

*Knowledge is power*



CURRICULUM SUPPLEMENT  
FOR K-8 TEXAS SCHOOLS

Watt Watchers is a free, state-sponsored program to help schools save energy and money by getting students involved. Students patrol their school looking for empty classrooms with the lights on. They turn out the lights and leave a ticket for the teacher. It may sound trivial but...when the teacher forgets to turn out the lights an extra 2 hours per day, at lunch and after school, for example —it costs the district \$50 every year.



Watt Watchers of Texas  
University of Texas at El Paso – Energy Center  
P.O. Box 68660  
El Paso, Texas 79968

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# Knowledge is power



## Program Manual

The Energy Center  
The University of Texas at El Paso  
P.O. Box 68660  
El Paso, Texas 79968

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Sponsored by:  
The Texas Comptroller of Public Accounts,  
State Energy Conservation Office,  
U.S. Department of Energy





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*'Knowledge  
is  
Power'*

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*Sir Francis Bacon  
1561 - 1626*

**A**lthough the adult human brain only weighs a little over 3 pounds and consumes a mere 20 to 40 watts it is none-the-less a powerhouse. The brain has 20,000,000,000 to 50,000,000,000 neurons that can fire at 0.5 to 4 micro second intervals — enough power to create great works of art and amazing scientific achievements. From the creativity and power of the human brain modern civilization was built. Mankind's relationship to and use of energy are likely to undergo dramatic changes in this generation. Today's students will re-invent the future with their brainpower. The more they know about energy – the better they will be able to decide what to do.

Knowledge is Power.

Use it wisely.

# Introduction

**K**nowledge is Power is an energy efficiency curriculum supplement for grades K-8. The lesson plans on energy conservation and energy efficiency are correlated to the Texas Essential Knowledge and Skills (TEKS) and include starter activities, extensions and discussion questions. The lessons range from coloring pages and school lighting surveys to cost effective buying and appliance surveys. Knowledge is Power covers a broad subject range including math, science, social studies, and language arts.

In addition to this printed version, Knowledge is Power is very easy to access. You can locate the lesson plans on the Watt Watchers of Texas website at [wattwatchers.org](http://wattwatchers.org) or on the Watt Watchers CD-ROM. Updates and corrections may appear in electronic versions first. Please give us feedback on these lesson plans and suggest additional topics you would be interested in.

## Watt Watchers of Texas Staff



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# Air Leakage at Home

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**Grade Level:** 4-5

**Lesson Overview:** Students will discuss where air leaks occur in the home and learn ways to stop them by installing switch plate and outlet cover templates and making draft dodgers. This will teach the students ways to be better energy savers.

**TEKS:**

**Math:** 4.12(A), 5.11(A,B)

**Science:** 4.1(A,B), 4.2(A), 5.1(A,B), 5.2(A)

**Social Studies:** 4.24(A,B), 4.22(B), 5.24(D), 5.25(B), 5.27(A,B)

**ELA:** 4.10(A), 5.4(A), 5.5(E), 5.10(A)

**Time:** 1 to 2 class periods

**Materials:** Switch plate cover and outlet cover template or rulers and paper, scissors, screwdrivers, plastic foam egg carton lids (one lid per two outlet covers), pencils

**Vocabulary:** electric outlets, switch plate, plug sealer, insulation



## Background Information:

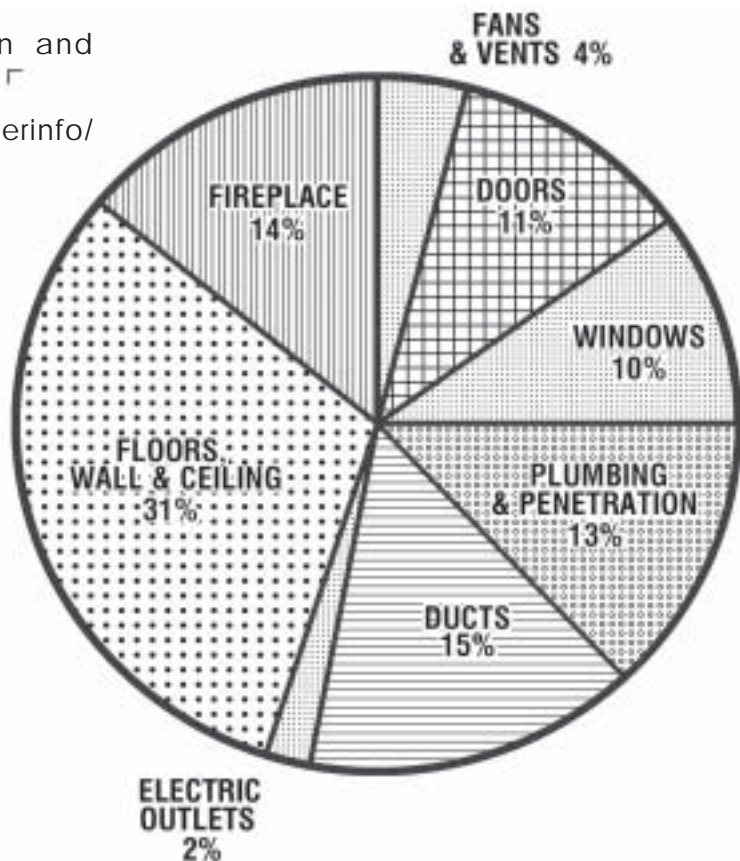
Air leakage occurs anywhere there is not a tight seal or insulation. This adds expenses to our home energy bill because we have to make more cold air to replace that which leaks out in the summer leaving, or heat up more warm air in the winter. The chart below describes areas in the home where leaks occur. A surprising amount of air leakage occurs through electrical wall outlets and switches. Special gaskets are readily available from your local home improvement store for sealing around an outlet or switch plate. These gaskets typically come in kit form with eight or more foam rubber gaskets and are installed inside the cover plate of the outlet or switch. These kits often come with plastic caps to plug unused outlets. The gaskets cost around twenty cents each. You can also make your own gaskets from plastic foam "egg carton" material. Ask a parent or other adult for help installing gaskets. The adult must be sure to turn off the circuit breaker controlling the outlets and switchplates you are working on.

Source: Energy Savers - Insulation and Weatherization

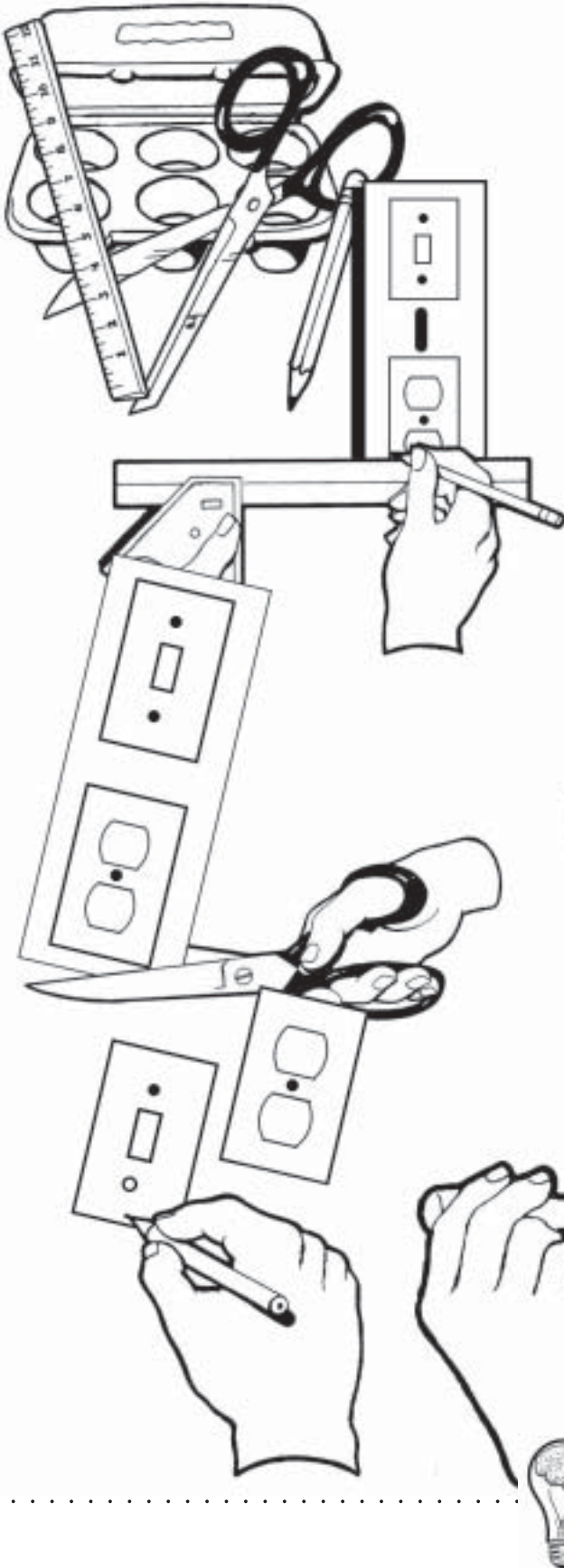
[http://www.eere.energy.gov/consumerinfo/energy\\_savers/insulation.html](http://www.eere.energy.gov/consumerinfo/energy_savers/insulation.html)

## Setting the Stage:

Ask your students where air might leak out of their homes. Where is this air coming from?, why this is a problem? Ask them if there are ways to keep the air inside their home instead? Show the students the chart form below and ask how the air is getting through the walls. Explain that they are going to learn a way to stop the air from going out through the wall plugs.



# Activity 1: Do it Yourself Switch plate and Plug Sealers

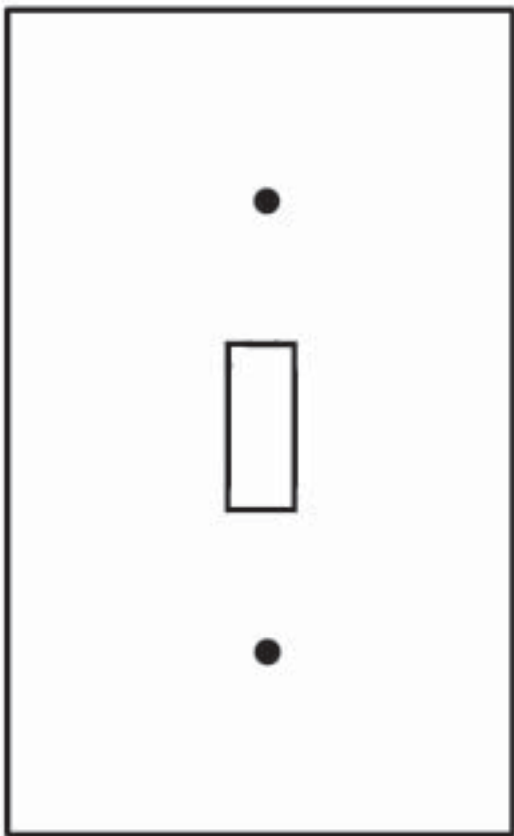
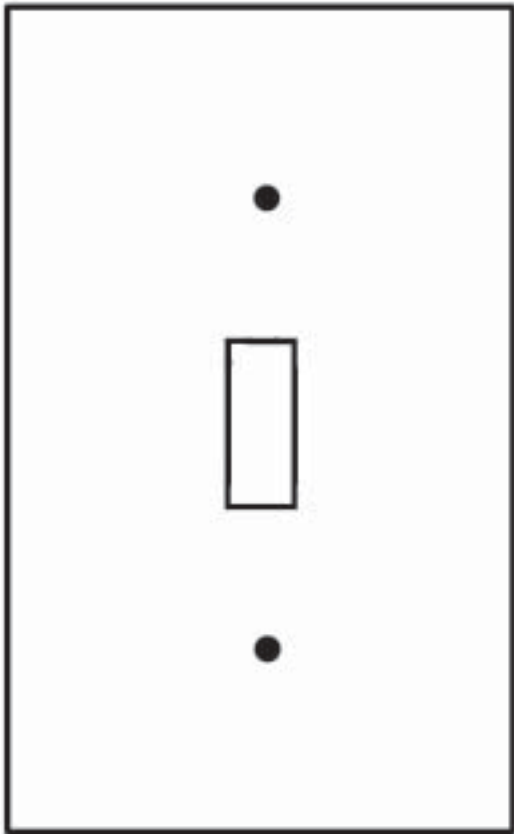
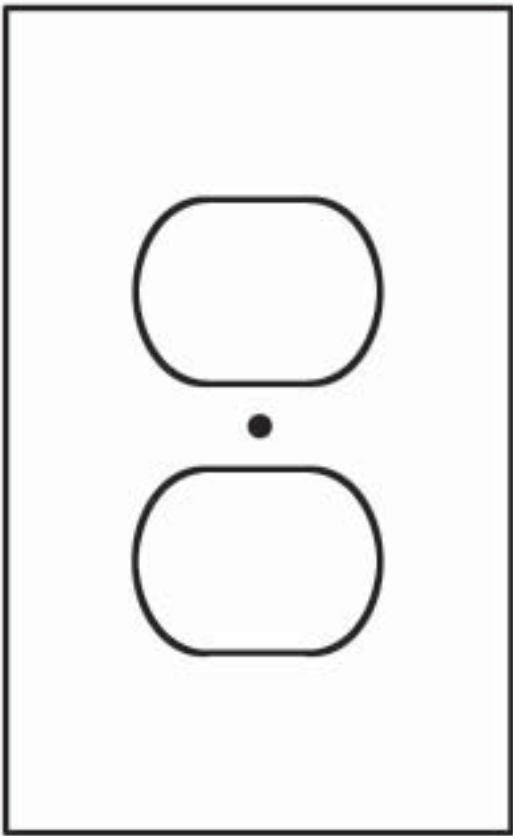
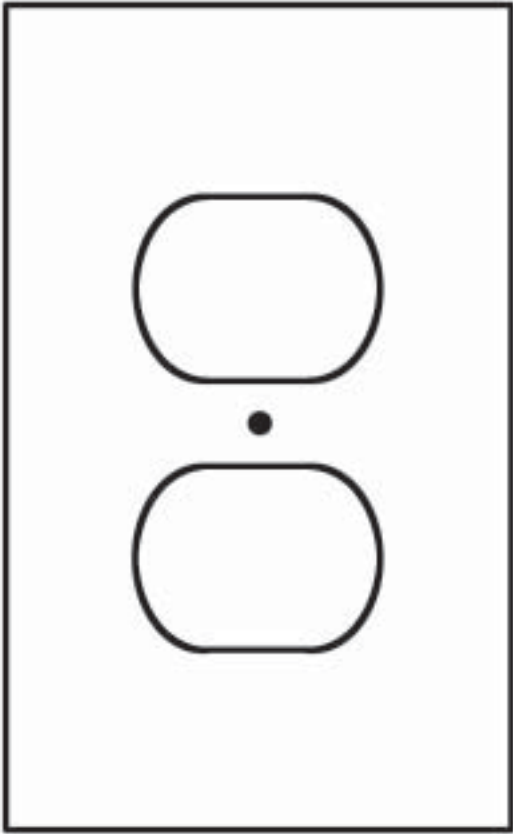


1. Collect needed materials.
2. Draw the outline of the switch plates and outlets on the inside of the egg carton lids, or use the templates provided. Remember to draw the area the switch goes in.
3. Cut them out and punch holes using a pencil to punch screw holes.
4. Ask an adult to turn off the circuit breaker and/or supervise. Install them by removing the faceplate from the outlet. Position the gasket cover over the switch or outlet and replace the faceplate. Always use adult supervision when working near electricity.

Caution: Switches and outlets have voltage and current that is very dangerous. Use appropriate caution when working on them.

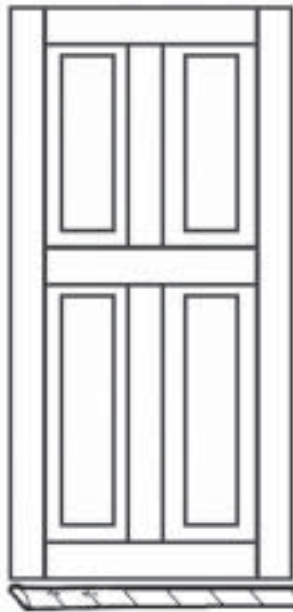
This activity requires adult assistance and supervision



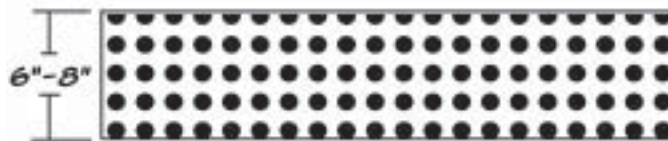


# Extension: Door Doggie or Draft Dodgers

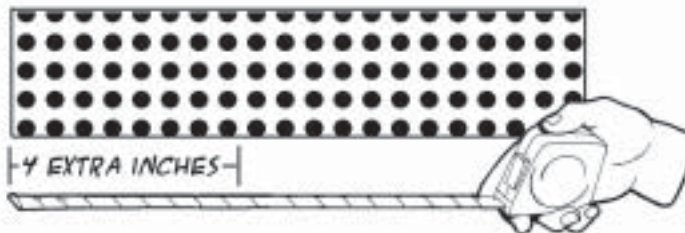
The cold wind blows around the house and right through the cracks and crevices of your home if it can! To put a stop to that cold wind, make a few of these door doggies, also known as draft dodgers. The name door doggie comes from the custom of decorating the tubes as dogs to make them more attractive.



1. Measure the width of the bottom of the window or door you plan to place your doggie in.



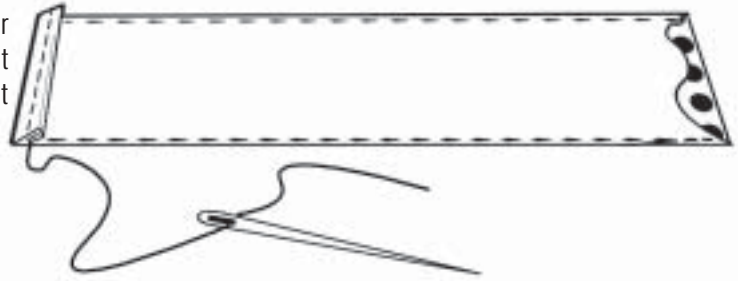
2. Cut two pieces of fabric that length PLUS four inches. Make the width of the fabric six to eight inches.



3. Place the two pieces together, finished sides facing inside. Beginning with one of the longer sides, stitch around three sides. Leave one short side open.



4. Hem the short side. Make sure your stitches are very small and tight otherwise the sand will leak out! Turn it inside out to show the printed side.



5. Now get your sand ready! Either place it in a plastic bag before you put it in the fabric sack you have just made, or place it directly in the sack. Fill it up about 3/4 full, with just enough "give" to drape nicely, but still having body enough to stand up on its edge.



6. Now, sew up the remaining short end tightly.

- MATERIALS:**
- Tape measure
  - Fabric
  - Scissors
  - Needle and thread (or sewing machine)
  - Sand (or peas, beans, rice, kitty litter, or kapok)
  - Plastic bag (optional)



If you do not feel comfortable with sewing you can use a long tube sock and make it the length of the window or door.

Note: You do not have to use sand — you could also use dried beans, peas or rice. If you use something other than sand it is not necessary to line the tube.

7. Place it at the bottom of your door or window and see how it keeps the wind at bay!



# Are Your Computers Wasting Energy?

Grade Level: 4-8

**Lesson Overview:** Students will take an audit of their home computers, and will learn how to make their computers energy savers instead of wasters.

