

# Biomass, Bagasse Cogeneration and Biodiesel: Crucial Sources for Sustainable Development of India

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**Abstract:** The total installed capacity of electricity generation in India is 225 GW and at present we are facing 25-35GW shortage. Still 400 million people living without light. Load shading is our daily problem throughout the nation including metro cities. Considering our growth and population in coming 12 years this electricity demand will reach 2.5 times the current established capacity. At the moment 2/3 of installed capacity is from thermal sector. Day by day per capita CO<sub>2</sub> emission is rising. Global warming and pollution are getting higher. This paper highlights the potential of biomass, bagasse cogeneration and biodiesel in our country. Moving towards electricity from surplus biomass and bagasse and use of biodiesel will certainly reduce burden of our economy. It will also solve the problem of climate up to some extent. It also helps to improve per capita income of farmers and overall rural economy.

**Keywords:** Biomass, Bagasse Cogeneration, Biofuel, Electricity Scenario of India, Renew-able Energy Resources

## Introduction

Though our electricity generation capacity is improved in this decade considerably still we are facing electricity scarcity problem. Our yearly per capita consumption of electricity is 717 KWh which is quite low as compared to developed nations. [16] In a poorly developed state like Bihar, there exists a huge electricity deficit. The average per capita consumption of electricity is 75 KWh/yr. Bihar has the maximum number of unelectrified villages with the number of villages as high as 18,395. Fig.1 shows sector wise electricity utilities for the year 2011-12.

Total consumption= 772603GWh

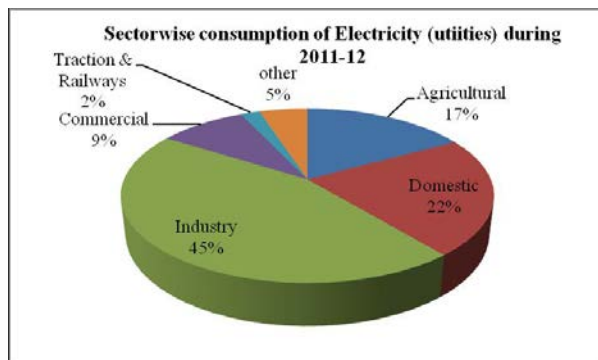


Fig.1 (Source: Energy Statistics 2013 MOSPI, India.)

Industry sector consumes 45% of total generated energy. Out of total power generated re-nearable is having 12.2 % share (excluding hydraulic power) [8].

## I. India's energy and environment challenge

India is having lot of challenges at present and in coming future regarding energy. Some important challenges are shown

in fig 2. To face these energy challenges successfully renewable energy is a imperative tool which can solve our energy need to some extent along with saving environment and climate. The fig.3 shows the comparison of different renewable energies with installed capacity and potential available with us. Further this paper reveals the potential and current capacity of electricity generation from biomass and ba-gasse cogeneration.



1. shortage is estimated at 25-35 GW
2. 400 million people still without electricity
3. In coming 12 years India's electricity demand to grow 2.5 times
4. India is dependent on oil imports for 80% of its demand
5. Climate change is also an important issue

Fig.2. India's Energy Challenge

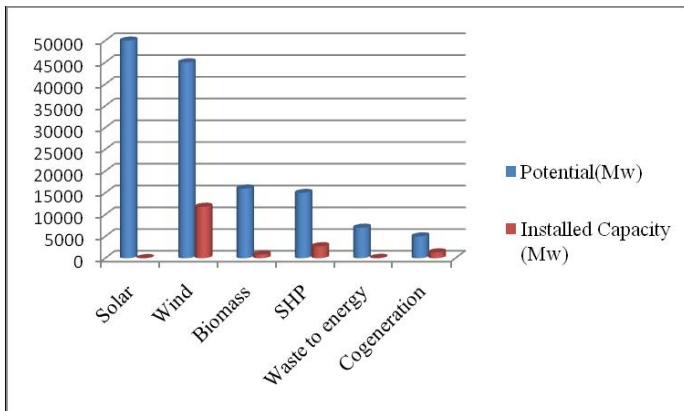


Fig.3 Potential and installed renewable energy capacity, by type (Source: MNRE Website)

## II. Potential of electricity from biomass

Biomass consists of organic residues from plants and animals that are obtained primarily from harvesting and processing agricultural and forestry crops. These are used as fuels in direct combustion power plants. The biomass is burned, producing heat that is used to create steam to turn turbines to produce electricity. The steam can often be used for other processes such as drying vegetables or in a factory. This is called cogeneration.

