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Biomass a Versatile Fuel for Energy and Power Generation

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***ABSTRACT*:** *Renewable energy sources demands are increasing day by day. To stop the harmful effect of global warming there is a need to adopt the changes .Most common form of the renewable energy is the biomass. Biomass is the term for the living material-plants, animals, fungi, bacteria. Taken together the earth's biomass represents an enomorous store of energy. The handling out facility of the solid biomass may also generate heat and the electricity. It has been estimated that just one-eighth of the total biomass produced annually would provide all humanity current demand for energy .To avoid the replenishment of the fossils fuels the much attention is being paid on identifying suitable biomass species, which can provide higher output energy. The biomass energy values for the plants are obtained from son energy through the process of the photosynthesis. The biomass needed depends upon the energy conversion methods used and the form of energy required. During the process of conversion the energy is released from the biomass in Heat form carbon is re-oxidized to carbon dioxide and the plant uses this for growing. Thus the biomass as well as the bio fuels gained a growing interest as sustainable and renewable energy.*

Keywords*: Biomass, Electricity, Renewable Energy, Sustainable Energy.*

I. INTRODUCTION

Since industrial revolution the demand and needs of the energy had been increased day by day. From the invention of steam engines and steam heating equipment importance of the fuel experienced. All the non renewable resources that are limited have been over used by human beings thus the desires of the alternative fuel have arisen. Global warming another chief reason to look for alternates for fossil fuel. The major reason 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[1]. Biomass is the plant derived material via converted by photosynthesis to store chemical energy and physical properties of the large molecules from which it is made. It is estimated that biomass, 90% of which comprises plant matter, it is equivalent to the current proven extractable fossil fuels of the world. In the supply of primary energy in many countries it plays a significant role. For the industrialized countries the share of biomass energy is not more than 3%.

Biomass: Biomass is mainly in the form of wood, is mankind's oldest form of energy. Animals feed on plants and grow through photosynthesis process using solar energy. The photosynthesis process is primarily responsible for generation of biomass energy. In the form of wood, agricultural residues, and food grains biomass is available. It has traditionally been used both in domestic as well as industries activities. For cooking and other thermal process in small industries solid biomass is used as fuel. On a renewable basis biomass is available, either through natural processes, or it can be by-product of human activities i.e. organic wastes. The associated energy bound in photosynthesis is $0.7 * 10^{14}$ W.[2] Consideration of the energy crops as source for biomass, the total energy potential of biomass for energy production might be larger than the energy potential of biomass residues.

Biomass Resources: The various types of biomass used are of five main types, namely;
Woody plants.
Agricultural residues.
Energy crops.
Aquatic plant.
Urban waste.
Crop residues such as straw, rice husk, coconut shell, sugar cane Bagasse are some of Agricultural residues. The energy crops are divided into 1) woody Energy crops, and 2) Herbaceous Energy crops.
Herbaceous Energy crops include both annual and perennial crops. The examples of the annual crops are corn and sweet sorghum and perennial crops are switch grass and Indian grass. The potential of bio-diesel through

the plantation of certain plants attracting attention over the world. For example: jojoba, karanj and jatropha curcas.

Biomass Components:-There are three components of biomass they are as follows:-

1) Lignin.
2) Hemicelluloses.
3) Cellulose.

The percentage of lignin in the biomass is about 15-25%.It has a complex organic structure. The energy content of the lignin is very high and its structure is very hard. The lignin is difficult to decompose [3]. The percentage of Hemicelluloses in the biomass is about 23-32% .And it is easy to decompose .The cellulose is about 38-50% it is a very good biochemical feedstock.

Biomass Conversion Technologies: There are many different ways of extracting energy from biomass. These energy-conversion technologies may be grouped into four basic types:

Physical method.

a) Pelletization.
b) Briquetting.
c) Expelling agro products.
d) Fuel extraction.

Biomass is decomposed in thermo-chemical processes having various combinations of temperatures and pressures. Biomass can be converted into gases, liquids, and solids through pyrolysis at temperatures of 500 -900°C by heating in a closed vessel in the absence of oxygen.

