Sixth Grade Energy and Conservation Unit
Parent Background Information

WHAT IS ENERGY?

The nature of energy is very complex, but it is best described by these characteristics:

• energy is the ability to do work,
• work is the application of a force through a distance (e.g., carrying yourself and a loaded back pack up a mountain trail),
• force is that which can put matter into motion or stop it if it is already moving (e.g. , you are stopped at a stop sign and the car behind you doesn't see you stop, and can't stop before colliding with your rear bumper, pushing you into the intersection), and
• motion is a change in distance or direction with time (e.g., making a right hand turn). Energy can be possessed by an object in two different ways, as kinetic energy and potential energy. If this energy is due to the fact that matter is moving or is in use, it is called kinetic energy. If it is due to the position, structure of matter, or composition, it is called potential energy. Potential energy is stored energy.

WHAT ARE THE PRACTICAL SOURCES OF ENERGY?

The practical sources of energy include the fossil fuels, natural gas, petroleum (or oil), and coal. Fossil fuels are referred to as nonrenewable energy sources because, once used, they are gone. Scientists are exploring the practicality of other sources called renewable energy sources. These include sun, wind, geothermal, water, and biomass. The renewable energy resources are important in long range energy planning because they will not be depleted.

Natural Gas
Sometimes natural gas is confused with gasoline, the fuel in cars. They are not the same. Gasoline is a mixture of liquids, and natural gas is mainly methane and is piped into homes and office buildings where it is used as an energy source for heating, cooking washing, and drying. It is raw material to make other chemicals, and is the cleanest bumming fossil fuel. This means it contributes little environmental pollutants when bummed.

Petroleum or Oil
This is the black, thick liquid pumped from below the earth's surface wherever you see an oil rig. To make it useful, it is refined. Refining separates the gasoline portion which is used in transportation. Products from the remaining portions include synthetic rubber, detergents, fertilizers, textiles, paints, and pharmaceuticals.

Coal
Coal is the most abundant fossil fuel. It is not a widely used energy source due to the cost of mining and its impurities, which cause pollution (acid rain). There are two ways to mine coal; underground mining and strip mining. Disadvantage to these methods is the environmental change caused in the process.

New ways of using coal are being explored, such as liquefication, in which a product similar to oil is produced.

Solar

The sun is 93 million miles away and yet, this ball of hot gases is the primary source of all energy on earth. The high temperature of the sun is generated in the core, where small atoms of hydrogen are fused, that is, the centers of the two atoms are combined. Fusion releases far greater energy than splitting the atom (fission, see below). Without sunlight, fossil fuels could never have existed. The sun is the supplier of energy which runs the water cycle. The uneven heating of the earth produces wind energy. Solar energy can be used to cook food, heat water and generate electricity. It remains the cleanest energy source and it is renewable.

Wind

The unequal heating of the earth's surface by the sun produces wind energy, which can be converted into mechanical and electrical energy. For a long time, the energy of wind has been to drive pumps. Today windmills can be connected to electric generators to turn the wind's motion energy into electrical energy, and wind over 8 miles per hour can be used to generate electricity .It is a renewable, but unpredictable, energy source.

Wood

Wood provides U .S. homes and industries as much power as nuclear plants. Burning is the major global source of carbon dioxide in the atmosphere. Worldwide, wood is poor man's oil, providing 50-60% of the people with the barest energy necessities. Roughly half of the earth's forests have disappeared since 1950. Wood is considered a renewable energy source.

Hydroelectric (Falling Water)

When water is collected behind dams on large rivers, it provides a source of energy for the production of electricity. The enormous power of falling water is capable of turning giant turbines. These turbines drive the generators, which produce electricity. The degree of power is determined by the amount of water and the distance it falls. Hydroelectric power plants do not cause pollution, but there are fewer and fewer places to build dams. The environmental problem arises because a dam is typically built on a river creating a lake where land once stood. Water is a renewable energy source.

