Introduction to Use of Energy Corps Learning Modules and Knowledge Based Questions

Welcome to the home energy use unit! The following pages will provide you with a guide for educating a variety of age groups on the subject of home energy use, including a breakdown of the most important concepts to cover in any presentation. It will also supply you with a set of questions appropriate for each age group that you must ask as part of any presentation/workshop/survey you conduct related to home energy use. In addition to providing you with a starting point for your presentation, these questions provide change in knowledge data that fulfills your performance measurement requirements. Finally, you will find some tips on how to work with different age groups. These are, however, just a starting point. Including this information into your presentation should be considered a minimum requirement. There are sources included to help you find images and other material. We hope this teaching module will help you give effective presentations throughout your term of service. This module is an evolving document, and your feedback will help us improve our efforts to deliver information and to evaluate the effectiveness of that delivery.

By the end of your presentation, you should have touched on each of the concepts listed below. Student knowledge of each concept will be tested by the questions found in this unit. Each age bracket will contain at least one question relating to each concept. **You must ask these questions both before and after your presentation in order to document change of knowledge within your audience.** Feel free to go beyond what is listed here and explore concepts in greater depth or detail. These questions and concepts are deliberately broad to allow you to tailor your presentation to a specific audience, region or topic. Be creative! Contact your site supervisor or state coordinator with any questions.

Learning Objective

This unit will teach the different end uses of energy in the home, methods and tools to make homes more energy efficient, and ways to reduce energy costs.

Core Concepts

The following are the key concepts that any presentation on Home Energy Use should include.

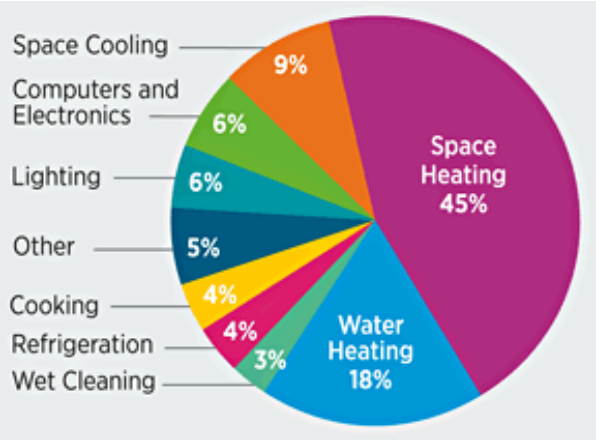
1. **The breakdown of energy use in a home**
2. **Space heating and cooling**
3. **Lighting**
4. **Water Use**

5. **Appliances efficiency/plug load**

Explanation of Concepts

1. The breakdown of energy use in a home:

Every home uses energy in a variety of different ways. Many people, perhaps most people, do little to track exactly how much energy they use. They may have a general sense of when they use more or less energy; for example a resident of San Antonio in South Texas knows that their energy bill goes up in the summer due to greater use of their air conditioner. However some folks may be somewhat clueless as to exactly how much energy goes to each function. This is important because, all other things being equal, the greater the amount of energy a certain function uses, the greater the benefit from making that function more efficient. The full picture is *much* more nuanced than that, but using this breakdown as a starting point can naturally lead a presenter into conversations about the specific areas where home owners can see the greatest gain in energy efficiency or savings.



What we see in this chart from the US Dept. of Energy is a breakdown of the various energy uses in American homes. The remaining 4 concepts in this unit can all be seen on this chart. Feel free to use this chart in your presentation. See the sources at the end of this unit, or the citation below for more information.

Figure 1 (2010 Buildings Energy Data Book, Table 2.1.1 Residential Primary Energy Consumption, by Year and Fuel Type.)