**TEKS:**

**Math:** 4.3(A,B), 4.14(A,B), 5.3(A,B), 5.14(A,B), 6.2(A,B,C), 6.11(A,B), 6.12(A), 7.2(B,F,G), 7.3(B), 7.13(A,B), 7.14(A), 8.2(A,B,C), 8.14(A,B), 8.15(A)

**Science:** 4.2(B,C,D), 5.2(B,C,D), 6.2(B,C,D), 7.2(B,C,D), 8.2(B,C,D), 8.4(A,B), 8.5(A)

**Social Studies:** 4.5(A), 4.21(B), 5.24(C,D), 6.20(A), 7.20(D)

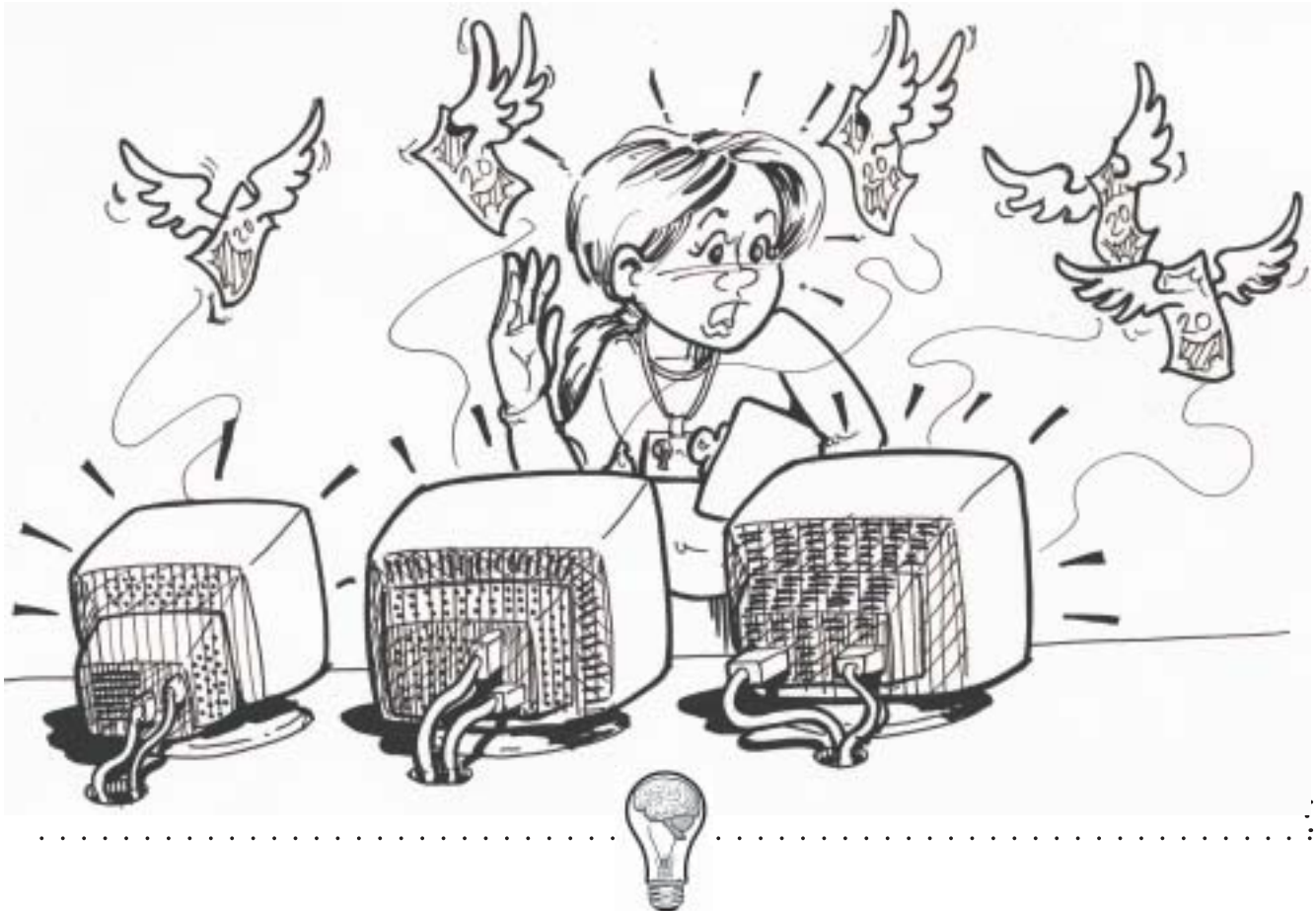
**ELA:** 4.4(A), 4.15(A), 5.4(A), 5.15(A), 6.4(A), 6.15(A), 7.4(A), 7.15(A), 8.4(A), 8.15(A)

**Technology:** 4th-5th grades - 1(A,B,C), 5(A,B) 6th -8th grades - 1(A,B,C,F), 5(A,B)

**Time:** Five 45 minute classes

**Materials:** computer access, internet connection or Watt watchers CD with EZ Wizard and EZ Save programs

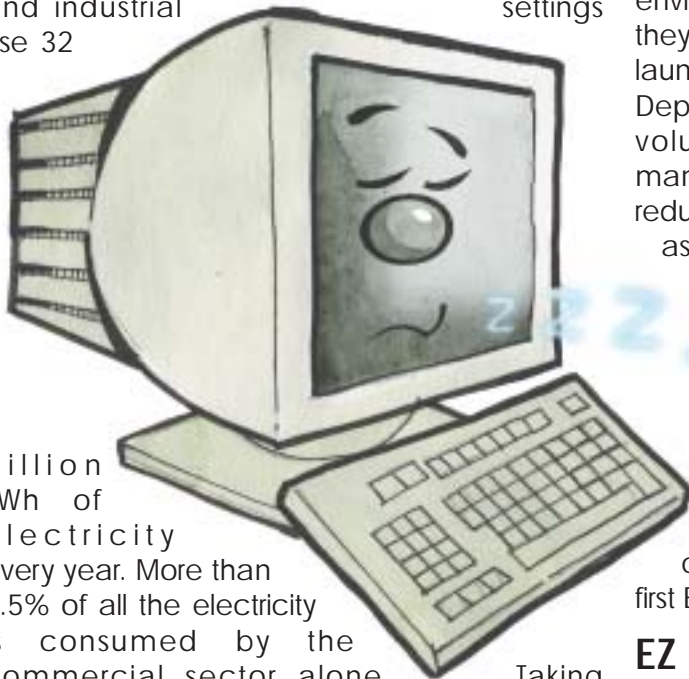
**Vocabulary:** power management, screen savers, Energy Star, EZ Wizard, EZ save, calculations,



## Background Information:

According to EPA estimates, the average powered workstation costs about \$37/yr.; a computer with full power management configuration can cost as little as \$16.40/yr. Seventy five percent of a workstation's energy usage comes from the monitor. Just by turning your monitor off when you are not at your computer will save you nearly half of your computer operating costs.

Power management is a process that allows monitors and computers to enter low power states when they are sitting idle. Typically, enabling monitor power management reduces the usage from 60-90 watts down to 2-10 watts. Nationwide, PCs and monitors in commercial and industrial settings use 32



billion kWh of electricity every year. More than 1.5% of all the electricity is consumed by the commercial sector alone. Taking two little steps has the potential to save over half of this energy: turning off PCs and monitors after work, and enabling monitor power management. Many people choose to enable power management for the monitor only so no conflict will occur while downloading from the Internet or when installing software and so on. This alone will capture 90% of the potential energy savings.

## Screen Savers

Screen savers do not save energy; they are pretty to look at. Older computer monitors used screen savers so the image would not burn into the screen. Today's computers do not do this, so screen savers are not necessary.

## Energy Star

The Environmental Protection Agency, better known as the EPA, began investigating the energy use of computers a few years back. They discovered that computers were not very energy efficient, and that the amount of energy used by computers was having an effect on the environment. Therefore, the EPA decided that they were going to try to address the issue and launched the Energy Star program jointly with the Department of Energy (DOE). Energy Star is a voluntary partnership with equipment manufacturers across a variety of industries to reduce the power consumption and the pollution associated with the use of electricity. Intel has been at the forefront of developing advanced power

management technologies in the computer world. In 1994, they released the first Energy Star qualified personal computer.

## EZ Wizard

The DOE has a program that will enable power management on your workstation automatically. Running this software takes 30 seconds, and by doing so, you will save around \$20 per year. All you have to do is download, install, double click the icon, and the software does the rest. It is simple and does not interfere will any other programs. Try out the Wizard at: <http://www.computerpowersaver.com/startdownload.asp?ref=wwt>



## EZ Save

For implementing monitor power management over a network using a server, there is a different program. The program, called EZ Save, is available at <http://www.energystar.gov/powermanagement>. This software has the potential to save school districts thousands of dollars in energy savings. For example, a school district with 10,000 computers can save \$171,173\* in energy costs by using EZ Save to implement monitor power management district-wide across the network.

\*Figure is based on the national averages for computer usage. See the Energy Star savings calculator for specific savings for your district: [http://www.energystar.gov/powermanagement/large\\_calculator.asp?orgtype=small](http://www.energystar.gov/powermanagement/large_calculator.asp?orgtype=small)

## Setting the Stage:

Ask your students how many have computers at home. Ask about their usage patterns: is it on all day, do they use it at night, do they turn it off when no one is using it, etc.

## Activity 1:

Give each student a Home Computer Energy Audit and a Watt Watcher Pledge Form. This audit has questions that need to be filled out at home and some word problems for them to do either at home or together in class. If the students install the monitor power management program on their home computer please have them fill out the pledge form and fax or mail it to Watt Watchers of Texas. We are keeping track of the number of computers put to sleep in Texas.

## Activity 2:

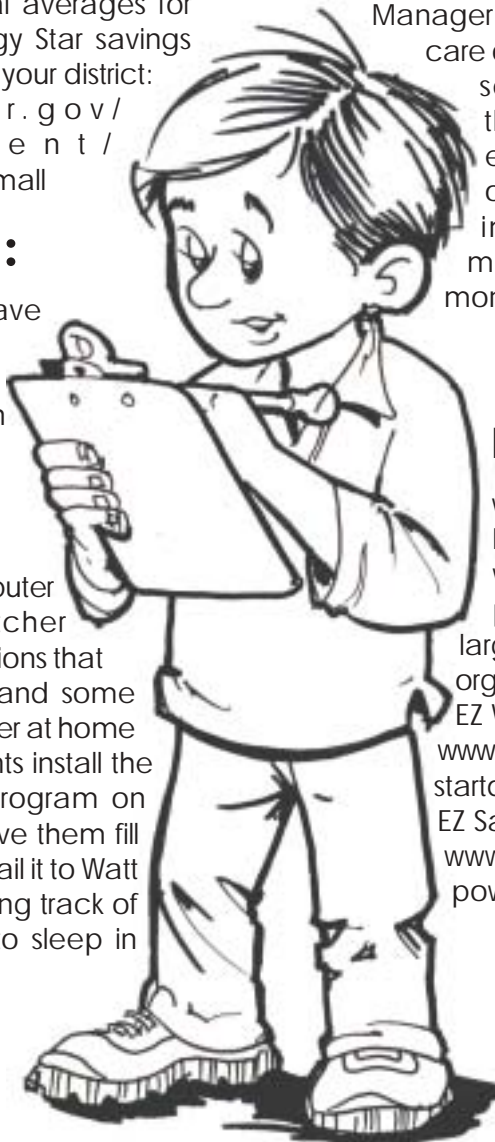
Give each student a copy of the School Computer Energy Audit. Have them go quietly around the school and fill in the information, or ask your school technology person to come to class. If you enable monitor power management on your school computers, please fill out a pledge form and fax that back to us.

## Extension:

As a class, write a letter to the Energy Manager or the person who takes care of the electricity bill for your school district informing them about the possible energy savings that could occur if your school implemented power management on all the monitors.

## Resources:

[www.wattwatchers.org](http://www.wattwatchers.org)  
Energy calculator  
[www.energystar.gov/powermanagement/large\\_calculator.asp?orgtype=small](http://www.energystar.gov/powermanagement/large_calculator.asp?orgtype=small)  
EZ Wizard <http://www.computerpowersaver.com/startdownload.asp?ref=wwt>  
EZ Save <http://www.energystar.gov/powermanagement>



Student Name: \_\_\_\_\_ Date: \_\_\_\_\_

# Home Computer Energy Audit

This computer energy audit will allow you to determine the amount of money you can save by activating Monitor Power Management on your computer.

(With help from your parents)

How many computers do you have? \_\_\_\_\_

Do you turn your computer off at night? \_\_\_\_\_

How many hours per day is your computer on? \_\_\_\_\_

What is your cost per kWh? \_\_\_\_\_

Go to <http://wattwatchers.utep.edu/WWsleepisgood.htm> and download the EZ Wizard program. Follow the steps to implement power management for your computer monitor. Make sure you write down your current settings.

Current Settings:

Turn off Monitor: \_\_\_\_\_ minutes

EPA recommends that you put your monitor to sleep after 10 minutes. The EZ Wizard program will give you a choice of 10, 15 or 20 minutes, choose the setting desired and you are done - it is that easy.

Using your current settings information and the information at the top of the page, calculate the amount of energy and money you will save.

Example: One computer is on for 16 hours per day at a cost of \$.08 per kWh.

16 hours on  
x.08 cost / kWh  
 3.28 cost / day to run the computer

The same computer now has monitor power management and is asleep for 12 hours during the 16 that it is turned on.

16 hours	4 hours of power	\$3.28 original cost
<u>- 12 hours asleep</u>	<u>x\$.08 cost / kWh</u>	<u>- .32 new cost</u>
4 hours of power	\$0 .32 cost / day	\$2.96 savings / day

Your computer:

Hours on _____	Hours on _____	Hours of power _____	Original cost _____
Cost/kWh _____	Hours asleep _____	Cost / kWh _____	New cost _____
Cost/day _____	Hours of power _____	Cost/day _____	Savings / day _____







# Watt Watchers 100,000 Monitor Pledge Form

for ENERGY STAR® Million Monitor Drive

\_\_\_\_\_ (*name*) is committed to saving energy and protecting the environment through computer monitor power management. With our pledge, \_\_\_\_\_ (*name*) joins ENERGY STAR in its quest to activate power management on one million computer monitors nationwide. We recognize the significant financial (over \$30 million/year), energy (over 400 million kWh/year), and environmental (over 300,000 tons of avoided CO<sub>2</sub> emission/year) savings achievable through setting one million monitors to enter a low-power sleep mode during periods of inactivity.

We pledge to enable power management features on \_\_\_\_\_ (*enter amount*) monitors by \_\_\_\_\_ (*enter month*), 200\_\_ (*enter year*).

\_\_\_\_\_  
Student

\_\_\_\_\_  
Parent

\_\_\_\_\_  
Date

\_\_\_\_\_  
Date

.....  
Please return this form to:

Watt Watchers of Texas  
UTEP-Energy Center  
P.O. Box 68660  
El Paso, TX 79968  
Phone/Fax: 1-888 US WATTS  
wattwatchers.org  
Saving Energy in Texas Schools



# Auto Tire Pressure

Grade Level: 6-8

**Lesson Overview:** Students will use a tire pressure gauge to determine if the tires are properly inflated. Students will learn how under inflated tires effect gas mileage for a vehicle.

**TEKS:**

**Science:** 6.1(A,B), 6.2(A,B,C,D,E), 6.3(D), 6.4(A), 7.1(A,B), 7.2(A,B,C,D,E), 7.3(D), 7.4(A), 8.1(A,B), 8.2(A,B,C,D,E), 8.3(D), 8.4(A,B)

**Social Studies:** 6.20(A,C), 6.21(B), 6.23(A,B), 7.20(A,C,D), 7.21(B), 7.23(A,B), 8.30(B), 8.32(A,B)

**ELA:** 6.1(D), 6.4(A), 6.5(B), 7.1(D), 7.4(A), 7.5(B), 8.1(D), 8.4(A), 8.5(B)

**Time:** 1 hour

**Materials:** tire pressure gauge, clipboards, ribbons, pens, copies of worksheet

**Vocabulary:** under-inflated, tire pressure gauge, psi, mpg



## Background Information:

America is driving around on under-inflated tires, according to a recent survey. Under-inflated tires lower gas mileage, wasting millions of dollars each year. Under-inflated tires are also a major safety hazard. Thousands of accidents each year may be caused by poor handling due to under inflated tires.

### Interesting Facts:

- One out of three light trucks and one out of four cars now on the road has a tire that's significantly under-inflated according to a recent NHSTA survey.
- You can improve your gas mileage by 3.3 percent by keeping your tires inflated to the proper pressure. Under-inflated tires can lower gas mileage by 0.4 percent for every 1 psi drop in pressure of all four tires. Properly inflated tires are safer and last longer.
- Six percent of light trucks (sport utility vehicles, vans and pickup trucks) are driven with all four of their tires under-inflated by 8 or more psi, compared with 3 percent of passenger cars. Twenty percent of light trucks have two or more tires under -inflated by 8 or more psi, compared with 13 percent of passenger cars.
- NHTSA estimates that 49 to 79 deaths and 6,585 to 10,635 injuries could be prevented annually if all vehicles were equipped with tire pressure monitoring systems. In addition, vehicle owners would benefit from better vehicle handling, increased tire life and better fuel economy.

### Setting the stage:

Ask your students if they have ever used a tire gauge, seen there parents add air to a tire, or if they have ever had a flat tire. Discuss gas mileage and factors that may affect it, and reasons why you want better gas mileage (less gas used, less energy usage, less money)

### Activity 1: So, when was the last time you checked your tire pressure?

Take the students out to the parking lot and show them how to check the tire pressure on a car. You may want to ask your high school auto mechanics class to bring a car over and show the students. Have the students fill out the tire pressure chart.

Send a tire pressure gauge (about \$2 at an auto parts store or Wal-Mart/K-Mart) home with your students if their parents do not have one. Include a drawing of a car showing each tire so they can record the pressures for each tire. Have the student research the proper tire pressure for their particular car and record it on the pressure chart. Then they should record the actual tire pressure for each of the tires on the car they researched. In class, total the number of under-inflated tires.

### Activity 2: Teacher Tire Check

Have the class survey the school parking lot. Students give ribbons and information to teachers the day before the tire check. If teachers want their tire pressures checked they put the ribbon on their dash or rearview mirrors. The class then checks all the marked cars in the lot and leaves a note card under the windshield wiper with the pressures for each tire recorded.

### Extension:

For upper grades or as a club project you may provide an option to the tire check, an "Air Station" you set up after school to get under-inflated tires pumped up. (This will require some air compressors, hose, etc.) Or this could be coordinated with a nearby service station that would permit students to help people get their tires inflated.

Handing out driving tips, recommended maintenance tips and mile per gallon calculators at the same time is a good idea.