The current availability of biomass in India is estimated at about 500 metric tonnes per year. According to a study by the Ministry of India, the surplus biomass availability is estimated at 120 to 150 million metric tonnes per annum covering agricultural and forestry residues corresponding to 18,000 MW. [4] In India, biomass is used for cooking and other domestic uses. This traditional biomass fuel - fuel wood, crop waste and animal dung - is a potential raw material for the application of biomass technologies for the recovery of cleaner fuel, fertilizers and electricity with significantly lower pollution. Biomass power generation in India is an industry that attracts investments of over INR 6 billion every year, generating more than 5,000 million units of electricity and yearly employment of more than 10 million man-days in the rural areas. Sugar mills, textile mills, paper, small and medium enterprises, pulp mills, rice industries etc. are utilizing biomass energy.

The surplus residue of various crops like paddy, wheat, maize, soya bean, mustard, jowar, bajra is available in plenty. Bagasse, rice husk, straw, cotton stalk, coconut shells, soya husk, de-oiled cakes, coffee waste, jute wastes, groundnut shells, saw dust etc. can be used for power generation. Table 1 shows the variety of crops and their residues. Punjab, Uttar Pradesh, Maharashtra, Haryana, Karnataka are having greater crop production and obviously more surplus biomass and proportionate electricity potential. The following Fig. 4

shows state wise electricity potential from biomass.

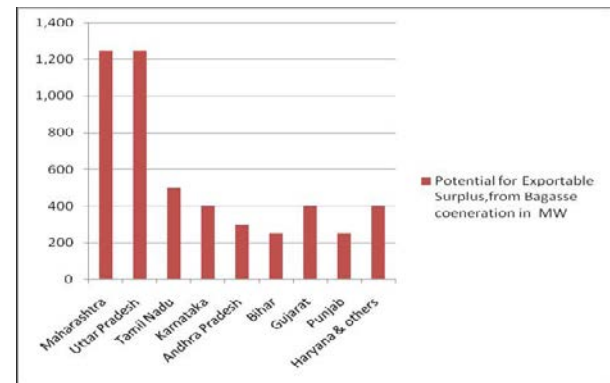


Fig. 5 State wise Potential of bagasse cogeneration in MW (Source: MNES Annual Report 2003 & Estimates from MITCON)

## III) Bagasse Cogeneration Plant

India is one of the major sugar producing countries in the world. The immense potential of electricity generation from bagasse cogeneration plants is available. Presently, the total electricity potential is estimated from bagasse cogeneration is 5,000 MW, considering 575 nation-wide sugar mills, but still we could manage to establish 865 MW generation capacities. [2] Indian sugar mills, either private or cooperative, have identified the need of efficient grid-connected cogeneration power plants. In fact, this is the way for these factories to remain in the worldwide competitive market.

TABLE 1: Residue-wise Biomass Data at National Level (major crops) (source- MNRE)

Sr. No.	Crop	Residue	Biomass generation ((kT/yr)	Biomass surplus kT/yr)	Power potential MWe
1	Paddy	Straw	149969	30594.3	3669.9
2	Wheat	Stalks	93361.7	16176.3	2102.9
3	Paddy	Husk	19995.9	12944.1	1423.9
4	Wheat	Pod	18672.3	8382.3	1173.5
5	Maize	Stalks	23421.3	4547.8	591.2
6	Soya bean	Stalks	9940.2	3284.4	427
7	Mustard	Stalks	6999	3173.9	412.6
8	Tapioca	Stalks	3959	2769.5	360
9	Groundnut	Stalks	13148.2	2066.9	268.7
10	Jowar	Cobs	5043.5	1912	267.7
11	Jowar	Stalks	17147.8	2042.7	265.6
12	Bajra	Stalks	12039.4	1919.5	249.5
13	Paddy	Straw	149969	30594.3	3669.9
<b>Total</b>			<b>415546.3</b>	<b>101880.5</b>	<b>12746.8</b>

Sugarcane is one of the most promising agricultural sources of biomass energy in the world. Sugarcane produces mainly two types of biomass, Cane Trash and Bagasse. Cane Trash is the field residue remaining after harvesting the cane stalk while

bagasse is the fibrous residue left over after milling of the Cane, with 45-50% moisture content and consisting of a mixture of hard fiber, with soft and smooth parenchymatous (pith) tissue with high hy-groscopic property. The fig. 4 shows the state wise potential of exportable surplus electric-ity from bagasse cogeneration in India.

#### IV) Biodiesels

Biodiesel is one of the most important form of renewable energy which can be used with or without changes in existing IC engine. Biodiesel can be intended to be used as replacement of petroleum diesel oil or it can be used by blending with petroleum diesel with some proportion. Biodiesel is biofuel produced from vegetable oil such as oilseed, rapeseed, soya beans, animal fats, algae, mustard, peanut, rice bran, canola etc. Our economy is de-pendent on import of crude oil, petroleum oil and coal. The fig. shows growth of import of above products in previous forty years. India is dependent on oil imports for 80% of its demand.