Table:1 Energy Available From Various Biomass Resources:

S.No	**Biomass sources**	**Biofuel produced**	**Conversion technology**	**Available energy (MJ/kg)**
1	Wood chips, sawmill dust, forest residue	Direct heat	Incineration	16-20
2	Wood chips saw mill dust forest residue	Gas Oil Char	Pyrolysis	40 40 20
3	Grain crops	Straw	Incineration	14-16
4	Sugar cane residue	Bagasse	Incineration	5-8(fresh cane)
5	Urban refuse	Direct heat	Incineration	5-16(dry input)
6	Sugar cane juice	Ethanol	Fermentation	3-6(fresh cane)
7	Animal waste	biogas	Anaerobic digestion	4-8(dry input)

Biomass Energy In India:

In India Biomass contributes over a third of primary energy. Biomass gives large amount of the energy for the domestic purpose. In rural households for cooking and water heating, as well as by industries biomass fuels are used. Biomass consumption estimation highly varies. The potential of the biomass is 19500 MW and status of percentage potential in MW is 613

Table: 2 Biomass Consumption (2004)

Fuel	**Million ton**
a)Fuel wood	205
b)Crop residue	116
c) Dry dung	35
Total	**356**

Table: 3 Fuel consumption by sector (2004)

Sector	**Million ton**
1)Household	
a)Forest rural	83
b)Non forest rural	65
c)Urban areas **Sub total**	17 **165**
2)Cottage industry	22
3)Rituals	4
4) Restaurant	14
Total	**205**

Problems of use Biomass Energy:

In India biomass energy is obtained from trees or cattle etc. The primary limitation of biomass energy consumption is to fulfill household's needs (cooking) and industries needs in rural areas. Biomass does not get resource value in developing countries as long as it is not inadequate. The biomass fails to get exchange value in substitution in market. Thus absence of market thus acts as a barrier to the penetration of efficient and clean energy resources and technologies.[7,8]Other problem related to it is too much pollution. The pollutants as CO_2, CH_4, nitrogen oxides etc. produced from incomplete combustion of biomass cause considerable damage to health, especially of women and children, thus main problems related with the biomass are - inefficient combustion technologies, environmental hazards and unsustainable harvesting practices. To overcome these problems modern biomass programs are being made.

Biomass Energy programme in India:

As per recent (dec.2007) estimate, about 50 million tones of solid waste and about 6000 million cubic meters of liquid waste is generated per year by our urban population. This translates into a potential for generation of over 2600MW of power from urban waste. The estimated potential of MSW (Municipal solid waste) for conversion to energy over the decades is given below.

Table:4

Year	Projected MSW Generation(TPD)	Potential for Power Generation (MW)
2012	215000	3650
2017	304000	5200

It has been estimated that there is a potential for recovery of about 1300MW of energy from industrial waste. The estimated potential for the recovery of the power generation from different solid and liquid wastes being generated in various industries is expected to increased to about 1600MW by 2012 and 2000 MW by the year 2017.Thirty nine projects aggregating to about 59MW has been installed in our country and eight other projects of 16 Mw are under installation[4]. A total of 95 MW is being generated from non-baggasse based plants.

Table: 5 Comparison of biomass with solar & wind

Power Generation	Solar Cell	Wind	Biomass
Total Investment (million US$)	1,830	12,700	6,300
Facility Scale (kW/year)	1,000,000	10,000,000	10,000,000
Yearly Operation Rate (%)	12	20	70
Yearly Electricity Generation (million kWh)	1,100	17,500	61,300
Unit Investment (US$/kW)	1.66	0.72	0.10

(Source: "21 Century by Biomass Energy", Sakai Masayasu)

Table: 5 is showing the investment cost of solar cell, wind and biomass and yearly operation cost. Biomass having the higher electricity generation with low Investment.[5,6] In India Biomass power plants commissioned 52 x 290MW by the year 2004, under implementation 41 x 284MW.

II. CONCLUSION

Biomass and bio-fuels have gained growing interest as sustainable and renewable energy. They currently provide a significant amount of global consumer energy but mainly for traditional domestic cooking and heating in developing countries. For the mass production and utilization of biomass as a renewable energy, the lack of energy and economic feasibility against other complementary energy sources as well as agricultural sectors such as food and textile production must be overcome by new and improved modern bio-energy technologies. To realize this, R&D efforts to attain technological innovation are definitely required. Policy makers should allocate valuable and shrinking research funds to the development of bio-fuel as a feasible alternative to oil while comprehending the global structure of research .Biomass is a sustainable fuel that can

both offer a significant reduction in net carbon emissions compared with fossil fuels and also many ancillary benefits. Most preferred fuels for gasification have been charcoal and wood. However biomass residues are the most appropriate fuels for on-farm system and offer the greatest challenge to researchers and gasification system manufactures. Biomass can be considered as low carbon fuel and biomass CO_2 absorption and emission is in balance. Biomass use covers a wide area from household cooking, rural electrification, fertilizer (municipal wastes, composting, etc.), process heat in small industries in the rural area and fuel for cogeneration facilities in oil palm and sugar plantation in future biomass used for methanol production, using producer gas in fuel cell for developing countries offer the greatest potentialities.

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