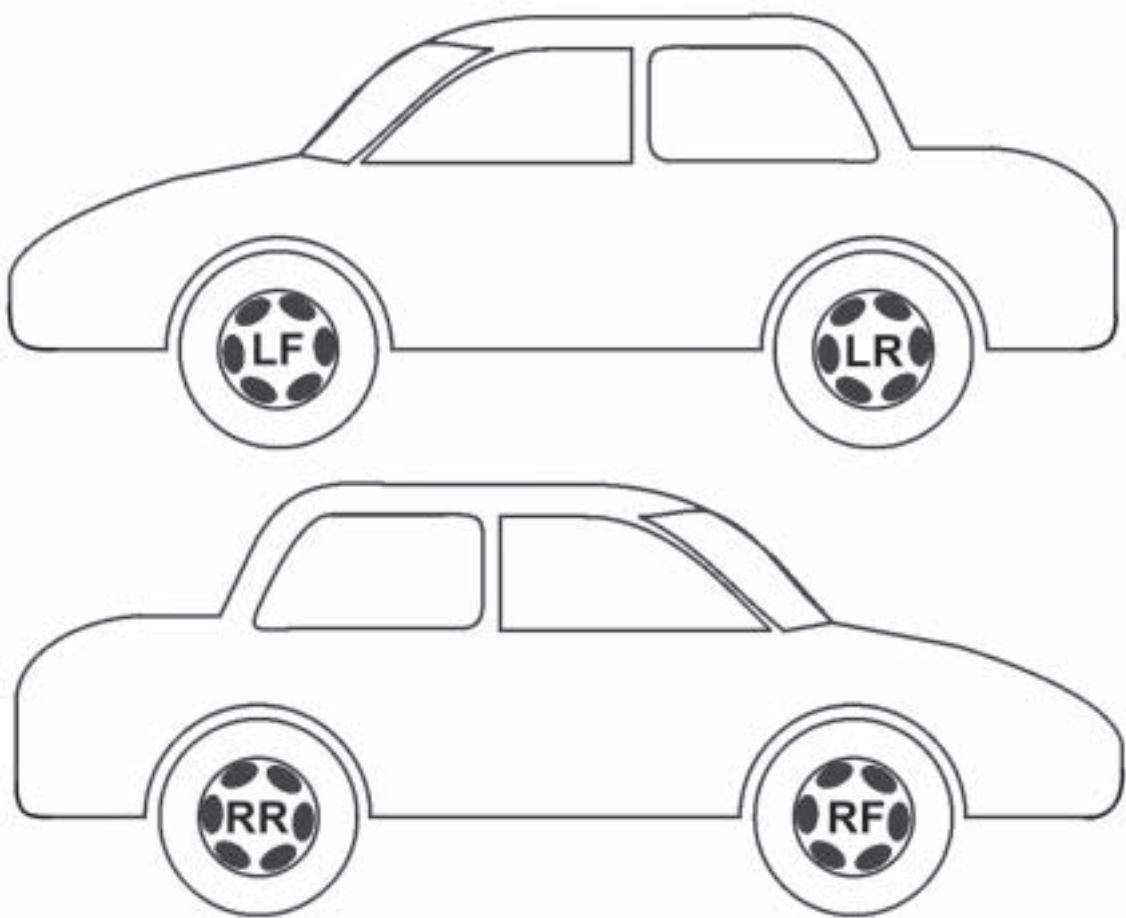


Student Name: \_\_\_\_\_ Date: \_\_\_\_\_

Transportation

Auto Tire Pressure Gauge Worksheet

Total Number of Under Inflated Tires \_\_\_\_\_



Tire	Recommended Tire Pressure	Actual Tire Pressure
LF - Left Front		
LR - Left Rear		
RF - Right Front		
RR - Right Rear		



# Cost-Effective Buying

Grade Level: 7-8

**Lesson Overview:** The students will learn how to evaluate energy related purchases in terms of cost effectiveness.

TEKS

**Math:** 7.2(F,G), 7.3(A,B), 7.11(A,B), 7.13(A), 8.2(B), 8.3(B), 8.11(A,B), 8.13(A,C)  
**Science:** 7.4(A,B), 8.4(A,B)  
**Social Studies:** 7.21(E), 8.30(B,E)

Time: 2-3 class periods

**Vocabulary:** simple payback, cost benefit analysis, rate of return, life cycle costing

**Materials:** one copy of worksheet per person, energy rating labels from different appliances, calculators

Based on standard U.S. Government tests

## ENERGYGUIDE

REFRIGERATOR ENERGY GUIDE  
 ALL QUANTITIES SHOWN ARE ESTIMATED  
 VALUES AND SHOULD BE USED AS A GUIDE  
 ONLY. CAPACITY: 18.5 CUBIC FEET

MODELS: MT1940RHW  
 MT1940RHS, MT1940RHA,  
 MT1940RHS, MT1940RHW

Compare the Energy Use of this Refrigerator  
 with Others Before You Buy.

This Model Uses  
 598 kWh/Year

Energy use (kWh/year) range of all similar models

Uses Least Energy	Uses Most Energy
533	732

kWh/year (kilowatt-hours per year) is a measure of energy (electricity) use. Your utility company uses it to compute your bill. Only models with 18.5 to 20.4 cubic feet and the above features are used in this scale.

Refrigerators using more energy cost more to operate. This model's estimated yearly operating cost is:

Based on a 2004 U.S. Government national average cost of 8.6¢ per kWh for electricity. Year actual operating cost will vary depending on your local utility rates and your use of the product.

ENERGYGUIDE

Energy consumption / Consommation énergétique

598 kWh  
 per year / par année

This Model/Ce modèle:

526 kWh	741 kWh
---------	---------

Uses least energy/  
 Consomme le moins  
 d'énergie

Type 3  
 18.5 - 20.4

Uses most energy/  
 Consomme le plus  
 d'énergie

Similar models  
 Consommation en kWh par année en plus

Model Number: MT1940RHW

Removal of this label before first use may void the warranty. La suppression de cette étiquette avant la première utilisation peut annuler la garantie.

Knowledge is Power



## Background Information:

When we feel compelled to buy a more fashionable garment or a stereo, VCR, or boat, we do so with satisfaction in the knowledge that the purchase will enrich our lives. We buy labor-saving appliances because they will minimize our work and give us more time for other activities (e.g. leisure).

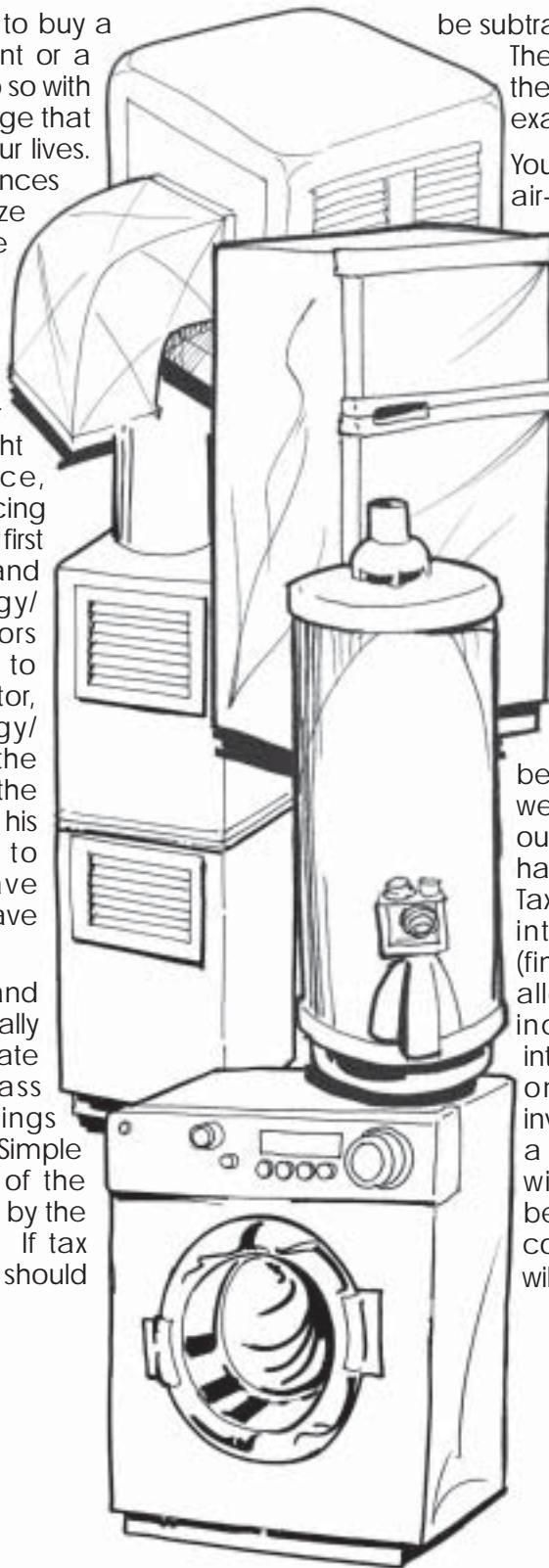
Consider the motivational factors for purchasing an "energy-saving" heating or cooling system. One might name convenience, dependability, good servicing support, brand name, low first cost, low cost to operate, and estimated future energy/money savings as factors influencing the decision to purchase. That last factor, estimated future energy/money savings, reflects the consumer's awareness of the rising cost of energy and his or her determination to reduce energy bills, save money, and as a result, save energy as well.

We expect the heating and cooling system to eventually "pay for itself." We calculate how much time will pass before the monthly savings offset the purchase price. Simple payback is the quotient of the total installed cost divided by the first year's dollar savings. If tax credits are available, they should

be subtracted from the installed cost. The inverse of simple payback is the first year's rate of return. An example will help clarify this:

You purchase a high efficiency air-conditioner to replace an older model. It costs \$360 installed and is estimated to save you \$10 each month it operates, or \$40 a year. Simple payback is \$360 divided by \$40/year, or 9 years. Rate of return for first year is  $(\$40/\$360) \times 100$ , or 11.1%.

These cost figures enable us to compare one purchase option against another. A more accurate analysis would take into account factors such as interest, tax, and inflation. Interest, for example, is always a factor because, even if we pay cash, we must consider the interest our capital would have earned had it been otherwise invested. Taxes are a factor because the interest we pay on a loan (finance charge) can be an allowable deduction on our income tax return and the interest which we may receive on our capital, otherwise invested, is taxable. Inflation is a factor because it has been with us a long time and because the limited supply of conventional energy resources will rise.



## Setting the Stage:

Ask students about a recent large purchase they or someone in their family made. Ask if it was to replace something that was worn out or just something fun. Ask how much research they put into their purchase.

## Activity 1: Cost Effective Buying

Explain simple payback and rate of return and write the equations on the board or overhead. Hand out the cost effective buying worksheet and work through one of the problems together and then allow the students to work the others.

### Answers to the Questions:

1. **Payback:** Insulation A = 1.67 yrs.  
Insulation B = 2.24 yrs.

**Rate of Return on Your Investment:**

Insulation A = 60 %    Insulation B = 45%

2. **Payback:** Water Heater A = 17.11 yrs  
Water Heater B = 9.83 yrs

**Rate of Return on Your Investment:**

Water Heater A = 6%    Water Heater B = 10%

3. **Payback:** Air Conditioner A = 14.67 yrs  
Air Conditioner B = 12.43 yrs

**Rate of Return on Your Investment:**

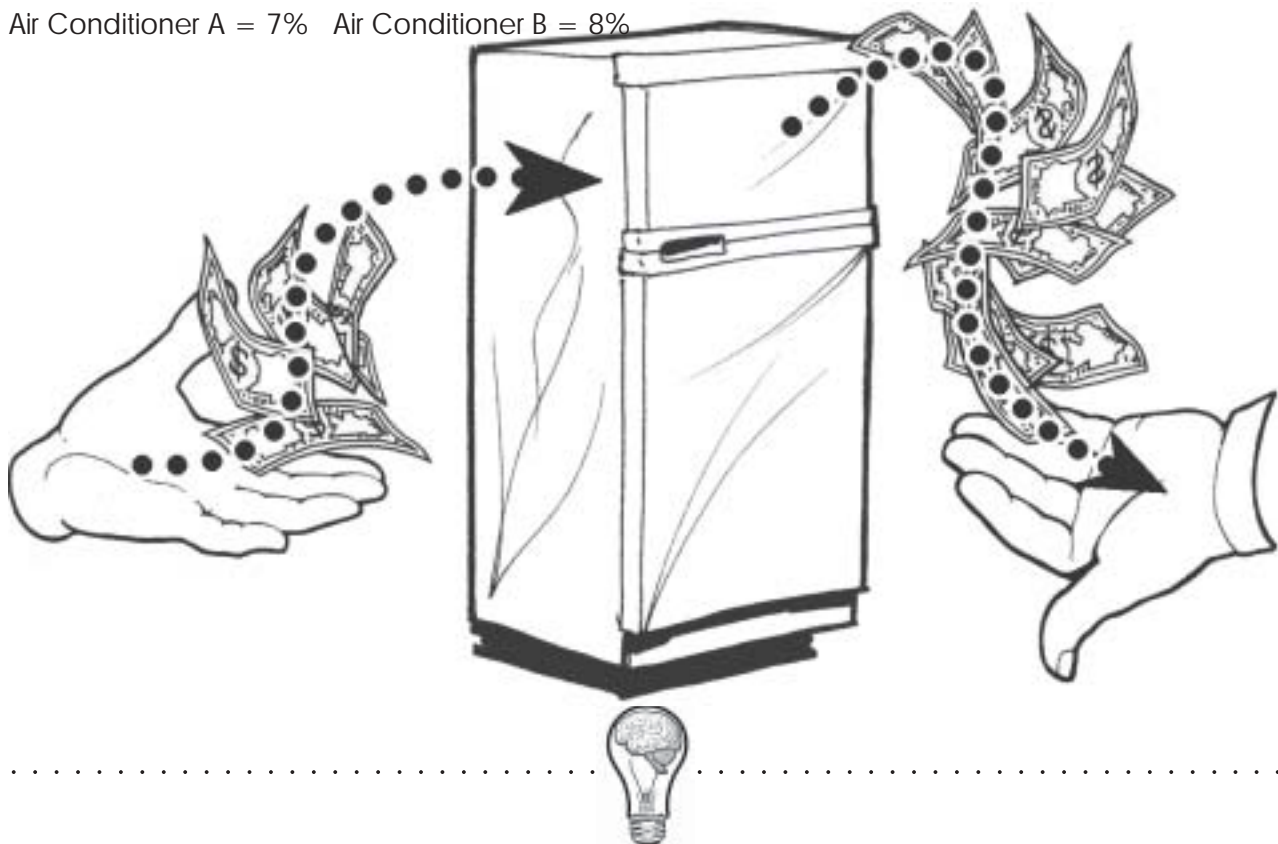
Air Conditioner A = 7%    Air Conditioner B = 8%

## Activity 2: Energy Rating Labels

Collect the energy rating labels from an appliance store for different appliances. Have your students record the initial cost and expected annual savings to compare different models of the same type of appliance (compare refrigerators to refrigerators). Students then find the payback and rate of return for each and decide which to purchase and why.

### Extension:

Based only on operating costs (e.g. ignoring maintenance cost) determine what the payback would be on a new car of your choice.



## Cost Effective Buying

The money you save by replacing a worn out energy consuming appliance with a more efficient one adds up and will eventually repay you for making the purchase, if the payback time is less than the appliance's lifetime. Simple payback is computed by dividing the total installed dollar cost by the annual dollar savings. The first year rate of return may be computed by dividing the annual dollar savings by the system's total installed dollar cost.

1. You are insulating your attic and can choose one of the following insulations:

Insulation A: Installed Cost = \$200 Annual Savings = \$120

Insulation B: Installed Cost = \$325 Annual Savings = \$145

Payback: Insulation A = \_\_\_\_\_ yrs. Insulation B = \_\_\_\_\_ yrs.

Rate of return on your investment:

Insulation A = \_\_\_\_\_ % Insulation B = \_\_\_\_\_ %

Which one do you choose? \_\_\_\_\_

2. You are installing a new water heater with the following results:

Water heater A: Installed Cost = \$325 Annual Savings = \$19

Thicker wall insulation in the new water heater

Water Heater B: Installed Cost = \$1475 Annual Savings = \$150

Solar water heater that only uses purchased energy when not enough solar energy is available.

Payback: Water Heater A = \_\_\_\_\_ yrs Water Heater B = \_\_\_\_\_ yrs

Rate of Return on your investment:

Water Heater A = \_\_\_\_\_ % Water Heater B = \_\_\_\_\_ %

Which one do you choose? \_\_\_\_\_

3. Your window unit air conditioner no longer works and you can choose one of the following room air conditioners with the following results:

Air Conditioner A Installed Cost = \$220 Annual Savings = \$15

Air Conditioner B Installed Cost = \$435 Annual Savings = \$35

Payback: Air Conditioner A = \_\_\_\_\_ yrs Air Conditioner B = \_\_\_\_\_ yrs

Rate of Return on your investment:

Air Conditioner A = \_\_\_\_\_ % Air Conditioner B = \_\_\_\_\_ %

Which one do you choose? \_\_\_\_\_



# Energy Conservation vs. Energy Efficiency:

## What's the Difference?

Grade Level: 5-8

**Objective:** The student will create a definition for energy conservation and energy efficiency based on discussion with classmates and input from teacher.

**TEKS:**

**Science:** 5.3(A,B,C), 6.3(A,B,C), 7.3(A,B,C), 8.3(A,B,C)

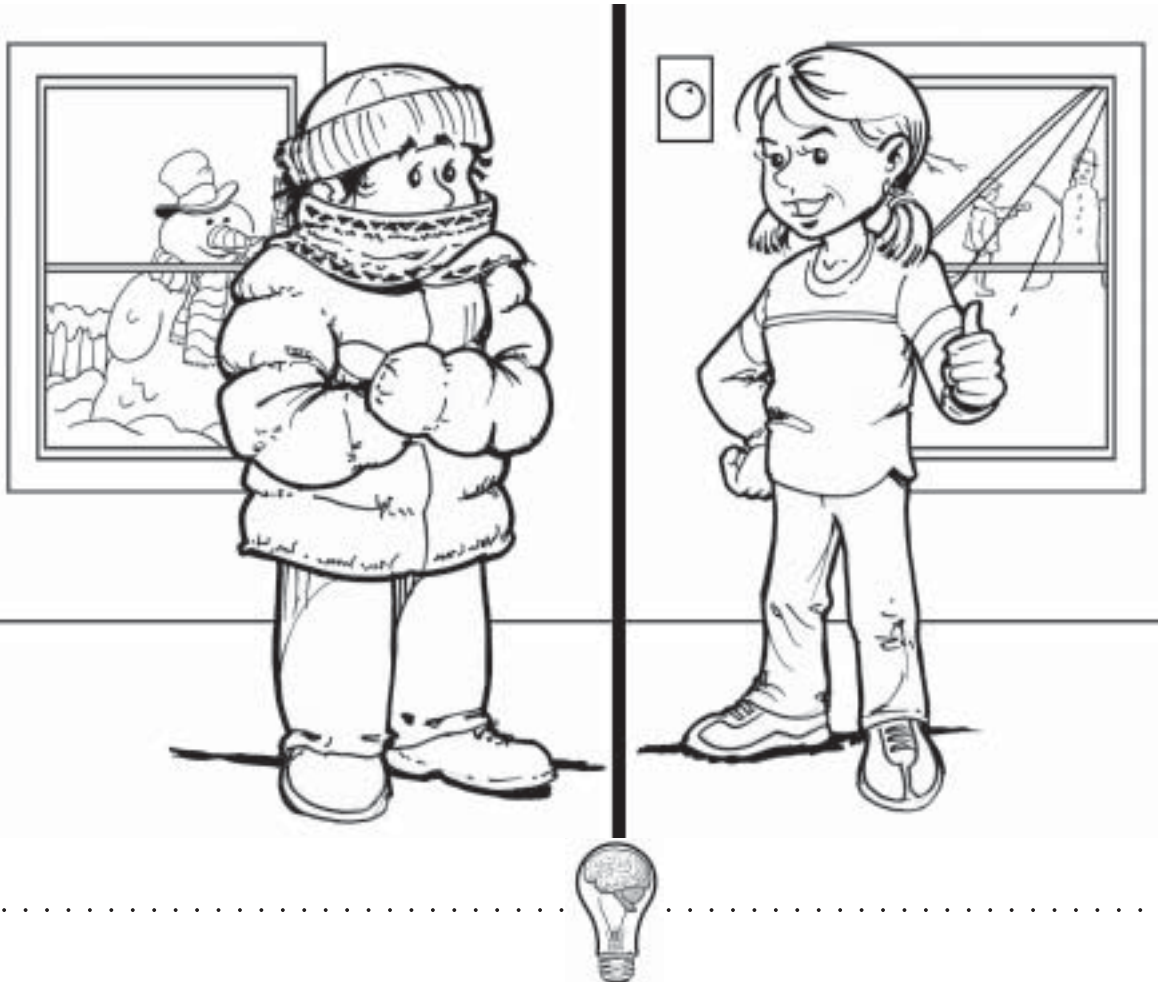
**Social Studies:** 5.25(A,B,C,D,F), 5.26(A,C,D), 6.21(A,B,C,D,F), 6.22(A,C,D), 7.21(A,B,C,D,H), 7.22(A,B,D), 8.30(A,B,C,D,H), 8.31(A,B,D)

**ELA:** 5.1(A,B,C), 5.4(A), 5.5(B,F), 5.13(A,G,H), 6.1(A,B,C), 6.4(A), 6.5(B,F), 6.13(A,G,H), 7.1(A,B,C), 7.4(A), 7.5(B,F), 7.13(A,G,H), 8.1(A,B,C), 8.4(A), 8.5(B,F), 8.13(A,G,H)

**Time:** One class period

**Materials:** one worksheet per student

**Vocabulary:** energy conservation, energy efficiency



## Background Information:

Energy shortages and gas lines of the 1970's, wearing sweaters as a kid instead of turning up the heat, and sleeping on the porch where it was cooler are all graphic examples of what most Americans think of when they hear the word energy conservation. Conservation is linked to sacrifice in many minds. The definition we give students in the Knowledge is Power glossary is; to keep from being lost, damaged or wasted; saved. Today's generation did not have to wait in line for gasoline. And most put on a sweater in the winter because mom said so not because the president asked us to turn down the heat to conserve the nations fuel. Reducing energy usage does not mean going without. Some people think of energy conservation as having to be uncomfortable or suffer to save energy. The truth is: comfort and conservation are completely compatible! Energy conservation usually means being more careful in the way we use energy or improving our habits. Like the definition says; keep from being wasted.

