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

Date: \_\_\_\_ / \_\_\_\_ / \_\_\_\_ Class Hour: \_\_\_\_

## It Pays To Save In Your Home

### Student Lesson

#### Introduction:

It seems hard to imagine today, but there was a time when energy was relatively cheap. Wasting it sometimes made more sense than conserving it.

Some homes were built with little or no insulation in their walls. It was cheaper to run the furnace hard all winter than to insulate the house. Few people bothered to weather strip their homes. Those materials didn't really cost very much, but they were hard to find. Leaving the lights on was just a bad habit for which parents scolded their children.

Everyone has to contend with the reality that energy is much more expensive today. Energy conservation is a priority when homes are built today. Properly engineered and constructed, the energy bills for some of these homes can be very low. But saving energy saves more than just money. For people wanting to "live green," the savings in natural resources and air emissions are just as important.

Saving energy, money, resources, and emissions can also be done in many ways in a house that has already been built. The purpose of this exercise is to educate you about saving energy in an existing home. What can be done? How much will it cost? How much will be saved? How long will it take for the savings to equal the cost? What should be done first? These are energy savings questions often faced by homeowners. They are questions you will face—and then answer—in this exercise.

#### Materials:

Computer with internet access and printer

## Procedure:

It's five years from now and congratulations are in order! With solid financial planning, a 10% down payment, and a good fixed-rate mortgage loan, you have purchased your first home.

Built in the late 1960's, your ranch home did not have many basic energy efficiency features built into it. It has three bedrooms, 1 1/2 bathrooms, a kitchen, dining room, and a small den. The basement is half finished, with another (full) bathroom, and recreation room. The unfinished portion of the basement is a work area that contains the home's utilities' access. The main floor of your ranch home occupies roughly 1600 square feet. An equal area in the basement requires heating in winter and cooling in summer.

Imagine that this is actually your first home purchase. In addition to the information above, you will be provided more information on a document of with the words **Situation** and **Research Questions** on it. Each of these documents distributed throughout the class describes a potential energy savings **Situation** in the home you've purchased. With each situation there are energy savings **Research Questions** related to that specific home situation. Your teacher will divide your class to have you and your classmates research and answer these questions. When your research has been concluded each person (or group) will follow directions on how to report their findings to the rest of the class.

You will find **it pays to save energy in your home!**

## **Situation 1 Home Exterior**

Your house is covered in original aluminum siding. Below that is half-inch plywood, nailed to 2 X 4 construction. Inside the walls is 3 1/2-inch fiberglass batting insulation, commonly used in the construction of a 1960's home.

### **Research Questions:**

- Research what should be done to make your home more energy efficient when replacing your siding.
- What factors need to be considered to enable you to make a decision on these efficiency improvements?
- Decide on the energy efficiency improvements.
- Roughly how much would the energy efficiency improvements cost?
- About how long would it take to recover the cost of the energy efficiency improvements? (Ignore the cost of the new siding itself when answering these questions.)
- Cite the sources of information you use to complete your research.

### **Notes:**

## **Situation 2 Landscaping**

The home faces generally west and occupies a good sized yard. There are no large trees, just a couple of ornamental deciduous trees and a couple of shrubs (the previous owners didn't like many plants in the way of the mower, and definitely did not like to rake leaves in the fall).

### **Research Questions:**

- How can landscaping be used to improve the energy efficiency of this home?
- What factors need to be considered when making landscaping decisions for energy efficiency?
- Decide on an energy efficient landscaping plan.
- Roughly how much would it cost?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

### **Notes:**

### **Situation 3 Attic Insulation and Ventilation**

The double garage contains the access to the attic. Insulation in the attic above the living area is loose fiberglass, about 8 inches thick. Ventilation in the attic is minimal because there are very few vents available to permit air to flow. For this reason, the attic gets very hot in the summer, something the previous owners alerted you to.

#### **Research Questions:**

- What can be done in the attic to improve the energy efficiency of this home?
- What factors need to be considered to enable you to make a decision on what should be done in your attic?
- Decide what should be done in your attic to improve your home's energy efficiency.
- Roughly how much would it cost?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

#### **Notes:**

## **Situation 4 Windows and Doors**

All 12 windows, and the 3 outside doors are standard size and have never been replaced. They are showing signs of wear and cracks that permit air to move into the house are visible around many of the windows and doors.

