

Biomass and Its Importance in Power Plant

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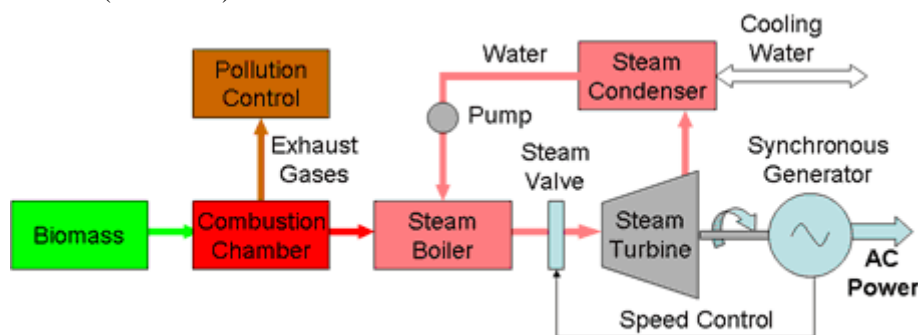
ABSTRACT : Biomass is a renewable energy source that is derived from living or recently living organisms. It is produced by metabolic activities of biological systems (plants and animals) and/or products of their decomposition or conversion. The chemical and energetic value of those materials is based on the carbon-carbon and carbon-hydrogen bond. Biomass power greatly reduces our dependence on foreign energy sources. It increases our national security and provides greater fuel diversity. As an energy source, biomass can either be used directly via combustion to produce heat, or indirectly after converting it to various forms of biofuel.

KEYWORDS : Biomass, Biomass liquefaction, Biomass anaerobic digestion, Combustion, Gasification combustion, Gasification mixed burning, Mixed burning.

I. INTRODUCTION

Key components of biomass power plant:

- Fuel storage and handling equipment.
- Combustor/furnace.
- Boiler.
- Pumps.
- Fans.
- Steam turbine.
- Generator.
- Condenser.
- Cooling tower.
- Exhaust/emissions controls.
- System controls (automated).



Electricity Generation Powered by Biomass

Fig. 1: Electricity generation powered by biomass

Woody source of biomass – Forest residues, landscaping residues, energy wood plantations, residues from food, industrial wood residue, waste wood residues. Non woody biomass – Oil, sugar, starch, energy plants from agriculture, straw and other harvesting residues from agriculture, residues from food industry, landscaping residues. Animal/Men (Fats/Proteins) – Farm slurry excrements, slaughter waste, organic waste from households and industry.

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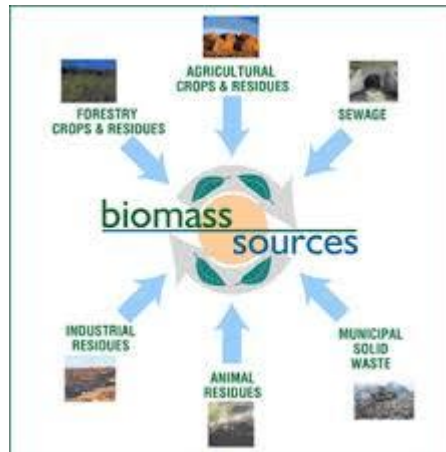


Fig. 2: Biomass sources

Wood remains the largest biomass energy source to date, examples include forest residues (such as dead trees, branches and tree stumps), yard clippings, wood chips and even municipal solid waste. In the second sense, biomass includes plant or animal matter that can be converted into fibers or other industrial chemicals, including biofuels. Industrial biomass can be grown from numerous types of plants, including switch grass, hemp, corn, poplar, willow, sorghum, sugarcane, bamboo, and a variety of tree species.