Energy efficiency invokes feelings of control and advancement. Energy efficiency means using state of the art technology to get better services to many people. The definition in the Knowledge is Power glossary is; ability to produce a desired effect or product with a minimum of effort, expense, or waste. This embodies exactly what we want to do, get more performance and productivity with less cost in dollars and energy use.

### Setting the Stage:

Write Good and Bad on the board. Read a list of statements and words to the students. Have them decide if the statement should go under the good column or the bad column. If there is a dispute, write it under both. Statements could include pollution, gasoline, compact fluorescent light bulb, turning off lights, leaving the TV on and leaving the room, or temperature settings of 78° in the summer and 68° in the winter. Leave the list up for the duration of the lesson. At the end of the lesson, ask the students if there are any statements they would like to move.

### Activity 1: Conservation or Efficiency?

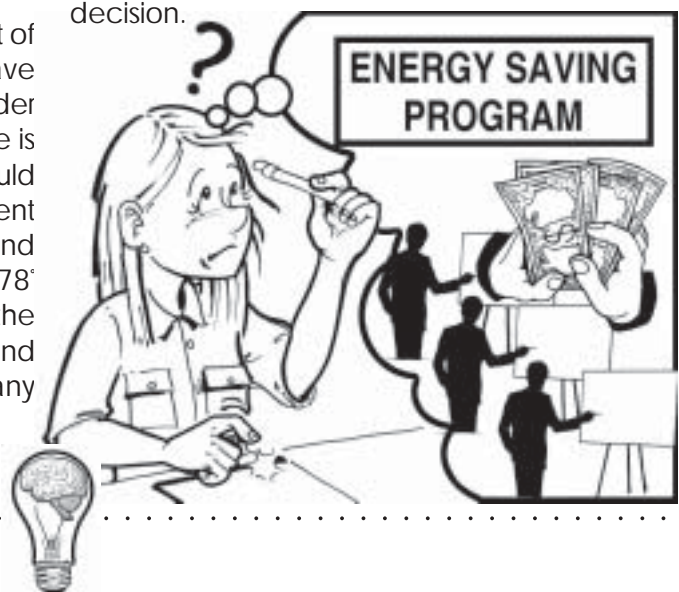
Have the students write what they think the definition of conservation and efficiency is on the worksheet. Then working in groups, have them decide whether each statement represents energy conservation, energy efficiency or both. After completing the worksheet, go over the answers with the students and discuss any that there are disputes over. Read the list that you have defined as energy efficiency and have the kids finalize a definition. Do the same for energy conservation. Do the definitions differ?

### Discussion:

Discuss how energy conservation and energy efficiency are similar terms and how they are different. Discuss which statements on the board would fall under the conservation heading and which would fall under the efficiency heading.

### Extensions: Dilemma Journals

Have your students keep a journal during your energy unit and give them a dilemma to write about each day. The dilemmas can be easy, such as: should you turn off the lights when the teacher forgets, or complex such as: you are the Superintendent, do you allot money to upgrade the school to an energy saving program this year knowing it will save money in the future or do you spend that money to hire new teachers. Have the students explain their reasoning behind their decision.



# Energy Conservation vs. Energy Efficiency: What's the Difference?

Define the following terms using your own words; without looking anything up.

Energy conservation: \_\_\_\_\_

Energy efficiency: \_\_\_\_\_

Read each statement below. Place the letters EC in the line if you think the statement represents Energy Conservation. Place an EE in the line if you think the statement represents Energy Efficiency. Write both if you think the statement refers to both Energy Conservation and Energy Efficiency.

- \_\_\_\_ 1. Not driving to the video store so you can save gas.
- \_\_\_\_ 2. Combining errands to save gas
- \_\_\_\_ 3. Wearing a sweater and using extra blankets in winter
- \_\_\_\_ 4. Using a programmable thermostat to change the temperature at the house when no one is home.
- \_\_\_\_ 5. Using advanced state of the art technologies to provide better quality energy services with less energy.
- \_\_\_\_ 6. Using resources wisely
- \_\_\_\_ 7. Eliminating energy waste
- \_\_\_\_ 8. Using technology to reduce energy use
- \_\_\_\_ 9. Turning off the lights by hand when you leave the room
- \_\_\_\_ 10. Turning off the lights in the classroom by motion sensor
- \_\_\_\_ 11. Using the EZ SAVE computer power management program to put your computer monitor to sleep when not in use
- \_\_\_\_ 12. Turning off the computer on Friday before going home for the weekend
- \_\_\_\_ 13. Turning the lights off on a vending machine without turning the vending machine off
- \_\_\_\_ 14. Turning off the TV when you are not watching it.
- \_\_\_\_ 15. Driving a hybrid car.

Now read over the statements you thought meant energy conservation. Reread your definition of energy conservation. Do you need to modify your definition? Do the same for statements you thought meant energy efficiency. Rewrite your definitions below.

Energy conservation: \_\_\_\_\_

Energy efficiency: \_\_\_\_\_



# Energy Trip Ticket

Grade Level: K-8

**Lesson Overview:** Students will learn about wasting energy, conserving energy, energy crisis and what to do about this by doing a hands on, minds on, classroom activity throughout the week.

**TEKS:**

**Math:** 1.10(A,B), 1.13, 2.11(A,B), 2.14, 3.14(A,B,C), 3.15(A,B), 4.13(C), 4.14(A,B), 5.13(B), 6.10(D), 6.11(A), 7.12(A), 7.13(A), 8.12(C), 8.14(A)

**Science:** K.1(B), K.3(A,B,C), 1.1(B), 1.3(A,B,C), 2.1B, 2.3(A,B,C), 3.1(B), 3.3(C), 4.1(B), 4.3(C), 5.1(B), 5.3(C), 6.1(B), 6.3(C), 7.1(B), 7.3(C), 8.1(B), 8.3(C)

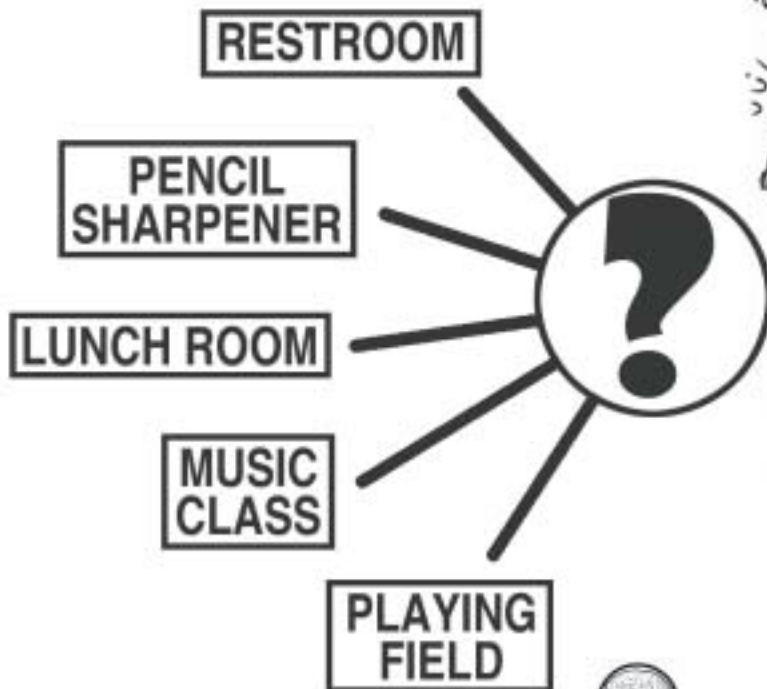
**Social Studies:** K.13(A,B), K.14(A,B), K.17(A,B), 1.7(A,B), 1.8(A,B), 1.16(A,B,C), 1.19(A,B), 2.7(B), 2.8(A,D), 2.16(A,B), 2.19(A,B), 3.7(A,B,C), 3.11(A,B), 3.18(A,B), 4.14(B), 4.21(B,C), 4.24(A,B), 5.13(A), 5.24(C,E), 5.27(A,B), 6.20(C), 6.23(A,B), 7.23(A,B), 8.32(A,B)

**ELA:** 1.2(A), 2.1(A), 3.2(A), 4.4(A), 4.5(B), 5.4(A), 6.4(A), 7.4(A), 8.4(A)

**Time:** 5 days on going during class periods

**Materials:** 15 energy trip tickets per student

**Vocabulary:** conserve, waste, crisis, strategies



## Background information:

Students use energy every day without thinking about where it comes from, how it arrives or even that they are using it. This activity will help to make students aware of their energy usage by making them “pay” for each energy trip they make throughout the day. This activity will also get students thinking about ways they can conserve or eliminate energy use by making them look at their day.

## Setting the stage:

Have the students make a list of all their school trips: to the pencil sharpener, the lunchroom, the rest rooms, music class, and so on.

## Activity: Energy Trip Ticket Game

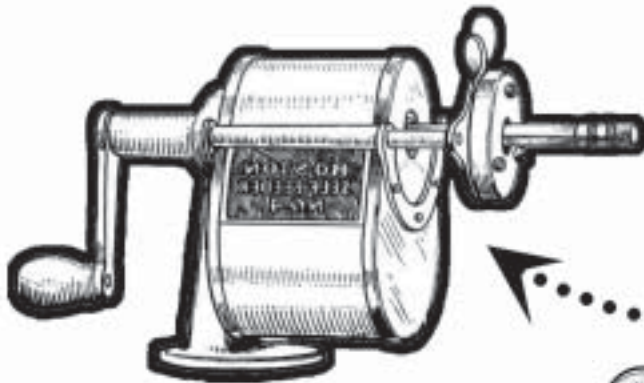
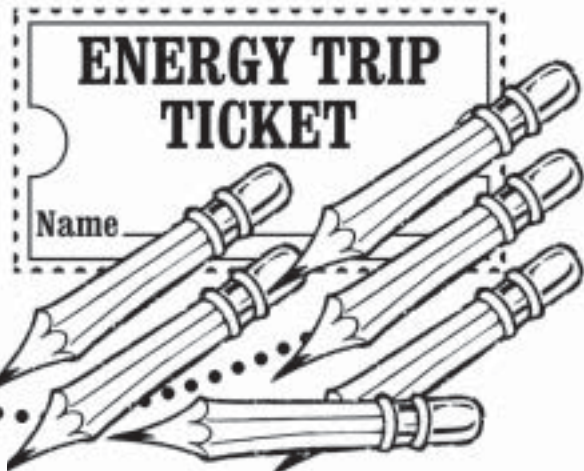
Give each student 15 “energy tickets” and announce that for the next five days, every trip will cost one ticket. At the end of each day, record the number of tickets each student has left on a large chart for all to see. Who’s wasting energy? Conserving it? How are they doing it? Discuss energy-saving strategies such as combining several errands on one ticket and “pencil pooling” (rotating the task of pencil sharpening within a small group of students). By the third day, the room will be a-buzz with talk of the impending “energy crisis.”

## Discussion:

Ask your students what effect the crisis is having on their standard of living. Now they are ready to devise some real-life conservation strategies. Developing conservation strategies can be fun, especially when your students know the priceless reward of their knowledge of energy conservation.

## Extension:

Have students write down their energy trip conservation goals at the end of the week. Have them keep track of their own energy trips for the next week and see how they did and what modifications were necessary to meet those goals.



**ENERGY TRIP  
TICKET**

Name \_\_\_\_\_

**ENERGY TRIP  
TICKET**

Name \_\_\_\_\_

**ENERGY TRIP  
TICKET**

Name \_\_\_\_\_

**ENERGY TRIP  
TICKET**

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**ENERGY TRIP  
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**ENERGY TRIP  
TICKET**

Name \_\_\_\_\_

**ENERGY TRIP  
TICKET**

Name \_\_\_\_\_

# Home Energy Survey

Grade Level: 3-6

**Lesson Overview:** In this lesson, students will become more aware of their energy use by conducting a home energy survey. They will answer questions to learn about appliances and air leaks in the home. Students will also discuss ways to save energy and develop a plan to start saving energy at home.

**TEKS:**

**Math:** 3.3(B), 4.3(A), 5.3(A), 6.2(B)

**Science:** 3.2(B,C,D), 4.2(B,C,D), 5.2(B,C,D), 5.8(A), 6.2(B,C,D)

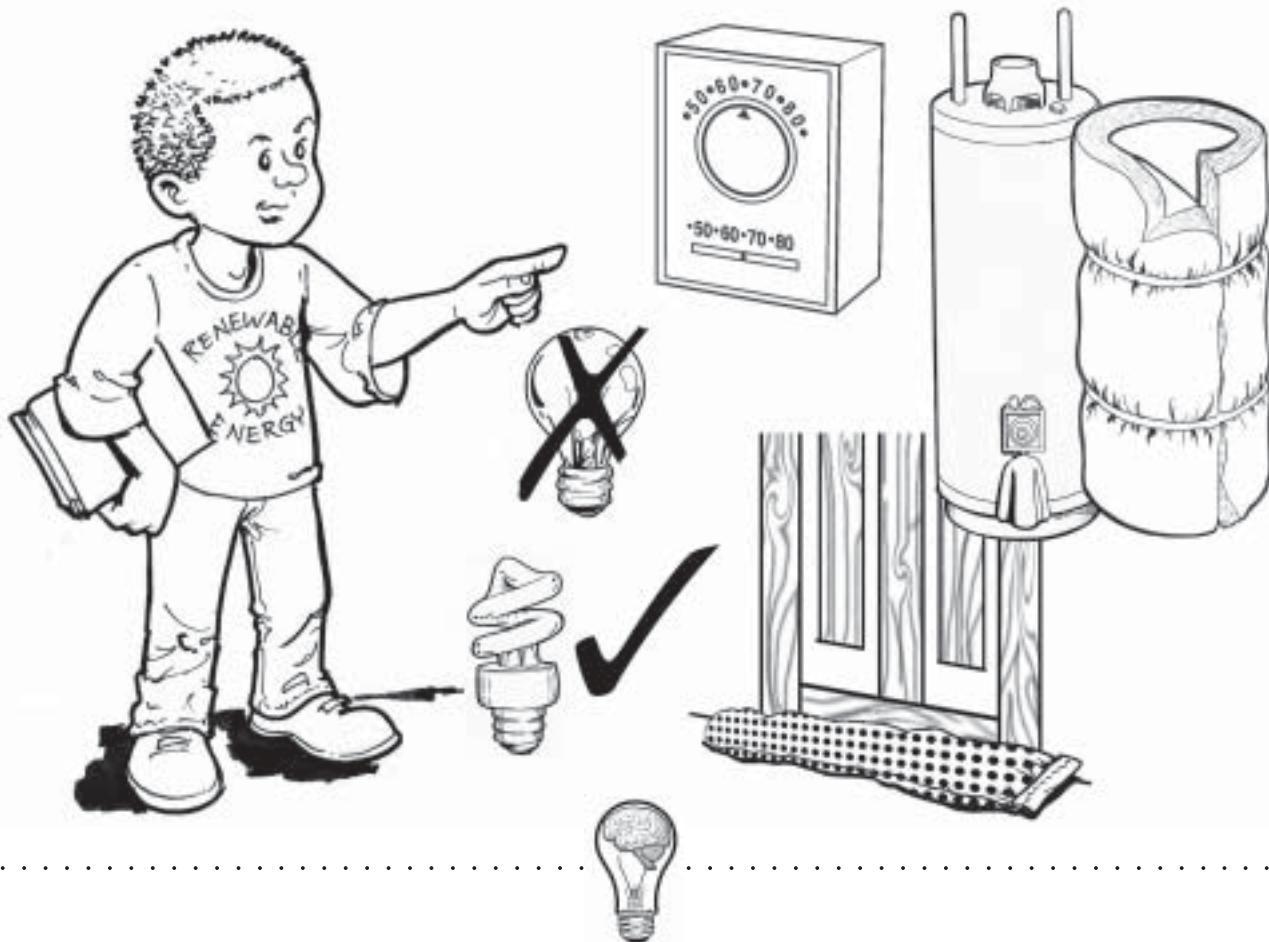
**Social Studies:** 3.18(A,B), 4.21(B,C), 4.24(A,B), 5.24(B,C,D,E), 5.27(A,B), 6.20(A), 6.23(A,B)

**ELA:** 3.2(A), 3.9(A), 3.13(A), 3.14(A), 4.4(A), 4.10(A), 4.14(A), 4.15(A), 5.4(A), 5.10(A), 5.14(A), 5.15(A), 6.4(A), 6.10(A), 6.14(A), 6.15(A)

**Time:** Approximately 30 minutes

**Materials:** one copy of the Home Energy Survey and the energy checklist per student.

**Vocabulary:** energy, thermostat, temperature, drafts, appliance, insulated, incandescent.



## Background Information:

People use energy without thinking about it all day. They turn on appliances and walk through rooms every day without a thought to where the electricity comes from, or how much they are using. The Home Energy Survey and Checklist are ways to make the students aware of what they are using throughout the day.

