

# Introduction to the Sources of Energy

## **Energy:**

It is a scalar physical quantity that describes the ability to do some useful work. Energy is subject to a conservation law.

Different forms of energy include kinetic, potential, thermal, gravitational, electrical, chemical etc.

## **Sources of Energy**

According to availability, energy sources can be classified as –

1. **Conventional / Consumable Sources of Energy:** These are the energy sources used conventionally to produce mechanical work. Energy obtained from mineral or fossil fuels are examples of this category.
2. **Renewable Sources of Energy:** These are the energy sources often used as an alternative of the conventional sources and are naturally replenishing in character. Energy generated from natural resources – such as sunlight, wind, rain, tides, geothermal heat are termed as Renewable energy and these sources are called renewable sources of energy.

## **Fossil Fuels**

Fossil fuels or mineral fuels are fossil source fuels, that is, hydrocarbons found within the top layer of the Earth's crust. They range from volatile materials with low carbon – hydrogen ratios like methane, to liquid petroleum to nonvolatile materials composed of almost pure carbon, like anthracite coal.

### **Coal**

Coal is a fossil fuel formed in ecosystems where plant remains were preserved by water and mud from oxidization and biodegradation, thus sequestering atmospheric carbon. Coal is a readily combustible black or brownish-to-black rock. It is composed primarily of carbon and hydrogen along with small quantities of other elements, notably sulfur. Coal is extracted from the ground by coal mining, either underground mining or open pit mining (surface mining).

### **Petroleum Oil**

Petroleum is a naturally occurring, flammable liquid found in rock formations in the Earth consisting of a complex mixture of hydrocarbons of various molecular weights, plus other organic compounds. The most common method of obtaining petroleum (crude oil) is extracting it from oil wells found in oil fields. The most common distillations of petroleum are fuels. Fuels are obtained by the fractional distillation of crude oil at various temperatures. The fuels include Ethane, Diesel, Petrol, Jet fuel, Kerosene, LPG and Natural Gas (Methane), etc.

**Natural Gas:**

Natural gas is a gaseous fossil fuel consisting primarily of methane but including significant quantities of ethane, propane, butane, and pentane—heavier hydrocarbons removed prior to use as a consumer fuel—as well as carbon dioxide, nitrogen, helium and hydrogen sulfide. Another form of natural gas, generally used in transport sector is known as compressed natural gas (CNG). It is a substitute for gasoline, diesel, or propane fuel and is considered to be a more environmentally clean alternative to those fuels. CNG is made by compressing natural gas (which is mainly composed of methane) to less than 1% of its volume at standard atmospheric pressure. It is stored and distributed in rigid containers, at a normal pressure of 200–220 bar, usually in cylindrical or spherical shapes.

**Renewable Sources of Energy**

Renewable energy is energy generated from natural resources—such as sunlight, wind, rain, tides and geothermal heat—which are renewable (naturally replenished). Renewable energy technologies include –

1. Solar Energy
2. Wind Energy
3. Hydro Energy
4. BioMass Energy
5. BioFuel Energy
6. Wave Energy
7. Tidal Energy
8. Geothermal Energy
9. Fuel Cell

**Solar Energy:**

Solar energy refers to the utilization of the radiant energy from the Sun. Solar power is used interchangeably with solar energy, but refers more specifically to the conversion of sunlight into electricity, either by photovoltaics or by using solar thermal devices.

**Wind Energy:**

Wind power is the conversion of wind energy into a useful form, such as electricity generation or for water pumping for irrigation, using wind turbines. Individual turbines can provide electricity to isolated locations. In windmills, wind energy is used directly as mechanical energy for pumping water or grinding grain. Wind energy is plentiful, renewable, widely distributed, clean, and reduces greenhouse gas emissions.

**Hydro Energy:**

Hydropower, hydraulic power or water power is power that is derived from the force or energy of moving water, which may be harnessed for useful purposes. Hydroelectricity is a form of hydropower, and is the most widely used form of renewable energy. It produces no waste, and does not produce carbon dioxide (CO<sub>2</sub>), a greenhouse gas. Most hydroelectric power comes from the potential energy of dammed water driving a water turbine and generator.

