ENERGY UNIT

Appendix

Appendix A

Energy Past and Present

Name: _____

Use the charts above and your knowledge of the past to answer the following questions:

1. What are some of the reasons energy use in Michigan has increased?

2. What types of energy were used in the past for cooking, heating, and transportation? What about today?

3. Think about an appliance such as a dishwasher or washing machine. Using these items increases our energy use. What benefits do these items provide? How do we decide whether the benefit and convenience of an item is worth the increased use of energy?

4. Our technological advances have benefited our society by creating new products that make our lives easier and more fun. Why should we be concerned about increasing energy consumption?

Directions: Fill out the table below to look at ways that energy use may have changed over time.

	You and your family	Your parents as kids (approx. 30-50 years ago)	Your grandparents as kids (approx. 50-75 years ago)
Number of rooms in the home			
Number of vehicles			
Method of travel to school or friend's house			
Method of washing dishes			
Method of washing clothes			
Method of staying cool in the summer			
Number of TVs			
Number of computers/laptops/tablets			
Number of cell phones/portable gaming devices/MP3 players			
Number of microwaves, blenders, mixers and other kitchen devices			
Number of tools or yard items such as lawn mowers/snow blowers that run on electricity or gas			

Appendix B

Poster Directions

*Depict one nonrenewable energy source

-Include the origin, use and effects of each

*Depict one renewable energy source

-Include the origin, use and effects of each

You may use magazine clippings or draw on your poster. Once completed, tape your poster to the white board. Choose one member of your team to present to the class and explain your poster.

Note: Check with me to sign up for your source so we don't duplicate efforts.

Exit Slip

As a result of what we did today, I learned these three facts about energy sources:

1. _____
2. _____
3. _____

I would like to know more about/I have questions about:

1. _____
2. _____
3. _____

Appendix C

Timeline Activity

Name(s): _____

1. Draw a timeline of the history of water in our Great Lakes state.

2. List 15-20 facts about the history of water and hydroelectricity.

3. Once your timeline is created, be ready to present to the class.

Appendix D

Hydropower Experiment

Name(s): _____

WHAT YOU'LL NEED:

- Half gallon paper juice carton (empty and washed out)
- Gallon of water to fill carton with
- Nail
- Masking tape
- Ruler/meter stick
- Permanent marker
- Scissors
- Pencil
- Tub for water to disperse into if no sink available in room

EXPERIMENTAL PROCEDURE

1. Cut off the top of the juice carton. From the bottom of the juice carton, measure up ½ inch and using the nail, punch a single hole in the center of the side of the carton. Measure up one inch from the bottom and punch another hole in the center. Measure up two inches from the bottom and punch a third hole above the other two holes. Measure up four inches from the bottom and punch a final hole in the center of the side. **Note:** All holes should be the same size in diameter.
2. Take a long piece of tape and tape all four of the holes.
3. Put the carton on the edge of a sink, bucket or bench outside with the holes pointing towards the sink/bucket/ground.
4. Mark a line on the carton near the top. Always fill or refill the carton with water to this line.
5. Quickly remove the tape that is covering all four holes and watch what happens. Measure how far away each of the streams of water hits the sink/bucket/ground. (you may have to do this more than once to measure all four holes) **Note:** you can let the water flow out onto the ground if you do this outside by placing the container on a bench and then placing a meter stick on the ground to measure the distance.
6. Let all of the water empty out. Watch what happens as the water level drops. What happens to the streams of water for each hole?

Hole #	Distance of hole from bottom of carton	1st Attempt	2nd Attempt	3rd Attempt	Average of all 3 attempts
1					
2					
3					
4					

Experiment adapted from http://www.energyquest.ca.gov/projects/hydro-power

Appendix E

Background Information: Coal

Name: _____

INTRODUCTION

Coal, the most abundant fossil fuel in the U.S. and the world, has been used for thousands of years as a valuable natural resource. The U.S. has approximately 24 percent of all the world's known coal reserves. There are enough coal reserves worldwide to supply energy, at the current rate, for over 200 years. The interest in coal energy fluctuates due primarily to environmental concerns.

ENERGY RESOURCES

The luxuries and necessities in our everyday lives create an increasing demand for energy resources. Most of the energy consumed by the world comes from nonrenewable resources, which are limited in quantity and can be exhausted.

These resources are primarily fossil fuels: coal, petroleum and natural gas. Petroleum accounts for approximately 37 percent of the world's energy consumption. Coal and natural gas together supply approximately 48 percent. Uranium is another non-renewable energy resource used in nuclear power plants. It is only used for approximately 6 percent of the world's energy.

Renewable energy resources account for approximately 8 percent of the world's energy consumption. Hydroelectric power, derived from running water, is the most widely used form of renewable energy. These resources also include biomass (from plants, garbage and agricultural waste), solar, geothermal (heat energy within the earth) and wind.

COAL: A FOSSIL FUEL

Fossil fuels are derived from animal and plant matter. They formed naturally over millions of years. These energy-producing fuels are the remains of ancient life that have undergone changes due to heat and pressure. The primary fossil fuels are coal, petroleum and natural gas. Together they account for 85 percent of the world's energy consumption.

Coal is a dark, combustible material formed through a process known as coalification, from plants growing primarily in wet, swampy regions. Layers of fallen plant material accumulated and partially decayed in these wet environments to form a spongy, coarse substance called peat. Over time, this material was compressed under sand and mud, and heated by the earth to be transformed into coal. Some scientists refer to coal as sedimentary rock. Coal is primarily composed of carbon, oxygen, hydrogen and nitrogen.

There are several classifications of coal, which are rated according to their carbon content and heating value. The heating value of coal is expressed in BTUs per pound.

