

What Makes A Home “Energy Efficient”?

Grades: 9-12

Topics: Energy Efficiency and Conservation, Buildings

Author: Alexis Durow

Owner: ACTS

Education Module

Title:
Home Energy Investigation

Author:
Alexis Durow

Grade Level/Subject
9th/10th Grade Environmental Science

Relevant curriculum standards:

CONTENT STANDARD D: As a result of their activities in grades 9-12, all students should develop an understanding of

- Energy in the earth system
- Geochemical cycles

CONTENT STANDARD E: As a result of activities in grades 9-12, all students should develop

- Abilities of technological design
- Understandings about science and technology

CONTENT STANDARD F: As a result of activities in grades 9-12, all students should develop understanding of

- Personal and community health
- Population growth
- Natural resources
- Environmental quality
- Natural and human-induced hazards
- Science and technology in local, national, and global challenges

CONTENT STANDARD G: As a result of activities in grades 9-12, all students should develop understanding of

- Science as a human endeavor
- Nature of scientific knowledge
- Historical perspectives

Teacher's overview:

As energy demands increase and the resources to meet those demands dwindle and continue to prove harmful to the environment, society is becoming more conscious of conserving energy. One way to do this is to improve one's home energy efficiency. Through this module, students will understand where energy can be wasted in the home, how to rectify this and come up with a plan to improve their homes.

I am basing this module on a workshop I took through the Colorado Energy Science Center (CESC). I have used this lesson plan for the last 2 years, and I am writing this module to make it more challenging and interesting for high schoolers. The activity guide may be requested from the CESC at <http://energyscience.org/index.html>.

The final project will be for the students to design a realistic, research based report on how much time, money and energy it would cost/save if they were to improve their own homes so that they are more energy efficient.

As a part of the lesson, the students may enter the Colorado Energy Science Center's Home Energy Contest:

<http://energyscience.org/education/homeenergy/index.html>

They may also enter Excel Energy's Contest:

http://smartenergyliving.org/ecm/Contest/Xcel_06.html

Learning objectives:

- Investigate how energy is used in homes
- Explore how energy can be used more efficiently
- Perform some of the tasks of real professional energy engineers by providing real data on the money and energy saved in an improved home
- Articulate what they have learned to home energy users & professionals in their community
- See that their work can make a tangible difference in their communities by reducing energy costs.
- Understand the larger picture of energy use and sources in our society
- Understand what a renewable energy source is
- Design a plan to improve the efficiency of their own home

Time allotted:

Approximately 6-10, 55 minute classes. If the students want to enter the contest, more time will be needed.

Vocabulary:

Energy: sources and forms of

Conservation Laws

Fossil fuels

Efficiency

Renewable energy sources

Resource materials:

Go to <http://energyscience.org/index.html> to order an activity guide. It is free! There are several of the activities that I will not do or modify.

Prerequisite knowledge:

No prerequisite knowledge is needed. However, about 2 weeks before this lesson, have the students start to collect their electric/heat bills for the last 12 months, to be used during the lesson. You may also want them to work on their 'Home Energy Check Up' before you begin the lesson.

Main activities:

1) Pre-test:

- sources and forms of energy
- conservation
- efficiency
- energy efficient materials
- units for electricity and heat
- ways to conserve energy

2) Start a discussion or have the students discuss in small groups, using the following questions:

- How much energy does your home use? (dollars or Kw-hours)
- Where does this energy come from?
- How much energy does your home waste?
- Can you really cut your energy bills by hundreds of dollars by making your home more energy efficient?

3) Give notes:

- sources and forms of energy
- fossil fuels
- environmental and societal issues with fossil fuels (this could lead to a good class discussion)
- conservation laws
- Amendment 37.

Discuss assignment and give a model/example of what will be expected at the end of the assignment.

4) Begin 'Home Energy Check Up'. Have the students finish parts 1 and 2 (climate and fuel prices and insulation), including the questions.

5) Discuss the answers to part 1 of the 'Home Energy Check Up'.

6) Activity: 'The Color Competition': What is the most efficient color for a roof or a house? This is a very simple activity, so I might just demo it and give the students the data. To make this more challenging, I will have my students do the section on Stefan-Boltzman's law.

7) Have the students research how much it would cost to have their homes painted and possible yearly savings, if needed. Remind them to keep this data for their final project.

8) Discussion/notes:

- What is most of the energy in a home used for (use the Home Energy Check Up)
- Units for electricity and heat
- How does our society compare to the rest of the world's energy use? The following website is a good source.

<http://www.solarenergy.org/resources/energyfacts.html>

9) Activity: 'The Insulation Race': What materials are the best insulators?

10) Discuss the results to the 'Insulation Race' and the questions to part 2 of the 'Home Energy Check Up'.

11) Discuss the design of the student's homes. Have them research an actual cost and possible yearly savings if they improve the insulation in their homes. The following is a helpful website:

http://smartenergyliving.org/ecm/Energy_Efficiency/Insulation.html

12) Quiz:

- forms and sources of energy
- units for energy
- environmental and social issues with fossil fuels

13) Activity: 'Heat Conduction': How much heat is lost through windows in the winter? I have not done this activity, but I do like it and will incorporate it this year.

14) Discuss the questions to this activity, as well as parts 3 and 4 of the Home Energy Check up.

15) Have the students do research and find cost and yearly savings if they were to replace windows, if needed. The following website is helpful:

http://smartenergyliving.org/ecm/Energy_Efficiency/Windows.html

16) This would be a good time to give the students a chance to pull all of their data together and begin a rough draft for their final project (see *Evaluation*)

17) Activity: 'Light Bulbs or Heat Bulbs?': What kind of lighting is the most energy efficient? This is a simple activity. Again, I may just give the students the data and have them do the calculations.

18) Discuss the design of the student's homes and part 5 of the Home Energy Check Up. Have them research an actual cost and yearly savings to replacing the light bulbs in their homes. The following is a helpful website:

http://smartenergyliving.org/ecm/Energy_Efficiency/Lighting.html

19) Activity: Passive Solar: How can a house utilize the sun's energy most efficiently?

20) Discuss the questions to the lab.

21) Activity: Electrical Appliances. I have not done this activity, so I will just go along with the lesson plan.

22) Discuss the answers to the activity and parts 6 and 11 from the Home Energy Check Up. Have the students research what it would cost and yearly savings if they were to replace their appliances with energy efficient ones.

http://www.smartenergyliving.org/ecm/Energy_Efficiency/Appliances.html

23) Activity: Evaluate a year's worth of electricity and heat in your home and 5 other house holds. Graph both Kw-hrs, therms and prepare a qualitative evaluation of each home. In the past, I have had a guest speaker come to the class and do this with them. If you contact the CESC, they will arrange something.

24) Work on final project and review for test

25) If possible, take a field trip and visit a home that is efficient or even 'off the grid'. Contact CESC to arrange this.

Extensions:

- The CO₂ Heat Trap
- Positive Feed Back Loop
- Resonance
- Meter Reading
- Power of Exponential Growth
- Part 7 of Home Energy Check Up: Showerheads
- Part 8: Furnace
- Part 9: Air Conditioning
- Part 10: Water Heater

Evaluation:

- Post test
- Design a plan for improving the student's homes. This needs to include materials, costs, contractors as well as energy and money saved. This may be in the form of a paper, power point presentation or a 3-D model.
- Enter the CESC or the Excel Home Energy Contest.