### Setting the Stage:

Write the question, "Where have you used energy today?" on the board. Have the students make a list of all the energy using devices they have used. You may want to start with energy use since the start of the school day or since lunch for younger students. Prompt them to list more as you go through a typical day.

### Activity1: Home Energy Survey

Send the Energy home survey home with the students to fill out with an adult as they go about their day. This will reinforce the starter activity as there may be many more appliances that they had not thought of.

The following day have the students compare their surveys in groups. Have the group brainstorm ways they could use less energy based on their lists. Have each student write an essay on three ways they could change their day to use less energy based on the brainstorming of the group.

### Activity2: Energy Checklist

Send the energy checklist home with the students to fill out with an adult. This checklist gives their home an energy score based on items around the house.

The following day discuss ways some of these scores could be easily changed. Some examples of things to do include:

**Temperature:** changing the temperature on the thermostat.

**Windows:** caulking, curtains, draft doggies

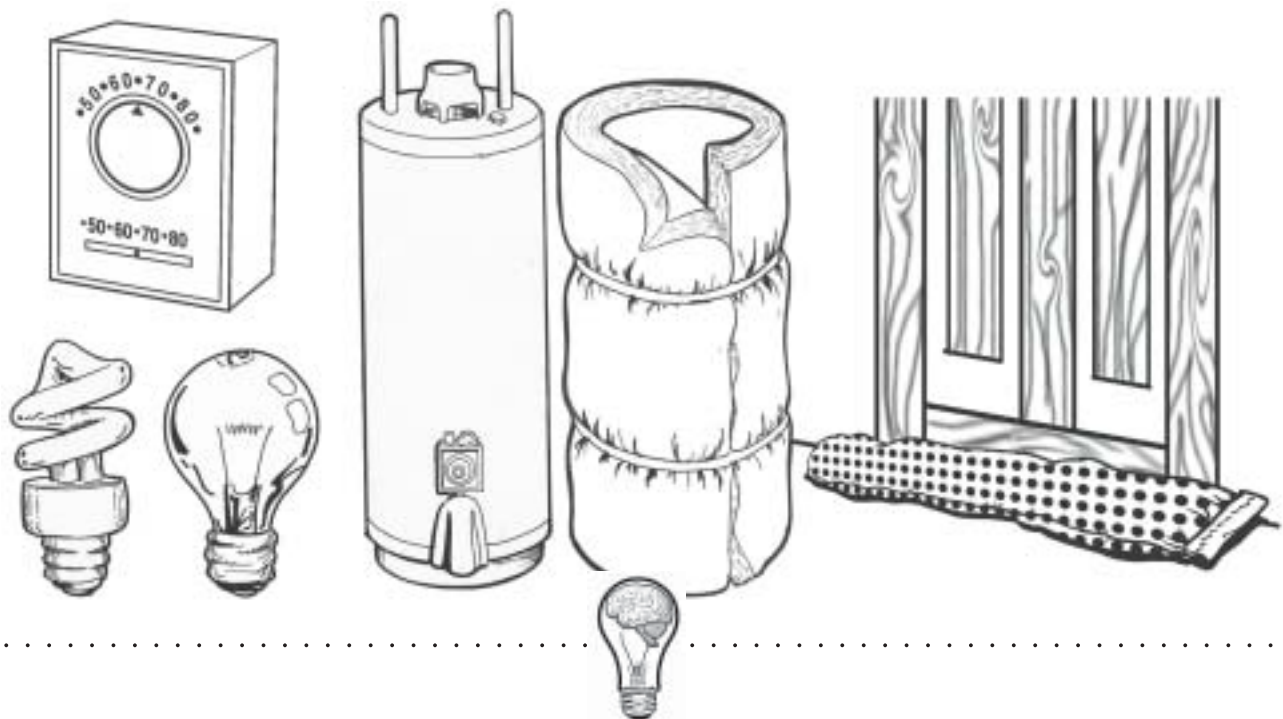
**Water Heater:** water heater blankets cost \$15-20 and are easy to install

**Light bulbs:** CFL bulbs use less energy and are relatively inexpensive.

**Leaving lights on:** change in habit, reminder notes

### Extensions:

Have students do the energy checklist in parts of your school building. Make a presentation to the Principal, energy manager and school board about what they found and ways they could make the building more energy efficient.



# Home Energy Survey

Dear Parents:

Choose a block of time during which you and your child will record all the ways that you use energy. Go about your normal activity but keep this survey sheet with you. Record every time you turn on a light, use an appliance, talk on the phone, etc. Check everything that was used during this block of time.

The following list identifies some typical ways energy is used in the home. This is a starting point to keep track of what energy you and your family use.

Typical home energy use:



lights.....



dryer.....



hot water.....



toaster.....



home heating..



blender.....



television.....



dishwasher.....



radio.....



stereo.....



telephone.....



can opener.....



hair dryer.....



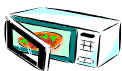
electric blanket...



stove.....



refrigerator.....



microwave.....



vacuum cleaner..



computer.....



washer.....



iron.....



air conditioner.....



Student Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Energy Checklist

- 1. What's Your Temperature?** Check your thermostat to see where it's set. Give yourself 1 point if:
  - It's a cool day, the heat is on, and the thermostat is set at 68 F or lower.
  - It's a cool night, the heat is on, and the thermostat is set at 60 F or lower.
  - It's a warm day, the air conditioning is on, and the thermostat is set at 78 F or higher
  - Give yourself 2 points if neither the heat nor air conditioning is on!
- 2. Window Watch:** Take a look at your windows. Are there storm windows on every one? Give yourself 3 points if all your windows have storm windows, 2 points if just some of them do, and 0 points if none have storm windows.
- 3. Dreaded Drafts:** Check for drafts around windows and doors. Put your hand where the window or door meets its frame and feel for moving air. (This works best on a windy day or when there's a big difference between inside and outside temperatures.) Give yourself 2 points if you don't have any drafty windows or doors, 1 point if just some of them are drafty, and 0 points if all are drafty.
- 4. Hot Stuff:** Is your water heater insulated? If it is, give yourself 3 points. And if you have insulation around your hot water pipes, you get 1 point.
- 5. A Bright Idea:** Check your lights to see if they are equipped with incandescent light bulbs. Give yourself 3 points if you find fluorescent bulbs instead of incandescent bulbs.
- 6. Lights Out?** Check the rooms in your house. Are the lights, TVs, and stereos off in all the rooms that aren't being used? If they are, you get another 3 points.

### Energy Scores:

*12 – 17 points:* Your home is a super energy saver!

*9 – 11 points:* Your home has a few energy "leaks" that need fixing, but you're doing OK!

*5 – 8 points:* You're on the right track, but you really can improve your energy savings.

*5 points:* Your house needs some energy savings help!



# How Much Energy Do You Use?

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Grade Level: 3-6

**Lesson Overview:** This lesson expands upon the awareness of a student's energy usage learned in the Energy Home Survey lesson. The students will add math to their information to determine which appliances are energy eaters. They will work on utility math problems and a comparison of the results.

**TEKS:**

**Math:** 3.1(A), 3.3(A), 3.4(A,B), 3.15(A,B,C), 4.1(A,B), 4.3(A,B), 4.4(C,D,E),  
4.14(A,B,C), 5.3(A,B,C), 5.14(A,B,C), 6.2(A,B,C), 6.3(A,B), 6.11(A,B,C)  
**Science:** 3.2(A,B,C,D), 4.2(A,B,C,D), 5.2(A,B,C,D), 6.2(A,B,C,D)  
**Social Studies:** 5.13 (A,B)  
**ELA:** 3.2(A), 3.4(A), 3.14(A), 4.4(A), 4.15(A), 5.4(A), 5.15(A), 6.4(A), 6.15(A)

**Time:** 15 minute preparation, one day's homework, one class

**Materials:** calculators

**Vocabulary:** periodic appliance, incandescent and fluorescent lights



## Background Information:

U.S. residents use more energy now than we ever have in the past. There are many reasons for this. As more people populate the country, energy needs rise. Technology advances, such as industrial processes, sophisticated machinery and computers also require increased energy. Our everyday lives are filled with electrical appliances that our grandparents never used.

This activity gives your students a chance to work on some real-life math problems. This activity bases its numbers on cost figures from one utility. Energy figures in your area may be different. Your local energy utility can give you figures that show the average expenditure per household in your community.

### Setting the Stage:

Start by asking your students if they have ever heard their parents complain about the cost of energy. Explain that the monthly utility bill is directly related to the amount of energy the household uses, and that this activity will help them find the "energy-eaters" in the house. Show them a sample electricity bill from a local utility company

### Activity 1: What is the Cost?

Distribute the work sheet. Have them fill out the second and third columns (# on am, # on pm) on the front side at home, and the first column of the periodic appliance use chart. The next day, assist them in a few of the math problems and have them complete the charts and questions.

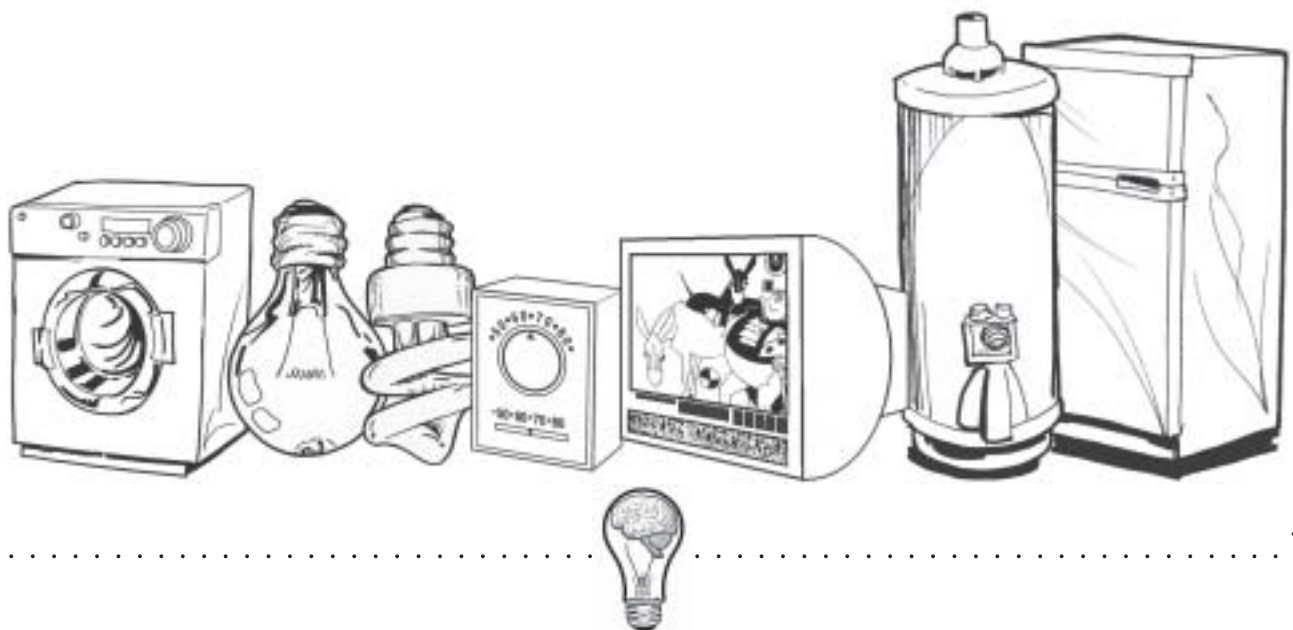
Part two includes appliances that are run periodically. Students fill out information relating to the number of loads they do each week. After reading the second chart, have the students estimate their energy bill. Compare with actual or sample bills.

### Discussion:

After they have found out how much it costs to run appliances each day ask them if they found any they could live without (such as an electric can opener), or if there were any they could use less (shutting off lights and stereo when leaving the room).

### Extension:

Bring in a speaker from your local utility to talk about ways to change habits to lower home energy costs, or have your school energy manager speak about energy saving techniques in the school.



Student Name: \_\_\_\_\_ Date: \_\_\_\_\_

## What is the Cost?

Do this survey twice: once in the morning before school, and once just before dinner. It will help you determine how much energy you use.

To finish the row, multiply the number of appliances you had on (take an average if you had more at one time than at the other survey time) by the cost to run that appliance (the fourth column). This is the cost per hour.

Some of these appliances will be on for more than one hour, some less. Based on what you

know about your household, write the total numbers of hours the appliance is on in the next column. To find the total cost per day for these appliances multiply the number of hours the appliance is on by the cost per hour.

Now find a subtotal for the cost per hour column by adding all the numbers in this column. This subtotal is the total cost for all these appliances in one hour. Do the same for the cost per day column. This is the total cost to run your appliances for one day.

Electrical Appliances	# on am	# on pm	multiply by	Cost per hour	Number of hours on per day	Total Cost Per Day
Example Appliance	2	2	\$0.02/hr	2x0.02=\$.04	10	10x\$.04 per hour =.40 per day
Incandescent Light			\$0.01/hr			
Fluorescent Light			\$0.01/four hours			
Television			\$0.04/hr			
Radio			\$0.01/hr			
Stereo			\$0.02/hr			
Computer			\$0.01/hr			
Vacuum Cleaner			\$0.09/hr			
Portable Heater			\$0.15/hr			
Air Conditioner			\$0.55/hr			
Total Cost of energy for one hour					\$	
Total Cost of energy in one day						\$
Total Cost for energy in one month (multiply total in one day by 30)						\$



Student Name: \_\_\_\_\_ Date: \_\_\_\_\_

## What is the cost? Part two

### Periodic Appliances

Some items are not used all the time. They create a cost only when they are used. This chart gives you the total cost per month, based on how much your family uses these appliances.

Periodic Appliances Appliance and average use per month	Total per month
Gas water heater:	\$13.00
Electric water heater:	\$45.00
Refrigerator	\$16.00
Extra Freezer	\$18.00
Electric Heating System	
Small Home	\$85.00
Large Home	\$250.00
Gas water heater:	
Small Home	\$28.00
Large Home	\$120.00
Total for one month	

Appliances and loads per month	Multiply by	Total per month
Dishwasher loads=	\$0.15 per load	
Washing machine loads=	\$0.30 per load	
Electric dryer loads=	\$0.40 per load	
Gas Clothes Dryer Loads=	\$0.16 per load	
Total Usage for month		

With your teacher's help, figure out your home energy costs for one month. Compare it to a real bill someone receives each month. How do they compare?

My estimate: \_\_\_\_\_ A real bill: \_\_\_\_\_

Did your estimate come close to the actual cost? If not, why do you think they differ?

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List three things you could do to lower your daily energy cost.

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List three things you could do to lower your monthly energy cost.

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Adapted from: *The National Wildlife Federation's Animal Tracks Activity Guide for Educators.*  
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# Incandescent vs. Fluorescent

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Grade Level: 6-8

**Lesson Overview:** Students will learn how to be energy efficient at home. They will do a home survey for fluorescent lights and compare the wattage use of a compact fluorescent light (CFL) and an incandescent light.

**TEKS:**

**Social Studies:** 6.20(A), 6.21(B,C), 6.23(A,B), 7.20(A), 7.21(B,C), 7.23(A,B), 8.30(C,B)

**Science:** 6.4(A,B), 7.4(A), 8.4(A), 8.5(A,B)

**Math:** 6.2(B,C), 6.11(A,B,D), 7.2(B,D), 7.3(B), 7.13(A,B), 8.2(A,B), 8.14(A,B)

**ELA:** 6.4(A), 6.9(E), 6.10(A), 7.4(A), 7.9(E), 7.10(A), 8.4(A), 8.9(E), 8.10(A)

**Time:** 2 days - 1 day each activity and discussion

**Materials:** incandescent light bulb, compact fluorescent light bulb, calculators.

**Vocabulary:** energy, incandescent, fluorescent, compact fluorescent bulb, lifetime cost



## Background Information:

Not all light sources are created equal. Some are much more energy efficient than others. Why should we use these and save energy? Three reasons:

- Saving energy means saving money
- Saving energy helps to make sure our population has enough energy to meet its needs.
- Saving energy reduces the effects that producing electricity may have on wildlife.

The standard incandescent bulbs currently lighting your home have changed very little from Thomas Edison's original light bulb in 1879. Only 10% of the energy used by these standard bulbs produces light; the other 90% produces only heat. And what about halogen lights? A typical halogen bulb burns at 1,000 degrees F. These old fashioned bulbs waste energy and can potentially cause burns or fires.

Fluorescent lighting is much more efficient. It uses bulbs that are usually long tubes that fit into ceiling fixtures. Fluorescents last longer and use much less energy to produce the same amount of light.

There is a new kind of fluorescent light that is changing the way people light their homes. It is called the compact fluorescent light (CFL). Unlike the fluorescent tube, a CFL can screw directly into most lamps and ceiling fixtures. Compact fluorescents are more expensive than incandescent lights, but they can last up to 10 times longer and they use 75 percent less energy.

ENERGY STAR qualified CFLs provide the same high quality light as incandescent bulbs, but generally at temperatures of less than 100 degrees F. Why spend money heating rooms in your home with lighting?

## Setting the Stage:

Show your students the Tale of Two Light Bulbs power point presentation from our website or CD. Or, show them an incandescent light bulb and a compact fluorescent light bulb. Share some of the background information. Ask if they have CFL bulbs at their homes or if they have ever seen one in the store. Ask if they have ever bought something that was more expensive, but would actually be cheaper in the long term because it would have to be replaced less often.

## Activity 1: Battle of the Bulbs

Have your students take this sheet home and fill out the top portion with a family member. The brainteaser questions will reinforce the background information you gave in the starter.

## Activity 2: Watt's It All About?

Have your students use the information they have gained about CFL bulbs to compare them to incandescent bulbs. Fill in the chart to find out how much you would save by switching to CFL bulbs.

## Extension: CFL's at Home

Send one CFL home with each student and have them secretly replace a bulb in their home to find out what happens. Does anyone notice the change in light intensity or warmth of the room? Does anyone have opinions about the change?

## Resources:

[www.bulbs.com](http://www.bulbs.com), [www.homedepot.com](http://www.homedepot.com), pricing for CFLs

[www.wattwatchers.org](http://www.wattwatchers.org) , Tale of Two light bulbs presentation.



Student Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Battle of the Bulbs

Take this sheet home, and with your family, do a light bulb survey. Begin by counting the number of bulbs inside and outside your home.

How many bulbs are incandescent? \_\_\_\_\_

How many bulbs are fluorescent? \_\_\_\_\_

How many bulbs are compact fluorescent? \_\_\_\_\_

**Brainteaser #1:** Compact fluorescent bulbs last 10 times longer than incandescent bulbs. If an incandescent bulb lasts 1,000 hours, how many hours will a compact fluorescent last?

Answer \_\_\_\_\_

During its lifetime, a fluorescent bulb requires much less energy than an incandescent. Here's what happens if you replace one 100 watt incandescent bulb with an equally luminous, but much more efficient 27watt compact fluorescent:

- You'll save the equivalent of 800 pounds of energy producing coal.
- Over 365 pounds of Carbon Dioxide (CO<sub>2</sub>) and other greenhouse gases will not be released into the atmosphere.

**Brainteaser #2:** If everyone in your classroom installed one compact fluorescent in his or her home, how many pounds of coal would be saved?

Answer \_\_\_\_\_

Discuss with your family the possibility of replacing one incandescent bulb with an energy-efficient compact fluorescent. They are usually available at your local hardware or home improvement store. You'll be saving money energy as well!