2. Space heating and cooling:

Looking at figure 1, it is easy to tell the largest energy uses in the home. By adding them together, we find that space heating and cooling account for a total of 54% of energy use in the average American home. The rest of this unit flows from this chart and these concepts. It is important to remember that these numbers can vary from season to season and in different regions. There are many ways that people can save money and heat and cool their home more efficiently. Basic building envelope design is a quick route to greater efficiency; proper insulation of walls and design of windows is crucial. The myriad ways energy is lost through windows and walls is an important part of your presentation. According to the US Dept of Energy website, “An insulating material’s resistance to conductive heat flow is measured or

rated in terms of its thermal resistance, or R value ("Insulation"(2012) (energy.gov/energysaver/articles/insulation) According to the DOE (www.energy.gov) proper insulation and air sealing can save 20% on a home's heating and cooling costs. Other important lessons on energy efficient heating and cooling are the advantages of programmable thermostats, which can control temperature of a home down to the minute; the ability of fans to keep residents cool at a fraction of the cost of A/C; and the importance of windows that prevent energy loss through properly sealed gaps and seams, curtains/drapes that can be closed, and storm windows. Energy is lost through windows in a variety of ways. (see "Energy Loss Through Windows" http://www.modernbuilderssupply.com/mbsgreen/energy-loss-through-windows.htm) Finally, there are ways to heat homes with alternative, cleaner energy sources, such as geothermal heat pumps, which make use of Earth's relatively constant temperature.

(http://www.mge.com/home/saving/thermostat.htm)

The more you set back, the more you save

Set back	8 hours per day	16 hours per day	24 hours per day
5°	5%	10%	15%
7°	7%	14%	21%
11°	11%	22%	33%
13°	13%	26%	39%

Check with your doctor if you have a medical condition that requires different temperatures. If you have had problems with pipes freezing during extremely cold weather, correct the problem before setting back.

Recommended thermostat settings

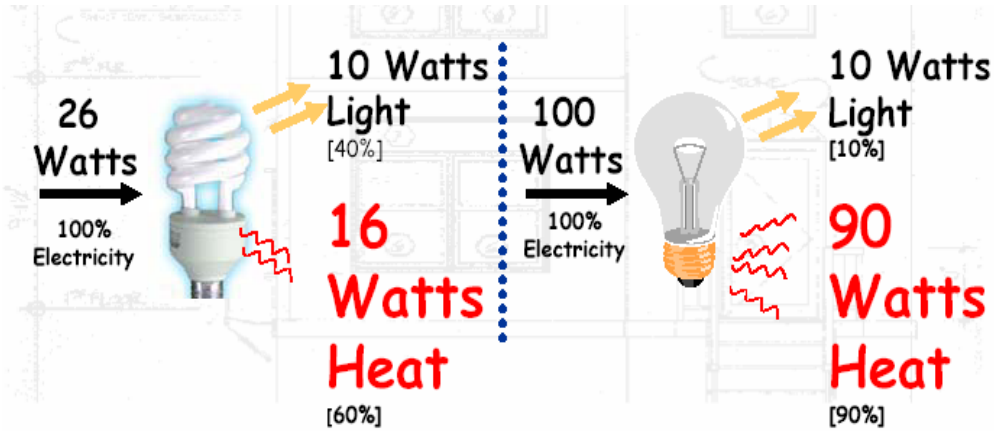
	Winter	Summer
When you're home:	68°*	78°
When you're not at home:	55°*	85°
When you're sleeping:	55°*	78°

*Or as low as health permits. Check the owner's manual if turning down the temperature for more than 24 hours.

http://www.mge.com/home/saving/thermostat.htm

3. Lighting:

The central solution to efficient lighting is the use of more efficient lightbulbs. CFLs and LEDs use less electricity and are more efficient in how they use that electricity. The Incandescent bulb, wonderful as it was in Edison's time, is incredibly inefficient; it converts 90% of the energy it uses into Thermal (heat) energy, and just 10% into light. As a result, the best strategy homeowners can take is to replace incandescent bulbs with Compact Florescent Lamps (CFLs) or Light Emitting Diodes (LEDs). Both are available in a variety of different sizes and shades of light. CFLs achieve about 75% in energy savings, while LEDs are even better at 75 – 80% or more. LEDs are also exceptionally durable and long lasting, 25x longer than a comparable incandescent. CFLs are recyclable, and should always be recycled due to the very small amount of mercury they contain. (see "Lighting Choices to Save You Money" (2012) www.energy.gov) This amount of mercury is approx 4 milligrams, or 0.8% that contained in an old style mercury thermometer. No mercury is released during operation of bulbs that are intact, and they *still* reduce the amount of mercury emitted to the environment because they reduce mercury emissions from coal fired power plants. (US. Dept. of Energy http://energy.gov/energysaver/articles/frequently-asked-questions-lighting-choices-save-you-money#mercury)