- Peat, with a heating value of approximately 4,500 BTUs, contains up to 60 percent carbon when dried. Peat hardens over time and under pressure into lignite, a cheap brown coal, containing approximately 70 percent carbon.
- Lignite has a heating value of approximately 7,000 BTUs.
- Sub-bituminous coal, with an approximate heating value of 9,300 BTUs, contains about 78 percent carbon.
- Bituminous coal is a more developed coal and the most common type. With a heating value that ranges from approximately 11,250 – 14,350 BTUs, it contains about 85 percent carbon.
- Anthracite, the hardest and most expensive coal, has a heating value of approximately 13,600 BTUs. It contains 92-95 percent carbon.

COAL MINING

The two main types of coal mining are surface (strip) mining and underground mining.

TYPES OF SURFACE MINING:

- **Mountain top mining** is done in relatively flat locations. Coal is removed in one location at a time with large machines such as draglines.
- **Contour mining** is done where coal is located in hills or mountains. Coal is excavated in circular tracks around the landscape.

TYPES OF UNDERGROUND MINING:

- Longwall mining is used to remove most of the coal in an area underground. A longwall mining machine cuts wide tunnels with rotating disks of steel teeth. Large steel jacks must be used to support the roof to prevent it from collapsing.
- **Room and pillar mining** involves removing part of the coal in an underground site. Much coal is left untouched to support the roof of the tunnels. This underground excavation looks like rectangular rooms, divided by coal pillars.

Strip mining involves removing coal deposits close to earth's surface (usually no more than 100 feet from the surface). Topsoil and rocks are removed from the surface to expose the coal deposits. Explosives and heavy machinery are used to break up and remove layers of coal.

Underground mining involves removing coal deposits hundreds of feet below the earth's surface. (Some mines may be close to 2,000 feet deep.) Shafts or tunnels are dug into the coal layers and made wider to allow room for the miners and coal cars or conveyor belts. Additional shafts may be excavated to increase air ventilation for the miners to breathe.

The history of coal mining is difficult, with tragic occurrences. Mining accidents, methane gas explosions, violence fueled by labor strikes and respiratory ailments - primarily Black Lung Disease - were common in the past. More than 100,000 miners have been killed in coal-mining accidents in the U.S. since 1900. The United Mine Workers of America Union

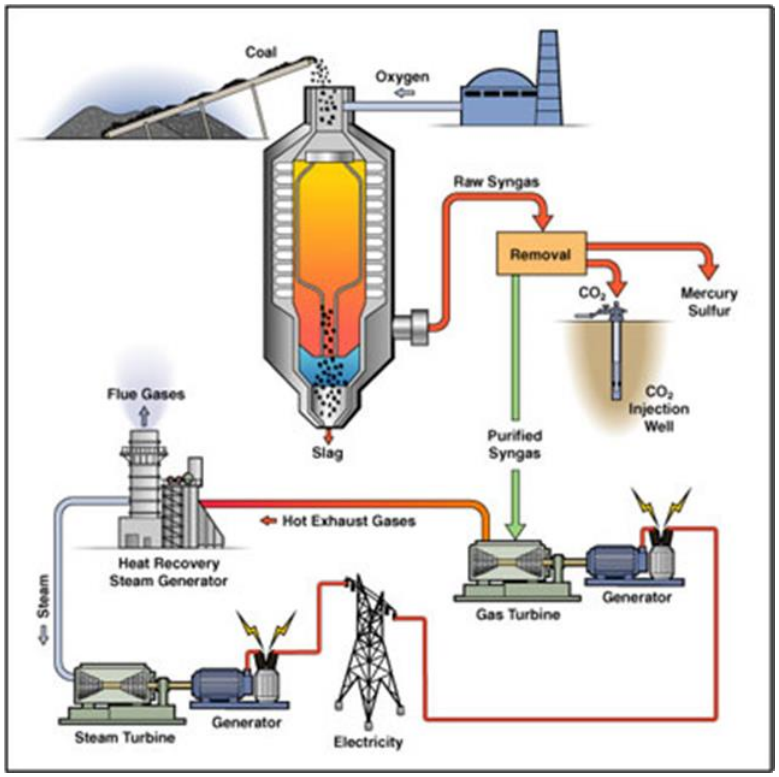
was formed in 1890 to promote safer working conditions. Several health and safety acts were established in 1969 and 1977 setting stricter standards. The Miner Act of 2006 was created to significantly improve health and safety concerns. New safety regulations and technologies in mining have greatly improved conditions for miners.

COAL USES

Coal is used to produce electricity, generate heat and make steel and industrial products. It is used worldwide as a fuel, second only to petroleum as the most consumed energy resource. Simple burning of coal produces heat for homes and industries. Coal is a major fuel for producing electricity. The coal is burned to turn water into steam, which turns the blades of a turbine and drives generator to produce electricity.

Coal is used for approximately 50 percent of electricity production in the United States and 40 percent of the world's electricity. **Coke** is a hard material produced when coal is heated, without air, at approximately 1000 degrees C (1832 degrees F). Coke (which is almost pure carbon) is used to smelt iron ore for the production of steel. **Coal tar,** a sticky black liquid derived from coke, is used for paving roads and tarring roofs. The extraction and distillation of coal tar into separate compounds produces a variety of products for making drugs, plastics, paints and synthetic fibers.

Coal gas, composed of methane and hydrogen, is a by-product of burning coal. Coal gas was used in the 1940s for residential lighting and cooking, but was phased out because it was expensive. Today, coal gasification processes are being developed to be more cost effective. Methanol is now being developed and used as a fuel for engines.



