

# RENEWABLE ENERGY AND GREEN TECHNOLOGY

**ASAE 2203**

# INTRODUCTION

- **Energy is the ability to do Work.**
- **Derived from Greek word en-ergon**
- ***Different forms of energy:***
  - ***Heat (thermal),***
  - ***Light (radiant),***
  - ***Mechanical,***
  - ***Electrical,***
  - ***Chemical,***
  - ***Nuclear energy.***

# India's Energy scenario

- **India has approximately 1% of world's energy resources but it has 16% of world population.**
- **Per capita energy consumption in India is less than 500 kgoe, compared to the global average of nearly 1,800 kgoe, Indonesia: 729, Egypt: 73, UK: 3982, Japan: 4099, USA: 7996**
- **Economic growth rate of over 9% per annum, which has been achieved with an energy growth of less than 4% per annum.**
- **Number of people without electricity, by 2011 - 487.2 (millions)**
- **Coal supplies more than 50% of the country's total energy requirements India requires 114 MT of oil annually, and 75% of it is imported.**

Cont..

- **More than 60% of Indian households depend on traditional sources of Energy for cooking & heating needs.**
- **At current rate of consumption & production, coal reserves in India would last for about 130 years.**
- **At current rate of consumption & production, oil in India would last only for about 20 to 25 years.**
- **In commercial energy consumption, coal constitutes 29%, Oil & gas 54% & electricity 17%.**
- **We are using only 20% of total hydro-power potential. (Estimated annual energy potential from hydro-electric sources is around 90000 MW while we are currently producing only 18000 MW.**
- **Out of total electricity production, 65.8% comes from thermal power plants, 26.3% from hydro electricity & only 3.1% from nuclear power. Non-conventional, renewable energy sources like solar, wind energy constitute nearly 4.9%. (As per NIC site on Ministry of Power).**

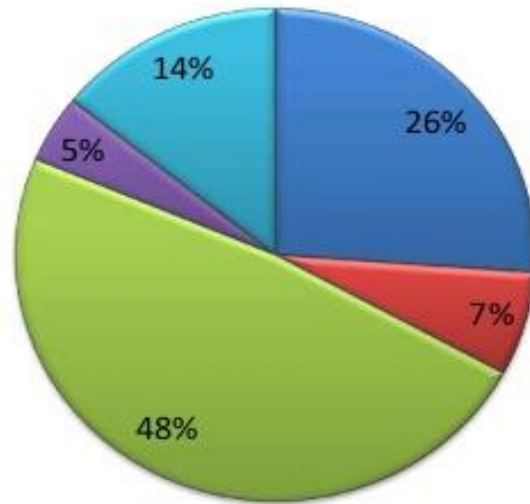
- Millions of poor people in India **spend up to 100 man-days every year in gathering fuelwood for cooking purposes.**
- Demand for coal rises @ 4 to 5% per year, for petroleum products 6 to 7% per year & for electricity 9 to 10% per year.

# Patterns of fuel consumption

- Domestic sector
- Transportation sector
- Agricultural sector
- Industry sector

# Energy Consumption in India

■ petroleum ■ Natural Gas ■ Coal ■ electricity ■ Non-Conventional



# CLASSIFICATION OF ENERGY SOURCES

- About 70% of India's energy generation capacity is from fossil fuels, with coal accounting for 40% followed by crude oil and natural gas at 24% and 6% respectively.
- Due to rapid economic expansion, India is expected to be the 2nd-largest contributor to the increase in global energy demand by 2035.
- India has the world's 5th largest wind power market and plans to add about 20GW of solar power capacity by 2022.
- India also envisages to increase the contribution of nuclear power to overall electricity generation capacity from 4.2% to 9% within 25 years.



