

Energy Production from Biomass: Review

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Abstract—There are many power plants like thermal, solar, hydro, nuclear etc. but there are some disadvantage of it like CO₂ emission pollution, problem of global warming requirement of fuels cost etc. To avoid such factors we developed system is biomass power plant to meet the demands of electricity and environment concern day by day price of fuels that fact to which motivate o use renewable energy in India. Biomass is renewable in nature, carbon neutral and has the potential to provide large productive employment in rural areas. It is considered as one of the promising sources for generation of power / energy using commercially available thermal and biological conversion technologies.

Keywords—Energy Generation, Renewable Energy, Non-Conventional, Power Generation And Biomass.

I. INTRODUCTION

Enough biomass resources are world to cover the world energy demand by most used for facility heating, electric power generation. Biomass resources are available in large and also available easily. The major culprit contributing in global warming is carbon dioxide. More than 50% of CO₂ is emitted from transport sector and 70% is from the power sector. Human being with his basic nature for easy living has over used this limited nonrenewable resource. In 1973 crises there is a hike in the petroleum product price. It had necessitated the western countries and petroleum starved countries to look for alternate fuels. Another major compelling reason to look for alternates for fossil fuel is the global warming. In India 370 billion tons of biomass is available per year. 1MW/YEAR electricity generation required about 15000 tons of biomass. It is more economic and environmentally safe. There are same technology of biomass to electricity conversion they below.

II. BIOMASS

Biomass refers to the biological material derived from living, or recently living organisms. Biomass is renewable energy resources derived from human, animal and natural waste. It mainly consist of agriculture crop, raw material from forest major household waste and wood. There are biological content from living or recent living organism. We get energy like methane gas as well as transportation fuel like ethanol biodiesel. Biomass directly on combustion to produce heat or indirectly can be converted into various forms of biofuels.

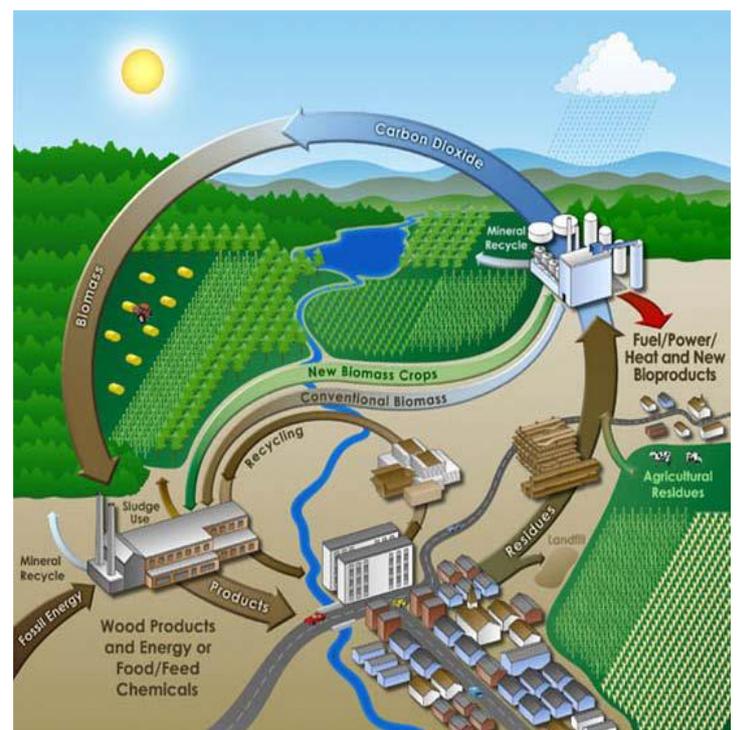


Fig. 1: Biomass Energy Cycle

III. SOUCES OF BIOMASS FUEL

- Agricultural crops & residue
- Municipal solid waste like Bio-medical waste or hospital waste as infectious waste. Municipal solid waste consists of household waste, construction and demolition debris, sanitation residue, and waste from streets.
- Forest residues such as dead trees, branches, yard clippings, wood chips and even municipal solid waste. Wood energy is derived by using biomass as fuel.
- Animal residues
- Industrial residues
- Sewage

State wise availability of major crops of India:

Crop	States
Rice	UP, Punjab, West Bengal
Wheat	UP, Punjab, Haryana
Bajra	Rajasthan, Gujarat, Maharashtra
Jowar	Maharashtra, Karnataka, MP, AP
Sugarcane	UP, Maharashtra, Karnataka
Cotton	Maharashtra, UP, Andhra Pradesh
Groundnut	Gujarat, Tamil Nadu, Andhra Pradesh
Oilseeds	MP, Rajasthan, AP, Karnataka, Maharashtra

Table 1. Crop Analysis

IV. BIOMASS ENRGY CONVERSION TECHNOLOGY

A. Biomass Combustion

Combustion is the most conventional method of obtaining heat from biomass. The chemical energy of biomass is converted into heat energy through a series of chemical reactions when biomass is burnt. The efficiency of combustion depends primarily on good contact between the oxygen in the air and the biomass.