## Watt's It All About?

Is a light bulb worth \$5? That is approximately how much an 18-watt compact fluorescent light bulb costs. It may seem like a lot when a 75-watt incandescent bulb costs only \$0.75, but the answer is not as easy as it seems. The cost of purchasing a light bulb, or any other electrical appliance, is only a fraction of its lifetime cost. The lifetime cost includes the cost of purchasing the appliance, plus the cost of operating it for as long as it lasts. We must also consider the

external costs of producing and operating the bulb. Although the cost of purchasing energy efficient appliances or light bulbs may be more than that of other appliances, when you figure in the lifetime costs, they may be much less expensive.

Let's compare the 20-watt compact fluorescent bulb with the 75-watt incandescent bulb.

	Compact Fluorescent		Incandescent	
1. Bulb Wattage	20		75	
2. Light Output	1200		830	
3. Life Expectancy	8,000		750 hours	
4. kWh used				
5. Electricity Cost (kWh used x .08 )	\$ _____		\$ _____	
6.. Cost of the new bulb	+\$5.00		+\$0.75	
7.. Lifetime Cost	=\$ _____		=\$ _____	
8. Life expectancy of CFL/ life expectancy of incandescent				
9. Cost Comparison	=\$ _____		=\$ _____	



# Meter Reading

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**Grade Level:** 3-8

**Lesson Overview:** Students will learn to read utility meters and compute energy use. After learning to read gas and electric meters, students will then proceed to monitor the energy used in their homes and keep a daily record. At school the information will be compiled and discussed.

**TEKS:**

**Math:** 3.1(A), 3.3(A,B), 3.14(A,C), 3.15(A), 3.16(A,B), 4.1(A,B), 4.3(A), 4.4(D), 4.14(A), 4.15(B), 5.3(A,B), 5.12(A), 5.14(A), 5.15(A), 6.11(A), 6.12(A), 7.11(A), 7.13(A), 8.1(B), 8.2(A,B), 8.14(A), 8.15(A)

**Science:** 3.1(A), 3.2(A,B,C,D,E), 3.16(A,B), 4.1(A), 4.2(A,B,C,D,E), 4.3(C), 5.1(A), 5.2(A,B,C,D,E), 5.3(C), 6.1(A), 6.2(A,B,C,D,E), 6.3(C), 6.4(A), 7.1(A), 7.2(A,B,C,D,E), 7.3(C), 7.4(A), 8.1(A), 8.2(A,B,C,D,E), 8.3(C), 8.4(A),

**Time:** 45 minutes for first lesson; 10 minutes per day over one week or more.

**Materials:** One home meter reading worksheet per student, one sample sheet per group, teacher sheet on an overhead.

**Vocabulary:** kilowatts, meter, dials.



## Background Information:

Meter reading can be kind of tricky. It helps to remember these rules:

- The dials are like watch faces, but every other dial moves counter-clockwise.
- Always read the faces from left to right.
- Each of the dials represents a ones, tens, hundreds, thousands or ten-thousands column.
- If the pointer is between two numbers, always record the number it has just passed (this is the smaller number, except when passing from 9 to 0: the 0 represents 10 in this case).
- If the pointer seems to be pointing directly at the number, refer to the dial to the right. If the hand on the dial to the right has recently passed zero, then you should put down the number that the other hand seems to be pointing at. If the dial on the right has not passed zero, put down the next lower number. (Meter needles are not always positioned precisely; they may appear to have reached a number before it is appropriate.)

Note: Some meters are marked with a x10 or x20. These meter readings should be multiplied by 10 and 20 respectively.

### Setting the Stage:

Show the students a sample energy bill and show the students how to read it. Ask them how a clock's hands move. Ask if anyone knows where the meters are at their home or if they have ever seen meters in public.

### Activity 1: Sample Meters

Give each student a sample meter reading sheet and place the teacher meter sheet on the overhead. Teach the class how to read their meters, reviewing the rules from the background section with them. Draw pointers on your meters (or on a sheet placed over the overhead so you

can erase and change them). Assign groups of four to practice "round robin" style with one student doing a problem and the rest checking and comparing with him or her. The next student does the next problem and so on.

### Activity 2: Personal Meters-School and Home

Explain to the students how they will be checking their electricity meters at home daily for the next week. They will compute a total for kilowatt-hours of electricity if possible (some students may have only one). If possible, show the students the school's meters and have each student read one dial.

Each day in class take a few minutes to discuss any problems or questions the students have. At the end of the week, subtract the beginning numbers from the last numbers to find the amount of energy used in that student's home.

### Discussion:

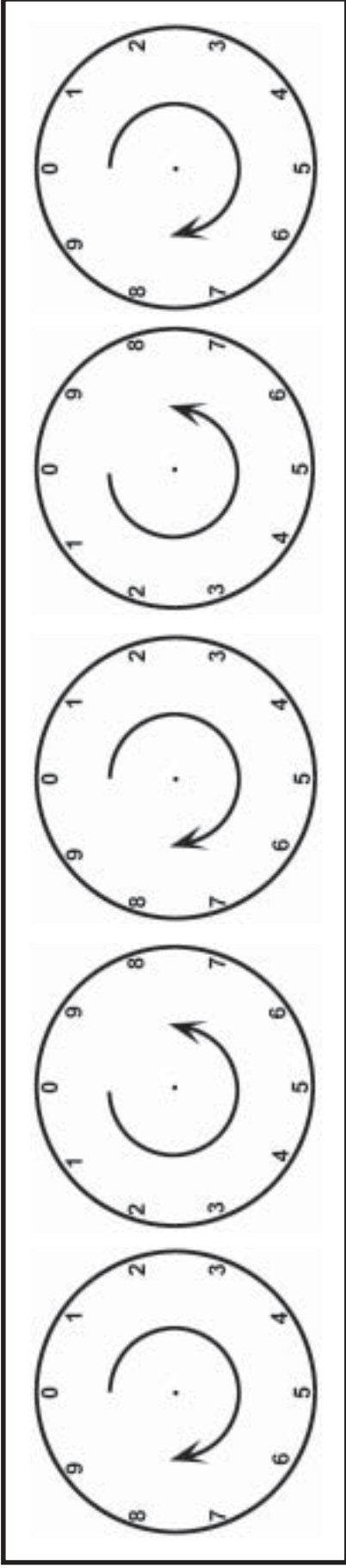
1. Does your family spend more money on gas or electricity?
2. Can you think of five ways to use less gas and electricity?
3. Where do your gas and electricity come from?
4. How much gas and electricity would the families in the whole class use in a week? A year?
5. How much gas and electricity would the families of the whole school use?

### Extensions:

1. Do a spelling bee activity with meter reading: set up a few dials on the board and change the arrows for each player.
2. Chart or graph a year's worth of your own energy bills and present them to your class. Discuss with the students the possible reasons for the fluctuations.



4: Knowledge is Power



# Sample Meter Reading Worksheet



1. \_\_\_\_\_



2. \_\_\_\_\_



3. \_\_\_\_\_



4. \_\_\_\_\_



5. \_\_\_\_\_



Student Name: \_\_\_\_\_ Date: \_\_\_\_\_

### Home Meter Reading

Read your home electric meter each day at about the same time for one week. At the end of the week subtract the day 1 numbers from day 5 numbers to find out how much electricity you used in one week.



1. \_\_\_\_\_



2. \_\_\_\_\_



3. \_\_\_\_\_



4. \_\_\_\_\_



5. \_\_\_\_\_



\_\_\_\_\_ kilowatt hours  
used in one week

# Secret Mission Behind Power Lines: Watt Watchers Survey

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**Grade Level:** K-8

**Lesson Overview:** Students will survey their school for energy waste or savings to determine if being Watt Watchers will save energy and money for their school. This activity can be modified for any age or ability group.

## TEKS

**Math:** K.14(A), K.15, 1.9(A,B), 1.11(A), 1.12(A), 1.13, 2.12(A), 2.13(A), 2.14, 3.15(A), 3.16(A), 4.14(A), 5.14(A), 6.10(D), 6.11(A), 7.11(A,B), 7.13(A), 8.14(A)

**Science:** K.2(A,B,C,D,E), K.3(A,B,C), 1.2(A,B,C,D,E), 1.3(A,B,C), 2.2(A,B,C,D,E), 2.3(A,B,C), 2.10(B), 3.2(B,C,D), 4.2(B,C,D), 5.2(B,C,D), 6.2(B,C,D), 6.4(B), 7.2(B,C,D), 7.4(B), 7.14(C), 8.2(B,C,D), 8.4(B)

**Social Studies:** K.13(A,B), K.14(A,B), K.15(C), K.16(A), K.17(A), 1.16(A,B,C), 1.17(C), 1.18(A,B), 2.7(A,B), 2.8(A,C,D), 2.16(B), 3.4(A), 3.16(E), 3.17(D), 4.9(A,B,C), 4.21(A,B,C), 4.22(C), 5.9(A,B,C), 5.13(A), 5.24(C,D,E), 5.25(C), 6.6(B), 6.7(C), 6.9(B), 6.20(C), 6.21(C), 7.20(C,D), 7.21(C), 8.30(C)



**ELA:** K.2(A), K.4(A,B), K.15(C), K.16(A,B), 1.4(A,B), 1.15(C), 1.18(C), 1.23(A,B), 2.4(A), 2.14(A), 2.20(A,B), 3.20(A,B), 4.21(A,B,D), 5.21(A,B,D), 6.20(A,B,D), 7.20(A,B,D), 8.13(G,H,A)

**Time:** 1 week or 15 minutes twice daily all year

**Materials:** check sheets, pencils; also helpful are clipboards or other writing surfaces and a map of the school

**Vocabulary:** check sheet, tally, survey, waste, efficiency, energy

## Background Information:

Survey your school to see if the Watt Watchers program will save your school money. Use the Watt Watchers check sheet to tally the empty classrooms at your school with the lights on. By patrolling the halls of your school you can see just how much energy is going to waste. You can also see if the teachers are saving energy and using equipment efficiently or if they could improve their habits and save energy and money.

Don't tell anyone outside your class what you are doing. Your operation must be completely unknown to anyone outside your class. Make sure that everyone in the class understands that the idea is to check up on everyone's habits as they are now – before they know what you know. That is, turning out the lights in one empty classroom two hours each day saves \$50 over a 180- day school year.

So your job is to go quietly through the hallways without causing anyone to wonder just what you are up to. By quietly checking for wasted energy without fanfare, you can find out just how important it is to turn off lights and computer monitors when they are not needed. The best times to check are when classrooms are likely to be empty: before school, recess, lunch periods and after school. Keep a record of the number of empty classrooms you find and add them up at the end of one week. What would the savings be if you started a WW program and changed these teacher's habits?

### Activity: Watt Watcher Survey

Checking for energy waste in your school is very simple. All you need is your Check Sheet, a pencil and a few quiet students.

1. Take your materials and start your energy patrol. Your mission is to go to every classroom in the school and check to see if energy is being saved or wasted.
2. When you come to a classroom where energy is being used because there is a class in the room, you put a check on your check sheet.

3. When you come to a classroom Where energy is being used but there is no one in the room, then energy is being wasted. Put an X on your check sheet.
4. When you come to a classroom Where energy is not being used and there is no one in the room, then energy is being saved. Put a 0 on your check sheet.
5. After you have patrolled for a week you can give an award to the teacher who saved the most energy. You can find a copy of the Zero Hero Award at our website.

### Discussion:

Ask the students ways to:

1. Inform each teacher of their energy use habits.
2. Educate the students about energy conservation.
3. Remind students and teachers why energy conservation is important.

### Extension:

Continue your survey throughout the year through the Watt Watcher program. Call 1-888-USWATTS or email us at [info@wattwatchers.org](mailto:info@wattwatchers.org) for more information and to order a FREE kit full of materials to help you and your students.

### Resources:

- [www.wattwatchers.org](http://www.wattwatchers.org) - The Watt Watchers website has an enormous amount of information that will help you adapt this lesson. If you decide that you want to start a full Watt Watchers program in your school, log on to the website, click on the enrollment form, and we will send you a FREE kit!





# Texas Public Transit and You

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**Grade Level:** 5-8

**Objective:** The students will discover statistics about public transit and discuss reasons behind those statistics.

**TEKS:**

**Math:** 5.3(A,C), 5.14(A,B,D), 5.16(A,B), 6.2(C,D), 6.11(A,B,D), 7.1(B), 7.2(A,B), 7.13(A,B,D), 8.14(A,B,D),

**Science:** 5.2(A,B,C,D), 5.3(A,B,C), 6.2(A,B,C,D), 6.3(A,B,C), 7.2(A,B,C,D), 7.3(A,B,C), 8.2(A,B,C,D), 8.3(A,B,C)

**Social Studies:** 5.8(D), 5.14(E), 5.25(A,B,C,D,F), 5.26(A,C,D), 6.5(A), 6.21(A,B,C,D,F), 6.22(A,C,D), 7.21(A,B,C,D,H), 7.22(A,B,D), 8.30(A,B,C,D,H), 8.31(A,B,D)

**ELA:** 5.1(A,B,C), 5.4(A), 5.5(B,F), 5.13(A,B,C,D,E,G,H), 6.1(A,B,C), 6.4(A), 6.5(B,F), 6.13(A,B,C,D,E,G,H), 7.1(A,B,C), 7.4(A), 7.5(B,F), 7.13(A,B,C,D,E,G,H), 8.1(A,B,C), 8.4(A), 8.5(B,F), 8.13(A,B,C,D,E,G,H),

**Time:** One class period

**Materials:** one worksheet per student, one Texas map per group, and literature about each town

**Vocabulary:** ridership, public transit, rank



## Background Information:

Ridership is defined as the number of people that ride public transit in a day. Large cities spend lots of dollars and hours to determine ways to increase ridership. Houston and Dallas have put in mass transit trains to better serve their populations. Corpus Christi has increased the areas and neighborhoods the bus goes to and streamlined the use of special service busses. These services are very important to the populations that currently use public transit and will be useful to more residents as the cities grow and traffic becomes heavier.

The following information was put together by visiting the websites of each city's public transit system and/or from speaking to the transportation director in some of the smaller towns. If your area has a public transit system, call the transportation director of your city and add the information to the chart.

## Setting the Stage:

Ask the students how many have ridden on public transportation (not a school bus). Have them describe where, why and how they felt.

## Activity 1:

Make a photocopy of the chart worksheet for each student. Have them fill in the percent column by dividing the total population into the number of riders each day. Have them rank the cities based on their ridership numbers. Which ones have the most riders, which has the least, which ones have the largest percentage of their population using public transit, etc.

City Name	Rank in size Nationally	Population of City	Number of Riders Each Day	% of the population riding public transit
Houston	4	1,953,631	323,287	16.5%
Dallas	8	1,188,580	258,630	21.7%
Austin	16	656,562	130,000	19.8%
San Antonio	9	1,144,646	113,714	9.9%
Corpus Christi	59	277,454	19,000	6.8%
El Paso	22	563,662	35,616	6.3%
Galveston	504	57,247	3,141	5.4%



## Activity 2:

Make a graphic organizer with three columns. In the first column have the students list things they know about each city. Have them work in groups to fill in this column. It can be a bulleted list or a train-of-thought random listing. The next column is things the students want to know about the cities. This would be a good time to have the students share some of the categories of information they have come up with (Austin has several colleges, or Austin is the home of The University of Texas). You could also give examples such as, size, lay-out, colleges, type of jobs there, activities in that town, etc. Then give each group a Texas map and some literature about the cities that they can draw more information from. Place this information in the third column, things they learned about the cities. This is a modified KWL approach. A sample KWL chart is included for you.

Switch groups and have each child share with the new group. Armed with data and facts about each city, have the students discuss why some cities have better ridership than others and how to increase the ridership in a city. Complete the worksheet.

## Discussion:

Who rides the bus? What factors make it easier for people to ride public transit in some cities? How can a city increase ridership?

## Extensions:

Write a plan for starting (or increasing) ridership in your town. List major pick-up and drop-off locations and reasons why your town should have public transit. Write a letter to your mayor explaining the project and include a copy of your proposed ridership plan.

## Resources:

[http://www.apta.com/links/state\\_local/tx.cfm](http://www.apta.com/links/state_local/tx.cfm)  
Texas transit links to all cities  
<http://www.demographia.com/db-usc98.htm> data on city size  
[www.capmetro.org](http://www.capmetro.org) Austin  
[www.DART.org](http://www.DART.org) Dallas  
[www.elpasotexas.gov/sunmetro/sunasm.asp](http://www.elpasotexas.gov/sunmetro/sunasm.asp)  
El Paso  
[www.hou-metro.harris.tx.us](http://www.hou-metro.harris.tx.us) Houston  
[www.viainfo.net](http://www.viainfo.net) San Antonio

What I Know Map (or KWL)		
Topic		
What I Know...	What I want to know	What I learned



Student Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Busses, Population, and You

Fill in the missing squares by dividing the number of riders each day by the population of that city.

City Name	Rank in size Nationally	Population of City	Number of Riders Each Day	% of the population riding public transit
Houston	4	1,953,631	323,287	
Dallas	8	1,188,580	258,630	
Austin	16	656,562	130,000	
San Antonio	9	1,144,646	113,714	
Corpus Christi	59	277,454	19,000	
El Paso	22	563,662	35,616	
Galveston	504	57,247	3,141	

Answer the following questions using the chart above.

1. Which city has the most riders? \_\_\_\_\_
2. Which city has the least riders? \_\_\_\_\_
3. Which city has the largest percentage of the population riding public transit?  
\_\_\_\_\_
4. Which city has the least percentage? \_\_\_\_\_
5. Which city is closest to you? \_\_\_\_\_



What do you know about these cities? List all the things you know about each city after its name.