# TYPES OF ENERGY

- Heat energy
- Light energy
- Mechanical energy
- Nuclear energy
- Solar energy
- Electrical energy
- Chemical energy

# Energy can also be classified as :

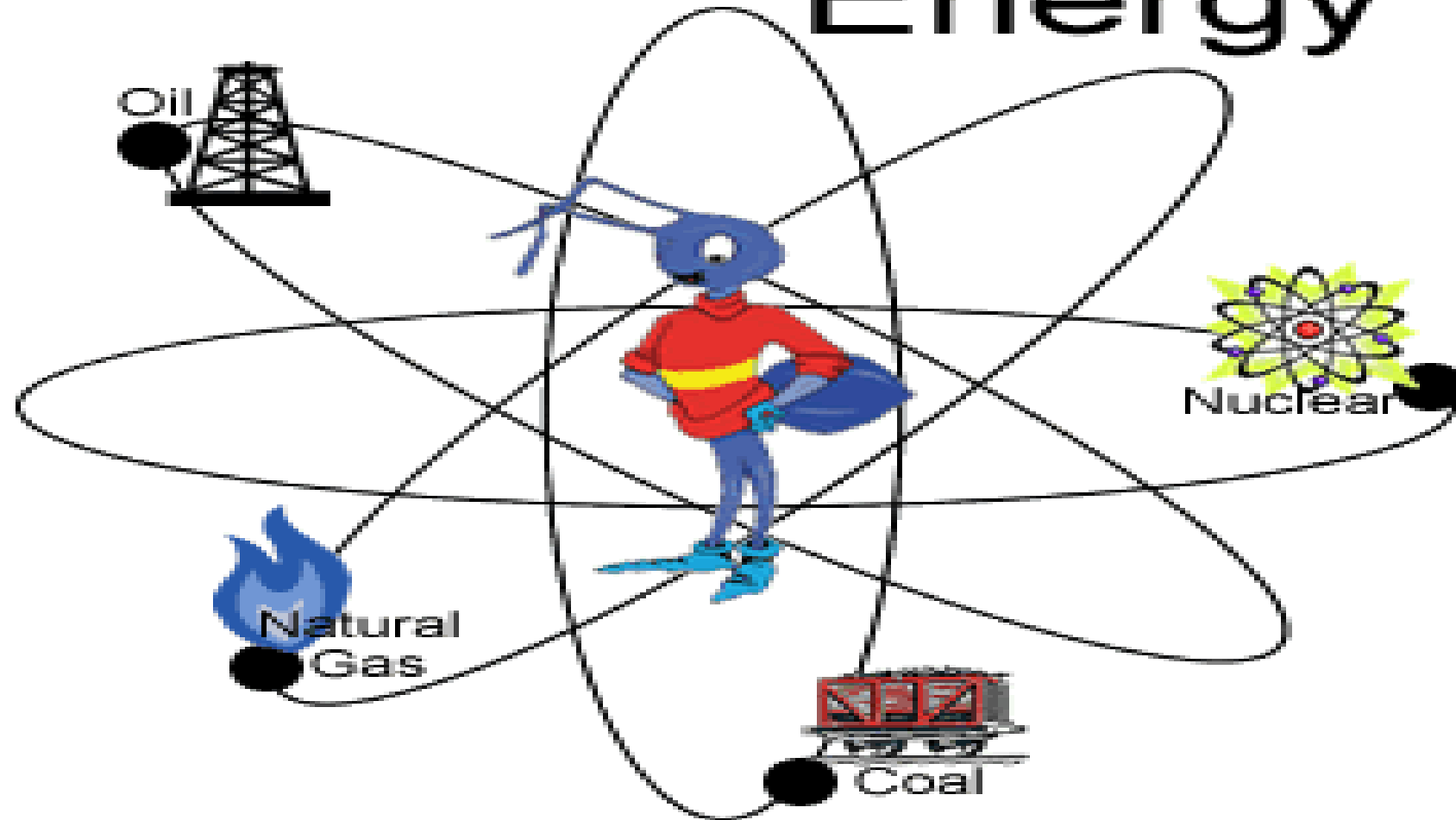
## Renewable energy source:

- Energy sources, which are continuously and freely produced in the nature and are not exhaustible are known as the renewable sources of energy.
- Eg: solar energy, biomass and wood energy, geo thermal energy, wind energy, tidal energy and ocean energy.

## Non renewable energy source:

- Non-renewable sources of energy or conventional sources of energy are being accumulated in nature for a very long time and can't be replaced if exhausted. Nature gifted resources which are consumed can't be replaced.
- Eg: coal, petroleum, natural gas, thermal power, hydro power and nuclear power are the main conventional sources of energy.