COAL ENERGY: ENVIRONMENTAL IMPACTS AND MODERN TECHNOLOGY

The mining and burning of coal has a long history of negative environmental impacts. Land, water and air pollution standards were not part of the coal industry's early history. In 1955, the Air Pollution Control Act (Clean Air Act) was created. This legislation raised the nation’s awareness of industrial coal pollution. In 1977, the Surface Mining Control and Reclamation Act (SMCRA) was passed, requiring coal-mining sites be restored to natural areas or productive land.

Courtesy of: safeenvironment.wordpress.com

Regulations and environmental awareness have helped improve the coal industry, but problems still exist. Newer operations have been employing positive environmental techniques, including cogeneration, waste-coal usage, clean coal technologies and land reclamation.

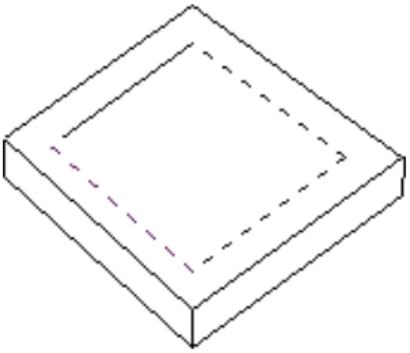
Several modifications have been made to improve sulfur emissions from coal-fired power plants. First, washing the coal chunks before they are sent to power plants removes some of the impurities. At some power plants, crushed coal is mixed and burned with limestone in a boiler of moving air, a "fluidized bed boiler." This process allows the limestone to combine with sulfur particles to form a compound, which is then extracted. Another method reduces sulfur dioxide gases after the coal is burned. This process takes place in "scrubbers," or flue gas desulfurization units. A combination of water and crushed limestone is sprayed into the coal gases as they rise in the smokestacks. The limestone absorbs much of the sulfur dioxide before the gases are expelled into the environment. To decrease the emission of nitrogen oxide, coal is burned at lower temperatures. Together, these practices remove more than 95 percent of the pollutants caused by sulfur and nitrogen. Over the past twenty years, the coal industry has made substantial progress.

Solar Oven Activity

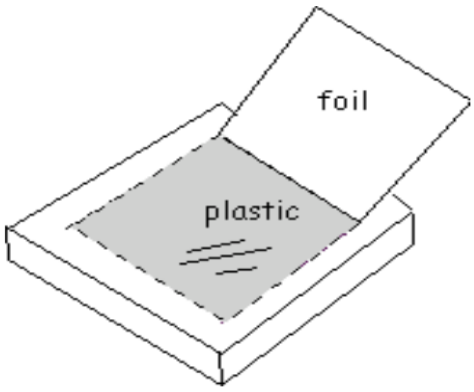
Name: _____

PROCEDURE:

1. Draw a one-inch border on all four sides of the top of the pizza box. Carefully cut along three sides leaving the line along the back of the box uncut. (Uncut side will be folded back.)

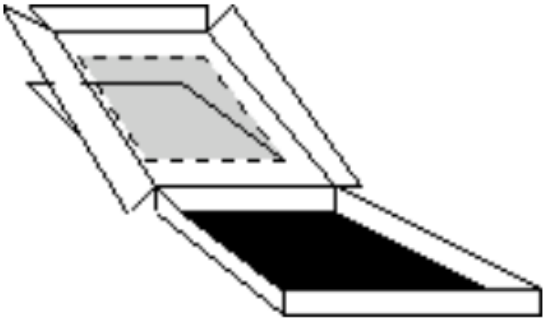


2. Form a flap by gently folding back along the uncut line to form a crease. Cut a piece of aluminum foil large enough to fit on the inside of the flap. Smooth out any wrinkles and glue into place. Measure a piece of plastic to fit over the opening you created in your pizza box.
   The plastic should be cut larger than the opening so it can be taped to the underside of the box top.

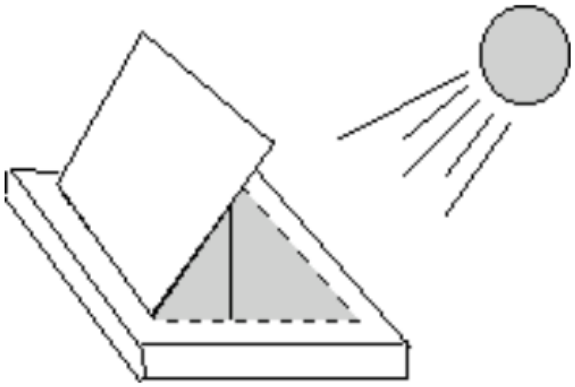


3. Be sure the plastic becomes a tightly sealed window so air cannot escape from the oven interior.

4. Cut another piece of aluminum foil to line the bottom of the pizza box and carefully glue into place. Cover the aluminum foil with a piece of black paper and tape the paper into place.



5. Close the pizza box top (window) and prop open the flap of the box with a straw or wooden dowel, facing the oven toward the sun. Adjust the box until the aluminum reflects the maximum sunlight through the window into the oven interior.



6. Your oven is ready! You can try heating s'mores, nachos, English muffin pizzas or even try baking cookies or biscuits. Test how hot your oven can get using a simple oven thermometer! **Note:** Expect the cooking time to take about twice as long as conventional methods, and allow about one half hour to preheat your solar oven. A general rule for cooking in a solar oven is to get the food in early and don't worry about overcooking.

Appendix G

Methane Production Experiment

Name: _____

1. Mix the scraps of vegetables and grass into the soil thoroughly. Discuss with your group why the soil is being added into the mix.

