# ENERGY RESOURCES FROM BIOMASS IN INDIA

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## I. INTRODUCTION

Biomass has been one of the main energy sources for the mankind ever since the dawn of civilization, although its importancedwindled after the expansion in use of oil and coal in the late 19th century. There has been a resurgence of interest in the recent years in biomass energy in many countries considering the benefits it offers.

It is renewable, widely available, and carbon-neutral and has the potential to provide significant productive employment in the rural areas. Biomass is also capable of providing firm energy.

Estimates have indicated that

15%–50% of the world's primary energy use could come from biomass by the year 2050. Currently, about 11% of the world's primary energy is estimated to be met with biomass. 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..

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.

According to Ministry of Non- Conventional Energy ,India, approximate estimate of potential capacities from Renewable Energy is as follows

Table I

| Source | Approximate Potential(MW) |
|---|---|
| Biomass energy | 19,500 |
| Solar energy | 20,000 |
| Wind energy | 47,000 |
| Small Hydropawer | 15,000 |
| Ocean energy | 50,000 |

## II. BIOMASS ENERGY

The Kyoto Protocol encourages further use of biomass energy.Biomass may be used in a number of ways to produce energy. The most common methods are:

- Combustion
- Gasification
- Fermentation
- Anaerobic digestion

India is very rich in biomass. It has a potential of 19,500 MW (3,500 MW from bagasse based cogeneration and 16,000 MW from surplus biomass). Currently, India has 537 MW commissioned and 536 MW under construction


Following is a list of some States with most potential for biomass production:

- Andhra Pradesh (200 MW)
- Bihar (200 MW)
- Gujarat (200 MW)
- Karnataka (300 MW)
- Maharashtra (1,000 MW)
- Punjab (150 MW)
- Tamil Nadu (350 MW)
- Uttar Pradesh (1,000 MW)

### *A. BIOMASS ENERGY IN ASIAN DEVELOPING COUNTRIES*

Biomass remains the primary energy source in the developing countries in Asia. Share of biomass in energy varies - from a very high over three quarters in percent in Nepal Laos,Bhutan, Cambodia, Sri Lanka and Myanmar; nearly half in Vietnam,

Pakistan and Philippines;nearly a third in India and Indonesia, to a low 10 percent in China and 7 percent in Malaysia.

*BIOMASS ENERGY IN INDIA: STATUS*

Biomass contributes over a third of primary energy in India.Biomass fuels are predominantly
used in rural households for cooking and water heating, as well as by traditional and artisan industries. Biomass delivers most energy for the domestic use (rural - 90% and urban - 40%)in India. Wood fuels contribute 56 percent of total biomass energy (Sinha et.al, 1994).

*MODERNISATION OF BIOMASS ENERGY IN ASIA AND INDIA*

Modernization in biomass energy use in Asia has happened in the last two decades along three routes –

i) Improvement of technologies in traditional biomass applications such as for cooking and rural industries
ii) Process development for conversion of raw biomass to superior fuels(such as liquid fuels, gas and briquettes), and
iii) Penetration of biomass based electricity generation technologies.

These developments have opened new avenues for biomass energy in several Asian nations, besides India.
The three main technologies being promoted by the MNES for productive utilizationof biomass are bagasse-based cogeneration in sugar mills, biomass power generation, and biomass gasification for thermal and electrical applications.

*Bagasse-based Cogeneration*

In simple terms, cogeneration is the process of using asingle fuel to produce more than one form of energy in sequence. Cogeneration of steam and electricity can significantly increase the overall efficiencies of fuel utilization in process industries. A minimum condition for cogeneration is the simultaneous requirement of heat and electricity in a favourable ratio, which is well fulfilled in the sugar industry. The thermodynamics of electricity production necessitates the rejection of a large quantity of heat to a lower temperature sink. In normal electricity generation plants, this heat rejection takes place in condensers where up to 70% of heat in steam is rejected to the atmosphere. In cogeneration mode, however, this heat is not wasted and is instead used to meet process heating requirement.The overall efficiency of fuel utilization can thus be increased to 60% or even higher in some cases. Capacity of cogeneration projects can range from a few kilowatts to several megawatts of electricity generation along with simultaneous production of heat ranging from less than a hundred kWth (kilowatts thermal) to many MWth (megawatts thermal).