Ocean Tides

Ocean tides are very powerful forces. To harness the rising and falling of the tides would be an expensive process, but it would be a very important future source for Eastern United States. Perhaps underwater windmills or floating generating stations could utilize this potential energy source to produce electricity.

Geothermal

Geothermal energy refers to the energy deep within the earth. It shows itself in the fountains of boiling water and steam known as geysers. Geothermal energy was generated by the decay of natural radioactive materials within the earth. In addition it is the heat energy remaining within the earth from gravitational formation of the earth. This energy source is not popular in the United States, but

Yellowstone has some geysers. Geothermal energy is used to heat some homes, greenhouses, and factories. The actual usable geothermal sites are few, but is considered a renewable energy source.

Biomass

This is garbage! As bacteria decomposes organic waste such as manure, septic tank sludge, food scraps, pond- bottom muck, etc., methane is produced. This methane is the same as natural gas from the ground. There are power plants in the United States, which use methane derived from these organic wastes (mainly manure). Some cities produce electricity by burning garbage in especially designed power plants.

Nuclear Fission

This is splitting of the uranium atom. In the 1930's scientists found that splitting the nucleus of an uranium atom releases a tremendous amount of heat energy. This knowledge was used to make atom bombs. Today, power companies use the heat produced by nuclear fission to produce electricity. Some people think nuclear energy should be our main source of future energy. Other people feel that the dangers are too great from radioactive waste products, meltdowns, and radiation exposure of workers.

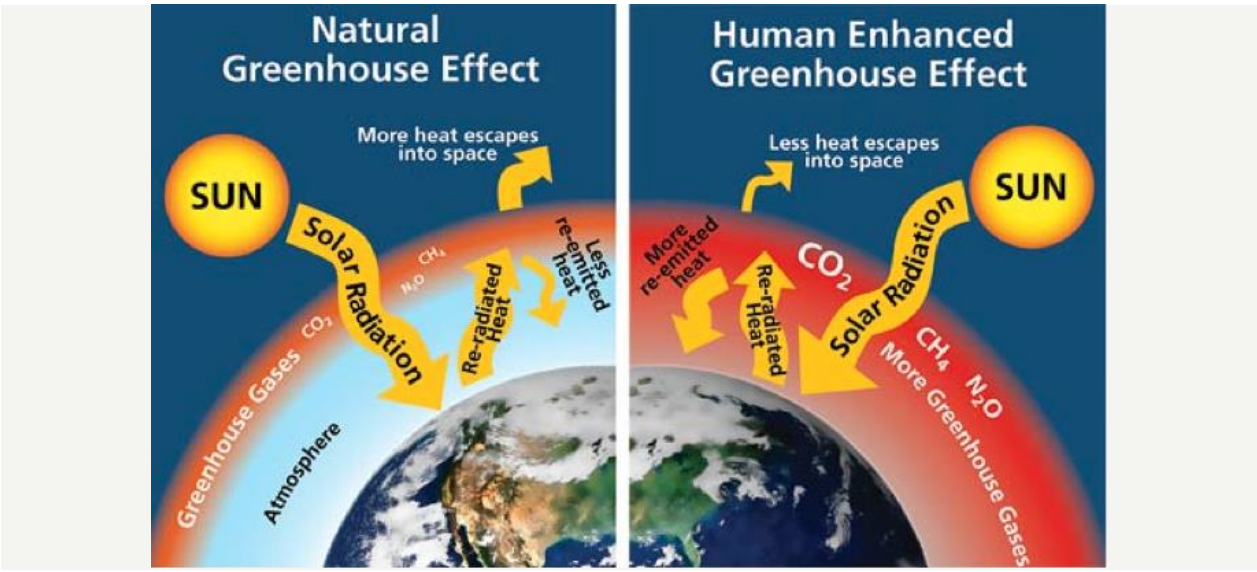
Currently the nonrenewable resources supply the majority of our energy needs because we have designed ways to transform their energy on a large scale to meet consumer needs. Regardless of the source of energy, the energy contained in the source is changed into a more useful form. In summary, energy sources can be classified as renewable or nonrenewable:

Renewable	Nonrenewable
1. sun	1. coal
2. water	2. natural gas
3. wood	3. petroleum
4. wind	4. nuclear fission
5. biomass	
6. geothermal	
7. ocean tides	

(Source: http://www.nrel.gov/docs/gen/fy01/30927.pdf)

GREENHOUSE GASES AND CLIMATE CHANGE

The greenhouse effect is a naturally occurring process in the Earth's atmosphere that warms the planet. In the absence of a greenhouse effect, the average temperature at the Earth's surface would be approximately 60^{o}F colder. Visible light from the sun passes through the atmosphere and is absorbed by the Earth's surface, heating it up. That energy is then emitted back to the atmosphere as heat. Greenhouse gases in the atmosphere can absorb this energy, preventing it from escaping back into space. This raises the temperature of the atmosphere and ultimately, the Earth's surface. You can think of greenhouse gases as a blanket- and human-induced increases in greenhouse gas concentrations make this blanket thicker, warming the planet.



"Global warming" refers to the increase of the Earth's average surface temperature due to a build-up of greenhouse gases in the atmosphere. "Climate change" is a broader term that refers to weather trends observed over relatively long periods of time (many decades or longer). Climate change can include many variables (temperature, precipitation, wind direction, wind speed) and different geographic scales, over a continent, within an ocean, for the Northern Hemisphere, for the planet.

Several pieces of evidence support the view that greenhouse gas concentrations in the atmosphere are increasing because of human activities. Here are a few:

- Ice cores from Greenland and Antarctica tell us that carbon dioxide and other greenhouse gas concentrations were relatively stable for thousands of years, but began to rise around 200 years ago, about the time that humans began to engage in very large-scale agriculture and industry. Concentrations for these gases are now higher than at any time for which we have ice core records, which stretch back 800,000 years.
- Some greenhouse gases, such as industrial halocarbons, are only made by humans. Their accumulation in the atmosphere can only be explained by human activity.
- In 2013, a surface temperature study published in *Science* found that global warming over the past 100 years has proceeded at a rate faster than at any time in the past 11,300 years.
- Carbon comes in different isotopes (carbon-12, carbon-13, carbon-14; the numbers indicate the atomic weight). Carbon dioxide from fossil fuels has a certain isotopic "signature" that differs from other sources of CO_2. Scientists measure the different isotopes to confirm that the increase in carbon dioxide in the atmosphere is predominantly from fossil fuel combustion.

Those who deny climate change point to some of the following evidence:

- Earth's climate has always warmed and cooled due to things like volcanic eruptions and fluctuations in the sun's activity, and the 20th century rise in global temperature is within the bounds of natural temperature fluctuations over the past 3,000 years. Although the planet has warmed 1.4 ^{o}F over the 20th century, it is within the +/- 5^{o}F range of the past 3,000 years.

- A 2003 study by researchers at the Harvard-Smithsonian Center for Astrophysics found that "many records reveal that the 20th century is probably not the warmest nor a uniquely extreme climatic period of the last millennium." A 2005 study published in *Nature* found that "high temperatures- similar to those observed in the twentieth century before 1990- occurred around AD 1000 to 1100" in the Northern Hemisphere.
- According to a 2010 study in the *Chinese Science Bulletin*, the recent global warming period of the 20th century is the result of a natural 21-year temperature oscillation, and will give way to a "new cool period in the 2030s."
- According to an Aug. 2012 study in *Nature*, the rate of global carbon uptake by the earth's carbon sinks, such as its forests and oceans, doubled from 1960-2010 and continues to increase

As with any debate in science, it is important to evaluate the research studies: are they peer-reviewed, by whom are they funded?