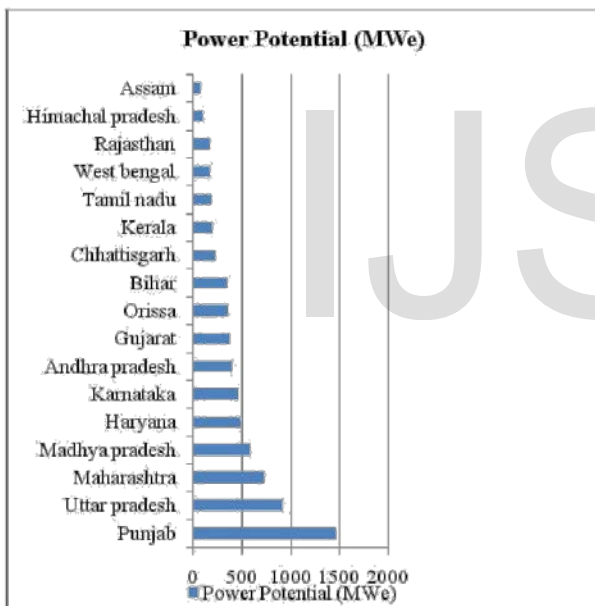


Fig. 4 Major Biomass potential states (source: MNRE, India)

Jatropha a biodiesel crop plantation can also solve the problem up to some extent. Jatropha can yield 1.6 tons of crude jatropha oil per hectare, but even so, under this assumption planting 4% of India's land with jatropha would supply 15% of India's current petroleum consumption. This production of Jatropha crop is not necessarily considered from main agricultural land. We can grow it on marginal available land. In some countries 5% to 10% blending of ethanol is mandatory. In January 2003 Government of India launched Ethanol Blended Petrol Program (EBPP) in nine states and Indian territories promoting the blending of ethanol with gasoline and blending of 5% ethanol with diesel. In 2004 due to short-age of ethanol this made optional. By 2017 India is thinking of blending biodiesel up to 20%.

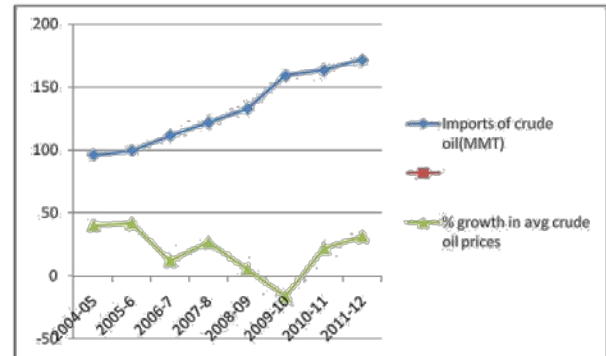


Fig. 6 Yearwise growth of imports of crude oil prices and % growth in avg. crude oil prices (source Ministry of Petroleum & Natural Gas)

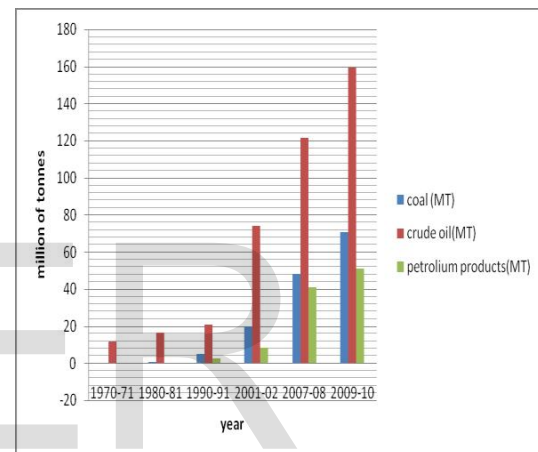


Fig. 7 Increase in demand over 40 years (source: Indian Petroleum & Natural Gas Statistics 2011-12)

#### V) Conclusion

India is facing plenty of economical challenges. The prominent hurdles for development are very high expenditure on import of crude oil, petroleum oils and coal, scarcity of electricity etc. Barrier between rural and urban economy is increasing. As a result millions of people are shifting towards metro cities. Lot of basic problems are creating due to mam-moth population growth in cities. Pollution and global warming is also a one of the bigger obstacle. As a result millions of premature deaths are happening due to respiratory diseases and heart diseases etc.

Making use of renewable energy resources particularly biomass, bagasse cogeneration and biofuel will be a part of solution on above problems. Production of biofuel crops to fulfill increasing demand of petroleum base fuel will assist our overall economy. Efficient use of surplus biomass residue and bagasse for electricity generation will lead to sustainable growth. It will certainly bring improvement in rural economy. It will solve environment related problems up to some extent. It will significantly reduce the dependence of our nation for crude

oil, petroleum oils and coal import.

## **VI. Reference**

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