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| **CMGT 235 – Electrical and Mechanical Systems** |
| **Discussion No. 01** | **Unit 1 - Mechanical Systems** | **Fall 2019** |

**HVAC Fundamentals**

**Energy**

**Definitions**

*Conservation of Energy*: A principle stating that the total energy of an isolated system remains constant regardless of changes within the system. Energy can neither be created nor destroyed.

*Energy*: Energy is the capacity to do work.

*Kinetic Energy*: The energy of motion.

*Mechanical Energy*: Energy that is composed of both potential energy and kinetic energy.

*Potential Energy*: The energy of position, or stored energy. Energy

**What do these three things have in common? Energy**

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| **Chemical Energy** | **Electrical Energy** | **Gravitational Potential Energy** |
|  | **A picture containing indoor, sitting, cup, bottle  Description automatically generated** | **A person jumping in the air  Description automatically generated** |

**Common Forms of Energy** [Light – Heat – Chemical – Kinetic – Electrical]

All forms of energy fall under two categories:

**Kinetic Energy** is the energy that any moving object has by virtue of its motion (motion of waves, electrons, atoms, molecules, and substances).

KE = ½ (mass x velocity2) = (1/2) mV2

**Potential Energy** is stored energy that has the potential to do work or be converted to another form.

An object that can move downward under the force of gravity has gravitational potential energy.

A compressed spring and a stretched rubber band have elastic potential energy, because they can do work as they move back to their natural position.

PE = mass x g x height = mgh

**Thermal Energy** , called heat, is the energy of any object with a temperature above absolute zero, due to the kinetic energy of its molecules. For a given quantity of material, the higher its temperature, the more thermal energy it has.

**Chemical Energ**y is a particular form of potential energy. It is the energy stored in a chemical that can be released by some reaction of that chemical. An example is the chemical energy in coal that is converted to thermal energy when the coal is oxidized (burned).

**Electrical Energy** is energy that is made available due to the flow of an electrical current through a conductor. Electrical energy is actually energy in transit. For example, it is converted to heat when electrical current passes through a resistor, or it is converted to kinetic energy when electrical current passes through the windings of an electrical motor, causing the motor to turn.

**Mechanical Energy** is a term used to refer to the sum of the kinetic energy and potential energy of a system.

**Energy Conservation and Conversion among the Forms of Energy**

The first law of thermodynamics is an expression of the conservation of energy. It states that energy can be neither created nor destroyed (in the absence of nuclear reactions). Energy can, however, be converted from one form to another and can be used to do work. Some examples of energy conversion are as follows.

**Potential energy to kinetic energy**: If a car at rest at the top of a hill is allowed to coast down the hill, most its initial potential energy will have been converted to the kinetic energy of the moving car at the bottom of the hill. Some of the initial potential energy will have been converted to thermal energy (heat) due to friction between moving parts.

**Chemical energy to electrical energy**: A battery contains stored chemical energy that can be converted to electrical energy by connecting an electrical conductor across the terminals of the battery. The electrical energy will in turn be converted to heat or mechanical energy, depending upon what kind of device is connected across the terminals of the battery.

**Chemical energy to thermal energy**: When natural gas is burned in a furnace the chemical energy in the fuel is converted to heat (thermal energy) to keep a building warm.

**Energy Conversion**

Energy can be converted from one form to another.

Standing on the stool – potential energy (stored energy)

Jumping off the stool - Kinetic Energy (energy of motion) right before landing on the ground

Landing on the ground – ground absorbs your energy and turns it into heat energy

**Non-Renewable and Renewable Energy Sources**

In relatively recent times, the classification of energy sources as either nonrenewable or renewable energy sources has become increasingly important. The huge quantity of the fossil fuels (coal, petroleum, and natural gas) stored underground seemed to provide an infinite supply of readily usable energy when they were first discovered and put to use. As the rate of use of fossil fuels has mushroomed, however, we've come to realize that there is a finite supply that is diminishing. As a result, the importance of developing and using renewable energy resources, like solar energy, wind energy, and biomass energy has become more prominent.

<http://twentyonecelsius.com.au/blog/everything-you-need-to-know-about-hvac-systems/>

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<https://www.brighthubengineering.com/hvac/90595-basics-of-hvac/>