

Energy

Energy is the ability of a body to do work. There are two kinds of energy- Potential energy also called stored energy and Kinetic energy also called movement energy.

Potential Energy

Gravitational potential energy

If the object is in a position above the surface of the Earth, it possesses stored energy called gravitational potential energy.

Examples: Books on a shelf, child at the top of a slide, an apple growing on a branch.

Elastic potential energy

Elastic potential energy is also called elastic potential energy. Some materials can be easily squashed, stretched or bent, but spring back into shape once the force acting on them is removed. They are called elastic materials.

Examples: A spring stores energy when it is stretched or squashed, Gases store energy in them when they are squashed.

When the gas used in an aerosol is squashed into a can it stores strain energy. Some of this is used up when the nozzle is pressed down and some of the gas is released in the spray.

Chemical Energy

Energy can be stored in the chemicals from which a material is made. The chemicals are made from atoms that are linked together to make molecules. The chemical energy is stored in the links between the atoms. Food, fuel and the chemicals in an electric cell are examples for stored energy.

The energy is released when the links between some of the atoms are broken and the molecule in which energy is stored is broken down into smaller molecules. For example, carbohydrates are a store of chemical energy in food. During respiration, carbohydrate is broken down into carbon dioxide and water. The energy that is released in this process is used by your body to keep you alive. The energy released by a fuel is used to heat homes, to heat water to produce steam for generating electricity in power stations.

Kinetic Energy

Sound energy

Sound energy is a form of energy that gives the sensation of sound. It is produced by vibration of an object.

Electrical energy

Electric current is the movement of electric charges through a conductor such as copper or graphite. The electric charges are given electrical energy by the battery and carry it to the working parts of a circuit.

Internal energy

Internal energy is also called thermal energy. All substances are made up of particles. They possess a certain amount of energy, which allows them to move. When the substance is heated the movement increases.

Electromagnetic energy

There is a form of energy that can travel through space at the speed of light. This kind of energy travels in waves that have some properties of electricity and some properties of magnetism. They are called electromagnetic waves. This form of energy is also called radiation energy.

Light energy

Light energy is a form of energy that gives a sensation of sight.

Energy changes

We use energy in many ways- for example to cook food, light our homes and move cars and buses. When energy is used it always changes from one form to another and some always changes into heat energy. For example, when you switch on a light, electrical energy is changed into light energy and heat energy. When you play a guitar, chemical energy in your body is changed into movement energy and sound energy.

Wasted energy

When we turn on a lamp, the light is useful to us. We do not use the heat that is produced so it is wasted, and hence termed wasted energy.

Fuels

Many substances are burned to release their chemical energy to provide heat and light. They are called fuels. Wood, coal, gas, charcoal, oil, petrol, natural gas and wax are examples of fuels.

Coal, gas and oil were all formed from plants and animals that lived millions of years ago, so they are known as fossil fuels.

Fossil fuels

Coal is formed from large plants that grew in swamps about 275 million years ago. These plants used energy from sunlight in the same way that plants do today. When they died they fell into swamps. There was a lack of oxygen in the swamp water, which prevented bacteria growing and decomposing the dead plants. Eventually the plants formed peat. Later the peat became buried and was squashed

by the rocks that formed above it. The increase in pressure squeezed water out of the peat and warmed it these processes slowly changed the peat into coal.

Tiny plants and animals live in the upper waters of the oceans and form plankton. When they die, they sink to the ocean floor. Over 200 million years ago, the dead plankton that collected on the ocean floor did not decompose because there was not enough oxygen there to allow bacterial decomposers to live. The remains instead formed a layer, which eventually became covered by rock. The weight of the rock squeezed the layer and heated it. This slowly converted the layer of dead plankton into oil and methane gas. This is the gas that is supplied to homes as natural gas. Several fuels are obtained from oil.

