to keep food cold, younger family members may stand in front of the fridge thinking about their choice for a longer time and more often. All family members need lights on in the evenings, but younger family members may leave lights or appliances on when leaving a room. Since kids use a lot of electricity, they are very important members, if not the most important members, of the team to save energy.

Be a Power Partner!

Share your knowledge with others and help everyone use energy wisely. Be aware of the time of day you use electrical items, and keep an eye out for phantom loads. Use electricity wisely to make sure there will be enough for the future, because life is more comfortable and more enjoyable with electricity!



Overload!

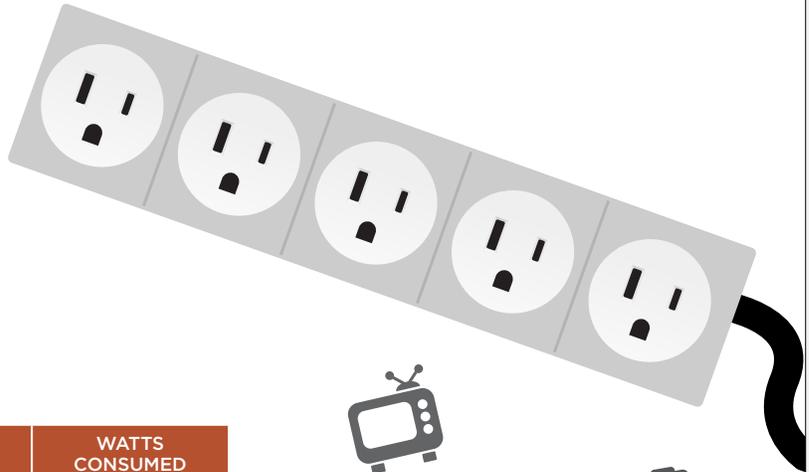
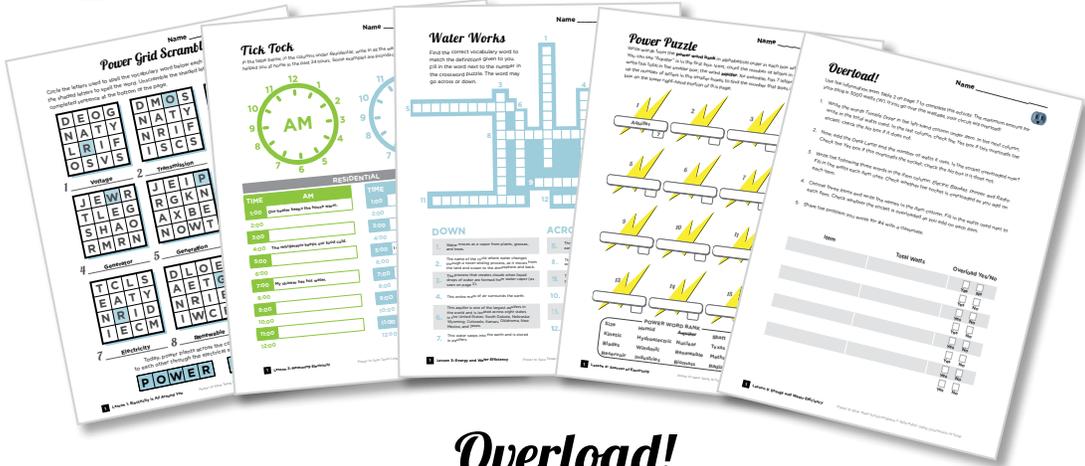


TABLE 2

DEVICE	WATTS CONSUMED
Computer Monitor	100 W
Desktop Computer	700 W
Desk Lamp (with 60-watt lamp)	60 W
Dishwasher	2200 W
DVD Player	28 W
Electric Blanket	60 W
Game Console	200 W
Hair Dryer	2200 W
Hair Straighteners	100 W
Iron	2800 W
Microwave	100 W
Mobile Phone Charger	700 W
Printer	60 W
Radiator (Electric)	2200 W
Radio	28 W
Satellite TV Box	28 W
TV 42" HD	60 W
Toaster	200 W
Tumble Dryer	2200 W
Vacuum Cleaner	100 W
Washing Machine	2800 W
Wi-Fi Router	2800 W



Overload!

Ask your teacher for the Overload! activity. You will receive one of three versions. Overload! uses wattage from common household items to discover which items can be plugged in at the same time without overloading a smart strip or outlet.

Long-Term Savings for Homes Tips

WINDOWS, DOORS & INSULATION

-  Save up to 10% on cooling costs by caulking windows and weather-stripping doors.
-  Upgrade to energy-efficient windows.
-  Add solar screens or window tint.
-  Check your ducts for leaks and seal them if needed.
-  Consider getting an energy audit.
-  Make sure your attic has proper ventilation and high R-value insulation. This will help your AC be more efficient and keep more cool air inside your home.
-  Use heavy-duty, clear plastic film on the inside of your window frames during the cold winter months.
-  Install tight-fitting, insulating drapes or shades on windows that feel drafty.

See more at www.powertosavetexas.org.

Scan this QR Code with your smartphone to visit the program website.



Focus on 5

Use these five questions for reflective journaling, short paragraph essays, or class discussion:

Reflective Journaling

1. List at least three positive attributes about this career that you found interesting or appealing.
2. List at least three negative attributes about this career that you thought did not apply or appeal to you.