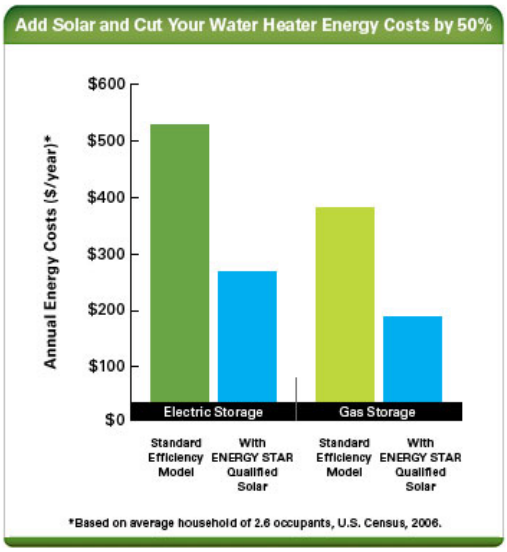


4. Water use:

Water use, whether for human consumption, bathing, washing, or other appliances, is a major part of a home's energy demand. Bathing alone accounts for 700 gallons per week for a family of four. Low flow shower heads, shorter showers, and shallower baths are easy ways to save money. Water heating uses a great deal of energy as well. Alternative ways to heat water are available (solar water heaters or geothermal systems) but the easiest way is to wash clothes or dishes with cold water. More efficient water heaters are available, including those with the Energy Star rating. (www.energystar.gov) Lastly, finding alternative sources of water, such as gray water or rain water collection can be an economical way to supplement municipal water and has many benefits.

Average Hot Water Use

Activity	Gallons per Use
Clothes washing	32
Showering	20
Bathing	20
Automatic dishwashing	12
Preparing food	5
Hand dishwashing	4



5. Appliances and electricity:

The last main concept is appliances and electricity usage for other purposes. This is a general, catch-all concept that considers energy use for cooking, computers, and other household appliances and activities that use electricity. Here the most important info for homeowners is the benefits of Energy Star or other efficient appliances, as well as the simple things they can do to save energy, such as unplugging appliances when not in use. Outlets that are on switches should be turned off. With efficient appliances, the concept of payback periods, if not yet introduced should be discussed here. Payback period is the time it takes for energy savings to add up to the price of the new appliance. In other words, the shorter the payback period, the sooner you start to save money. It does not necessarily mean you save more energy, because a more energy efficient appliance (say a coffee maker) can have a longer payback period than a less efficient coffee maker because the initial cost for the more efficient item is higher. A note on Energy Star: Energy Star is a program of the EPA and DOE that serves as an international standard for rating the energy efficiency of a device, appliance, or building. The program is independent of the manufacturers, and to meet the requirements a device, appliance, or building must achieve 20-30% greater energy efficiency than is called for in Federal standards.

Key relevant definitions[1]

Electricity:

1. A form of energy resulting from the existence of charged particles (such as electrons or protons)

[1] Definitions from Merriam Webster, US Dept. of Energy, and www.energystar.gov

2. The supply of electric current to a house or other building for heating, lighting, or powering appliances.

Energy Star:

1. EPA voluntary labeling program to identify and promote energy-efficient products

Kilowatt-Hour (KWh or KW-hr):

1. a unit of energy equal to the work done by a power of 1 kilowatt (or KW – 1000 Watts) operating for one hour.

R – Value:

1. An insulating material's resistance to conductive heat flow

Some pointers on different age groups

Part of your job as an Energy Corps member is to be able to work with a variety of age groups. To that end this unit provides you with questions deemed by NCAT to be appropriate for a given age group. There are 3 main age groups: grades 3 –5, grades 7 – 9, and upper-High School – Adult. Each set of questions has been designed for the middle of each age group. The upper High School/Adult age group is targeted at a high school junior or senior, assuming most adults have at least that degree of education. Here are a few things to keep in mind when crafting any presentation.