*Cogeneration in sugar industry*

The sugar industry across the world has traditionally used bagasse-based cogeneration for achieving self-sufficiency in steam and electricity as well as economy in operations.In India, almost all sugar mills have been practising some form of cogeneration. This is true even for mills that were set up 70–80 years ago. Technologies are now available for high-temperature/high-pressure steam generation using bagasse as a fuel. These technologies make it possible for sugar mills tooperate at higher levels of energy efficiency and generate more electricity than what they require. For example,when steam generation temperature/pressure is increased from400 ºC/32 bar to 485 ºC/66 bar, more than 80 kWh (kilowatt-hour) of additional electricity can be generated from each tonne of cane crushed.

*Biomass-based Power Generation*

India produces a huge quantity of biomass material in its agricultural,agro-industrial, and forestry operations. According to some estimates,over 500 million tonnes of agricultural and agro-industrial residue alone is generated every year. This quantity, in terms of heat content, is equivalent to about 175 million tonnes of oil. A portion of these materials is used for fodder and fuel in the rural economy. However,studies have indicated that at least 150–200 million tonnes of this biomass material does not find much productive use, and can be made available for alternative uses at an economical cost. These materials include a variety of husks and straws. This quantity of biomass is sufficient to generate 15 000–25 000 MW of electrical power at typically prevalent plant load factors. In addition, electricity can also be generated from biomass grown on wastelands, road and rail trackside plantations, etc. The quantum of electricity that can be produced from such biomass has been estimated to be in excess of 70 000 MW. Thus, the total electricity generation potential from biomass could reach a figure of about 100 000 MW.The technology for generation of electricity from these biomass materials is similar to the conventional coal-based thermal power generation. The biomass is burnt in boilers to generate steam, which drives a turbo alternator for generation of electricity.

*Advantages*

- These projects can be designed to match the electric loads as biomass can be stored and used according to demand.
- Equipment for these projects is similar to that for coal-based thermal power projects and hence, no new technological developments are required.
- Due to their proximity to the rural areas, these projects are likely to improve quality of electricity supply there.
- A variety of biomass materials can be used in the same plant, providing flexibility of operations.

*Biomass Gasification for Thermal and Electrical Applications*
Biomass gasification is thermo-chemical conversion of solid biomass into a combustible gas mixture (producer gas) through a partial combustion route with air supply restricted to less than that theoretically required for full combustion.

- Producer gas can be used as a fuel in place of diesel in suitably designed/adopted internal combustion (IC) engines coupled with generators for electricity generation.
- Producer gas can replace conventional forms of energy **i)** such as oil in many heating applications in the industry.
- The gasification process renders use of biomass relatively clean and acceptable in environmental terms.
- Large monetary savings can accrue through even partial substitutionof diesel in existing diesel generator (DG) sets.

Most commonly available gasifiers use wood/woody biomass; some can use rice husk as well. Many other non-woody biomass materials can also be gasified, although gasifiers have to be specially designed to suit these materials and the biomass may have to be compacted in many cases.
In India more than 2000 gasifiers are estimated to have been established with a capacity in excess of 22 MW and a number of villages have been electrified with biomass gasifier based generators. MNES has actively promoted research and development programmes for efficient utilization of biomass and agrowastes and further efforts are on.

Biomass gasification offers immense scope and potential for :

Water pumping

- Electricity generation : 3 to 10 MW power plants
- Heat generation : for cooking gas – smokeless environment
- Rural electrification means better healthcare, better education and improved quality of life.