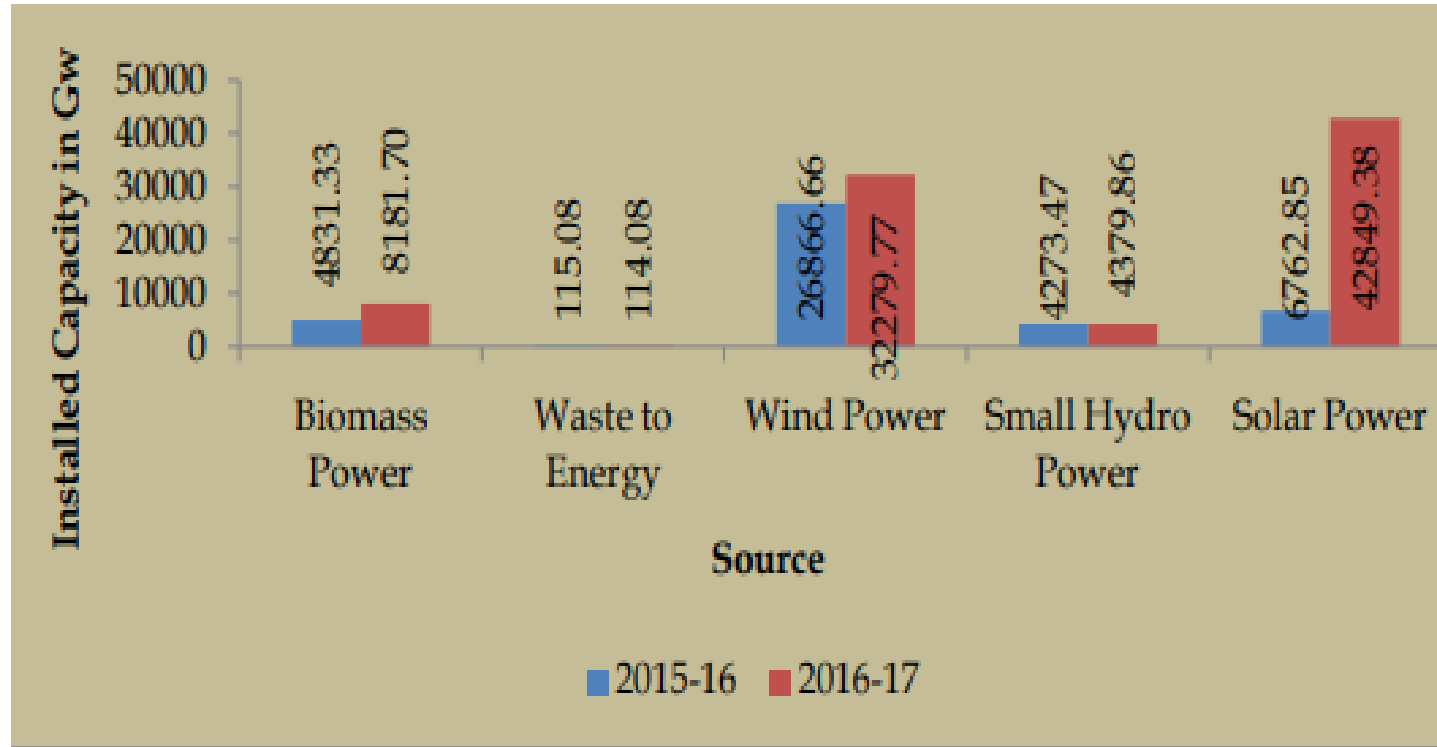
# Non-Renewable Energy



# SOURCES OF RENEWABLE ENERGY

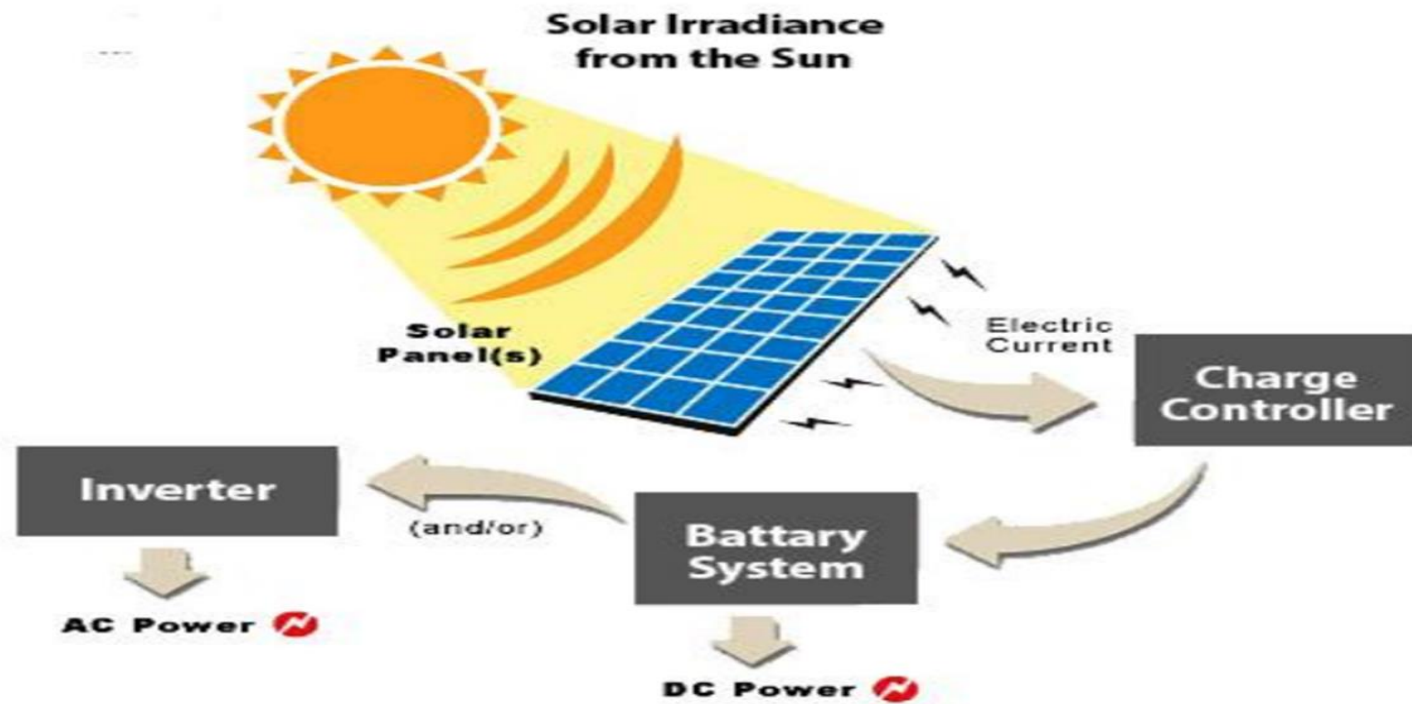
1. Solar Thermal
2. Solar Photovoltaic Energy
3. Biomass Energy
4. Wind Energy
5. Geothermal Energy
6. Hydroelectric power

