

Lesson Plan

Assessment	AFL, questions
Cross-curricular	

Big Ideas

- Energy sources are either renewable or non-renewable.

Learning Goals

- To familiarize themselves with different forms of energy
- To understand what renewable and non-renewable mean
- To appreciate how solar energy is transformed in so many ways and is really the energy making life, including ours, possible on Earth.

Specific Expectations:

2.4 use appropriate science and technology vocabulary, including energy, heat, light, sound, electrical, mechanical, and chemical, in oral and written communication

3.1 identify a variety of forms of energy (e.g., electrical, chemical, mechanical, heat, light, kinetic) and give examples from everyday life of how that energy is used (e.g., electrical energy for cooking; chemical/electrical energy to run our cars; mechanical energy to hit a baseball; light energy for managing traffic on the roads; heat energy to warm homes and schools)

3.2 identify renewable and non-renewable sources of energy (e.g., renewable: sun, wind, ocean waves and tides, wood; non-renewable: fossil fuels such as coal and natural gas)

Description:

This is the **first** lesson in a set of five on energy, with a focus on energy storage. Each lesson can be done on its own.

Materials/Resources:

Cheese cube, cracker, bread, marshmallow, etc. (dried foods work better)
 Needle and Cork (item to stick a needle into)
 Lighter or Bunsen burner, test tube, retort stand (OR an empty tea light container and tongs)

Safety Notes

Be careful if using an open flame.

Introduction

Motivation

A key factor in energy conservation is our ability to store energy. Without storage we cannot build a power grid that relies on renewable energies as the main energy source. Understanding this will lead the students to be able to better understand the issues surrounding energy conservation in general. Building an energy storage device is also major curriculum link. We aim to give a self-contained set of lessons to address this link in an innovative and fun way.

We will start the unit on energy by discussing what the students already know about different types of energy. We can fill in more information as we have this discussion.

Brainstorming – Forms and sources of Energy

- Start with a bit of quiet brainstorming. Give each student a few post-it notes or small pieces of paper. Ask them to write down each form and source of energy they can think of on a separate piece of paper.
 - Draw two large circles on the board to represent “renewable energy” and “non-renewable energy”.

Discussion – Renewable versus Non-Renewable

- Before we go through what students came up with, we need to introduce the concepts of renewable versus non-renewable energy.
- What do you think these categories mean? Discuss.
- Here are some points to consider during the discussion:
 - Renewable: A source of energy that does not run out. For example the wind will keep blowing no matter how many windmills we build. The Sun always keeps shining, and water always flows down inclines. This type of energy won't run out. Other renewable energy sources: geothermal, burning of various plants (wood, grass, corn, etc.), tidal, and biogas.
 - Non-renewable: Energy sources that can only be used once and then they are gone. For example once we burn coal, natural gas or oil it is forever gone as an energy source. One day we will run out of these resources. Nuclear energy is also non-renewable as it relies on uranium that we have to mine.
- Now let's discuss what you came up with.
 - As you go make the distinction between forms of energy and sources of energy.
 - Discuss the example. If it is a source of energy, where does it belong in the categories on the board?
 - Get all students with the same answer to put the post-its (or pieces of paper) on the board in the appropriate circle.
 - Add some sources at the end that students missed.
- Renewable versus non-renewable
 - Notice how many more renewable energy sources we have than non-renewable energies. How come we don't use them more?
 - Harder to harness and therefore often more expensive. Might depend on local availability etc.

Action

Human Energy

- Maybe the term “human energy” or something similar came up. What does that mean?
- Can you show me some human energy?
 - Have students get up and jump around etc. Keep going until students clearly burned some energy!
- Did that use energy? Where did that energy come from?
 - Lunch, which came from meat and vegetables. Animals eat plants too. Plants get their energy from the Sun. They use solar energy to grow through photosynthesis.
 - So what you just burned is SOLAR ENERGY!
 - Energy has been transformed from solar, to plant energy (chemical) to animal (again, chemical) until it reaches us.
 - We can't make or destroy energy. We have to take it from somewhere. That is because energy cannot be created. Only converted from one type to another. We will discuss this more in these lessons. We will see how in every example we can think of energy is always conserved but changes from one form to another.
 - Without the Sun most life on Earth would cease to exist – including us. We ARE solar energy in a way.
 - We are in fact stored solar energy! Solar energy is stored in us until we decide to use it to do something with it. Isn't that neat?

Demonstration - Burning

We can use a block of wood, a candle, or anything else that burns as a great analogy for ourselves as humans. It allows us to see very well how the energy is BURNED.

- We are not so unlike this candle (or whatever you decide to use). What is this candle made of?
 - Wax comes from bees that got their energy from flowers that got it from the Sun.
- Light the candle. Can you see the energy? (yes)
 - This candle, a block of wood, indeed even a tank of oil is stored up solar energy.
 - So today when you walk home – think of yourself as a little bundle of solar energy. Then look around yourself and notice all the other places where solar energy is stored! (trees, dogs, other people, the grass etc.)

Consolidation/Extension

Taking the candle analogy one step further

- We are actually very similar to a candle in more ways than being storage for solar energy.
 - Place a beaker/cup over the candle. It goes out. Why? (Lack of oxygen). Can we survive without oxygen? (No)
 - Hold hand close to flame. It's hot! Now touch your hand. Is it warm?
- In fact in our bodies are similar to this burning flame.
 - You are in fact BURNING energy in every cell of your body. That stored up solar energy (in the form of chemical energy in your cells) is burned and releases heat.
 - This is why you feel warm. You need oxygen just like this flame.

Demonstration: The Energy in Food – Burn It!

You have heard about calories in your food. Calories measure the amount of energy. We now know that this is the amount of stored up solar energy!

- Can we see this stored up energy? Let's try it!
 - Stick the eye of a needle into a cork or similar base.
 - Stick a piece of food on the needlepoint.
 - Carefully light the food with a lighter or Bunsen burner.
 - You may have to hold the flame up to it for a while to light it.
 - Now you can see the energy it contains!
 - Can we capture it?
 - Place a test-tube with a bit of water over it using a retort stand.
 - If you do not have a test-tube and retort stand you can try holding an aluminum tea light container filled with water over the burning food with a pair of pliers or tongs. You can measure/feel that the temperature of the water goes up.
 - Discussion items: Energy transformations that took place here. The release of solar energy.

Handout: Renewable and Non-Renewable energies

- Same exercise as we did in class at the beginning – put forms of energy and sources into the appropriate circles.
- Students can complete this at the end of class or for homework to consolidate learning.