A
SEMINAR REPORT

REVIEW – 1

On

BIOMASS FUELLED POWER PLANT

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INTRODUCTION

Biomass is a scientific term for living matter, more specifically any organic matter that has been derived from plants as a result of the photosynthetic conversion process. The word biomass is also used to denote the products derived from living organisms – wood from trees, harvested grasses, plant parts, and residues such as stems and leaves, as well as aquatic plants. The solid biomass processing facility may also generate process heat and electric power. As more efficient bioenergy technologies are developed, fossil fuel inputs will be reduced; biomass and its by-products can also be used as sources for fuelling many energy needs. The energy value of biomass from plant matter originally comes from solar energy through the process known as photosynthesis. In nature, all biomass ultimately decomposes to its elementary molecules with the release of heat. During conversion processes such as combustion, biomass releases its energy, often in the form of heat, and the carbon is re-oxidised to carbon dioxide to replace that which was absorbed while the plant was growing. Essentially the use of biomass for energy is the reversal of photosynthesis.

Biomass is renewable source of energy produced in nature through photosynthesis achieved by solar energy conversion and it play dual role in greenhouse gas mitigation [1] both as an energy source and as a carbon sink. It is available in the form of wood, agricultural residues, and food grains. Solid biomass is commonly used as fuel for cooking and other thermal process [2] in small industries, fuel for boilers, but it

can be transformed into gaseous and liquid fuel in the form of ethanol and biodiesel.

The need for energy and energy sources has multiplied exponentially with the industrial revolution. The need for fuels for automotive was realized with the invention of steam engines and steam heating equipment. Initially wood, sawdust [3] and other agricultural products were directly used of different size reduction, the need for high energy content, size reduction for convenience and other aspects and the experience of man in dealing with different natural products like coal, vegetable oils made new thought to look for alternate fuels.

After few centuries at low cost and its convenient form resulted in invention of new engines running on petrol, diesel, kerosene and petroleum gases. All conventional fuels were replaced with petroleum in the developed countries.

Human being with his basic nature for easy living has overused this limited non-renewable 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 [4]. Another major compelling reason to look for alternates for fossil fuel is the global warming [5]. The major culprit contributing in global warming is carbon dioxide. The major culprit contributing in global warming is carbon dioxide. More than 50% of CO2 is emitted from the transport sector and 70% is from the power sector.

LITERATURE REVIEW

Biomass-fuelled heating is the oldest and most well-established form of energy provision in the world, being inextricably linked with the development of the human race. However, it was largely made redundant by higher energy-density fossil fuels, and its application in modern energy systems, particularly in industrialized nations, has until recently played a declining role. Renewed interest in biomass-fuelled energy systems stems from a number of roots. These are dominated by interest in reducing greenhouse gas emissions, the advent of efficient new biomass conversion technologies, and reasonably sustained high fossil fuel prices and high price volatility.

Biomass has always been an important energy source for the country considering the benefits it offers. It is renewable, widely available, carbon-neutral and has the potential to provide significant employment in the rural areas. Biomass is also capable of providing firm energy. About 32% of the total primary energy use in the country is still derived from biomass and more than 70% of the country's population depends upon it for its energy needs. Ministry of New and Renewable Energy has realised the potential and role of biomass energy in the Indian context and hence has initiated a number of programmes for promotion of efficient

technologies for its use in various sectors of the economy to ensure derivation of maximum benefits Biomass power generation in India is an industry that attracts investments of over Rs.600 crores every year, generating more than 5000 million units of electricity and yearly employment of more than 10 million man-days in the rural areas.