# INSTALLED CAPACITY OF RENEWABLE ENERGY IN INDIA



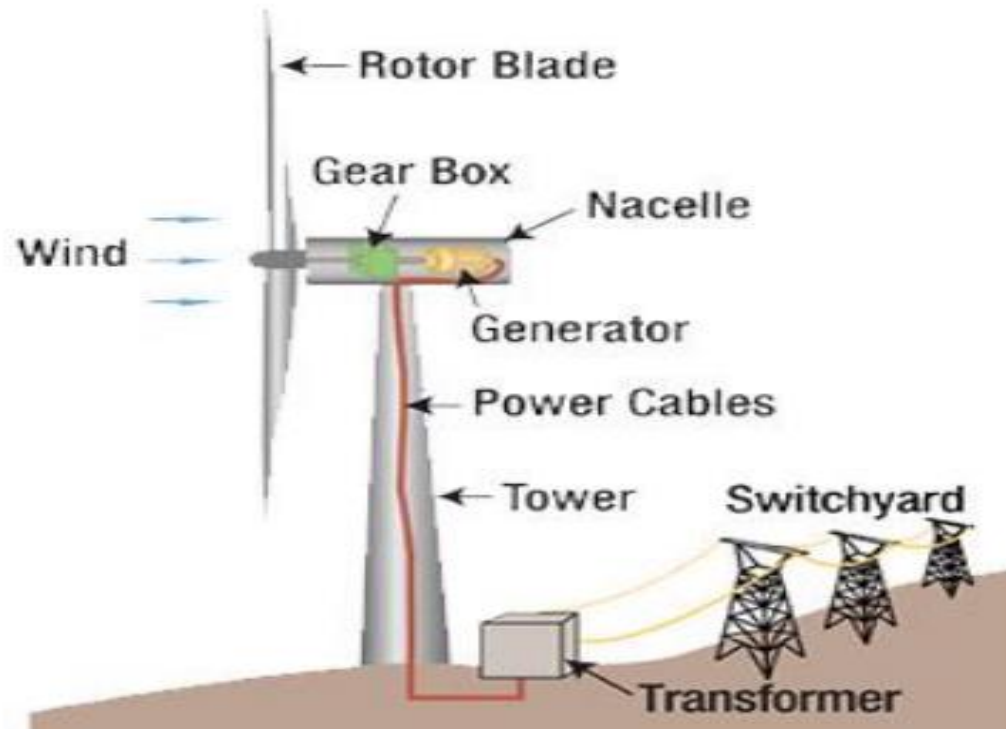
# SOLAR ENERGY

- Solar power systems use photovoltaic (PV) cell to collect the sun's energy. Each cell contains a semiconductor; most commonly silicon (single-crystalline, multi-crystalline, or thin-layer), with impurities (either boron or phosphorus) diffused throughout, and is covered with a silk screen.



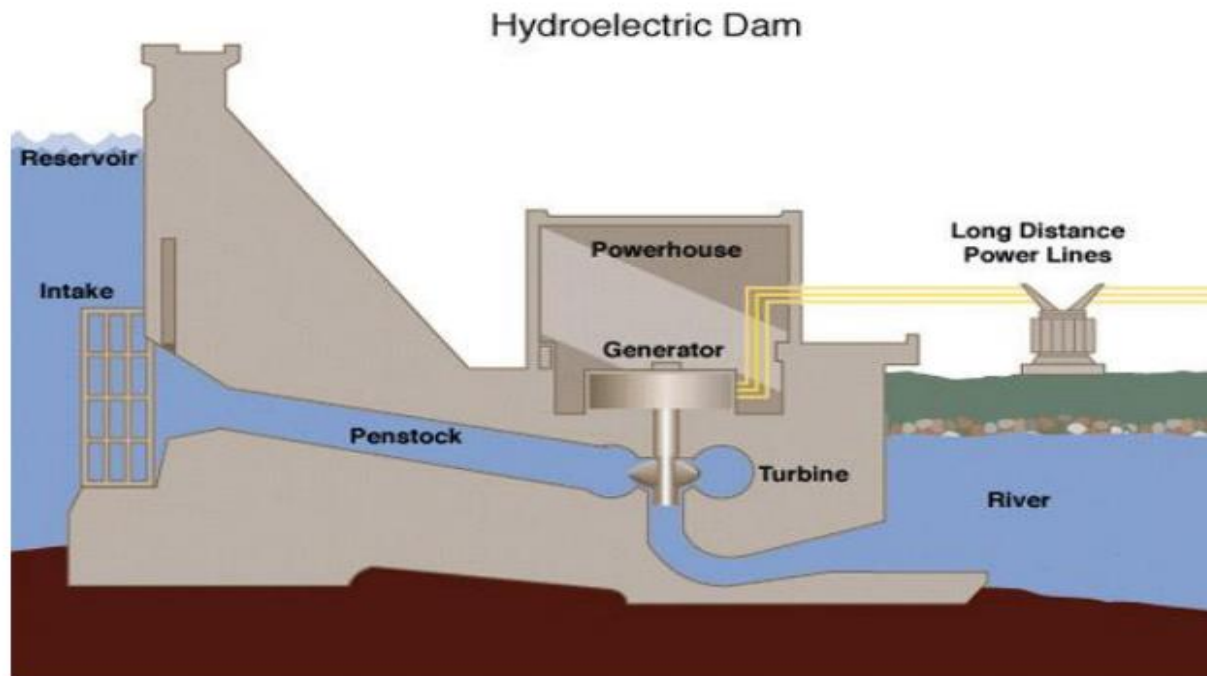
# WIND ENERGY

Wind energy is one of the most promising alternative energy technologies of the future.