Austin: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Corpus Christi: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Dallas: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

El Paso: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Galveston: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Houston: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

San Antonio: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

1. Who rides public transit? \_\_\_\_\_  
\_\_\_\_\_

2. What factors make it easier for someone to ride public transit? \_\_\_\_\_  
\_\_\_\_\_

3. Which city has best ridership and why? \_\_\_\_\_  
\_\_\_\_\_

4. What about that city is different than the others? \_\_\_\_\_  
\_\_\_\_\_

5. How could you increase the ridership in the city with the lowest percentage? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



# The Pay Me Game

Grade Level: 3 - 6

**Lesson Overview:** Students will use play money to understand the dollar cost of their energy habits.

**TEKS:**

**Math:** 3.1(C), 3.15(A,D), 4.3(A), 4.14(A,B), 5.3(A), 5.14 (A), 6.11(A)

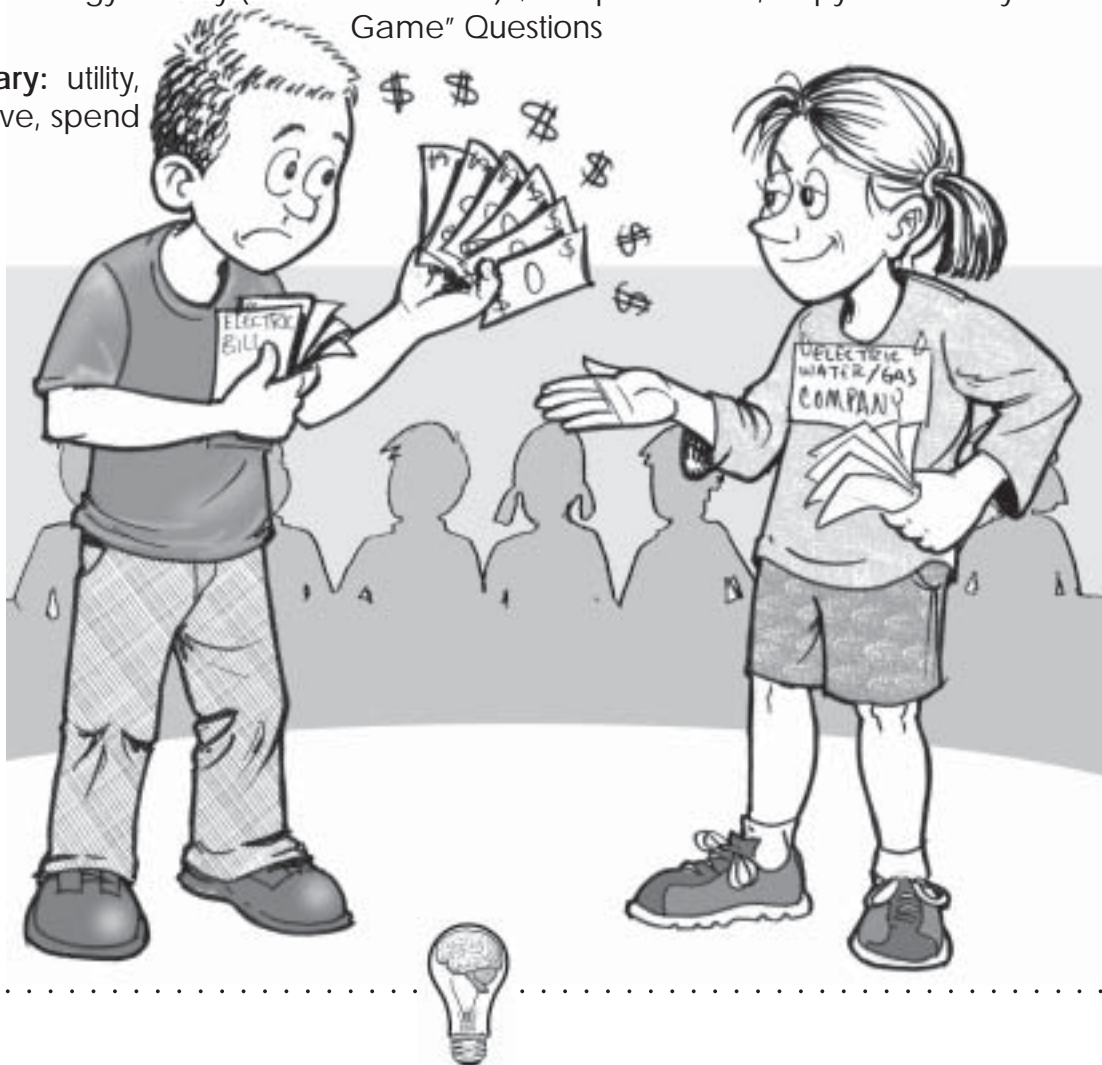
**Science:** 3.3(C), 4.3(C), 5.3(C), 6.3(C)

**Social Studies:** 3.6(A,B), 3.8(B), 5.13(A,B)

**Time:** 20-30 minutes

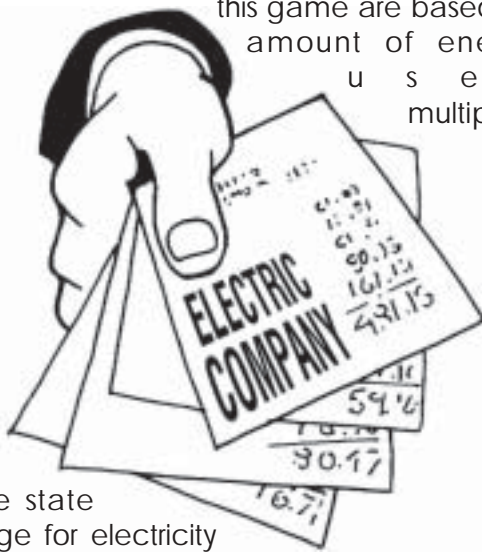
**Materials:** 2 envelopes, 1 marked "me" and 1 marked "utility" for each student, play energy money (see master sheet) \$100 per student, copy of "The Pay Me Game" Questions

**Vocabulary:** utility, save, spend



# Background Information:

Students have a hard time understanding how much energy they are using if it is not tied to dollar amounts. They know how much a candy bar, a pair of shoes or a movie ticket costs. In this lesson they will use play energy money to learn some of the dollar amounts attached to a shower, the refrigerator or their pool. The dollar amounts for this game are based on amount of energy used multiplied



by the state average for electricity costs.

## Activity 1: The Pay Me Game

1. Photocopy and cut out enough money sheets for each student to have \$100, made up of 20 \$1's, 10 \$5's, and 3 \$10's. Copying on green paper and laminating is a good idea if you are working with more than one class of students.
2. Give each student one: "me" envelope and one "utility" envelope.
3. Tell students that they have just gotten paid \$100, and whatever they and their family don't spend on energy at home, they can use to buy things they want. Read each question to the group. Depending on their answer, the students will put the required amount of money in either their "me" envelope or in their "utility" envelope. If a student runs out of money before the end of the game he may borrow from his "me" envelope to pay the "utility bill."
4. At the end of the game, students discard any

money that is still in their hand. Count the money in each envelope to show the students how much their energy habits are costing them.

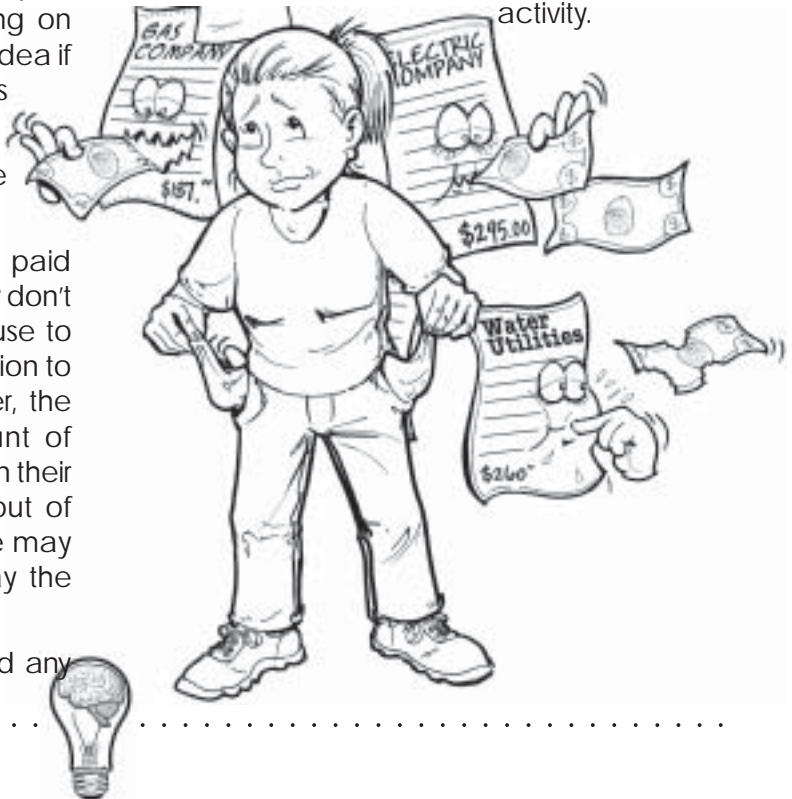
Note: you may want to delete questions or change them depending on students in your area. If you know no one has a pool at home you may want to omit that question, however if you do ask it, the students will see how much they are saving by not having a pool.

## Discussion:

How much the student learns from this depends on you. If you quickly discuss the "why's" of the questions with the students they will have a better understanding of how to change their energy practices. Stress to the students that this is a game for them to see how much extra energy they really use. So it is best if they answer the questions honestly. If this was real money, and students could use any money that they could save, what would they do?

## Extension:

Utility companies produce good pamphlets with energy saving tips. You could get copies for your students to take home as a follow - up to this activity.



# THE PAY ME GAME

**Question:** Have your parents ever heated the kitchen with the stove or oven?

**Yes:** pay UTILITY \$10

**No:** pay ME envelope \$10

(If you ever see someone doing this you should tell them that is dangerous, expensive and doesn't work very well.)

**Question:** Do you use a portable electric heater in the winter?

**Yes:** pay ME \$30

**No:** pay UTILITY \$10

(In general, portable heaters are one of the least efficient heating sources. If you're the only one that is cold, consider putting on an extra sweater or socks instead of using the heater to warm up your room.)

**Question:** Do you have air conditioning for your entire house?

**Yes:** pay UTILITY \$45

(A midsize air conditioner costs about 16 cents an hour to operate. You can save money on refrigerated air conditioning if you keep windows and doors closed during the heat of the day. At night you can turn off the air conditioner, open the doors and windows and turn on fans to get cool outdoor air into the house. Be sure to close the house back up before it gets warm the following day.)

**Question:** Do you have a window air conditioner for one room?

**Yes:** pay UTILITY \$20

**No:** pay ME \$20

(Cooling only one room or area of your house costs much less than cooling the entire house. Keep the doors closed to unused rooms.)

**Question:** In the summer are the drapes or blinds in your home closed to keep out the heat?

**Yes:** Pay ME \$10

**No:** pay UTILITY \$5

(Closing drapes and putting up shades keeps the sun and warm air from getting into your house, which keeps your house much cooler. Students will probably be familiar with how light coming through a window can heat up a car on a hot day. A house with direct sunlight coming in heats up the same way.)

**Question:** Do you take baths in the bathtub?

**Yes:** pay UTILITY \$6

(A bath takes at least 15 gallons of hot water, that's at least 10 cents per bath. In a month that's \$3 per person)

**Question:** Do you take showers that are less than 5 minutes long?

**Yes:** pay ME \$5

(A shower that is less than 5 minutes will use less than 6 cents of hot water.)

**Question:** How many members of your family take showers that are more than 5 minutes long?

**Yes:** pay UTILITY \$5 for each person in your family who does this.

**Question:** Do you use a hair dryer?

**Yes:** pay UTILITY \$3

**No:** pay ME \$3

(It costs about 8 cents every time you use a hair dryer.)

**Question:** Do you always turn off the lights every time you leave a room?

**Yes:** pay ME \$5

**No:** pay UTILITY \$5

(An average electric bill for lights alone is \$9 a month.)



**Question:** Are your clothes dried in a clothes dryer?

**Yes:** pay UTILITY \$13

**No:** pay ME \$13

(It costs about 80 cents an hour to operate. This can get very expensive after a few loads of clothes. Cleaning the filters after each load is dried and drying one load after another so the drum doesn't have to be reheated for each load will save money.)

**Question:** Do you have an electric blanket?

**Yes:** pay UTILITY \$2

**No:** pay ME \$2

(Electric blankets cost about 8 cents a night or \$2.40 a month per person. Using warm pajamas and blankets saves the most energy. But if your room is still too cold at night it costs less to use an electric blanket than it does to heat up the whole room.)

**Question:** Do you sleep in a waterbed?

**Yes:** Pay UTILITY \$20

(Keep the waterbed below 85 degrees and keep the mattress covered at all times to save money. There are special electric blankets that you can put on top of your waterbed which keeps you warm without having to heat up all the water. These electric blankets can save a lot of money.)

**Question:** Do you have an electric clock?

**Yes:** pay UTILITY \$1

**No:** pay ME \$1

(A wind-up clock doesn't use electricity.)

**Question:** Do you listen to the radio or watch a VCR?

**Yes:** pay UTILITY \$2

**No:** pay ME \$1

(It costs the average household about \$2.30 a month to use these.)

**Question:** Do you play video games?

**Yes:** pay UTILITY \$4

**No:** pay ME \$2

(Even though most video games are electronic and use a small amount of electricity, usually they are played for many hours and the electricity adds up.)

**Question:** Does your freezer have an ice maker?

**Yes:** pay UTILITY \$3

(It is cheaper to make ice cubes with ice trays in your freezer.)

**Question:** Do you wash and dry your dishes in the dishwasher?

**Yes:** pay UTILITY \$5

**No:** pay ME \$5

**Question:** Do you open the door to the dishwasher to let your dishes air dry instead of using the heat cycle?

**Yes:** Pay ME \$2

**No:** pay UTILITY \$2

**Question:** Do you use an electric can opener?

**Yes:** pay UTILITY \$1

**No:** pay ME \$1

(A good hand-operated opener works well for most people.)

**Question:** Do you have more than one refrigerator or freezer at your house?

**Yes:** pay UTILITY \$12 for every extra refrigerator or freezer

(Each extra refrigerator costs about \$12 a month; that's \$144 a year)

**Question:** Do you make food decisions with the refrigerator door open?

**Yes:** pay UTILITY \$4 for each person who does this

**No:** pay ME \$5

(It costs about 3 cents every time the door is opened.)

**Question:** Do you have a swimming pool?

**Yes:** pay UTILITY \$20

(Pools are expensive to operate, especially if you heat them. The pool filter alone costs about 10 cents an hour to operate.)









# Utility Bill Organizer

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**Grade Level:** 3-8

**Lesson Overview:** Students will learn about the cost of utilities at home. Students will find out information about where their home energy comes from and make a comparison of cost and use.

**TEKS:**

**Math:** 3.3(B), 3.14(A,B,C), 3.15(A), 3.16(A,B), 4.13(C), 4.14(A), 4.15(A,B), 5.5(B), 5.9, 5.13(A,B,C), 5.14(A), 5.15(A,B), 6.4(A), 6.7, 6.10(A,C,D), 6.11(A), 6.12(A), 7.4(B), 7.7(A,B), 7.13(A), 8.4, 8.5(A), 8.12(C), 8.14(A)

**Science:** 3.2(E), 3.3(B), 4.2(E), 4.3(B), 5.2(E), 5.3(B), 6.2(E), 6.3(B), 6.9(B,C), 7.2(E), 7.3(B), 8.2(E), 8.3(B),

**Social studies:** 3.7(A,B,C), 3.8(B,C), 3.16(E), 3.17(B), 4.5(A), 4.14(B), 4.22(C,D), 4.23(D), 5.13(A), 5.25(C,D), 5.26(D), 6.9(A,B), 6.21(C,D), 6.22(D), 7.20(D), 7.21(A,B,C,D,E,F,G), 7.22(C,D), 8.30(A,B,C,D,E,F,G), 8.31(C,D)

**Art:** 3.2(A,B,C), 4.2(A,B,C), 5.2(A,C), 6.2(A,C), 7.2(A,C), 8.2(A,C)

**Time:** Activity 1, 30-50 minutes; Activity 2, 30 minutes per day over a week

**Materials:** 1 sheet cardstock per student, graph paper, old magazines for collage artwork, glue sticks, promotional materials for utilities in your area

**Vocabulary:** utility, bill, organize, kWh, power generation



# Background Information:

We use energy for everything and could not make it through a single day without it. But we rarely even think about how much we use, what kinds of energy there are, the cost, or the pollution consequences. The place to start is by adding up our own household energy use and comparing it to the national average.

A simple utility organizer will help show what sources of power you are using to produce your electricity, the cost of natural gas over time and how much energy you are using.

Household and transportation energy costs are over \$2,500 per year for an average American family. The average American family spends \$1,338 on household energy or \$111.50 per month, and spends \$1,234 for vehicle fuel expenditures per household for an average of 572 gallons of gasoline per vehicle.

## Setting the Stage:

Ask students to find pictures of items that represent energy. Have some students explain their choices. Ask if any students know the name of the company their energy comes from. Ask if any know the source of the power generation that makes up that energy.

## Activity 1: Utility Organizer-Collage

Have students find pictures in magazines that represent energy use to them. It could be pictures of appliances, electric wires, light bulbs, waterfalls, pollution, etc. Students then glue their pictures to both sides of the cardstock forming a collage. Allow to dry over night before continuing.

## Activity 2: Utility Organizer-Information

Give students packets of information from the electricity companies that they may be using at home. This information can be found on the Electricity Facts Label for each utility. The Texas Power to Choose website, <http://www.powertochoose.org/partners/index.htm>, allows you to put your local zip code in and will provide you with the companies and fact

labels for your area. Have your students find the resources used to generate power for their chosen electric company (hopefully the one they use at home). Draw, and decorate a pie chart describing the resources used and attach this to the collage under the heading Electricity.

Make a line graph using natural gas prices over the last year. The Department of Energy website has average pricing for the state for the last few years listed, [http://www.eia.doe.gov/emeu/states/ngprices/ngprices\\_tx.html](http://www.eia.doe.gov/emeu/states/ngprices/ngprices_tx.html). Cut out the line graph (be sure all the axes are labeled and there is a title) and attach this to the collage under the heading Gas.

Create a bar graph to be filled out by the students each month based on their home energy use. This will allow the student to track the energy use in their own home. You may want to show them a filled out graph and have them discuss why peaks happen when they do. Attach this to the collage under the heading My Energy Use.

## Discussion:

1. What do the peaks in the natural gas prices signify? What can you do during those times to lower your total bill?
2. Why do you have a choice in electric companies? Why should you?
3. What differences were found in the resources used to generate power?
4. Which company would you chose and why if given the chance?

## Extension:

Invite a representative from a local utility to come speak about the power used to generate electricity in your area. Write a persuasive letter to your parents explaining why they should change (or keep) the electric company they have.

## Resources:

<http://www.powertochoose.org/partners/index.htm>

[http://www.eia.doe.gov/emeu/states/ngprices/ngprices\\_tx.html](http://www.eia.doe.gov/emeu/states/ngprices/ngprices_tx.html)



# What's Your Mode?

Grade Level: 6-8

**Objective:** Students will calculate fuel mileage of a family car and a school bus to determine which is a more efficient way to get to school.