2. Divide the mixture evenly and place into the bottles.

3. Stretch the balloons over the mouth of the bottle so that the opening fits tightly. Use duct tape to seal the balloons to the bottle and make sure no air can get in.

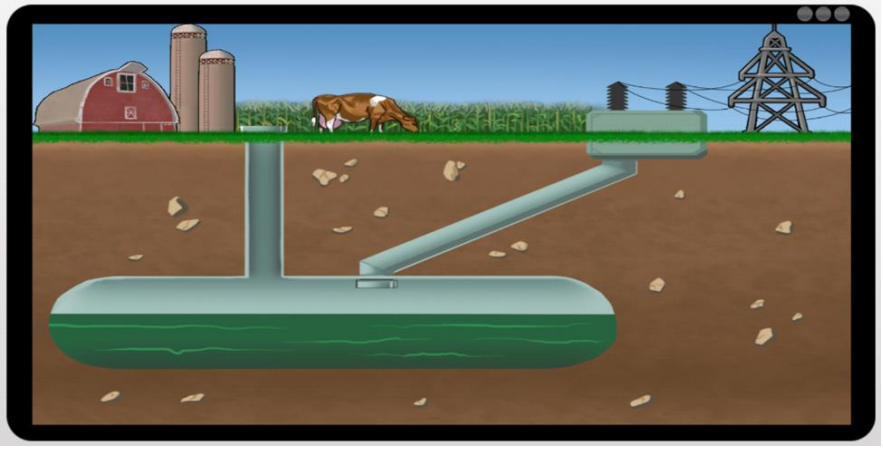
4. Make a line on the bottle with a permanent marker to mark the top of the mixture and write the date next to it. Measure the distance from the bottom of the bottle to the top of the mixture. Write this data onto the "Methane Production Chart."

5. Record the balloon circumference as zero on the "Methane Production Chart."

6. Place the bottles in a space in which they will receive sunlight. Over the next few days, the microbes in the soil will digest the food products and create methane gas. The methane will inflate the balloon. At the same time, the amount of mixture at the bottom of the bottle should decrease as the microbes are digesting it.

7. Every other day, make a line on the bottle to mark the amount of mixture in the bottle. Your group should measure the distance from the bottom of the bottle to the top of the mixture and record this data on your charts. Also measure the circumference of the balloon (by wrapping a string around the widest part of the balloon and measuring it) and record those results.

8. It will take about three weeks for the microbes to digest all the food in the soil. After that time period, review the "Methane Production Chart" with the class and discuss the questions that follow. Dispose of the gas by popping the balloons away from any source of fire. (You may want to do this outdoors.)



Picture taken from the app EmPOWERed Kids offered for FREE to download on any IOS or Android device.

GUIDING QUESTION: What will happen if we combine microbes with food?

PREDICTION:

_____

_____

_____

People can use methane gas to create energy they use every day in their life. Let's see if we can make some methane gas. Follow your teacher's directions for this experiment over three weeks and keep track of your data using this chart.

METHANE PRODUCTION CHART

Day	Level of Mixture in Bottle	Circumference of Balloon

REFLECTION QUESTIONS:

1. As the days went by, what happened to the circumference of the balloon?

2. As the days went by, what happened to the level of the mixture in the bottle?

3. What caused the circumference of the balloon to change?

4. What caused the level of the mixture to change?

5. How did the microbes get into the bottle?

6. Was your prediction correct? How do you know?

Smoke rises vertically.

Wind causes flag to extend.

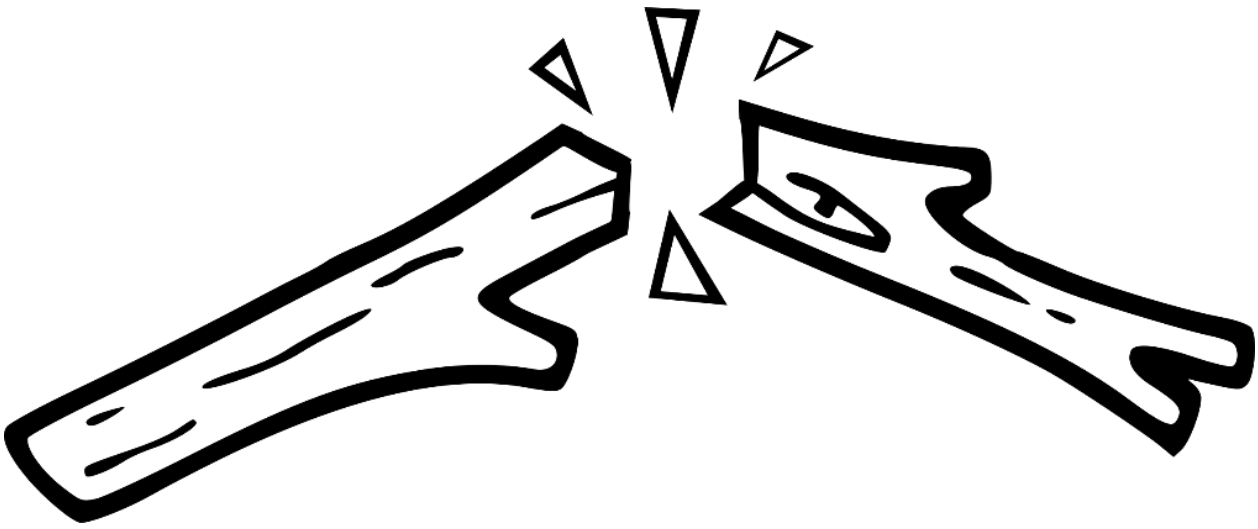
Trees get uprooted.

Wind blows around loose paper and leaves.