The combustible gases produced are burnt when secondary air is supplied usually in a combustion zone separated from the fuel bed. Temperatures in combustion systems typically reach 900–1400 °C.

Types of Combustion Systems

- Fixed bed combustion.
- Suspension burner’s combustion.
- Fluidized bed combustion

B. Biomass Cogeneration

Co-generation is the process where in obtain both heat and electricity from the same fuel. The process is also referred to as CHP (Combined heat and power). A variety of fuels can be

used for cogeneration including wood, natural gas, coal, biomass and which uses the waste of sugar mills.

A co-generation plant consists of four basic elements: prime mover, electricity generator, heat extraction or recovery unit, and control panel. Fuel is burnt in the system or prime mover to convert its chemical energy into heat energy which in turn produces the mechanical energy to run a generator and ultimately produce electricity. Prime movers for CHP systems include steam turbines, gas turbines, reciprocating engines, micro-turbines, and fuel cells. The heat energy from the system is also used directly as heat or indirectly to produce steam, hot water and hot air, thus making it a CHP or co-generation system.

C. Type of Co-Generation

Different types of cogeneration technologies are used depending upon the end use or purpose. Some commonly used cogeneration technologies are:

- Steam Turbines
- Gas Turbines
- Reciprocating Engines Steam turbine cogeneration

D. Biomass Gasification

Biomass gasification or producing gas from biomass involves burning biomass under restricted air supply for the generation of producer gas.

Producer gas is a mixture of gases:

- 18%–22% carbon monoxide (CO).
- 8%–12% hydrogen (H₂).
- 8%–12% carbon dioxide (CO₂)
- 2%–4% methane (CH₄)
- 45%–50% nitrogen (N₂) making up the rest.

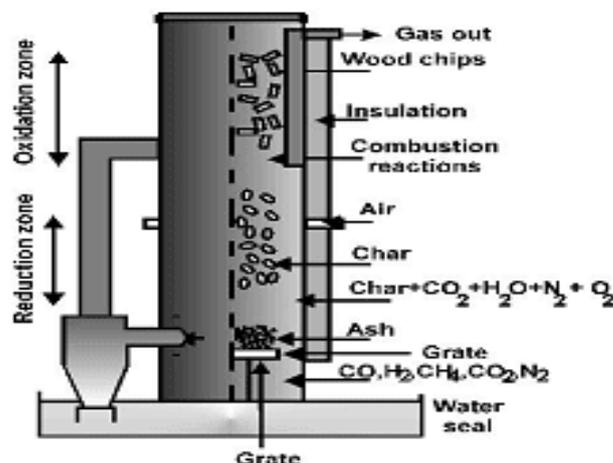


Fig.2 Gasification Process

A gasification reaction producing gas from biomass consists of the following main reactions which occur inside a biomass gasifier.

- a. **Drying:** Biomass fuels usually contain 10%–35% moisture. When biomass is heated to about 100 °C the moisture is converted into steam.
- b. **Pyrolysis:** After drying as heating continues the biomass undergoes pyrolysis. Pyrolysis involves burning biomass completely without supplying any oxygen. As result the biomass is separated into solids, liquids, and gases.
- c. **Oxidation:** Air is introduced into the gasified after the separated process. During oxidation which process takes place at about 700–1,400 °C the solid carbonized fuel, reacts with the oxygen in the air to produce carbon dioxide and heat.
 $C + O_2 \rightarrow CO_2 + \text{heat}$
- d. **Reduction:** At higher temperatures and under reducing conditions that is when not enough oxygen is available the following reactions take place release carbon dioxide then result is hydrogen and methane.
 $C + CO_2 \rightarrow 2 CO$
 $C + H_2O \rightarrow CO + H_2$
 $CO + H_2O \rightarrow CO_2 + H_2$
 $C + 2H_2 \rightarrow CH_4$

V. KEY COMPONENTS OF BIOMASS POWER PLANT

- a) Fuel storage and handling equipment
- b) Combustor
- c) Boiler
- d) Pumps
- e) Steam turbine
- f) Generator
- g) Condenser
- h) Cooling tower
- i) Emissions controls
- j) System controls.

Biomass gets from animal wastage, animal wastage, manure, wood, etc. Collected biomass goes to combustion chamber for heating. After heating reduction process was done and result pure gas like methane. In bio system not produce pollution but lit bit reduced or exhaust gasses they was use of pollution control at the top of combustion chamber.

Later gas is goes to Steam boiler is basically a closed vessel into which gas or water is heated until the water is converted into steam at required pressure. Then steam valve use like feedback system it will get the speed control of the steam turbine.

