

ESA 21: ENVIRONMENTAL SCIENCE EXERCISES

Energy: Synthesis and Analysis

Capstone Activity

Introduction

Over the last three weeks, we have been studying energy flow and usage in our homes. In week two, we observed that the material used in the construction of our homes has a tremendous impact on the rate at which heat flows through its exterior surfaces. In weeks one and three, we performed an energy audit of our homes to estimate the amount of money that it costs to power it.

As you have seen during our studies, there are many factors that affect the cost of energy in our homes. The right choices of materials, appliances, heating and cooling system, and fuel source can greatly reduce the amount of money that you spend. The situation for most of us is that these decisions have already been made, since our homes have already been built and stocked with appliances and systems. For us, the question is "Can my home be modified so as to save energy and money?"

After entering your data into the online calculator, you should have a gross estimate to the energy cost for your home (excluding lights and small appliances) in an average year. While the value may not be exact, it should be similar to what you pay if you remove the costs of running your lights, TV's, VCR, etc. What we would now like to know is if there are any changes that you could make to your home that would be of economic benefit. For instance, if you have single pane windows in your home, you could save energy by replacing these windows with double pane windows. Using the online calculator, you should be able to estimate how much energy and money this would save you each year. Of course, installing the windows will also cost you money. The amount of money that you would spend in making the change divided by the amount of money you would save each year will tell you how many years it would approximately take to pay off your investment. After that many years, the change would save you money.

Saving energy often involves making an upfront investment and having the energy savings pay off over the long haul. In the National Public Radio segment below, the energy efficiency of home appliances and their sales are examined. See if any of the issues mentioned relate to your willingness to make similar investments in energy efficiency in your home.



[Listen](#)

Topic: Energy-efficient Appliances

Date: October 23, 2000

Summary: NPR's Jack Speer reports on the Energy Department's new standards and guidelines for energy conservation on household appliances. The guidelines aim to boost consumer interest in energy savings at a time when energy costs are rising. From washing machines to dishwashers to refrigerators, a range of energy efficiency appliances are now on the market, but they can be too pricey, leading to concerns about how fast they'll catch on (<http://www.npr.org>). (5:10)

Link: <http://www.npr.org/ramfiles/me/20001023.me.08.ram>

Requires [RealPlayer](#)

In this module's capstone activity you will examine the costs and benefits of making changes to your home to improve its energy efficiency. In order to learn more about home energy issues, you must first visit the [Energy Savers](#) web site from the U.S. Department of Energy (requires [Macromedia Flash Player](#)).

DOE Energy Savers Web Site:
1. Learn about home energy usage by viewing the "Introduction" and "Your Home's Energy Use" sections.
2. Browse the links on "Windows", "Heating and Cooling", and other topics to investigate energy efficiency improvement options.
3. Explore the Interactive Virtual Home on the DOE web site. Be sure to visit all levels (for multi-level dwellings) and to click the "Best Features", "Save Money", and other buttons to learn about home improvements in detail.
4. Choose an energy-saving home improvement that can be investigated with the Home Energy Analysis calculator. Examples include upgrading windows/doors, improving the R-factor of walls and ceilings through additional insulation, insulating air ducts, and so on.

Analysis of Changes:

In this module's Capstone Activity, you will perform an economic analysis of three home improvements that could be performed on your home. You will determine how many years it would take to pay off your investment, and decide whether these scenarios would be economically feasible. If you rent, pretend that you own the property in order to answer these questions. The proposed changes must be substantial (e.g., installing more energy efficient windows or doors, improving insulation, etc.), and cannot include lifestyle changes like altered thermostat settings or reduced appliance usage. Describe the changes in detail on the Capstone Activity sheet.

You will need to provide supporting evidence to show that the estimated cost of making each improvement is reasonable. If you propose to do the work yourself (and do so only if you possess such skills), then you will need to provide the prices of the required materials from a local home-improvement store, listing the specific items and the store location (feel free to attach clippings from store circulars showing the items and prices). If the proposed work is to be done by a professional, you must provide an estimate from an independent, home improvement store-affiliated, or online contractor. You can obtain an estimate for select home improvements with the [ImproveNet](#) web site's Estimators function.

Once you know what it will cost, determine the amount of money that would be saved with each home improvement. Do this by running the Home Energy Analysis calculator **with** the improvement, and then compare the sum of your annual energy costs before (using your initial run of the calculator from Exercise 3) and after the improvement. Based on the cost of the improvement and annual energy savings, calculate the number of years required to recoup the costs of the improvement in reduced energy use. Attach printouts of the calculator for each of the three proposed changes to provide evidence of the cost savings through greater energy efficiency. Once your three analyses are complete, answer the remaining questions on the Capstone Activity sheet.

Internet Addresses of Linked Sites:

Energy Savers: http://www.eren.doe.gov/consumerinfo/energy_savers/

Energy Savers Virtual Home: http://www.eren.doe.gov/consumerinfo/energy_savers/virtualhome/

ImproveNet cost estimators: <http://www.improvenet.com/projecttools/index.html#estimators>

ESA 21: Environmental Science Activities

Capstone Activity
Module 2

Name:

Professor:

Describe in detail the three proposed changes below, list the cost of each and the annual savings, and calculate the payback time in years. Attach all supporting documentation (prices, estimates, calculator runs) to this sheet.

Scenario 1:

Savings/year = \$_____

Cost = \$_____ Payback time = ____ years

Description of change:

Scenario 2:

Savings/year = \$_____

Cost = \$_____ Payback time = ____ years

Description of change:

Scenario 3:

Savings/year = \$_____

Cost = \$_____ Payback time = ____ years

Description of change:

Analysis:

Compare/contrast the three scenarios that you have listed. Do any of them make economic sense to perform? Why or why not? Which of them would be the most feasible, and why?

The previous question examines the feasibility of home improvements solely from an economic standpoint. There is, of course, another perspective. Whenever you heat or cool your home, you are likely using energy derived from the combustion of a fossil fuel, which produces pollutants and contributes greenhouse gases to the atmosphere. The lower your home's energy efficiency, the more energy you will consume, and the more pollution you will generate. With this in mind, would you consider making improvements in your home's efficiency to reduce your energy usage (and therefore release of pollution) even if you did not recoup all of the costs associated with the improvement? Fully explain why or why not.