

Energy Basics

Definition of Energy

Energy is the ability to do work. In other words, energy produces change in something---it can do things for us.



Energy enables people to walk, run, and jump.



Energy allows cars, planes, and motor boats to go.



Energy permits a cell phone, light bulb, or television to be turned on.

Sources of Energy

Our environment supplies us with many sources of energy to do work for us.

Some energy sources need to be *harvested* extracted from the earth.

The earth contains fossilized remnants of plants and animals that died millions of years ago. These organisms decomposed and became fossilized. After burial and exposure to heat and pressure from the earth, the organic matter is transformed into fossil fuels such as petroleum, natural gas and coal.

Some energy sources need to be *harnessed*.

When the motion caused by wind is captured, it can be converted into electrical energy. The motion of the tides can be translated into electricity or other forms of energy.

Some energy sources are *derived* from other sources.

Electricity can be obtained by transforming another form of energy---like coal, oil, natural gas or wind---into electrical energy. Hydrogen fuel is not naturally available so it must be separated from another substance such as water that is composed of hydrogen and oxygen (H₂O).

Some energy sources are *utilized* in their natural form.

The sun's energy is absorbed into the roots and leaves of plants enabling them to grow. Some buildings are designed to be naturally heated by the sun's energy.

TAKE NOTE... The sun is the largest energy source because so many processes rely on it.

Energy sources fall into two categories: *nonrenewable* and *renewable*.

Nonrenewable Energy Sources

For a long time, our society has been relying on sources of energy with limited amounts. These are called **nonrenewable energy sources** because they cannot be replenished within a short period of time. If we continue to use nonrenewable energy sources, our supply will run out someday.



PETROLEUM: Oil wells pump out the petroleum from tiny pockets underground. When the wells run dry, there will be no more petroleum.



COAL: Mines are set up underground so people and machines can dig out the coal. Once all the coal is mined, there will be no coal left.



NATURAL GAS: Drilling is necessary to reach the natural gas trapped in pockets underground. Once all the gas is released, there will be no more.



PROPANE: Power plants and oil refineries separate out propane from petroleum and natural gas. When these things run out, so will propane.



URANIUM: Open-pit mines are dug into the Earth's crust to extract rocks that contain uranium. Once all the uranium is mined, it will be a depleted energy source.

Renewable Energy Sources

Recently scientists and engineers have developed methods to capture energy from sources that have unlimited supply. These sources are called **renewable energy sources** because they can be replenished in a short period of time, during a person's lifetime. In today's society, we mainly convert renewable energy sources into electricity.



SUNLIGHT: Solar panels to capture the sun's energy. We can use the sun's energy today, because the sun will shine again tomorrow.



WIND: Wind turbines capture the wind's energy. We can use the wind's energy now, because the wind will blow again later.



TIDES: Tidal stream generators capture the tide's energy. We can use the tide's energy now, because ocean waves keep moving.



RIVERS: Dams enable us to capture the energy of a moving river. We can use the river's energy now, because more rain will fall to replenish the water.

Forms of Energy

Energy is found in many forms. Coal is a form of energy---We burn natural gas so we can cook our food which we eat to give us energy. Sunlight is a form of energy---Plants absorb the sun's energy in order to grow. All forms of energy fall into one of two categories: ***potential energy*** or ***kinetic energy***. While there is only one kind of kinetic energy, there are three common kinds of potential energy – nuclear, electric, and gravitational.

POTENTIAL ENERGY

Potential energy is stored energy.

A roller coaster sitting at the top of the track has potential energy. Coal has potential energy because we need to do something to it in order to access its energy.



KINETIC ENERGY

Kinetic energy is the energy of motion.

A roller coaster zooming down the track has kinetic energy. Sunlight has kinetic energy because light waves are constantly in motion and can be absorbed.



Potential Energy

Here are some examples of stored energy.

CHEMICAL ENERGY (ELECTRIC)	NUCLEAR ENERGY	HYDROPOWER (GRAVITATIONAL)
Substances with chemical energy can supply energy once they undergo a chemical reaction that involves the interactions of atoms. For example, food has stored energy and our bodies supply the chemical reaction. Biomass and fossil fuels also have stored chemical energy.	Atoms have a lot of energy stored in their nucleus. When atom is split apart through fission, the nuclear energy can be released and used.	Water held in a reservoir has stored energy. The dam keeps the water from moving down river. When the dam is released, the water starts moving and falling which creates an energy that can be captured.

Kinetic Energy

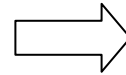
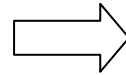
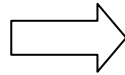
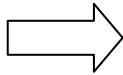
Here are some examples of energy in motion.

WIND ENERGY	TIDAL ENERGY	ELECTRICAL ENERGY
Wind is air particles in motion. Since the rotation of the Earth allows the poles to stay cold while the Sun heats the equator, air molecules continually move between these areas with different temperatures.	The tides are the source of tidal energy. The tides are continually in motion because the positions of the Moon and Sun relative to the Earth continue to change. Gravity makes the water move from high levels to low levels.	Electrical energy (electricity) can be supplied to our appliances when electrically charged particles are moving through the wire. The electric current does not exist unless electrons are moving.

Conservation of Energy

Energy is not created or destroyed, it simply changes form. Potential energy can be converted into kinetic energy. Kinetic energy can become electrical energy (electricity), thermal energy (heat) or another form of energy.

Let's take the hydroelectricity example to see how energy continues to change form:



Water in the reservoir has potential energy.

Dam is released and the moving water has kinetic energy.

We derive electrical energy (electricity) from the moving water.

Electrical energy becomes thermal energy (heat) to cook your food.

You eat your food (chemical energy) to provide you with energy!