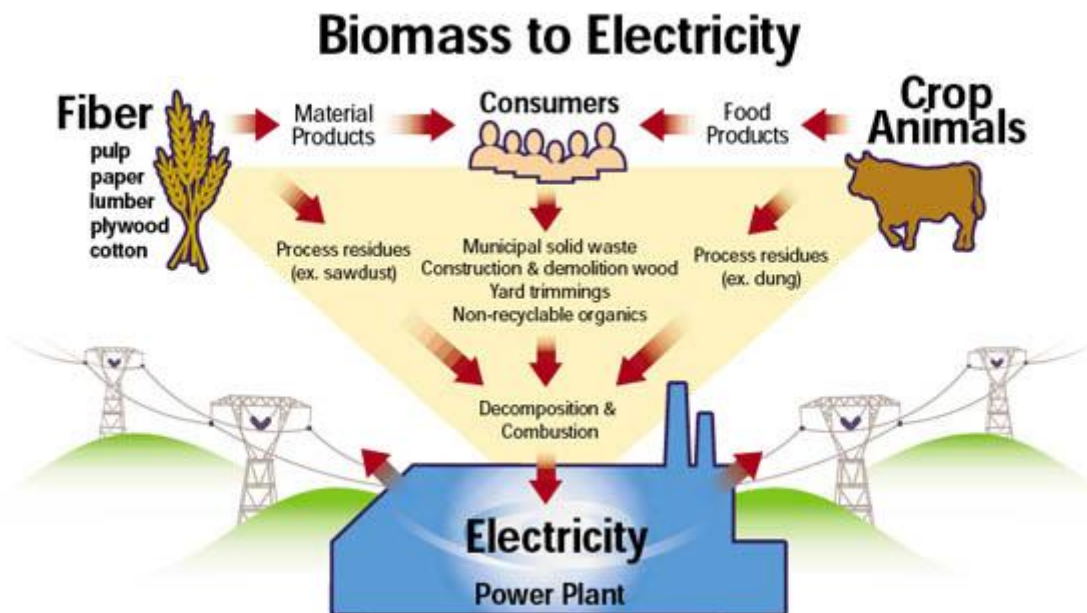


Fig. 3: Biomass to electricity

II. METHODOLOGY

Biomass power generation modes:

- Combustion
- Gasification combustion

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- Mixed burning
- Gasification mixed burning

Combustion – Biomass burned directly in boiler to produce steam to generate electricity.

- Advantage –
- i) Mature technology.
 - ii) Low running cost.
 - iii) Simple biomass pretreatment.
- Disadvantage –
- i) Low efficiency at small scale.
 - ii) Single biomass fuel.
 - iii) Large investment.

Application – Large scale power generation.

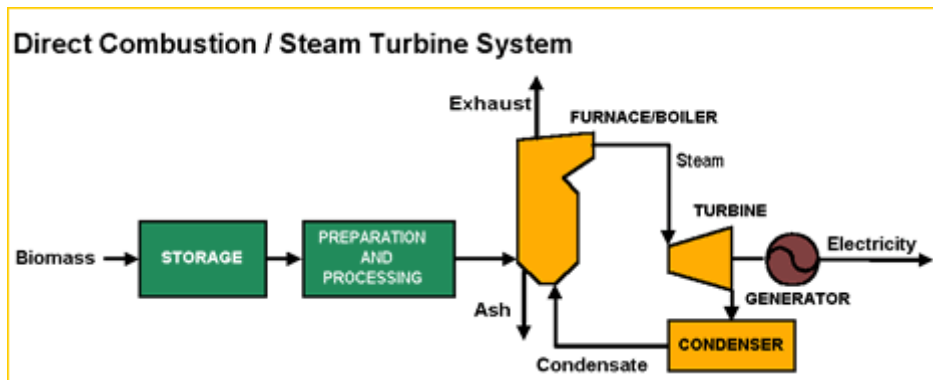


Fig. 4: Combustion

Gasification combustion –

- i) Solid biomass breaks down to form a flammable gas.
- ii) Biomass gasified first and then fuel gas burned in.

- Advantage –
- i) High efficiency at small scale.
 - ii) Flexible in capacity.
 - iii) Low investment.

Disadvantage –

- i) Complex equipment.
- ii) High maintenance cost.

Application –

- i) Medium and small system.
- ii) Combined cycles, which combine gas turbines and steam turbines to produce electricity.

Mixed burning – Biomass mixed with coal and burned in boiler.

- Advantage –
- i) Simple and convenient operation.
 - ii) Least investment if no reconstruction of existing device.

Disadvantage –

- i) Strict biomass pretreatment and quality.
- ii) Some impact on original system.

Application – Suitable for timber biomass.

Gasification mixed burning – Biomass gasified first and then fuel gas burned with coal in boiler.

- Advantage –
- i) Universal application.
 - ii) Low impact on original coal-fired system.
 - iii) Economic benefit.

Disadvantage –

- i) Complex management.
- ii) Certain metal erosion problem.

Application – Power generation system for mass biomass.

Biomass liquefaction via pyrolysis :

- A process similar to gasification.
- Heating of hydrocarbons in zero oxygen condition.



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- Condenses the vapours to obtain bio-oil (pyrolysis oil).
- Bio-oil is easily transportable, store and handle.
- Can be combusted in boiler for heat or electrical generation.

Biomass anaerobic digestion :

- A type of fermentation that converts organic material into biogas.
- It mainly consists of methane (approximately 60%) and carbon dioxide (approximately 40%).
- Power generation using scrubbed methane.

III. RESULT

Biomass power generates electricity that is:

- Reliable.
- Domestically produced.
- Economically competitive.
- Environmentally sustainable.

Economic benefits:

- Minimizes cost involved with waste disposal.
- Can generate money for community.
- It provide job opportunity in rural areas.
- Power from biomass gasifier based plants are cheap in rural areas.
- Overall cost of installation, running, transmission, labour etc. per unit cost of electricity is low.

IV. CONCLUSION

80% of biomass energy is produced for residential use. 18% of biomass is produced for industrial use. 2% of biomass energy is produced for transport. Biomass fuelled power plant operation is far to go and there is enough scope of research for implementation efficiently.

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