Leaves rustle.

Whole trees sway.

Twigs and small branches broken off trees.



Hurricane & Tornado destruction.

Appendix I

Beaufort Scale Activity

Name: _____

Beaufort Scale

Beaufort number	Wind Speed (mph)	Seaman's term		Effects on Land
0	Under 1	Calm		Calm; smoke rises vertically.
1	1-3	Light Air		Smoke drift indicates wind direction; vanes do not move.
2	4-7	Light Breeze		Wind felt on face; leaves rustle; vanes begin to move.
3	8-12	Gentle Breeze		Leaves, small twigs in constant motion; light flags extended.
4	13-18	Moderate Breeze		Dust, leaves and loose paper raised up; small branches move.
5	19-24	Fresh Breeze		Small trees begin to sway.
6	25-31	Strong Breeze		Large branches of trees in motion; whistling heard in wires.
7	32-38	Moderate Gale		Whole trees in motion; resistance felt in walking against the wind.
8	39-46	Fresh Gale		Twigs and small branches broken off trees.
9	47-54	Strong Gale		Slight structural damage occurs; slate blown from roofs.
10	55-63	Whole Gale		Seldom experienced on land; trees broken; structural damage occurs.
11	64-72	Storm		Very rarely experienced on land; usually with widespread damage.
12	73 or higher	Hurricane Force		Violence and destruction.

How can high wind speed be a problem for humans?

Are there situations where too little or no wind is a problem for humans?

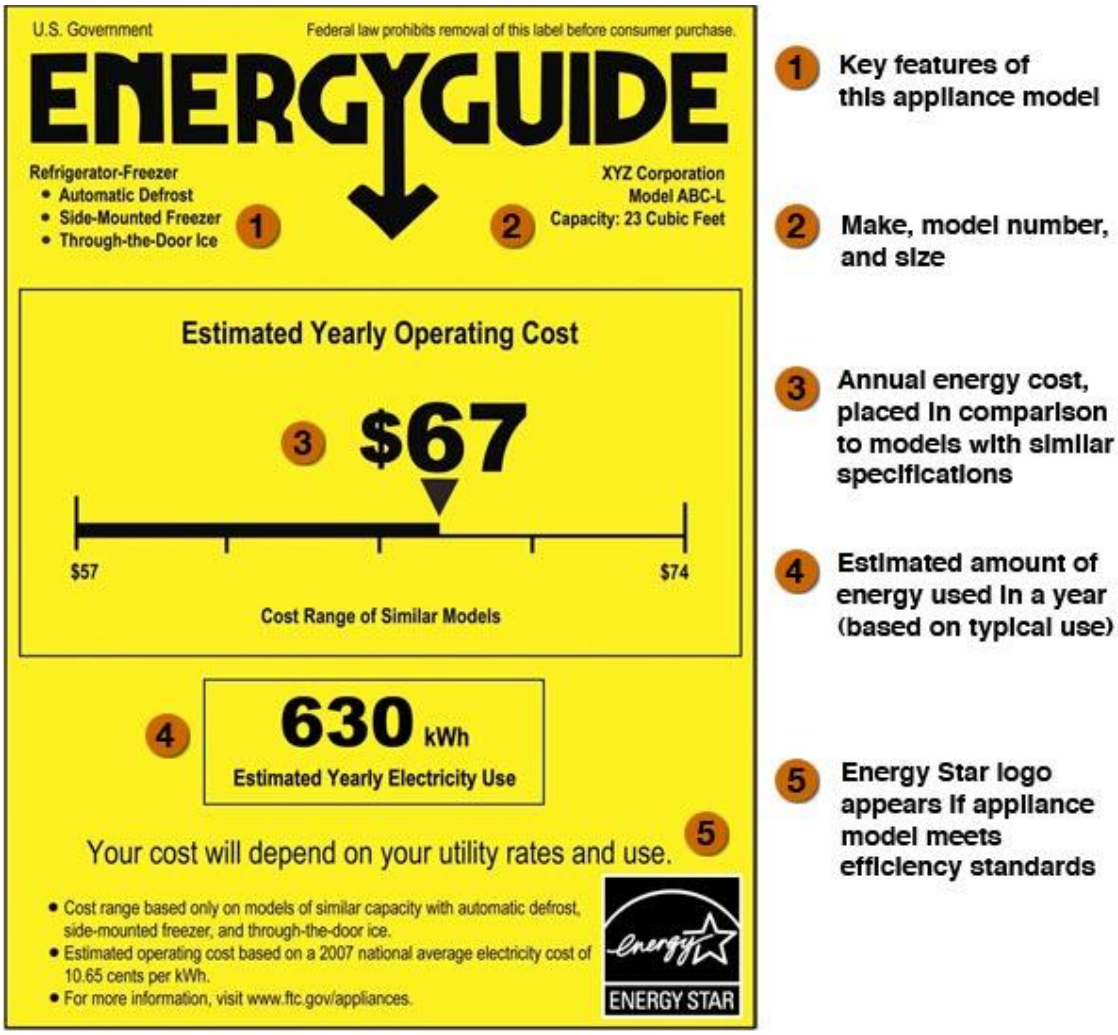
If so, what examples can you give?

Appendix J

Energy Guide Worksheet

Name: _____

Example of an Energy Guide:



What appliance is this Energy Guide for? _____

What is the model number?_____

How much does it cost to run this appliance for a year?_____

This guide shows that similar models can cost somewhere between $57 a year and $74 a year. How does this model compare to other models?

_____

What is the estimated amount of electricity per year that this appliance will use?_____

Is this model an Energy Star appliance? _____

EXPLORING ENERGY STAR®

Visit the website, www.energystar.gov and www.energystar.gov/kids to answer the following questions.

