



UTAH OFFICE OF
ENERGY DEVELOPMENT

Energy Efficiency Makes a Difference

Grade/Subject: Earth & Space Science

Strand/Standard ESS.4.4 Evaluate design solutions for a major global or local environmental problem based on one of Earth's systems. *Define the problem, identify criteria and constraints, analyze available data on proposed solutions, and determine an optimal solution.* Examples of major global or local problems could include water pollution or availability, air pollution, deforestation, or energy production. (ESS3.C, ETS1.A, ETS1.B, ETS1.C)

Lesson Performance Expectations: Students will consider their energy and carbon footprint by conducting a home energy audit. Students will create a plan to be more energy efficient in their own homes. Students will consider how their plan could affect the global challenge of energy production.

Materials:

- Any energy-efficient technologies available for visuals such as a CFL, LED, incandescent bulb, charger, converter box, power strip, smart strip, programmable thermostat, aerator, high-efficiency showerhead, weather stripping, insulation, or an example of water flow measurement bag or container.
- Internet access and device per student to use for research.

Time: 2 - 60 minute periods

Teacher Background Information:

- Energy provides us with electricity, which has standardized many basic comforts, such as heat in the winter and cool air for the summer. Our high quality of life requires the use of **natural resources**. In terms of energy, this comes from renewable or non-renewable such as fossil fuels. The use of energy resources can have environmental effects that impact our **quality of life**. As Utah's population rapidly increases, so do our energy demands. The residential sector accounts for 22% of Utah's electricity and natural gas use. In addition, utility costs are the second-largest burden for homeowners and renters after mortgage and rent (Source: [U.S. Energy Information Administration](#), accessed February 11, 2022.)
- **Energy efficiency** and **conservation** play an integral role in meeting the demands of our thriving economy and growing population. Our behaviors can reduce energy use, save money and preserve the **environment**. Technologies such as programmable thermostats, insulation, LED lighting, smart power strips as well as advancements in the smart grid can also increase energy efficiency. Imagine the difference we could make if we all used energy more efficiently through behavior and technology. We would conserve natural resources for the future. Each one of us can truly make a difference. All it takes is knowledge and action.

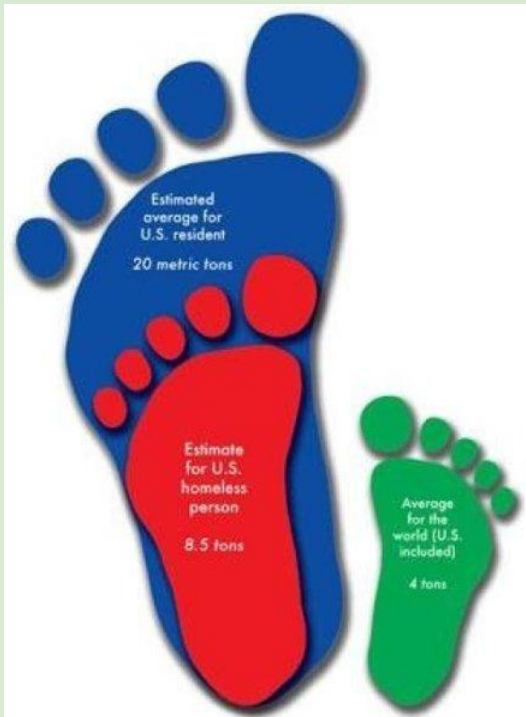
Student Background Knowledge:

- Students know that some energy is produced by burning fossil fuels.
- Students know carbon dioxide is a greenhouse gas and that it is released when fossil fuels are burned.
- Students know that using alternative and renewable sources is another way to produce energy.
- Students know that emissions are produced by burning fossil fuels.

Teacher Step by Step: A 3-d lesson should insist students do the thinking. Provide time and space for the students to experience the phenomenon and ask questions. The student sheet provided below provides guidance but is only an example of how students might respond.

1. Introduce Problem:

- a. Show students the following image and explain that a “carbon footprint” is a way to summarize the greenhouse gas emissions caused by activities of a person or a country. Energy use can contribute to the “carbon footprint.”



- b. Alternatively, have students calculate their carbon footprint at carbonfootprint.com
 c. Allow students time to write down three questions they have about carbon footprints.

2. Obtain Information

- a. Students will learn about energy conservation and things people can do in their daily lives to minimize their use of energy. It is responsible for using all resources efficiently and wisely. Our behaviors can reduce energy use, save money and preserve the **environment**.
 b. Use this video, [Energy Efficiency Tips for Homes](#). (6:41 min)
 c. Show examples of energy-efficient technologies.