- Some students, particularly younger students, will not have the same concept of "Energy" that you do. For example, they may think of Energy as the sugar rush they get from candy, or they may not yet have been taught what electricity is. This doesn't mean you can't present to them, but you must account for their level of learning.
- No matter what age, try to assess the educational level of your audience, and don't assume they know what you know.
- If you can coordinate with a teacher/group leader in advance of a classroom visit, do so.
- Have fun and be creative, especially with younger groups. They don't have long attention spans, but they will get excited if something is fun and different.
- If you have an age group not covered by this breakdown, contact your site supervisor or state coordinator to help you determine which set of questions to use, or to make your own set of questions.

The Questions

We have provided you with the following questions, approx. 5 for each of 3 age groups. These questions serve 2 purposes: A) they give you a set of questions that you can use during a presentation on the material covered above, so you aren't starting from scratch. B) They give Energy Corps a standardized set of performance measures across the program that allows us to better evaluate the impact our members are having at their respective host sites. Feel free to build or expand on these questions with those of your own.

Grades 3 - 5

1. Which task in the average home uses the most energy?
    a. Lighting
    b. Keeping food cold
    c. Washing and drying clothes
    d. **Heating and cooling rooms**

2. Which of these uses Energy?

a. 

b. 

c. 

d. **All of the above**

3. What kinds of energy does a light bulb make?
    a. Light and Movement
    b. Heat and Sound
    c. **Heat and light**
    d. Sound and light

4. Which of these is a way to save water?
    a. Leave the water running while brushing your teeth
    b. **Take shorter showers or use less water in a bath**
    c. Use hot water in the dishwasher or washing machine

5. True or False: Saving energy can save your family money?
    a. **True**
    b. False

Grades 7 - 9

1. Which task in the average home uses the most energy?
    a. Lighting
    b. Operating appliances
    c. Washing and drying clothes
    d. **Heating and cooling rooms**

2. Which of these light bulbs is the most energy efficient?
    a. **Compact Fluorescent**
    b. Halogen
    c. Incandescent
    d. All light bulbs are the same

3. What is the unit of measure for the electricity your family uses at home?
    a. Ampere
    b. **Kilowatt-Hour**
    c. Volt
    d. Watt

4. How is energy lost through window glass?
    a. Conduction
    b. Convection
    c. Radiation
    d. **All of the above**

5. How much water does the typical family of four use for bathing *each week?*
    a. 200 Gallons
    b. 500 Gallons
    c. **700 Gallons**
    d. 1100 Gallons

Upper High School – College/Adult

1. Which task in the average home uses the most energy?
    a. **Heating and cooling rooms**
    b. Operating appliances
    c. Lighting
    d. Washing and drying clothes

2. What device can control the indoor temperature of a home according to time of day?
    a. Boiler
    b. Programmable thermostat
    c. Thermometer
    d. Ventilator

3. An Incandescent bulb converts 10% of the energy it uses into _____ and 90% into _____?
    a. Chemical, Radiant (Light)
    b. Potential, Thermal
    c. Radiant (Light), Potential
    d. Radiant (Light), Thermal

4. The shorter the payback period of an energy efficient appliance…
    a. The more energy you save.
    b. The less energy you save.
    c. The longer you need to use the appliance to save money.
    d. The sooner you start to save money.

5. Properly insulating your home's attic, floors, crawl spaces, accessible basement rim joists with adequate R-value insulation, and reducing unwanted air leaks can save ____ on a home's heating and cooling costs?
    - **a.** 5%
    - **b.** 10%
    - **c.** **20%**
    - **d.** 40%

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5 Sources to get you started

(except where noted, all questions were developed from information from these sources)

American Council for an Energy-Efficient Economy – www.aceee.org

One of the most comprehensive national resources available. Can be tricky to navigate, but full of information on any conceivable topic.

National Center for Appropriate Technology – www.ncat.org

Your own organization! NCAT and Energy Corps have a wealth of resources available, including the experiences of staff and past Energy Corps members.

National Energy Education Development Project – www.need.org

An organization with a massive set of teaching manuals and "infobooks" covering all age groups

United States Dept of Energy - www.energy.gov

The pre-eminent federal organization, which can also link you to many other government websites including the EPA's Energy Star.

U.S. Energy Information Administration – www.eia.gov

Similar to DOE

Feel free to find your own sources to supplement these. Have fun and good luck!