

WEEK 1: BASIC ENERGY CONCEPTS

Energy basics:

- **What is energy?**
 - The word '**ENERGY**' itself is derived from the Greek word 'en-ergon', which means 'in-work' or 'work content'.
 - **Energy** is "*the capacity to do work*". It is the power to create, shape, transform and animate. "**Work**" is the action of moving something against a force. The work output depends on the energy input.
 - Energy is always conserved (or converted into mass) so is incredibly useful in working out the results of any kind of physical or chemical process.
 - It's essential to modern life. We depend on energy.
- **Energy balance**

Energy balances provide overviews, which serve as tools for analyzing current and projected energy positions.

$$\text{Source} + \text{Import} = \text{export} + \text{variation of stock} + \text{use} + \text{loss}$$

Energy data are to be translated into economic terms, for a further analysis of options for action.

It is useful for purposes of resource management, or for indicating options in energy saving, or for policies of energy redistribution, etc. However, care must be taken not to single out energy from other economic goods. That means that an energy balance should not be taken as our ultimate guide for action.

- **Energy units and dimensions**

Basic SI units: m, kg, s etc.

Derived SI units: W/m^2 , m/s^2 , J/kg , N/m , J/s etc.

- **Forms of Energy**

Kinetic Energy, Potential Energy, Thermal Energy, Mechanical Energy, Electrical Energy, Magnetic Energy, Chemical Energy, Nuclear Energy, Gravitational Energy and so on.

- **What is energy conversion**

- Energy conversions means converting energy from one form into another.
- No energy can be created or destroyed.
- All we can do is transform or convert energy from one form into another.
- In all conversions, we find that part of the energy is lost. This does not mean that it is destroyed, but rather that it is lost for our purposes, through dissipation in the form of heat or otherwise.

Examples of energy conversion: We convert radiation energy into electricity with photovoltaic cells, whereas with light bulbs we do the reverse. Wind turbine generates energy, which means it converts kinetic energy from wind into mechanical energy. Diesel engine generates energy, which means that the engine converts chemical energy of oil into mechanical energy.

- **Energy losses and efficiency**

$$\eta = (\text{output energy}) / (\text{input energy})$$

- **Renewable vs. Non-Renewable Energy Resources**

Renewable Energy is energy obtained from sources that are essentially inexhaustible. Examples of renewable resources include wind power, solar power, geothermal energy, tidal power, and hydroelectric power. The most important feature of renewable energy is that it can be harnessed without the release of harmful pollutants.

Non-renewable energy is the conventional fossil fuels such as coal, oil, and gas, which are likely to deplete with time.

- **Non-renewable energy resources**

- Conventional energy resources (COAL, OIL, GAS): They are *global primary energy reserves*.
- Product-Market Consumption Trends of Conventional Energy Sources
- Investigations of demands region by region from 2014-2020.

References:

1. International Energy Agency: Excellent source of Global statistical information.
<http://www.iea.org>
2. <http://www.ourenergypolicy.org/growing-poor-slowly-why-we-must-have-renewable-energy/>
3. <http://www.fao.org/docrep/u2246e/u2246e02.htm>