ENERGY

Energy can be defined as the influence on matter that causes them to change in position or state. However, on molecular level, changes of state are actually movements of atoms or molecules. For instance, the degree of heat energy contained in a substance is a measure of the relative vibrational motion of the atoms and molecules of the substance. Therefore we can define energy as the "ability to move matter." Additionally, energy generates force that causes matter to move, that is to do work in the direction of the force. As such, we can also say that energy is the capacity to do work.

Forms of Energy

There are many forms of energy. These include:

i. Mechanical energy,
ii. Heat (or thermal) energy,
iii. Light energy,
iv. Chemical energy,
v. Electrical energy,
vi. Atomic energy,
vii. Solar energy, etc.

Kinds of Energy

Energy is classified into two types —potential and kinetic energy.

Potential Energy (PE) is simply stored energy or the energy possessed by a body by virtue of its position or state. Such stored energy is used to do work when the body is free to move. A heavy stone on top of a table has potential energy. When allowed to fall on to a glass plate on the floor, it will shatter the plate. The potential energy of the stone due to its position above the floor is expended in shattering the plate.

A body may have a potential energy due to its position in a force field (a place under the control of a special force not in contact with the affected

body). If the force field is the gravitational force field, the body is said to possess a gravitational potential energy. The stone resting on top of a table has gravitational potential energy due to its height above the ground level. If the body is of mass m and the height of the table is h, then the gravitational potential energy is given as

$$E_{gp} = mgh$$

Where g is the acceleration due to gravity. If m is in kg, g is in ms^{-2} and h is in metres, then E_{gp}, the gravitational potential energy is in joules.

Other examples of potential energy are

(i) A magnet at rest in a magnetic field (magnetic potential energy).
(ii) An electric charge at rest in an electric field (electrical potential energy).
(iii) A coiled spring when stretched or compressed possesses elastic potential energy.
(iv) Chemical potential energy is contained in petrol, wood and other fuels.

Kinetic Energy is energy possessed due to action or motion. Light shining, heat pressing a cloth, physical motion and electric current are all forms of kinetic energy.

While gravitational potential energy depends on the mass of the body, its height above a reference level and the acceleration due to gravity, kinetic energy depends only on the mass and velocity of the body. In other words, the possibility of the moving body to cause stationary body to move depends basically on its mass and velocity (speed). The kinetic energy (KE) of a body in motion is given by

$$KE = \frac{1}{2}mv^2$$

where m is its mass and v is its velocity.

Transformation and Conservation of Energy

There is an important law of nature which governs the changes in forms of energy. This law is known as the Law of Conservation of Energy.

The law of conservation of energy states that in an isolated or closed system, the total amount of energy is always constant although energy may be changed from one form to another.

By an isolated or closed system, we mean a group of objects that neither receives energy from or gives energy to objects outside the system. For example, the whole universe is an isolated system, because there is nothing outside it, the universe cannot share energy with things outside it.

Considering mechanical energy, the law shows that the sum of the potential energy and kinetic energy is always constant for a given body, but the energy may change from potential energy to kinetic or from kinetic to potential energy.

World Energy Resources

There are many resources currently available to the world. These can be classified into two broad classes: renewable energy resources and non-renewable energy resources.

Renewable Energy Resources are those that can be replaced as they are used. They are continually replenished. Examples are

a. Solar energy is the energy available from the sun. The sun is the ultimate energy resource available to man. Its energy does not deplete, it cannot be used up. It can be converted to electrical energy using photocells. Solar energy can also be used for heating homes and boiling water.
b. Wind energy driven by thermal energy of the sun is used by sailing ships and turning windmills.
c. Water energy provides the source of energy in modern dams, hydroelectric plants, etc. Ocean tides are powered by water energy.
d. Biomass energy from cornstalks, garbage, sugarcane, seaweed, etc.

Non-renewable Energy Resources are those energy resources that are depleting, they cannot be replenished as they are used.

a. Nuclear Energy from Radioactive Materials: this provides enormous heat to operate turbines and drive ships and aircrafts. Fission and fusion energy are examples of nuclear energy.
b. Petroleum and Natural Gas: these often occur together and they currently constitute the world major energy resources. Such fuels known as fossil fuel are a depleting energy resources. Other examples of fossil fuels are coals and wood.