1. What two reasons are listed for why the Energy Star label was established?

_____

_____

2. The website lists many items that can earn the Energy Star label.
List at least four items you can buy that have been labeled as "Energy Star" efficient.

_____ _____ _____ _____

3. Which of the following actions can save energy? (There might be more than one correct answer)

   A. Unplugging electronic devices that aren't being used
   B. Changing out your furnace filter
   C. Covering pots on the stove
   D. Keeping the lights on when you leave the room for just a minute instead of turning them off and back on
   E. Buying a programmable thermostat
   F. Completely turning off the heat if you aren't going to be home during the day.

4. Visit the "Take The Pledge" section of the website and look at some simple actions people can do to be more energy efficient.

Which of these actions could you do at your house?

- Replace standard lightbulb with LED lightbulb
- Have your computer go into sleep mode when you aren't using it
- Seal air leaks and use draft dodgers
- Add insulation to your attic

5. What other interesting facts did you learn from www.energystar.gov and www.energystar.gov/kids?

_____

_____

_____

_____

_____

Appendix K

Energy Star Homework Assignment

Name: _____

Complete the following assessment for five different washing machines either by visiting a hardware store or using a website that sells washing machines.

Name	Model #	Top Loading or Front Loading (This is a preference, but can impact energy efficiency)	Estimated Yearly Operating Cost with an Electric Water Heater	Estimated Yearly Operating Cost with a Natural Gas Water Heater	Estimated Yearly Electricity Use	Purchase Price	Size in Cu. Ft. (This determines how much laundry can fit in the washing machine)	Energy Star? Y or N
			$	$	kWH	$	Cu. Ft	
			$	$	kWH	$	Cu. Ft	
			$	$	kWH	$	Cu. Ft	
			$	$	kWH	$	Cu. Ft	
			$	$	kWH	$	Cu. Ft	

1. Which washing machine has the lowest purchase price? _____
2. Which washing machine has the lowest yearly electricity use?_____
3. Do washing machines cost more to run with an electric water heater or a natural gas water heater?_____
4. How many of the washing machines had an Energy Star label? _____

5. Does the largest washing machine cost the most? _____
Does it use the most electricity?_____

6. What are some reasons to buy a large washing machine? A small washing machine?
_____
_____
_____
_____

7. Looking at the cost of using the washing machines with a natural gas water heater, how much money will you save per year if you buy the washing machine with the lowest yearly operating cost compared to the washing machine with the highest yearly operating cost?

Highest Estimated Yearly Operating Cost with a natural gas water heater

(A) $_____

Lowest Estimated Yearly Operating Cost with a natural gas water heater
(B)$_____
(A) – (B) =$_____in savings per year

8. Most people use a washing machine for seven years. Based on the savings per year, how much will you probably save over the lifetime of the washing machine?

(Answer from Question 7)*7 years=$_____total savings

EXTRA CREDIT

9. Are the energy savings worth it?

This is not always an easy question to answer because it depends on several factors. To begin, compare the prices of Washing Machine A and Washing Machine B from Question 7.

Washing Machine A $_____ Washing Machine B $_____

If Washing Machine A costs more, you will know that Washing Machine B is a better deal because Washing Machine B also saves you energy costs.

If Washing Machine B costs more, you will need to do a little more math.

Washing Machine B $_____ - Washing Machine A $_____
=$_____more you paid for Washing Machine B.

Compare the amount more you paid for Washing Machine B $_____ to the total savings you had from Question 8 $_____.

If the extra cost of Washing Machine B is more than the total savings you had from Question 8, you might decide it's not worth the extra purchase price. However, other factors might influence your decision, like additional features, the style you are looking for or the space the washing machine takes up in your home.

If the extra cost of Washing Machine B is less than the total savings you had from Question 8, you would likely decide it is worth the extra cost.

Appendix L

Exit Slip

Pretend that you need to buy a new washing machine for your house. Based on what you've learned, what are some energy related questions you should ask?

1. _____?
2. _____?
3. _____?

Appendix M

Energy Brainstorm Chart

Name: _____

Procedure:

1. Develop a list of ways you can conserve energy or become more energy efficient
2. Decide whether your suggestions are conservation or energy efficiency
3. Rate your suggestions from easiest to hardest to complete
4. Rate your suggestions from least impact to most impact

Way to Save Energy	Is this Conservation or Energy Efficiency?	Easiness Rating	Effectiveness Rating

Appendix N

Light Bulb Worksheet

Name: _____

Type of Bulb	Approximate cost for a 60 watt bulb or equivalent	Lumens (measure of brightness)	Actual Watts used	Average Lifespan
Incandescent	$1.00	840	60 watts	1 year
Compact Fluorescent	$2.25	900	14 watts	7-8 years
LED	$10.00	800	9.5 watts	18-20 years

REFLECTION QUESTIONS:

1. Which lightbulb cost the most to purchase? _____
2. Ten (10) incandescent lightbulbs cost about the same as 1 LED lightbulb. If you could buy 10 incandescent lightbulbs or 1 LED lightbulb to go into your lamp, which would last longer?

   _____
3. A 60 watt incandescent bulb running for 1 hour uses 60 watt-hours (watts x hours). Electric bills measure electric use through the kilowatt hour, which is equal to 1000 watt hours. So, a 60 watt incandescent bulb running for 1 hour uses .06 kilowatt hours (watt-hours/1,000).

   How many kilowatt hours would the Compact Fluorescent and the LED bulb use?