### **Research Questions:**

- Research what can be done to make your home more energy efficient by replacing your windows and doors.
- What factors need to be considered?
- Decide on energy efficient replacement windows and doors for your home.
- Roughly how much would it cost to replace
  - one standard size window, and
  - one standard size door with good, energy efficient versions? Multiply these numbers accordingly to determine how much it would cost to replace all windows and doors
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

### **Notes:**

## **Situation 5 Window Treatments**

The inside window treatments and coverings for your 12 windows are standard blinds, shades, and curtains. They are all usable, but are all showing signs of wear.

### **Research Questions:**

- Research what can be done to make your home more energy efficient when replacing your window treatments.
- What factors need to be considered?
- What kinds of window treatments can best be used to improve the energy efficiency of this home?
- Should different strategies for window treatments be employed on different sides of the house (north, south, east, west)?
- Roughly how much would it cost to buy them?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

### **Notes:**

## **Situation 6 Space Heating**

The home is heated in winter by a natural gas forced air furnace. It is over 20 years old. If replaced, it could be converted to an electric furnace, or it could remain fueled by natural gas.

### **Research Questions:**

- Research energy efficient natural gas and electric forced air replacement furnaces.
- What factors need to be considered to enable you to make a decision on a replacement?
- Decide on a good, energy efficient, natural gas or electric forced air replacement furnace.
- Roughly how much would it cost?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

### **Notes:**

## **Situation 7 Air Conditioner**

In summer the home is cooled by a central air conditioner, which is 12 years old.

### **Research Questions:**

- Research energy efficient replacement central air conditioners.
- What factors need to be considered to enable you to make a decision on a replacement?
- Decide on a good, energy efficient, replacement air conditioner.
- Roughly how much would it cost?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

### **Notes:**

## **Situation 8 Hot Water Heating**

Hot water is supplied to your home by a ten-year-old natural gas hot water heater with a 40-gallon tank. It has a standing pilot light and no insulation blanket covering it. If replaced, it could be easily converted to electric hot water, or could remain fueled by natural gas.

### **Research Questions:**

- Research energy efficient natural gas and electric replacement hot water heaters.
- What factors need to be considered to enable you to make a decision on a replacement?
- Decide on a good, energy efficient, 40-gallon capacity natural gas or electric replacement hot water heater.
- Roughly how much would it cost?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

### **Notes:**

## **Situation 9 Energy Audit**

The previous owners told you that they always wanted to have an energy audit done on the house, but never did.

### **Research Questions:**

- Research information about how to have an energy audit conducted on your home.
- What is typically done during an energy audit?
- Roughly how much would it cost to have a residential energy audit done on your home?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

### **Notes:**

## **Situation 10 Dehumidifier**

A dehumidifier needs to run in the basement about six months of the year. The previous owners gave it to you. It was in the basement when they moved in. It works but is old.

### **Research Questions:**

- Research energy efficient replacement dehumidifiers.
- What factors need to be considered to enable you to make a decision on a replacement?
- Decide on a good, energy efficient, replacement dehumidifier.
- Roughly how much would it cost?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

### **Notes:**

## **Situation 11 Dishwasher**

The dishwasher in the kitchen is about 6 years old. It is a standard model that was not advertised as energy efficient or water efficient.

### **Research Questions:**

- Research energy efficient replacement dishwashers.
- What factors need to be considered to enable you to make a decision on a replacement?
- Decide on a good, energy efficient, replacement dishwasher.
- Roughly how much would it cost?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

### **Notes:**

## **Situation 12 Lighting**

All lighting fixtures built into the home have standard, common lightbulb sockets. All of the light fixtures you plan to move into the house with you are made the same way. The lamps in all of these fixtures are a mixture of incandescent bulbs and CFL's.

### **Research Questions:**

- Research what can be done to improve energy efficiency lighting your home.
- What factors need to be considered to enable you to make a decision on lighting energy improvements?
- Decide what should be done to improve energy efficiency in the lighting of your home.
- Roughly how much would it cost?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

### **Notes:**

### **Situation 13 Kitchen Range**

You bought the standard electric push-in range from the previous owners. It is a little over ten years old. A natural gas line runs just below it in the floor. For this reason, if you replace the range, it could be easily changed to a natural gas range.

#### **Research Questions:**

- Research energy efficient replacement push-in electric and natural gas ranges.
- What factors need to be considered to enable you to make a decision on a replacement?
- Decide on a good, energy efficient, replacement push-in electric or natural gas range.
- Roughly how much would it cost?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

#### **Notes:**

## **Situation 14 Refrigerator/Freezer**

You bought a used refrigerator/freezer at a garage sale for \$50. It looks fine and works adequately. However, there is condensation in several places along the magnetic seals of the refrigerator and freezer doors when it is running. Your best estimate puts this appliance at 20 years old.