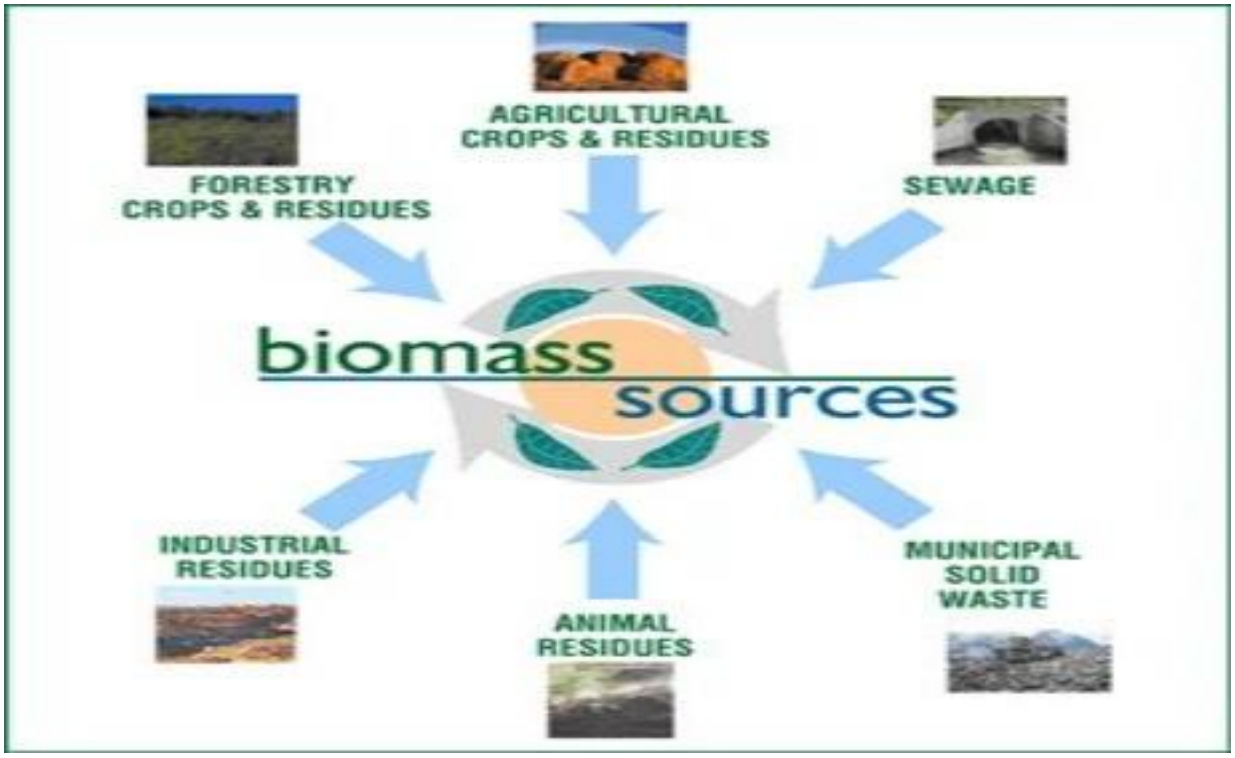
BIOMASS AND BIOMASS POWER PLANT

Electricity that is produced as a result of utilizing surplus biomass sources into energy is considered biomass power. Biomass combusted in a boiler produces steam. This steam drives a turbine generator that produces electricity. This electricity will be fed into the high voltage transmission grid to be transported to end-users. Generating power through the use of biomass represents the cost-effective and cleanest way to provide renewable electricity in biomass potential regions with high levels of biomass resources and its processing activity. Furthermore, use of this resource helps become more energy independent and use of a locally derived fuel provides employment and direct economic benefit to local communities.

MAIN RESOURCES BIOMASS FUELLED POWER PLANT: -

The main resources which are required to run the biomass fuelled power plant are as follows: -

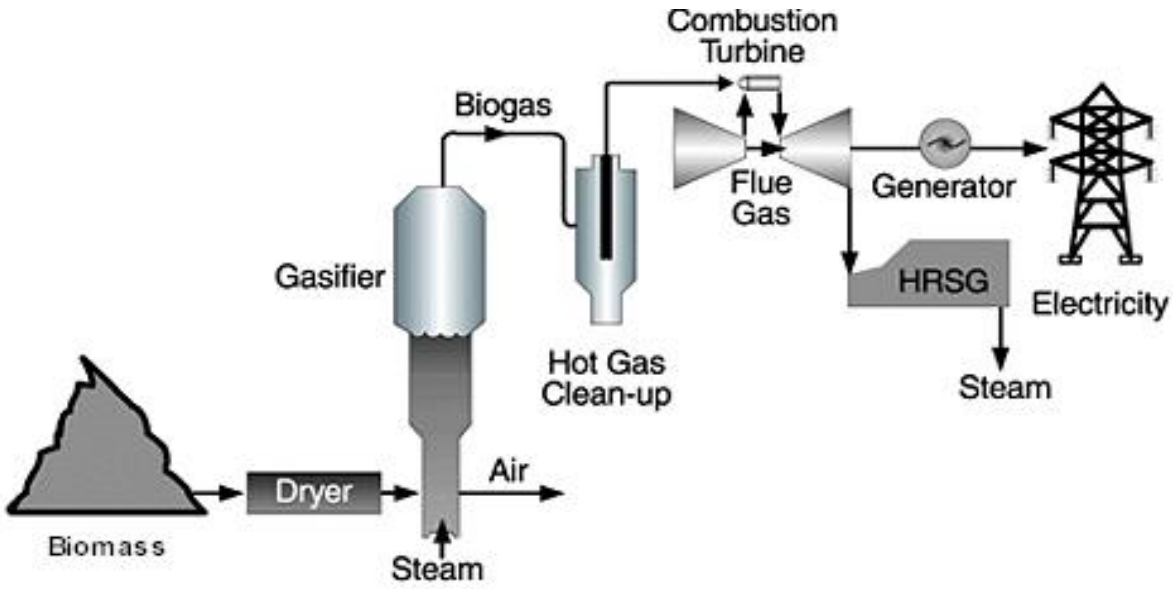
Biomass Resource Categories	Examples
Residues from primary biomass production	Wood from forestry thinning and felling residues; straw from a variety of cereal crops; other residues from food and industrial crops such as sugarcane, tea, coffee, rubber trees and oil and coconut palms
By-products and wastes from a variety of processes	Sawmill waste, manure, sewage sludge and organic fractions on municipal solid waste, used vegetable cooking oil
Dedicated plantations	Short rotation forestry crops such as eucalyptus and willow; perennial annual crops such as miscanthus; arable crops such as rapeseed and sugarcane



