



**Energy Audit Project: Energy Efficiency in your Household**

**MA State Standards addressed by the lesson** (Include minimum of two state frameworks goals for this subject and grade level that this lesson aligns to):

**8.M.1** Select, convert (within the same system of measurement), and use appropriate units of measurement or scale.

**8.N.10** Estimate and compute with fractions (including simplification of fractions), integers, decimals, and percents (including those greater than 100 and less than 1).

**8.P.5** Identify the slope of a line as a measure of its steepness and as a constant rate of change from its table of values, equation, or graph. Apply the concept of slope to the solution of problems.

**8.P.6** Identify the roles of variables within an equation, e.g.,  $y = mx + b$ , expressing  $y$  as a function of  $x$  with parameters  $m$  and  $b$ .

**8.P.10** Use tables and graphs to represent and compare linear growth patterns. In particular, compare rates of change and  $x$ - and  $y$ -intercepts of different linear patterns.

**8.P.7** Set up and solve linear equations and inequalities with one or two variables, using algebraic methods, models, and/or graphs.

**National Education for Sustainability Standards addressed by the lesson** (Include minimum of two EfS standards that this lesson aligns to):

**2.3 Energy Economics** - Students survey their own household energy uses, explore opportunities for increased energy efficiency and conservation, and then calculate potential savings over time. (See project steps #1-12)

**2.4 Multiple Perspectives** – Students consider an issue or challenge related to sustainability, through a variety of lenses or perspectives and they explain how approaching that issue or challenge from different perspectives may result in different decisions and outcomes. (See project step #12)

- 3.1 Personal Responsibility** - Students know the difference between actions that they can take themselves and those that require the involvement of other people, organizations, and government. They identify and carry out a personal action that will enhance quality of life in environmental, social/cultural, or economic sectors. (See step #12)

**Brief Summary of Project (including curricular content and unit goals):**

This project is a culmination of the previous two lessons on percent of change and systems of equations. Students will select a household item that uses electricity and research a more energy efficient model. Students will look at the energy savings using the new model versus their model as a percent of change. Students will also determine how long it will take for the new item to pay for itself in energy savings by solving a system of equations. Finally students will reflect on these findings and how they might help them make better decisions in their future lives. The project will be presented in poster form as well as a brief 3-5 minute presentation in class.

**Stage 1 – Identify desired results**

**Enduring understandings (what understandings are desired?):**

*Mathematical Understanding:*

- Understand patterns, relations, and functions
- Represent and analyze mathematical situations and structures using algebraic symbols
- Use mathematical models to represent and understand quantitative relationships
- Understand numbers, ways of representing numbers, relationships among numbers, and number systems

*Sustainability Understanding:*

Students recognize the concept of sustainability as a dynamic condition characterized by the interdependency among ecological, economic, and social systems and how these interconnected systems affect individual and societal well-being. They develop an understanding of the human connection to and interdependence with the natural world.

Students develop a multidisciplinary approach to learning the knowledge, skills, and attitudes necessary to continuously improve the health and well-being of present and future generations, via both personal and collective decisions and actions. They are able to envision a world that is sustainable, along with the primary changes that would need to be made by individuals, local communities, and countries in order to achieve this.

**Essential questions (what essential questions will be considered?):**

How do elements in a system depend on each other?

How is mathematics used as a tool in the world around us?

Outcomes (what key knowledge and skills will students acquire as a result of this lesson/unit?)

*Students will know...*

That initial price is different from overall costs

*Students will be able to ...*

- Write a linear equation for a real-world situation
- Solve a system of linear equations using graphing and substitution
- Calculate energy costs over time
- Find percent savings (percent of change)

Stage 2 – Determine acceptable evidence

Performance tasks (what evidence will show that students understand?):

The poster-see tasks as outlined on student handout.

The presentation-see tasks as outlined on student handout.

Other evidence (quizzes, tests, prompts, observations, dialogues, work samples): Not applicable

Stage 3 – Learning plan

Learning activities (what will students do and what will you, the teacher do, to prepare the students to achieve the desired outcomes?):

Prerequisite Skills and Knowledge:

- Students will be able to find percent of change.
- Students will be able to write an equation for a linear situation.
- Students will be able to solve a system of equations using graphing or substitution.
- Students will know their ecological footprint and what actions have an affect of altering their footprint.
- Students will have a beginning grasp of the concept of long term costs versus initial price.

Misconceptions Students May Have Prior to Project:

- Students may still have some of the same misconceptions they had before either the Percent of Change lesson or the Systems of Equations Lesson.

Materials Needed:

- Copy of Energy Audit Project Worksheet
- Poster Board
- Graph Paper
- Computer w/ printer
- Markers, Colored pencils
- Digital Camera (can be borrowed from library media center)

Sources:

- Home Electricity Audit, Part I: Electricity Calculation Lesson from [www.creativechange.net](http://www.creativechange.net) (This source was selected because it has been used before and fit nicely with the lesson.)
- The basic electricity rate was provided by [www.nationalgridus.com](http://www.nationalgridus.com) (This source was used because it is a primary source.)
- Students will research energy efficient models at local stores and store websites. (This was used because it is an easy way for students to gain this information.)

Procedure/Suggested Timeline:

Day 1: Students will complete steps #1-4.

Day 2: Students will complete steps # 5-8.

Day 3: Students will complete steps #9-11.

Day 4: Students will complete step #12.

Day 5-7: Students will complete step #13.

Grading Rubric can be found at the end of the student handout. Rubric was created by using modifications from [www.rubistar.4teachers.org](http://www.rubistar.4teachers.org).