Compact Fluorescent: 14 watts x 1 hour = _____watt-hours
_____watt-hours/1,000=_____Kilowatt-hours

LED: 9.5 watts x 1 hour = _____watt-hours
_____watt-hours/1,000=_____Kilowatt-hours

4. The average price of electricity in the United States per kilowatt hour is 12 cents. How much would each of these bulbs cost to run for 1 hour?

   Incandescent: .06 kilowatt-hours x 12 cents =.72 cents

   Compact Fluorescent: _____kilowatt-hours x 12 cents =_____ cents

   LED: _____kilowatt-hours x 12 cents =_____ cents

5. Based on your analysis above, which type of bulb uses the least amount of electricity?_____

6. The number of lumens is an indication of the brightness of the bulb. Which bulb is the brightest? _____Which bulb is the least bright? _____

Appendix O

Electric Meters Worksheet

Name: _____

1. List the things a smart phone can do that a standard telephone can't do?

2. Knowing that old electric meter technology only measures the amount of energy a home or business is using, what do you think the new smart meter might be able to do?

3. Has Consumers Energy upgraded electric meters in your area?

4. Have you gone online to look at your own home energy use information?

5. Each new electric meter has a yellow label on its face – do you have one?

6. What problems might occur when a meter reader is sent to read meters outside or insides people's homes?

Appendix P

Careers Worksheet

Name: _____

Electric Lineworker -The person in this job drives a truck and either climbs utility poles or rides in a bucket that carries him or her up to electric lines in order to work on or repair them. This job requires special training. The worker must wear protective gear such as a hard hat, rubber gloves, rubber sleeves, safety glasses, etc. and should not be afraid of heights! Sometimes, electric lineworkers are asked to help restore power in other states when energy companies need extra help.

Natural Gas Service Worker- The person in this job drives a truck and installs or repairs natural gas lines, which are buried underground. This job requires special training. The natural gas service worker must wear protective gear such as a hard hat, safety goggles and gloves. These workers use shovels and clippers and operate different types of excavation equipment, such as backhoes and diggers.

Customer Service Representative (Call Center)- This job requires employees to handle calls from customers. Customers call for several reasons: to ask questions about their bill, get help turning on or off their electric and natural gas service or report an emergency like a downed power line or natural gas leak. As a result, Customer Service Representatives need to be good listeners and problem solvers.

Engineer- At Consumers Energy, engineers fuel the company's brain power. They help the company provide safe, reliable and affordable energy. They design, operate and maintain power plants, and miles of electrical distribution lines and natural gas piping. Engineers usually need a four-year college degree. There are many different types of engineers,

including civil, environmental, chemical, electrical, computer, industrial, mechanical and material engineers. Consumers Energy employs all of these engineers.

Executive Communications- Even an energy company needs people to help communicate to their customers! This job requires a lot of travel and creativity. Employees in this field usually need a four-year college degree. This job requires strong writing, presentation and public speaking skills.

Information Technology (IT)- Consumers Energy needs many different types of IT workers, from networkers to system programmers to web designers! It takes a lot of technology to deliver reliable energy to our 6.8 million customers. IT professionals usually have a four-year degree. They must enjoy working on a computer and solving problems.

Forestry- Foresters keep trees from interfering with power lines. 30 percent of power outages are caused by tree interference. Workers need to know how trees grow and differences between types of trees. They work closely with customers, property owners and crews who annually trim trees near power lines.

To see job openings at Consumers Energy, visit www.ConsumersEnergy.com/careers

Appendix Q

Careers Project Outline

Name: _____

RESEARCH

Gather a minimum of the following information:

i. Title of job
ii. What type of education or training is required
iii. Where does that person work (inside office or outside in the field)
iv. Do they use special tools or equipment

PRESENTATION

Present a model, poster board or PowerPoint to the class

Presentation Rubric Energy Sources	Unsatisfactory 0-2	Poor 3	Good 4	Excellent 5	Total
Organization	Audience cannot understand presentation because facts presented do not seem to be in order.	Presentation is very short. Audience has difficulty following presentation because student jumps around.	Presentation is appropriate length. Student presents information in logical order which audience can follow.	Student presents information in logical, interesting sequence which audience can follow.	
Subject Knowledge	Student does not seem to know information and cannot answer questions about subject.	Student is uncomfortable with information and is able to answer only simple questions.	Student is at ease with expected answers to all questions, but fails to give more details.	Student demonstrates full knowledge (more than required) by answering all class questions with explanations and details.	
Speech	Student mumbles, incorrectly pronounces words, and speaks too quietly for students in the back of class to hear.	Student's voice is low. Student incorrectly pronounces words. Audience members have difficulty hearing presentation.	Student pronounces most words correctly. Most audience members can hear.	Student uses a clear voice and correct pronunciation of terms so that all audience members can hear presentation. Student is happy.	
Eye Contact	Student reads all of report with no eye contact.	Student occasionally uses eye contact, but still reads most of report.	Student maintains eye contact most of the time but often returns to notes or maintains eye contact only with teacher.	Student maintains eye contact with entire audience, seldom returning to notes.	

Appendix R

Electric Safety Awareness Project

Name: _____

Do some research on each topic and pick one to focus on for either option 1 or 2 below.

Report a Natural Gas Leak

Do you smell natural gas or a rotten egg smell? Leave the area immediately and call (800) 477-5050

Report a Down Wire

Stay at least 25 feet away from a down wire and anything it may be touching and call (800) 477-5050

Call Before You Dig

Call 811 three working days before any digging projects. It's the law.