# HYDROELECTRIC POWER

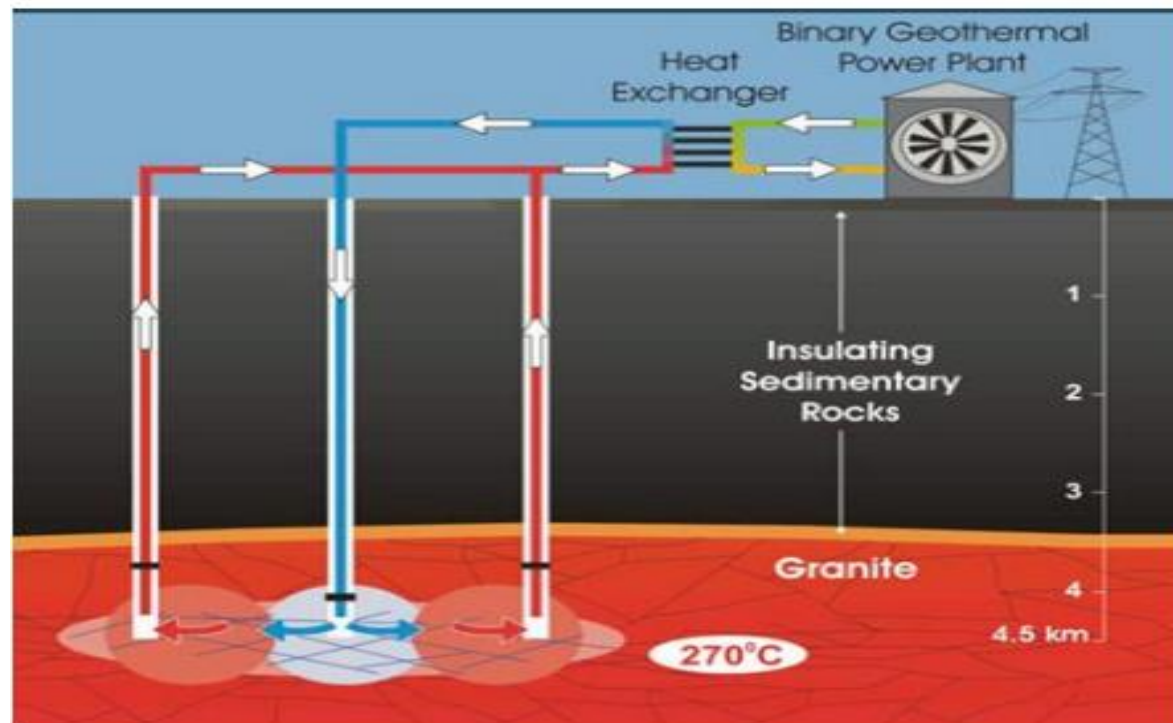
Harvesting energy from water is possible due to the gravitational potential energy stored in water. As water flows from a high potential energy (high ground) to lower potential energy (lower ground), the potential energy difference thereby created can be partially converted into kinetic, and in this case electric, energy through the use of a generator





# GEO THERMAL ENERGY

- Geothermal energy is one of the only renewable energy sources not dependent on the Sun. Instead, it relies on heat produced under the surface of the Earth.