3. Obtain Information

- a. Students will conduct a Home Energy Audit at their house. They will use this information to look at ways to conserve energy. You can locate the audit in the student handout (page 5).

4. Analyze Information

- a. Students will look at solutions to their energy consumption.
 b. Students will have a budget of \$500 to make their homes more energy-efficient.
 c. Direct students to the following site: [DOE Energy Saver](#)

- d. Students will choose the options that will help make their homes more energy-efficient.
- e. Students will analyze the criteria and constraints of their choices and make an implementation plan.

5. Communicate Information

- a. Students will present their energy efficiency plan to the class. This can be a poster, PowerPoint, or handout.

Assessment of Student Learning.

- Students will present their energy efficiency plan. The proposal should make specific recommendations with realistic costs.
- Students will conduct a home energy audit to the best of their ability (apartment-dwelling students may find the information difficult to get).

Standardized Test Preparation:

Energy Efficiency Makes a Difference

1. How does a “carbon footprint” summarize a person or country’s energy use?
 - a. It shows how much energy is used by a single person or country.
 - b. It shows how much carbon is located in each country.
 - c. It demonstrates how much more carbon a person consumes than in other places.
 - d. It includes carbon emissions associated with energy use from a single person or a country *

2. How is energy use related to carbon? Choose all that apply.
 - a. Much of our energy use releases carbon dioxide.*
 - b. Carbon is found in most of the fuels we use.*
 - c. Carbon is a naturally found element that is necessary for life.
 - d. People must eat carbon to carry out life functions.

3. What is the purpose of a home energy audit? Choose all that apply.
 - a. To find sources of energy for the home.
 - b. To discover the best ways to heat the home.
 - c. To see how much energy is being used in the home.*
 - d. To show where energy may be wasted or over-used.*

4. Which of the following are ways to make a home more energy efficient?
 - a. Turn off the lights when not in use.
 - b. Buy energy-efficient light bulbs.*
 - c. Turn down the thermostat.
 - d. Purchase modern appliances.*

Extension of lesson: Ask students to share their energy efficiency plan with their parents or guardians and get a response from them.

Career Connections: Arrange a field trip to or a visit from your school or district's Facility Manager (custodian, energy manager, etc.) and investigate the energy-saving methods/structures for your school.

Energy Efficiency Make a Difference

Name _____

Observe the “carbon footprint”. Write three questions you have:

- 1.
- 2.
- 3.

How does energy contribute to the carbon footprint worldwide??

Conduct a Home Energy Audit. (on page 2) Depending on the type of home or apartment you live in, some of this information may not be available but do your best. Parents can be good sources of information.

Give your home a point for every “yes” answer. What is your score? _____

Analyze ways to improve your homes’ energy efficiency. You have a budget of \$500 to propose solutions to make your home more energy-efficient. You may use the following site:

<https://www.energy.gov/energysaver/energy-saver> for additional information.

Describe the solution, criteria (specific details), and constraints (limitations) of each option you choose.

Solution/Cost	Criteria	Constraints

Prepare a 3-5 minute presentation on your Home Energy Efficiency Plan.

Home Energy Audit

- Windows and doors have good weather stripping T F NA
- Window coverings are open on cold, sunny days and closed on hot days. T F NA
- Window coverings are closed at night when heating or cooling systems are on. T F NA
- Thermostat is set at 68 F (20 C) or lower in winter. T F NA
- Air conditioning is set a 78 F (26 C) or higher in summer T F NA
- Ducts are insulated in unheated/uncooled areas. T F NA
- Garage is insulated. T F NA
- Air filters on the furnace and air conditioners are cleaned and changed regularly. T F NA
- An energy audit has been conducted from your local utility in the last 3 years. T F NA
- Thermostat is adjusted at night T F NA
- Fireplace damper is kept closed when the fireplace is not in use. T F NA
- Are older appliances replaced with more energy-efficient ones? T F NA
- Is your water heater insulated? T F NA
- Is the temperature of water set at 120 degrees F? T F NA
- Are electronics unplugged when not in use? T F NA
- Are LED or CFL light bulbs replacing older incandescent bulbs? T F NA
- Are lights turned off when not needed? T F NA
- Do doors fit tightly? T F NA
- Is there insulation in the ceiling or walls? T F NA
- Are windows shaded by trees or curtains from the summer sun? T F NA