**Wave Energy:**

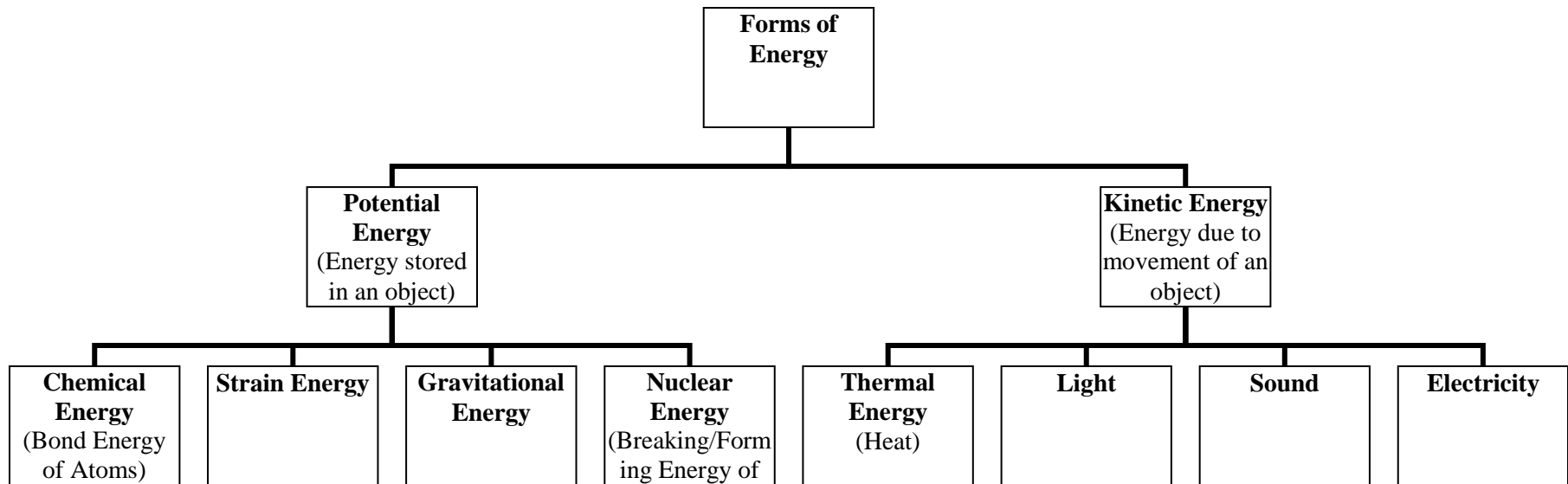
Wave energy or wave power is power that is derived from the ocean surface waves, which may be harnessed for useful purposes. It is distinct from the periodic flux of tidal power and the steady gyre of ocean currents.

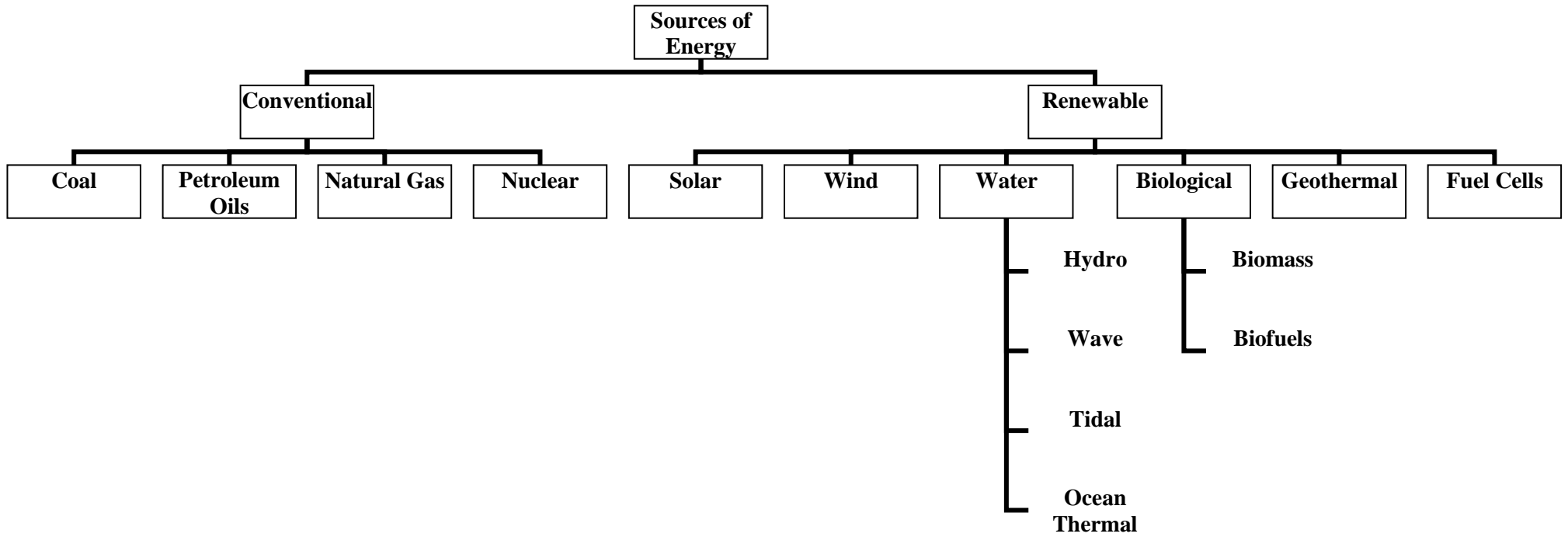
**Tidal Energy:**

Tidal energy is a form of hydropower that converts the energy of tides into electricity or other useful forms of power. Tidal power can be harnessed either from tidal streams, using barrages to obtain the potential energy or by using tidal lagoons.

**Geothermal Energy:**

Geothermal power is energy generated by heat stored beneath the Earth's surface, or the collection of absorbed heat derived from underground in the atmosphere and oceans.





## Some Energy Conversion Devices called Machines

<b>Name of the Machine</b>	<b>Input form of Energy</b>	<b>Output form of Energy</b>	<b>Comments</b>
Electric Motor	Electrical	Mechanical	
Electric Generator	Mechanical	Electrical	
Pump	Mechanical	Hydraulic	Pump is used for liquid only.
Fan/Blower/ Compressor	Mechanical	Hydraulic	All are used for gases. Fan produces the lowest pressure and Compressor the highest pressure. Blower lies in-between.
Water Turbine	Hydraulic	Mechanical	
Steam Turbine/Gas Turbine	Thermal+Hydraulic (called "Enthalpy")	Mechanical	
Petrol/Diesel/Gas Engine	Chemical/Thermal	Mechanical	