A steam turbine is a device that extracts gas energy from pressurized steam and uses done mechanical work on a rotating output shaft. This output shaft is connected to Generator. Generator is electrical device that convert the mechanical energy into electrical energy.

VI. ENVIRONMENTS EFFECT

In this day world has big problem which is pollution. That is air pollution environmental like crops, municipal wastage, hospital, hotel, school, colleges and homemade wastage, vegetable wastage etc. in every place and site. This wastage is spoils the beauty of good location. Air pollution is created by carbon dioxide in power sector. This cause produce the big question in now day in the world is global warming.

The biomass energy plant is not producing the carbon dioxide so it helps avoid or reduce the global warming. Also this is cleaning the villages and cities and beauty of location is keep as it is. Biomass energy plant also is help income for rural population. That means it provide the job opportunity in rural areas.

A. Advantages of Biomass Energy

- 1. Biomass Energy is renewable source of energy.
- 2. Biomass Energy is comparatively lesser pollution generating energy.
- 3. Biomass energy plant helps in cleanliness in villages and cities. Biomass energy is carbon dioxide natural that means t is help to avoid global warming.

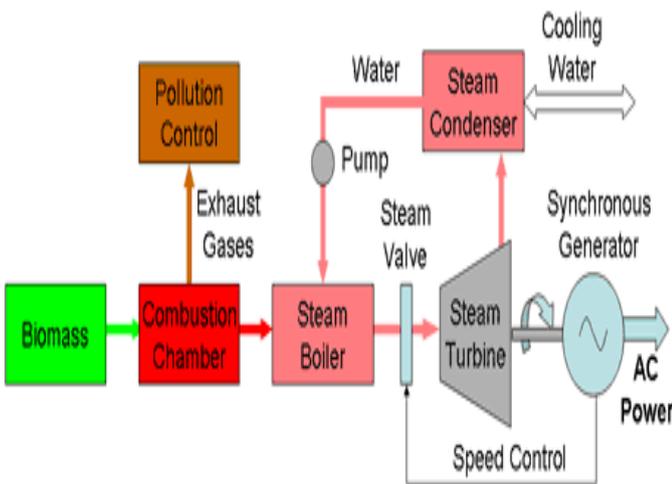


Fig.3: Biomass Power Generation

Biomass is collected from various sources which is available in rural area Collected biomass get from animal, wastage, animal wastage, manure, wood, etc. Collected biomass goes to combustion chamber for heating. On combustion biogas is related with less pollutants and methane gas is produce. Later biogas produce goes to the boiler and steam formation is occurred. That’s steam with high pressure supplied to turbine which connected to generator through shaft which produces electricity. By using this system we can produce sufficient amount of energy which is very useful for people leaving in rural area. Such plants can be implemented in a rural area which is beneficial.

4. Biomass energy generated in a distributed manner, can provided good quality, reliable, dependable electricity to village for lighting, drinking water supply, irrigation, milling etc.
5. Biomass energy is relatively cheaper and reliable.
6. Biomass Energy can be generated from everyday human and animal wastes, vegetable and agriculture left-over etc.
7. Biomass energy has distinctive advantages over other renewable sources like wind and solar:-
 - Reliable
 - Efficient
 - Cost effective.
8. Biomass energy can be easy to hybrid with the solar and wind.
9. Wind, Sun and Hydro energy is site and season specific. Biomass energy can be generated all season the year at any site.
10. Recycling of waste reduces pollution and spread of diseases.
11. Overall cost of installation, running, transmission, labor etc. per unit cost of electricity is low.

VII. DISADVANTAGES OF BIOMASS ENERGY

- 1) Continuous supply of biomass is required to generate biomass energy.
- 2) Biomass plant requires space and produces dirty smell.
- 3) Due to improper construction many biomass plants are working inefficiently.

VIII. CONCLUSION

It can be concluded that huge potential exist for exploration of available biomass in world to convert it to energy. Various resources in wide variety and different form of biomass are available. Diverse sources are there to obtain waste biomass e.g. agricultural waste, food wastes, industrial wastewaters generated in large volumes which hints the tendency to switch over to non-conventional source of energy.

At present three major technologies are being used to convert biomass into energy combustion, co-generation, gasification. Selection of conversion technologies for biomass depends upon the form in which the energy is required like combustion produce heat, mechanical, electricity energy etc. Gasification processed biomass to form syngas. Also generating power by using co-generation technology where the waste of sugar mills is used. These plants have not only solved the rural electrification problem for the remote villages where infrastructural costs could have been quite high for conventional electrification but also the power generation cost has also been relatively low. The prime motto of biomass energy plant is to provide the use of non-conventional energy

sources of energy which helps in sustainable development of nation.

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