

# BIOMASS ENERGY

# What is biomass?

- The residues of agriculture and forestry, animal waste and discarded material from food processing plants are known as Biomass.
- The energy released by the use of biomass is known as Biomass energy.

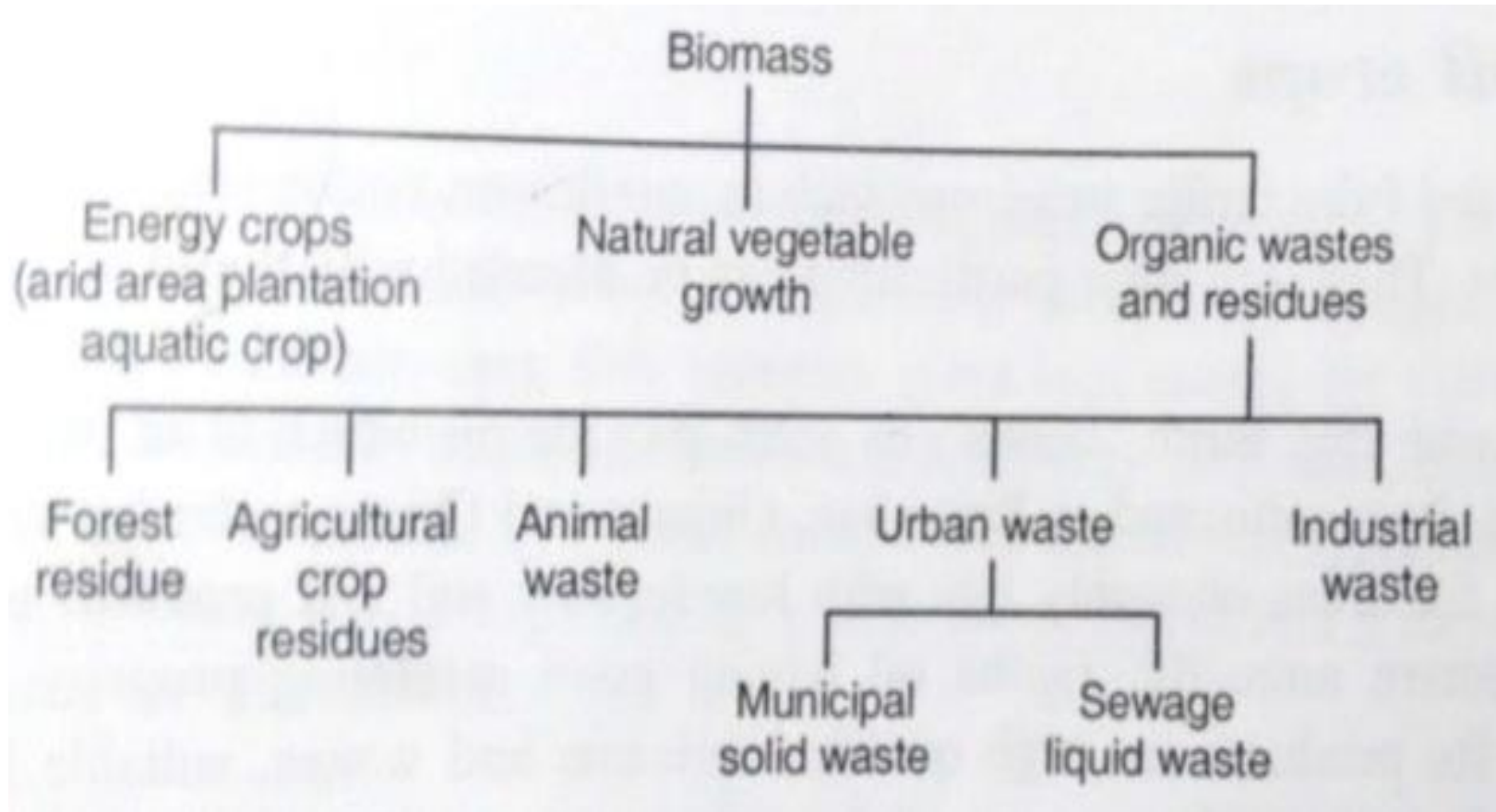
# Advantages of Biomass energy

- It is a renewable source
- The energy storage is an inbuilt feature of it
- It is an indigenous source requiring little or no foreign exchange
- The forestry and agricultural industries that supply feed stocks also provide substantial economic development opportunities in rural areas.
- The pollutant emission from combustion from biomass are usually lower than those from fossil fuels
- Commercial use of biomass may avoid or reduce the problems of waste disposal in other industries, particularly municipal solid waste in urban centers