WORKING OF BIOMASS FUELLED POWER PLANT: -

In Biomass fuelled power plant , there are various modes of power generation but in this status report we will try to discuss two basic modes of power generation which are:

1. **Biomass Gasification.**



Gasification is the conversion by partial oxidation at elevated temperature of a carbonaceous feedstock into a gaseous fuel. The product gas is a mixture of hydrogen, carbon monoxide, methane, carbon dioxide, water vapour, and small quantities of heavier hydrocarbons. The oxidizing medium is normally air, oxygen or steam. Inorganic residues and an oil-tar fraction are also produced in the process. The product gas generally has a heating value between one tenth and half that of natural gas, depending on the composition of the biomass input and the gasification process employed. This gas may be burnt in boilers or, after cleanup to remove tars, may be used as a fuel in engines or gas turbines. It can also be reformed to produce fuels such as methanol or hydrogen. Gasification enables the production of bioelectricity using modern gas turbines, giving relatively high efficiency (compared with Rankin cycle systems) and low unit costs at the modest scales of biomass systems. Gasification also provides a route for small scale, decentralized bioelectricity production using gas engines.

2. Direct Firing method in Biomass fuelled power plant

Biomass direct combustion is generally based on the Rankine cycle, where a steam turbine is employed to drive the generator. This type of system is well developed, and available commercially around the world. Most bioelectricity plants today are direct fired In direct combustion, steam is generated in boilers burning solid biomass which has been suitably prepared (dried, baled, chipped, formed into pellets or briquettes or otherwise modified to suit the combustion technology).

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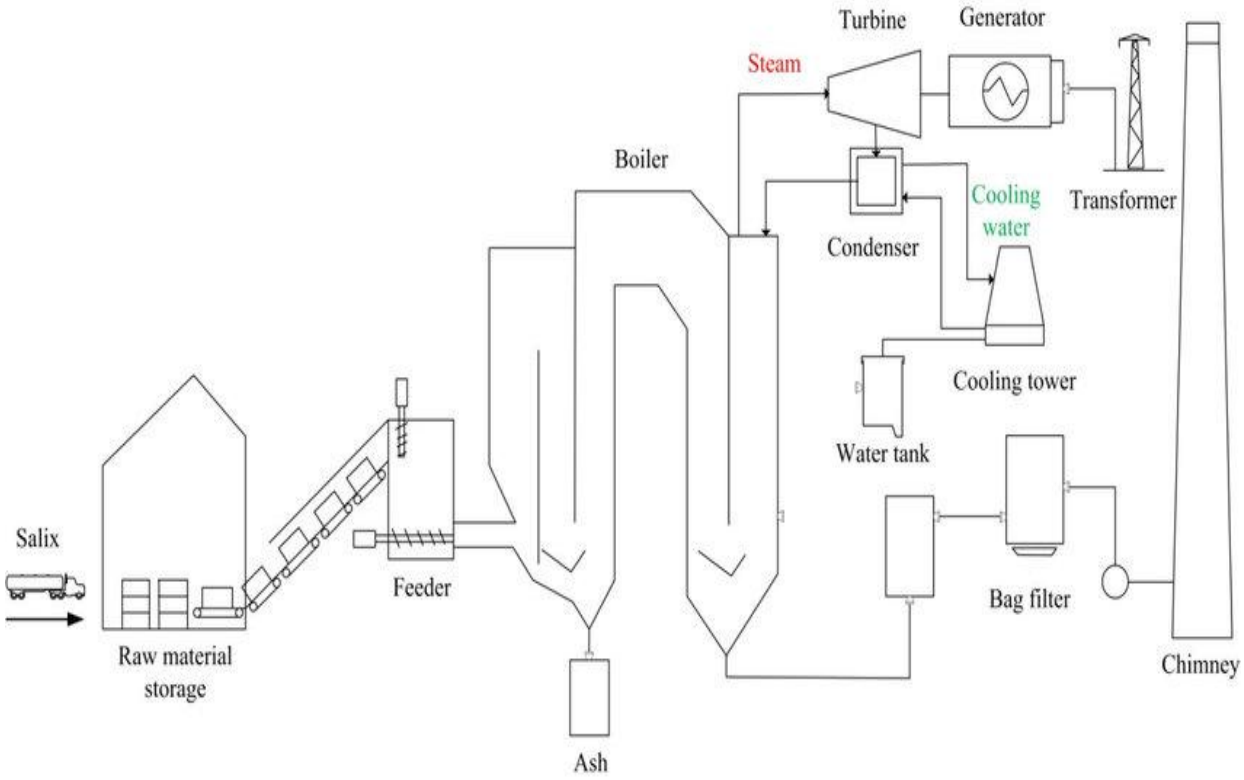