Visit the website: http://www.consumersenergy.com/safety to learn more about safety based on three topics; Natural Gas, Downed Power Lines and Calling Miss Dig before you Dig

Option 1

Sharing knowledge with others is a great way to help your school community. Now that you know more about how to be safe around electricity, natural gas and the benefits of calling MISS Dig at 811, you can share that information with others so they can be safe too. Your project is to create a poster relating to safety teaching others about electric and natural gas safety or calling 811. The poster must contain a major safety message about the safety topic you choose, along with at least three facts supporting the message. For example, you could say, "Electricity is Dangerous," but now you will need to list three facts explaining why electricity is dangerous. Artwork must be appropriate and support the major safety message. Think about billboards or signs you see around town. Too many words will make the message confusing, but too few words might not give enough information.

Project Requirements:

1. Create a poster with an important safety message.
2. Include three supporting facts about your safety message.
3. Pictures and artwork should be appropriate and support the major safety message.
4. Present your poster to the class and explain your message and why it's important. (Rubric follows)

Presentation Rubric Safety Awareness Poster	Unsatisfactory 0-2	Poor 3	Good 4	Excellent 5	Total
Organization	Poster does not contain an important safety message or 3 supporting facts. Artwork is unrelated to the topic.	Poster contains a safety message and supporting facts, but the message is not clear or the facts don't support the message. Artwork is only slightly related to the topic.	Poster contains an important safety message and 3 supporting facts. Artwork is related to the safety message.	Poster contains an important safety message with 3 supporting facts. Artwork is related to the safety message. A good balance of words and visuals are represented.	
Subject Knowledge	Poster contains an incorrect or confusing safety message. No supporting facts are included.	Poster contains an incorrect or confusing safety message. Supporting facts don't support the safety message.	Poster contains an important safety message and 3 facts related to the safety message.	Poster contains an important safety message and 3 facts that clearly support the safety message.	
Speech	Student mumbles, incorrectly pronounces words, and speaks too quietly for students in the back of class to hear.	Student's voice is low. Student incorrectly pronounces words. Audience members have difficulty hearing presentation.	Student's voice is clear. Student pronounces most words correctly. Most audience members can hear presentation.	Student uses a clear voice and correct pronunciation of terms so that all audience members can hear presentation. Student is happy!	
Eye Contact	Student reads directly off the poster with no eye contact.	Student occasionally uses eye contact, but still reads mostly from the poster.	Student maintains eye contact most of the time but often returns to notes or maintains eye contact only with teacher.	Student maintains eye contact with entire audience, seldom returning to notes.	

Option 2

Sharing knowledge with others is a great way to help your school community. Now that you know more about how to be safe, you can share the information with others so they can be safe too. In groups of four, your project is to create a commercial teaching others about your safety topic. You will present your commercial to the class. Your commercial must contain a major safety message, along with at least three facts supporting the message. For example, you could say, "Electricity is Dangerous," but now your commercial will need to include three facts explaining why electricity is dangerous. The content of your commercial must be appropriate and support the major safety message. Think about commercials you see on TV. Are some commercials more interesting or exciting than others? What are some interesting elements you can add to your commercial to make it something people would want to watch?

Project Requirements:

1. Create a commercial of one minute or less with an important safety message. (record using a tablet, smart phone or other device when possible)
2. Include three supporting facts about your safety message in the commercial.
3. Present the commercial in front of the class. (Rubric follows)

Presentation Rubric Safety Awareness Commercial	Unsatisfactory 0-2	Poor 3	Good 4	Excellent 5	Total
Organization	Commercial does not contain an important safety message or 3 supporting facts. Commercial does not make sense.	Commercial contains a safety message and supporting facts, but the message is not clear or the facts don't support the message.	Commercial contains an important safety message and 3 supporting facts.	Commercial contains an important safety message with 3 supporting facts. Interesting elements such as music or voiceover are added to make the commercial more interesting.	
Subject Knowledge	Commercial contains an incorrect or confusing safety message. No supporting facts are included.	Commercial contains an incorrect or confusing safety message. Supporting facts don't support the safety message.	Commercial contains an important safety message and 3 facts related to the safety message.	Commercial contains an important safety message and 3 facts that clearly support the safety message.	
Team Work	Not all team members actively participate in the commercial.	The commercial is mostly presented by one or two members of the group.	All team members have a role in the commercial.	The team came up with creative solutions to ensure that all members are actively involved in the commercial.	
Speech	Students mumble, incorrectly pronounce words, and speak too quietly for students in the back of class to hear.	Students' voices are low. Students incorrectly pronounce words. Audience members have difficulty hearing presentation.	Students' voice are clear. Students pronounce most words correctly. Most audience members can hear presentation.	Students use a clear voice and correct pronunciation of terms so that all audience members can hear presentation.	
Eye Contact	Students present the commercial with no eye contact.	Students occasionally use eye contact.	Students maintain eye contact most of the time but often return to notes or maintain eye contact only with teacher.	Students maintain eye contact with entire audience. Commercial is all or mostly memorized.	

Appendix S

B I N G O

		Consumers Energy Count on Us		

- Beaufort scale
- Biogas
- Biomass energy
- Chemical energy
- Coal
- Coalification
- Consumers Energy
- Electrical energy
- Energy
- Energy conservation
- Energy efficiency
- Energy Star
- Fossil fuels
- Geothermal energy
- Gravitational energy
- Hydroelectricity
- Kinetic energy
- Microbes
- Mining
- 811 MISS DIG
- Motion energy
- Natural gas
- Non-renewable resources
- Nuclear energy
- Petroleum
- Pollution
- Potential energy
- Radiant energy
- Renewable resources
- Safety
- Smart meters
- Solar energy
- Substation
- Sustainable energy
- Thermal energy
- Transformer
- Transmission
- Voltage