# Disadvantages of Biomass energy

- It is a dispersed and land intensive source
- It is often of low energy density
- It is also labor intensive and the cost of collecting large quantities for commercial application is not significant
- It is not feasible to set up at all locations

# Classification of Biomass



# Forests

- Forests are a rich source of timber, fuel, wood, charcoal and raw materials for paper mills and other industries.
- Forests also provide plant leaves and logging residues.
- One important characteristics of forest residue is its caloric value which is 4399 to 4977 kcal/kg for softwood foliage and 3888 to 5219 kcal/kg for hard wood species.

# Energy crops

- Energy farming refers to the cultivation of fast growing plants which supply fuel wood, biomass that can be converted into gaseous and liquid fuels like biogas, vegetable oil and alcohol.
- To harvest biomass for power generation, energy plantation is done.

# Vegetable oil crops

- Oil can be extracted from fertile area crops such as sunflower, cotton seed, ground nut, palm and coconut.
- These oils after purification can be blended with diesel oil suitable as engine fuel.
- There is an arid area shrub “Jajoba” its seeds provide oil which is an important renewable source of energy. It is cultivated in Orissa, Gujarat, Rajasthan under hot arid condition.
- It is also used as transformer oil due to its good insulating property.



# Aquatic crop

- It constitutes three water plants namely algae, hyacinth and sea weed. These plants grow abundantly in water bodies and provide organic matter for biogas plants.

• ALGAE

WATER HYACINTH

SEA WEED



# Animal waste

- Animal waste, an organic material with combustible property, is a rich source of fuel.
- Dung cake prepared with animal waste are used for cooking in rural and semi urban areas



# Urban waste

- It is of two types
  - MSW(Municipal solid waste) that includes human excreta, household garbage and commercial waste.
  - Sewage liquid waste: from domestic sewage and effluents from institutional activities.
- As per the report about 42 million tons solid waste and 6000 million cubic meters of liquid waste are generated every year in urban areas.

# Industrial waste

- Pulp & paper industry effluent, starch and glucose industry waste, palm oil industry, distillery waste.
- Each project is aimed to treat its waste for the production of bio-energy which can be used for power generation.

# Biofuels

To harness fuel value, technologies are required to convert biomass into a high quality usable solid, liquid and gaseous fuels called biofuels.

# Biofuel Types

- Charcoal
  - it is a smokeless dry solid fuel with high energy density. Modern charcoal retorts contain 75-80% carbon and it is useful as a compact fuel. It can be burnt to produce heat for domestic, commercial and industrial applications.
- Briquetting
  - It is the process of densification of loose biomass into high density solid fuel. Biomass of any form such as cotton sticks, rice husk, coconut shells etc are converted into briquettes.
- Vegetable oil
  - Vegetable oil such as palm, coconut and cotton seed oil can substitute diesel as engine fuel.
  - Jajoba trees cultivated in marginal lands produce oil seeds. 14

# Biogas

- It can be produced by digestion of animal, plant and human waste.
- digestion is a biological process that takes place in a digester with anaerobic organism in absence of oxygen at a temp between 35-70°C
- In rural areas, household biogas plants operate from cow and buffalo dung which provide gas for cooking and lighting.
- Biogas is a mixture of CH<sub>4</sub>(55-65%),CO<sub>2</sub>(30-40%),H<sub>2</sub>,H<sub>2</sub>S and N<sub>2</sub>(<10%) having a calorific value between 5000 and 5500kcal/kg.

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# Producer gas

- It is obtained by partial combustion of wood or any cellulose organic material of plant origin.
- It is a mixture of few gases and its constituents are CO<sub>2</sub>(19%), CH<sub>4</sub>(1%), H<sub>2</sub>(18%), CO(11%) and N<sub>2</sub>(45-60%)
- Producer gas can be burnt in a boiler to generate steam.
- It is also used as fuel in IC engine used for irrigation pumps, in spark ignition engines and gas turbines for power generation.



# Liquid fuel(Ethanol)

- Ethanol( $C_2H_5OH$ ) is a flammable colorless biofuel.
- It can be produced by fermentation of any feedstock which contains sugar or starch and even cellulose material.