Direct combustion technologies may be divided into fixed bed, fluidized bed and dust combustionIn **direct co- firing**, the appropriately prepared biomass is fed directly into the coal furnace. There are a number of ways in which this may be done. The simplest approach involves blending the biomass with coal on the fuel pile and providing the mixed fuel as input to the coal mills before supply to the boiler's coal feeding system. This method is generally used at low biomass blend percentages. Alternatively, the biomass fuel preparation and feeding may be handled by a separate system which then feeds the prepared biomass to the coal burners or to separate, dedicated burners.

MODERN TECHNOLOGY IMPLENTED IN BIOMASS POWER: -

A decade of experience with modern biomass technologies for thermal, motive power and electricity generation applications exists in India. Gasifier technology has penetrated the applications such as village electrification, captive power generation and process heat generation in industries producing biomass waste. Over 1600 gasifier systems, having 16 MW, total capacity, have generated 42 million Kilo Watt hour (kWh) of electricity, replacing 8.8 million litres of oil annually (CMIE, 1996).

An important aspect of small gasifier technology in India is the development of local 12 manufacturing base. The large sized gasifier-based power technologies are at R&D and pilot demonstration stage. The thrust of the biomass power programme is now on the grid connected megawatt scale power generation with multiple biomass materials such as rice straw, rice husk, wood waste, wood, wild bushes and paper mill waste. Nearly 55 MW of grid connected biomass power capacity is commissioned and another 90 MW capacity is under construction. Enhanced scale has improved economics as well as the technology of biomass power generation. Technology improvement is also derived from joint ventures of Indian firms with leading international manufacturers of turbines and electronic governors.

Advantages of Biomass:

Biomass power generates electricity that is:

- reliable,
- domestically produced,
- Economically competitive and
- Environmentally sustainable.

Since biomass energy uses domestically produced fuels, biomass power:

- greatly reduces our dependence on foreign energy sources,
- increases our national security and
- Provides greater fuel diversity.

Biomass projects benefit the regions where they are built in several ways.

- Biomass plants provide high paying jobs during construction and operation.
- Facilities increase local tax revenues and in many cases are the single largest taxpayers in their areas.

Fuels used mostly come from an area within 75 miles of plant sites, generating income for local forestry farmers.

Biomass energy facilities provide a range of environmental benefits, including cleaner air and climate change benefits.

Biomass plants also produce far less particulate matter than open burning of wood wastes, the way most wood waste is currently eliminated.

Unlike energy derived from fossil fuels such as coal, oil and natural gas, biomass energy does not contribute to climate change. The carbon, which is stored in biomass material as it grows, is already part of the atmosphere. Biomass energy does not add new carbon to the active carbon cycle, whereas fossil fuels remove carbon from geologic storage.

Carbon emissions from biomass facilities would have been released back into the atmosphere through natural decay or disposal through open burning. The advanced emissions controls on a biomass energy facility significantly reduce the amount of carbon dioxide emitted into the atmosphere along with other emissions such as particulate matter.

Disadvantages of Biomass Fuelled Power Plant: -

1) Agricultural wastes will not be available if the basic crop is no longer grown.
2) Additional work is needed in areas such as harvesting methods.
3) Land used for energy crops maybe in demand for other purposes, such as faming, conservation, housing, resort or agricultural use.
4) Some Biomass conversion projects are from animal wastes and are relatively small and therefore are limited.
6) In some cases, is a major cause of pollution

CONCLUSION

The current availability of biomass in India is estimated at about 500 million metric tonnes per year. Studies sponsored by the Ministry has estimated surplus biomass availability at about 120 – 150 million metric tonnes per annum covering agricultural and forestry residues corresponding to a potential of about 18,000 MW. This apart, about 5000 MW additional power could be generated through bagasse-based cogeneration in the country's 550 Sugar mills.

Today, Biomass Fuelled Power plant is the most important source to increase the production of energy based on renewable sources of energy. In this report we have tried to cover various important facts related to power plant such as thermo chemical conversion, biomass gasification process, newspaper articles, blogs, comments by esteemed guides and engineers.

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