Short Essays

3. Why do you think the future of this job is predicted as it is shown?
4. In your city, who would be an employer you could contact to ask for more information about this career choice?

Class Discussion

5. Why do you think this job was featured as a part of this lesson?

Career Connection / Job Profile:

Do you like to figure out how things work?
Are you good at building things?
Are you good at math?



If you answered, "Yes," to these questions, you might like to be an electrician. Electricians put in and maintain electrical systems in homes, businesses, and factories. They work on wiring, light fixtures, and other equipment through which electricity flows.

As an electrician, you would:

- Put in, test, and fix wiring, lights, and other equipment.
- Read blueprints, plan wiring layouts, and figure costs.
- Pull wire through walls and connect to switch boxes or outlets.
- Use hand tools, power tools, and testing devices.
- Work from ladders and roofs, dig trenches, and lift heavy objects.
- Inspect and test systems to make sure they work and are safe.
- Keep work records, write reports, and order supplies.
- Train others to put in and fix wiring, lights, and other equipment.
- Set up lights and place flares during an emergency.
- Keep license up to date to meet government rules.

Will There Be Jobs in the Future?

In Texas and nationally, this occupation is growing at a high rate.

Education Required:

- To work as an electrician, you typically need to:
- Have a high school diploma or GED; and
 - Complete an apprenticeship program; and
 - Pass a state licensing exam.

Provided courtesy of: www.onetonline.org

NOTES:

Focus on 5

Use these five questions for reflective journaling, short paragraph essays, or class discussion:

Reflective Journaling

1. List at least three positive attributes about this career that you found interesting or appealing.
2. List at least three negative attributes about this career that you thought did not apply or appeal to you.

Short Essays

3. Why do you think the future of this job is predicted as it is shown?
4. In your city, who would be an employer you could contact to ask for more information about this career choice?

Class Discussion

5. Why do you think this job was featured as a part of this lesson?

Career Connection / Job Profile:

*Do you like using computers?
Do you like working with other people?
Are you good at math?*



If you answered, "Yes," to these questions, you might like to be a database administrator. Database administrators use software to organize and store data for companies. They manage data such as financial records or Internet customer information. They make sure data is available to employees who need it and that the data stays private and safe.

As a database administrator, you would:

- Work with project teams to plan the best ways to store data.
- Use math to figure how much data new systems can handle.
- Draw models on computers to show how systems will work.
- Write codes and revise software so all parts of systems work together.
- Plan ways to keep data safe and create guidelines for use.
- Set up and test new systems, fix errors, and watch how they perform.
- Limit users to only the parts of systems that they need to work with.
- Train users and answer their questions.
- Figure time and cost needed to make changes asked for by users.
- Use systems manuals as guides to making changes.

Will There Be Jobs in the Future?

In Texas and nationally, this occupation is growing at a high rate.

Education Required:

- To work as a database administrator, you typically need to:
- Have a high school diploma or GED;
 - Have a bachelor's degree; and
 - Have one to five years of related work experience.

Provided courtesy of: www.onetonline.org

NOTES:

Stop Directions - Page 3

Objective:

Students will determine the cost of phantom load devices and calculate potential savings by reducing the use of those devices.

Instructions:

Have students use Table 1 on page 4 to select their personal preference for eliminating a device known for its phantom load. The cost of each phantom load is listed in Table 1. Ask students to tabulate the savings for eliminating a variety of specific devices or students may create their own, then pair and share. Answers will vary.

Sample word problems for students using information in Table 1 are provided below:

1. Student A eliminates the TV (for a savings of \$2.97) and a laptop (for a savings of \$8.81). Student B eliminates a microwave oven (for a savings of \$3.05) and a printer (for a savings of \$5.21). Which student will save more?
2. How much would you save if you unplugged the electric toothbrush every day and gave away your game console?
3. How much would you save if you bought a smart strip and then plugged in your desktop computer and printer? Let's agree that the smart strip saved you the same amount as six months of phantom energy use.
4. How much would you save if you plugged the cable box with DVR and the DVD? The smart strip still saves you the same amount as six months of phantom energy use.
5. How much would you save if you decided to sell your mom's CD player, the desktop computer, and a power tool?

Bonus:

1. How much would you save if you unplugged all the items in your home while you spend a year in the mountains?
2. How much would you save if you sold your satellite box with DVR in March, after you had unplugged it for three months?

Stop Directions - Page 8

Visit the [Teacher Portal](#) to access all three versions of the Overload! activity and distribute it to your students. Directions for this activity are listed below.

Objective:

Students will record wattage used in a variety of devices and determine if there is a wattage overload.

Instructions:

Provide each student with one version of the Overload! activity. Distribute the appropriate level(s) for your class. Step-by-step directions vary according to level and are listed on student worksheets.



Limited English Proficient

Use the information from Table 2 on page 7 to complete this activity. The maximum amount for your plug is 3000 watts (W). If you go over this wattage, your circuit will overload!



At Grade Level

Use the information from Table 2 on page 7 to complete this activity. The maximum amount for your plug is 3000 watts (W). If you go over this wattage, your circuit will overload!



Advanced Grade Level

Use the information from Table 2 on page 7 to complete this activity. The maximum amount for your plug is 3000 watts (W). If you go over this wattage, your circuit will overload!

Bonus:

Have students write a short paragraph explaining why it may be surprising to learn how a socket can become overloaded regardless of how many items are plugged into it.