### **Research Questions:**

- Research energy efficient replacement refrigerator/freezers.
- What factors need to be considered to enable you to make a decision on a replacement?
- Decide on a good, energy efficient, replacement refrigerator/freezer.
- Roughly how much would it cost?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

### **Notes:**

## **Situation 15 Clothes Washer**

Your clothes washer was given to you by your parents, who replaced it with a new one. It works fine but is over 20 years old. The washer is a standard, top-loading machine, with very few wash options available.

### **Research Questions:**

- Research energy efficient replacement clothes washers.
- What factors need to be considered to enable you to make a decision on a replacement?
- Decide on a good, energy efficient, replacement clothes washer.
- Roughly how much would it cost?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research

### **Notes:**

## **Situation 16 Clothes Dryer**

Your clothes dryer was also given to you by your parents, who replaced it with a new one. It works fine but is over 20 years old. The dryer is a standard, front-loading electric dryer. It once had a humidity sensor that would turn off the dryer when clothes were dry. That no longer works, so now it has to be set to your best guess for the correct number of minutes to dryness.

### **Research Questions:**

- Research energy efficient replacement clothes dryer.
- What factors need to be considered to enable you to make a decision on a replacement?
- Decide on a good, energy efficient, replacement clothes dryer.
- Roughly how much would it cost?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

### **Notes:**

## **Situation 17 No Cost Energy Savings**

One of the reasons you bought this house is because you knew you could develop some energy savings without spending any money at all.

### **Research Questions:**

- Research information on as many no cost things you--or just about anyone--can do to save energy or make your home more energy efficient.
- List at least 10 of the most common no cost energy savers.
- Explain how each no cost energy saver saves energy.
- List the approximate money saving associated with each.
- Cite the sources of information you use to complete your research.

### **Notes:**

## **Situation 18 Low Cost Energy Savings**

There seem to be some obvious things that can be done to improve the energy efficiency of your house. It is one of the reasons you bought it--you knew that you could do some simple, inexpensive things to improve it in a hurry.

### **Research Questions:**

- Research information on as many low-cost things you--or just about anyone--can do to save energy or make your home more energy efficient.
- List at least 10 of the most common low cost energy savers.
- Explain how each low-cost energy saver saves energy.
- List the approximate money saving associated with each.
- Cite the sources of information you use to complete your research.

### **Notes:**

## **Situation 19 Solar Photovoltaic Array**

In buying the home, you had a solar photovoltaic electric generating system in mind. There are no trees or other obstructions between the sun and your rooftop. It could be an ideal location for a solar photovoltaic electrical generating system.

### **Research Questions:**

- Research solar PV, grid connected, electric generating systems.
- What factors need to be considered to enable you to make a decision on whether or not to install a grid connected solar PV electric generating system?
- Roughly how much would it cost to install a 6-kilowatt, fixed-array, grid connected solar PV electrical generating system on the roof of your home?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

### **Notes:**

## **Situation 20 Solar Thermal**

In buying the home, you had a solar thermal (hot water) system in mind. There are no trees or other obstructions between the sun and your rooftop. It could be an ideal location for a solar hot water heating system.

### **Research Questions:**

- Research solar thermal systems.
- What factors need to be considered to enable you to make a decision on whether or not to install a solar hot water system?
- Decide on a good solar hot water system.
- Roughly how much would it cost to have it installed on your home?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

### **Notes:**

## **Situation 21 Fuel Conversion**

Your home currently has a natural gas forced air furnace and a natural gas hot water heater. Both of these, when replaced, could be converted to electric appliances. You also have an electric range and an electric dryer, which could be converted to natural gas when replaced. A natural gas service lines is readily available near the current locations of both the range and dryer.

### **Research Questions:**

- Research information on electric vs. natural gas energy and appliances.
- Which energy source makes the best sense to use from a cost and air emissions standpoint?
- Determine whether or not to switch to a different energy source for your furnace, water heater, or dryer when the time comes to replace them.
- Roughly how much would it cost to switch fuels (ignore the cost of any new appliance)?
- About how long would it take to recover the cost?
- Cite the sources of information you use to complete your research.

### **Notes:**

## **Situation 22 Electrical Rate Structure**

In converting the energy utilities to your name, you find there are different homeowner electric rate billing options to choose from. There are standard rates, and time-of-use rates.

### **Research Questions:**

- What are the advantages and disadvantages of each rate structure
  - fixed homeowner electric rate, and
  - time-of-use electric rates?
- What needs to be considered in determining which rate structure to choose?
- Which rate should be chosen to achieve maximum energy and money savings?
- Why did you select that rate structure?
- Cite the sources of information you use to complete your research.

### **Notes:**