**TEKS:**

**Math:** 6.2(A,B,C,D), 6.3(A,B,C), 6.8(A,B,D), 6.10(D), 6.11(A,B), 6.12(A,B), 7.1(B), 7.2(A,B,D), 7.3(A,B), 7.13(A,B,D), 7.14(A), 8.1(A,B), 8.2(A,B,C), 8.14(A,B,D), 8.15(A,B)

**Science:** 6.2(A,B,C,D,E), 6.3(A,C,D), 6.4(A,B), 7.2(A,B,C,D,E), 7.3(A,C,D), 7.4(A,B), 8.2(A,B,C,D,E), 8.3(A,C,D), 8.4(A,B),

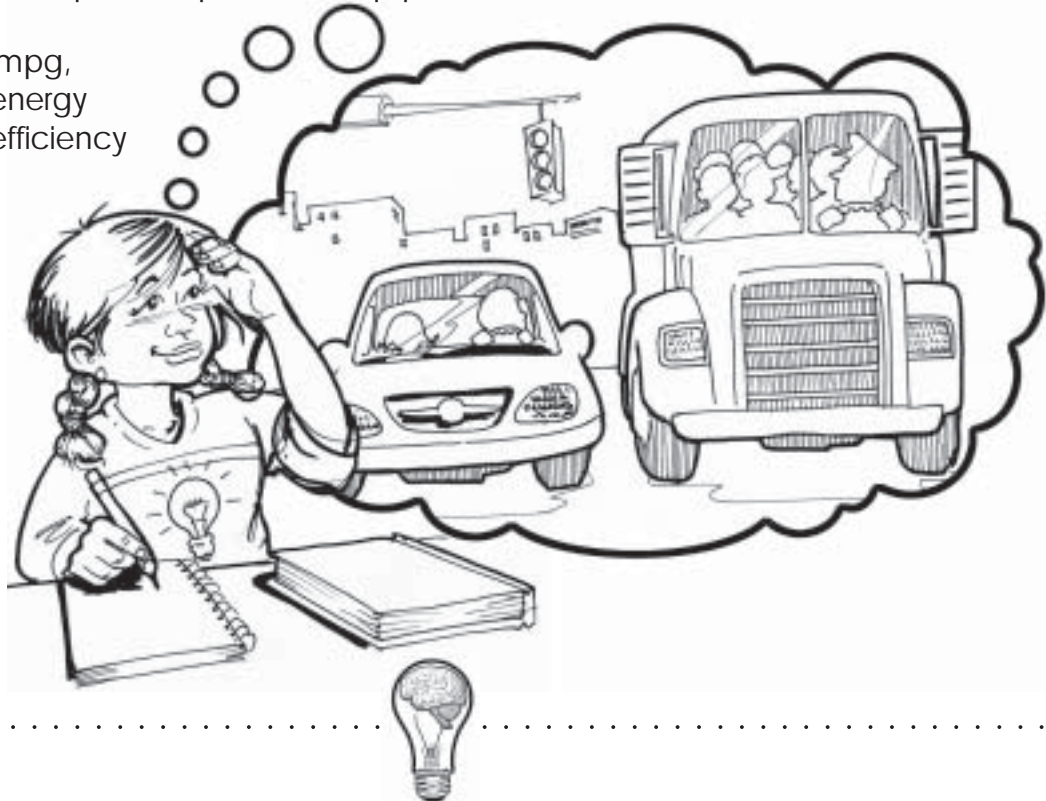
**Social Studies:** 6.3, 6.20(C), 6.21(A,B,C,D,F), 6.22(A,B,C), 6.23(A,B), 7.20(C,D,E,F), 7.21(A,B,C,E,H), 7.22(A,B,C,D), 7.23(A,B), 8.10(B), 8.30(A,B,C,E,H), 8.31(A,B,C,D), 8.32(A,B)

**ELA:** 6.1(A), 6.4(A), 6.15(A), 6.18(A), 7.1(A), 7.4(A), 7.15(A), 7.18(A), 8.1(A), 8.4(A), 8.15(A), 8.18(A)

**Time:** One to two class periods

**Materials:** 1 map of your area with a key per student, bus route maps showing number of students picked up, rulers, map pencils

**Vocabulary:** mpg,  
energy  
efficiency



## Background Information:

More students today ride to school with an adult or on the bus than ever before. This leads to fuel usage that previously was saved, as students were able and willing to walk to school. By calculating exactly what it costs for each child to get to school, better decisions can be made.

Bus costs vary greatly depending on what kind of busses you have. Contact your school's transportation department (bus barn) to find out what kind of busses your district uses, what type of fuel they use, the fuel cost (hopefully in gallons) and the mpg. Also ask if your school district participates in the adopt a bus system. More information on this program can be found in the resource section

## Setting the Stage:

Recruit a helper or two and greet each child upon entering the class with a sticker signifying how they got to school- green dots for walking/ riding a bike, blue dots for personal vehicle, yellow dots for school bus. At the start of class have the students group themselves by colored dot and discuss why they come to school the way they do. Have a few share their thoughts with the class.

## Activity1: Mapping

Give each personal vehicle and walking/riding student a map of the area and have him or her trace his or her route to school. Give each bus riding student a map of the area and a bus route list (something with the addresses/ corners where a particular bus stops along with information on how many students ride that bus). Have the students plot the bus route and color it with a light colored map pencil. Then have each student examine the route they take and see if it is the most efficient route that could be taken. Color the route they choose with a darker color map pencil. Have the student determine the distance to school in miles using the key and a ruler. When finding miles driven for the bus, don't forget the miles back to the bus barn, and when finding miles driven by personal vehicles, you have to double the trip- that person has to get home.

**PERSONAL VEHICLE:** Record this distance for a day/ week (multiply by 5); / month (multiply

by 20); and a school year (multiply by 180). Determine fuel used for each of those distances using some general statistics or the actual fuel mileage of the parent's vehicle. Have students share their original distance information with others who do not get to school by personal vehicle.

**BUS:** Determine mileage for the day/ week/ month and school year using information from your bus barn. Then determine the gallons of fuel used for the same time frames. Have students share their original distance information with others who do not get to school by bus.

**TOTALS:** Divide the gallons of fuel used by the number of students riding that mode of transportation. For example, if there were two students in personal vehicle we would divide the total fuel usage by 2. If there were 30 kids on the bus, we would divide the bus's total fuel usage by 30. Now use the average daily price of gasoline in your area and the fuel costs you received from your transportation department, to determine how much it cost those students to get to school.

Remember that this information is only for getting to school.

## Discussion:

What is the most energy efficient way to get to school? How can you make riding the school bus to school more efficient? (Change of route, fewer stops, more kids, new busses, busses that run on alternative fuels, etc.)How can you make riding in a personal vehicle to school more efficient? (Change of route, more kids, etc)

How can we encourage more students to get to school without using a fuel-powered vehicle (riding bike, walking)

## Extensions:

Have your transportation department manager speak to the students on how routes are chosen. Have the students show him or her the routes they choose and have them explain the thinking behind them.

## Resources:

<http://www.fueleconomy.gov/> information of fuel efficiency of many vehicles.  
[www.adopt-a-schoolbus.org](http://www.adopt-a-schoolbus.org)



# What's My Mode?

## Personal Vehicle

How many students were in the car? \_\_\_\_\_

Distance driven to school and back each day: \_\_\_\_\_

Distance driven to school and back each week: \_\_\_\_\_

Distance driven to school and back each month: \_\_\_\_\_

Distance driven to school and back each school year: \_\_\_\_\_

Amount of fuel used each day: \_\_\_\_\_

Amount of fuel used each week: \_\_\_\_\_

Amount of fuel used each month: \_\_\_\_\_

Amount of fuel used each school year: \_\_\_\_\_

## School Bus

How many students ride this bus? \_\_\_\_\_

Distance driven (round trip) to school and on to the bus barn each day: \_\_\_\_\_

Distance driven to school and on to the bus barn each week: \_\_\_\_\_

Distance driven to school and on to the bus barn each month: \_\_\_\_\_

Distance driven to school and on to the bus barn each school year: \_\_\_\_\_

Amount of fuel used each day: \_\_\_\_\_

Amount of fuel used each week: \_\_\_\_\_

Amount of fuel used each month: \_\_\_\_\_

Amount of fuel used each school year: \_\_\_\_\_

## TOTALS

### Personal vehicle

How much fuel was used per student riding to school in a personal vehicle? \_\_\_\_\_

How much would that fuel cost? \_\_\_\_\_

### School bus

How much fuel was used per student riding to school on the bus? \_\_\_\_\_

How much would that fuel cost? \_\_\_\_\_

What is the most energy efficient way to get to school?

How can you make riding the school bus more efficient?

How can you make riding in a personal vehicle more efficient?



# Who's Who in Electricity?

**Grade Level:** 4-8

**Objective:** The student will connect the contributions of scientists in the field of electricity to the concepts learned in class.

**TEKS:**

**Technology Applications:** 4.4(A,B), 4.5(A,B), 4.6(A,B,C), 5.4(A,B), 5.5(A,B), 5.6(A,B,C), 6.4(A,B), 6.5(A,B,C), 6.6(A,B,C), 7.4(A,B), 7.5(A,B,C), 7.6(A,B,C), 8.4(A,B), 8.5(A,B,C), 8.6(A,B,C)

**Science:** 4.3(E), 5.3(E), 6.3(E), 7.3(E), 8.3(E),

**Social Studies:** 4.6(A,B), 4.21(A,B), 4.22(A,B,C,F), 4.23(A,D,E), 5.5.5(A), 5.24(A,B,D), 5.25(A,B,C,F), 5.26(A,D,E), 6.20(A), 6.21(A,B,C,F), 6.22(A,D,E), 7.20(C,D), 7.21(A,B,C,H), 7.22(A,B,C,D), 8.29(A,B), 8.30(A,B,C,H), 8.31(A,B,C,D)

**ELA:** 4.4(A), 4.5(A,B), 4.13(A,B,C,D,E,F), 4.14(A), 4.15(A,C), 4.21(A,B,C,D,E), 4.25(A), 5.4(A), 5.5(A,B), 5.13(A,B,C,D,E,F), 5.14(A), 5.15(A,C), 5.21(A,B,C,D,E), 5.25(A), 6.4(A), 6.5(A,B), 6.13(A,B,C,D,E,F), 6.14(A), 6.15(A,C), 6.21(A,B,C,D,E), 6.25(A), 7.4(A), 7.5(A,B), 7.13(A,B,C,D,E,F), 7.14(A), 7.15(A,C), 7.21(A,B,C,D,E), 7.25(A), 8.4(A), 8.5(A,B), 8.13(A,B,C,D,E,F), 8.14(A), 8.15(A,C), 8.21(A,B,C,D,E), 8.25(A)

**Time:** One class period for research, one class period for the rest of the project

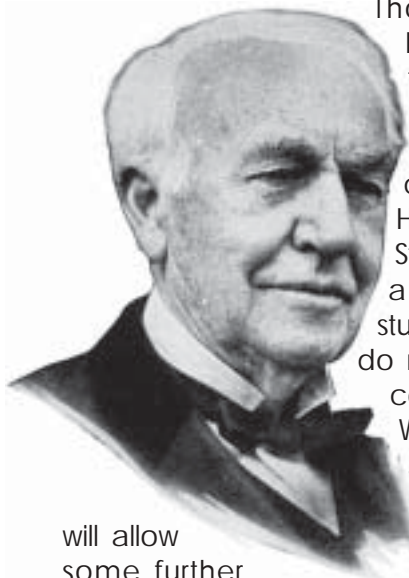
**Materials:** one sheet computer paper per student, scissors, map pencils, computer access, or research materials

**Vocabulary:** scientist, contribution



## Background Information:

All students know about the contributions of Thomas Edison and Benjamin Franklin to the study of electricity. What about the contributions of Louis Howard Latimer? Students use watt, volt, and amp when studying electricity, but do not know about the contributions of James Watt, Alessandro Volta and Andre'-Marie Ampere. This lesson will allow some further research into the people that contributed to the field of electricity.



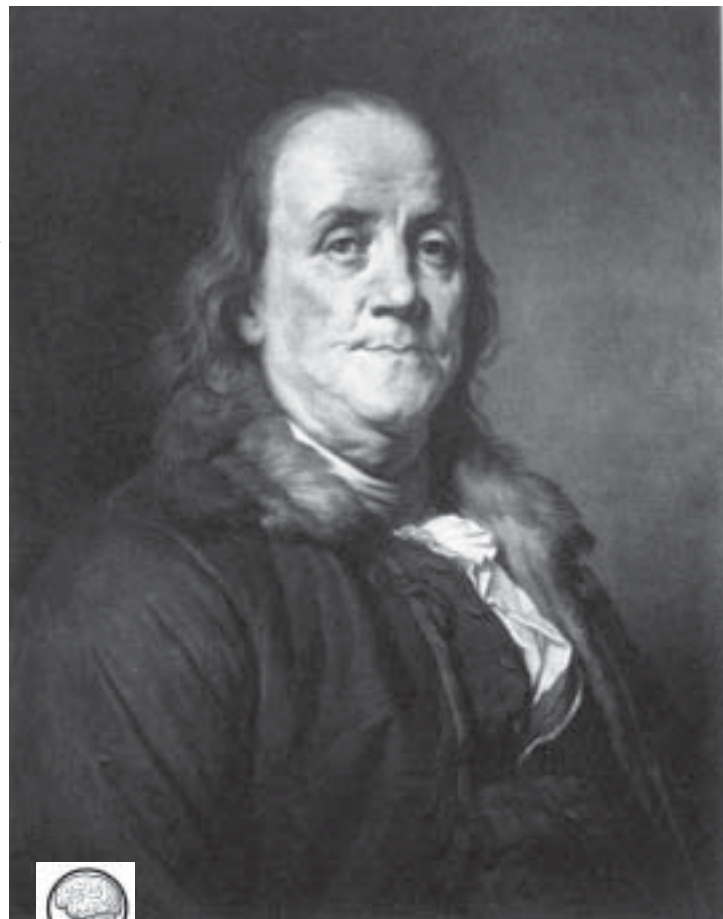
## Activity 1: Who's Who Research

Research the people that were instrumental in discovering and refining electricity. Using books, websites, and encyclopedias, find out the who, what, when and where of some of these scientists. If you are unable to use a computer lab or a library for your research, print the biographies and extra pictures for your students prior to class.

Some of the information you may want your students to find in their research may include: date of birth, place of birth, date of death, cause of death, education, obstacles in receiving an education, economic background, physical or learning abilities, prejudice or persecution due to gender, religion, race, or philosophical beliefs, major contributions, awards won, other interesting facts or stories

## Setting the Stage:

Gather some biographies of people you plan to study and find pictures of these scientists. Show the students a picture of Benjamin Franklin and ask the students who it is and what his contribution to science is. Do this again with Thomas Edison. Then continue with some of the more obscure people on the list. When the students cannot tell you who it is, or what he/she contributed, do not tell them the answer. Tell them, "That is what we are going to find out today."



The following is a list of scientists who were instrumental in the field of electricity:

- Andre'-Marie Ampere
- Amadeo Avogadro
- Niels Bohr
- Charles de Coulomb
- Thomas Edison
- Michael Faraday
- Benjamin Franklin
- William Gilbert
- Joseph Henry
- Heinrich Hertz
- James Joule
- Louis Howard Latimer
- James Clerk Maxwell
- Samuel Finley Morse
- Leopold Nobili
- Hans Christian Oersted
- Georg Ohm
- Charles Parson
- Gaston Plante'
- Joseph Priestly
- Charles Steinmetz
- Sir Joseph Wilson Swan
- Nikola Tesla
- Joseph Johnson Thomas
- Robert Van De Graff
- Alessandro Volta
- James Watt

## Activity 2: Who's Who Foldables

Hold a sheet of computer paper horizontally (landscape); fold both of the sides in so they meet in the center (shutter fold). Crease these folds. Fold the top half down to the bottom, crease the fold, then unfold. Cut crease in the center of the right and left flaps to the vertical crease. You now have a 5 ½ by 8 ½ inch sheet of paper with four flaps.

Label the flaps Who, What, When and Where. Have students find or draw pictures to place on the front of these flaps. Information about the scientists should be placed under the appropriate flap.





# Glossary

Word - Definition

- appliance** -A device or machine for performing a specific task.
- bill** - An itemized statement of goods or services
- blades** -A broad flat surface; found on turbines and windmills
- boiler** -A tank in which water is turned to steam for heating or power generation
- check sheet** -Form used during Watt Watchers of Texas patrols to record energy usage data
- coal** - A black combustible solid used to provide heat during power generation
- compact fluorescent bulb**- A type of fluorescent lamp which screws into a regular socket or plugs into a small light fixture, that uses less energy than a typical incandescent bulb
- conserve** - To keep from being lost, damaged or wasted; saved
- cost benefit analysis** - The process of weighing the total expected costs vs. the total expected benefits of one of more actions in order to choose the most profitable option.
- crisis** - A time of great danger whose outcome decides whether possible bad consequences will follow
- dial** - The face of a meter or gauge on which a pointer indicates an amount
- draft** - Breeze that occurs in a closed space. Air is leaking in from the outside causing the space to be less efficient.
- efficiency** - Ability to produce a desired effect or product with a minimum of effort, expense, or waste
- electric outlets** - Areas where appliances can be plugged in to receive electricity
- electricity** - An electric current supplied by a public utility for lighting or heating
- energy** - The capacity of a physical system doing work
- Energy Star** - A voluntary partnership with equipment manufacturers across a variety of industries to reduce the power consumption and the pollution associated with the use of electricity
- EZ Save** - A program for implementing monitor power management over a network using a server
- EZ Wizard** - A Department of Energy program that will enable power management on your workstation automatically
- fluorescent light** - A glass tube/bulb that is coated with a fluorescent substance that gives off light when the mercury vapor inside the tube is acted upon by a current
- gas** - The fluid form of a substance which can expand indefinitely (not a solid or a liquid)
- generator** - A machine for producing gas or steam
- high pressure steam** - Water is heated to create steam and is then forced against the blades of a turbine at high pressure to produce electricity
- incandescent** - Glowing with intense heat; shining brightly; a lamp in which the light is produced by a filament of conducting material contained in a vacuum and heated to incandescence by an electric current
- insulate** - To cover with a non-conductive material in order to prevent the passage or leakage of electricity or heat
- insulation** - Any material used to insulate
- kilowatts** - A unit of electrical power equal to 1000 watts



**kWh** - A unit of electrical energy or work equal to the power supplied by one kilowatt for one hour

**lifetime cost** - The cost of an appliance over the lifetime of the appliance

**meter** - An instrument for measuring and recording the quantity or rate of flow of gas, electricity or water

**mpg** - Miles per gallon; the number of miles a vehicle can drive using one gallon of gas

**oil** - Any of various kinds of greasy combustible substances obtained from mineral sources; petroleum

**organize** - To provide with structure

**periodic appliance** - An appliance that is used once in a while such as the washing machine or dishwasher

**plug sealer** - Used to insulate the opening around a switch or plug so that air cannot escape into the walls.

**power generation** - The process of creating electricity from an energy resource

**power management** - A process that allows monitors and computers to enter low power states when they are sitting idle

**psi** - Pounds per square inch; a unit of measure

**rate of return** - The quotient of the annual dollar savings divided by the system's total installed dollar cost. Expressed as a percent.

**save** - To preserve for future use; to avoid expense

**screen saver** - A program used on a monitor to protect the screen from burn in. No longer necessary with newer computers

**simple payback** - The quotient of the total installed cost divided by the first year's dollar savings of an appliance

**spend** - To use up, consume, exhaust or wear out

**strategy** - A plan or action

**survey** - A detailed inspection by gathering information through observations

**switch plate** - The cover over an electrical switch such as to turn on the lights

**tally** - An account or score

**temperature** - A measurement of hotness or coldness

**thermostat** - Apparatus for regulating temperature

**tire pressure gauge** - Apparatus used to measure the pressure inside a tire

**turbine** - An engine or motor having a drive shaft driven by the impulse of steam against the curved blades of a wheel

**under-inflated** - Not enough air inside an object

**utility** - A company providing services such as water, electricity or gas

**waste** - To use up or spend without real need

**windmill** - A mill operated by the winds rotation of large blades; used as a source of power



# Pass it on!

Do you know a teacher that would benefit from Watt Watchers? Encourage them to enroll. Every school should be a Watt Watchers school.



## ENROLLMENT FORM

Watt Watchers of Texas  
1-888-US WATTS (1-888-879-2887) Toll Free Phone & Fax  
P.O. Box 68660, El Paso, Texas 79968  
e-mail: [info@wattwatchers.org](mailto:info@wattwatchers.org)  
<http://wattwatchers.org>



(Please Print Clearly)

Your Name: \_\_\_\_\_

School Name: \_\_\_\_\_

School Address: \_\_\_\_\_

(Free kit will be shipped to your school – Street address preferred)

City: \_\_\_\_\_ Zip: \_\_\_\_\_ County: \_\_\_\_\_

School Phone: ( ) \_\_\_\_\_ - \_\_\_\_\_ School Fax: ( ) \_\_\_\_\_ - \_\_\_\_\_

E-mail Address: \_\_\_\_\_

Name of School District: \_\_\_\_\_

Date: \_\_\_\_\_