# Tidal Power

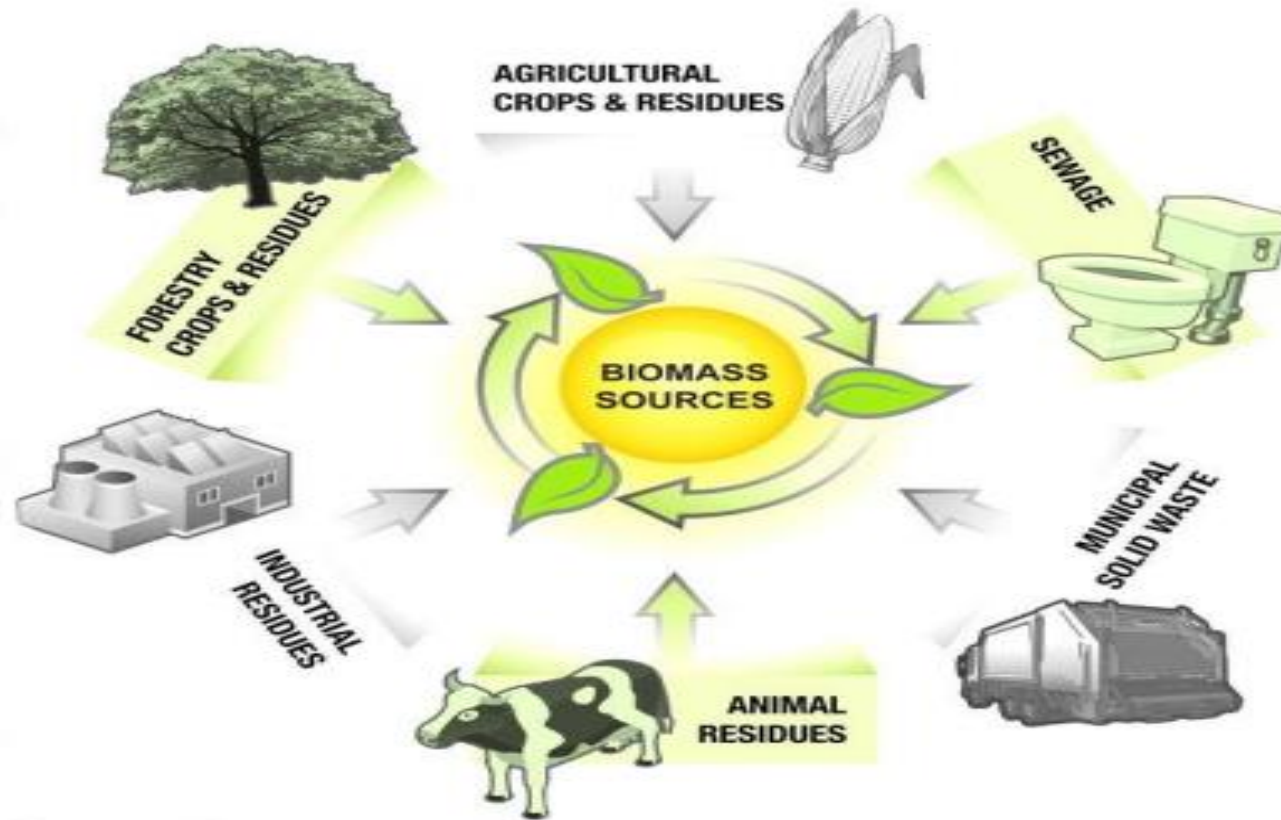


- **As the Earth's seas and oceans are subject to the forces and mechanisms in our solar system, large masses of water move and cause what we call the tides. The energy of this moving water can be converted into mechanical as well as electrical energy.**

# BIOMASS ENERGY

- **Biomass** is the solar energy stored in chemical form from living organisms in plant ,animal materials and their by-products. It supply 14% of primary energy consumption
- Biomass can be converted into biogas or bio-fuels for the automotive industry through a number of different processes, including solid fuel combustion, digestion, pyrolysis, and fermentation and catalyzed reactions.

# SOURCES OF BIOMASS



# INSTITUTIONS

- Odisha Renewable Energy Development Agency, Odisha
- Solar Energy Centre (SEC), Gurgaon.
- A Centre for Wind Energy Technology (C-WET), Chennai.
- Sardar Swaran Singh National Institute of Renewable Energy, Punjab.
- Alternate Hydro Energy Centre (AHEC) , Roorkee.
- The Indian Renewable Energy Development Agency (IREDA), New Delhi.
- National institute of solar energy, Haryana.
- Gujarat institute of solar energy, Gujarat.
- Indian institute of solar energy, Maharashtra.