Mining Methods

Coal is mined by two methods

- Surface or opencast method
- Underground or deep mining

Health risks associated with Coal mining

There are a great many risks to your health which can be linked to coal mining operations. Though there are obvious workplace hazards associated with working in a coal mine, these are not the only risks associated with mining activities. Simply living within proximity of a mine can actually cause a variety of health concerns, and both types of mining (deep and surface) pose their own set of problems.

Occupational Hazards of Miners

Miners face a plethora of dangers working in what often amount to cramped, unsafe facilities. The threat of injury is almost constant, miners often being injured from falling objects, equipment, and roof collapse. Though the threat of physical injury is a real concern for many, this is not the only threat that miners face. Miners also run the risk of respiratory damage through the high levels of dust and other chemical particulates present in deep coal mining facilities. Some of the disorders caused by these particulates include COPD, coal worker's pneumoconiosis (CWP, also known as black lung), and progressive massive fibrosis (PMF). The threat of damage to hearing is also a constant concern as the equipment miners work around is quite loud.

- **Deep Coal Mining Community Health Risks**

The health outcomes associated with living in a deep coal mining community are various. Everything from increased rates of lung cancer, respiratory disease, and low birth weight can be linked to communities that are located near mining facilities. Some illness and disease rates (COPD and hypertension specifically) are directly correlated to the number of tons of coal that are extracted from mines. These health issues pose a significant risk to all people located within proximity of deep coal mining facilities.

- **Surface Mining Community Health Risks**

Communities located within proximity of mountaintop mining sites face a broad array of health concerns due to several factors. The use of explosives at these sites causes a great amount of dust which can affect the respiratory health of nearby communities. These explosives are also created from chemicals which have been linked to poisoning in local area residents. These explosions are also capable of fracturing underground water tables and lead to the contamination of drinking water by heavy metals, mine drainage, and methane gas. Explosions have caused flying debris that have crashed into homes causing structural damage and even loss of life. Also, several of the illnesses associated with deep coal mining are also present in communities located within proximity of surface mining sites.

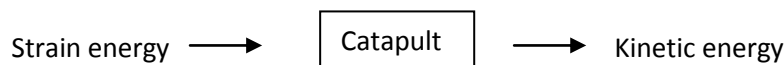
Energy transfer diagrams

Energy transformations can be shown by energy transfer diagrams. There are three parts to an energy transfer diagram

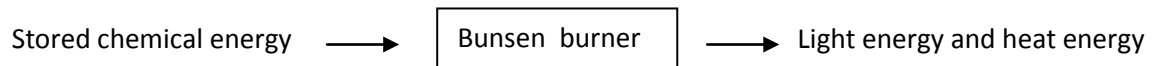
1. an arrow showing the energy input
2. a box showing an energy converter or transducer
3. arrows showing energy output.

Examples:

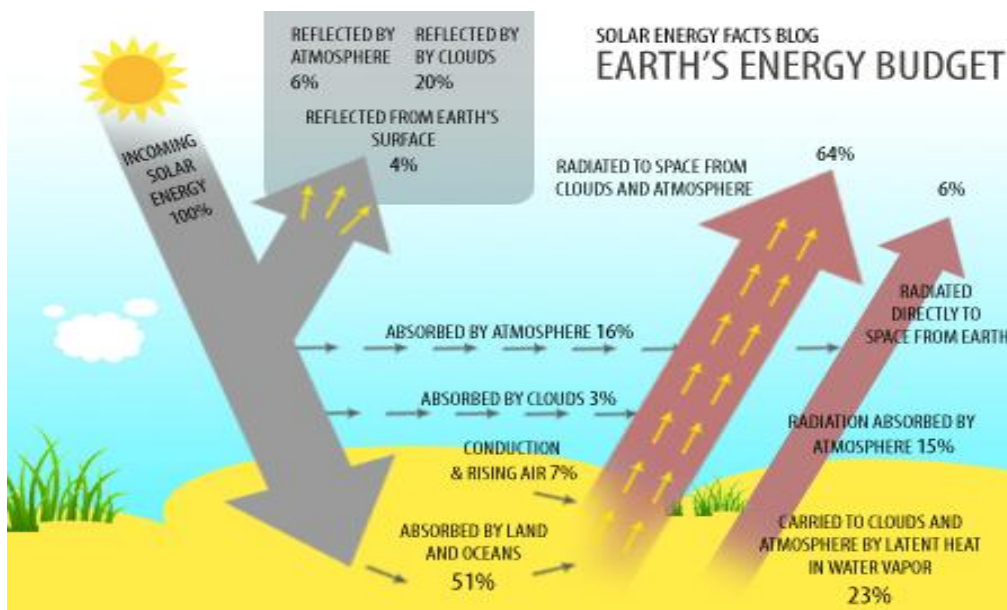
A. Releasing a catapult



B. Burning gas in a Bunsen burner



Energy from the sun



Plants and energy

When a seed germinates, its skin breaks open and the tip of the roots pops out. Energy stored inside the seed is used as the root grows and seeks out water.

Stored energy is also used by growing shoot. The shoot grows up through the soil and eventually reaches the surface. Energy from below, in the seed, is used as the shoot sends out leaves.

Some of the light energy falling on the leaves is trapped inside them. It is converted into stored chemical energy as the plant makes food using water from soil and carbon dioxide from the air. This process of making food using light energy is called photosynthesis.

The chemical energy stored in a plant is transferred to a herbivorous animal when it eats it. The herbivorous animal then has a store of chemical energy, which it uses to keep itself alive and to move about. Carnivorous animals feed on herbivorous animals. They take in stored chemical energy when they eat their prey. Thus the energy stored and used by animals originally came from light energy from the sun that was trapped by plants.

Energy and ourselves

When you cook meat on a barbecue you might have seen fat dropping through the grill and bursting into flames as it hits the hot charcoal below. If you do not take care when cooking the meat, you may even have seen it catch fire too. The meat and fat have stored chemical energy. In fact all foods contain energy.

The chemical energy in food is released in a process called respiration. Oxygen is needed for this process and your body takes it in from air you breathe into your lungs. When the energy is released, carbon dioxide and water are produced. The carbon dioxide is released into air when you breathe out. The water is used in your body or released in sweat and urine. Most of the energy that is released in your body is used for movement and for keeping the body warm.

Generating electricity

Electrical energy is a very useful form of energy because it is easy to generate and can be transported quickly wherever it is needed.

The bicycle dynamo

A bicycle dynamo is a type of generator attached to a bicycle to produce electricity for the bicycle's lights. The top of the dynamo touches the tyre's rim, which spins when the bicycle starts moving. Currently, the term dynamo refers to mechanisms that are capable of producing direct current, such as the small devices fitted to bicycles to generate power for the lights.

Typically, a bicycle dynamo has one or more permanent magnets with coils of wire spinning inside their poles. The device consists of a stationary part called a stator and a rotating part called an armature. When the coil spins in the magnetic field created by the magnets, the magnetic flux begins to change through the coils, resulting in an electric field that generates the charge carriers through the wire. This process produces an electric current. Small bicycle dynamos attain a low efficiency in converting mechanical motion into electricity. However, there are large machines, such as water wheels, that attain high efficiency under ideal conditions.

The power station generators

Inside a power station, there is a generator consisting of a huge electromagnet surrounded by coils of wire. The electromagnet is attached to a shaft to which turbine blades are attached. When the turbines are made to spin, the electromagnet also spins, generating an electric current in the surrounding coils of wire.

In about two-third of the world's power stations, water is heated to make steam. This takes place in a boiler. The energy that the water molecules receive increases their kinetic energy so much that they move apart from each other to form a gas- steam. The steam expands rapidly and exerts a force, which drives it from the boiler to the turbine blades. The steam's kinetic energy is passed to the turbine blades as the steam pushes past them making the blades spin on the central shaft.

The generator's electromagnet is connected to the end of the shaft. As it spins using kinetic energy from the turbine blades it generates an electric current in the coils of wires surrounding it. The electricity flows away from the power station to towns and cities in overhead power lines or underground cables.