*FUTURE OF BIOMASS ENERGY IN INDIA.*

Growing experience with modern biomass technologies in India suggests that technology push policies need to be substituted or augmented by market pull policies... Policy support for a transition towards a biomass based civilization in India should consider the following:
*A. Short-term Policies (1 to 5 years):*
Enhanced utilization of crop residues and wood waste, Information dissemination, Niche applications (e.g. remote and biomass rich locations), Technology transfer (e.g. high pressure boiler), Co-ordination among institutions, Demonstration projects, Participation of private sector, community and NGOs, Wasteland development, and Subsidy to biomass technologies to balance the implicit subsidies to fossil fuels.
*Medium Term (5 to 20 years):*
R&D of conversion technologies, Species research to match agro climatic conditions, Biomass plantation
Scale economy based technologies, Local institutional developments, and Removal of distortions in fossil energy tariffs.

*Long term (over 20 years):*
Infrastructure (logistics, T&D), multiple biomass energy products (e.g. gas, liquid, electricity), Institutions and policies for competitive biomass energy service market and Land supply for biomass generation.

Forecasts: What are the general forecasts for the next decades? Around the world, a growing number of nations have recognized the economic, social, and environmental benefits of renewable energy and are enacting tax incentives and other policy measures favorable to renewable technologies. In Germany, Japan, Spain, and a handful of other countries, clear government commitments to renewable energy and strong, effective policies have overcome barriers and created demand for these technologies, leading to dramatic growth.

The power ministry revealed that the utilization of biomass resources could soon be increased for the generation of electricity.According to ministry, in India, the electricity generated from renewable sources presently stands at about 13,200 MW out of the total electricity production of 147,400 MW. Of this, the usage of biomass resources for generating electricity is just 650 MW as opposed to a potential of 16,000 MW.

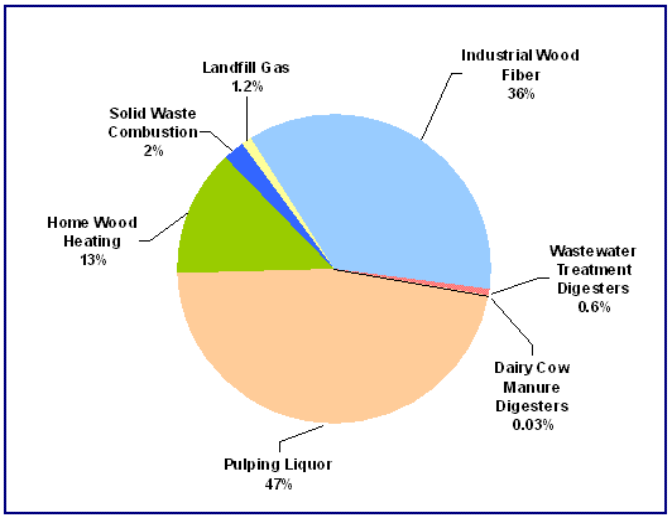
AllGreen Energy, a Singapore-based renewable energy company, has decided to set up 10 biomass-based renewable energy projects in India by the next two to three years with a total investment of Rs 500 crore.During the initial phase, the company plans to launch three plants in Karnataka, Tamil Nadu and Madhya Pradesh by March 2010. The investment for each project is Rs 50 crore.Each plant is likely to produce 6.5 MW of power by March 2010 and will give a 24x7 continuous power. After completion of all the 10 plants, it

would produce about 65 MW of power.AllGreen is taking up the tested and patented Biomass Gasification Technology from Indian Institute of Science (IISc) and will partner with GE Energy and ITC to identify potential biomass-rich locations. Biomass will be procured from various sources such as biomass plantations, agricultural farms and post-harvest processing industries.The annual biomass requirement of the projects will be 50,000 tonnes and local employment generation opportunities are expected. Part of the electricity generated will be provided to the village where the plant is established

## III. CONCLUSION

Biomass potential in rural India is almost unnoticed. We expect our strategy to bring down price of biomass energy. Biomass is a key link between Energy,Environment and Climate Change.Significant social and environmental benefits make biomass a deserving alternative for support from governments committed to sustainable development. Indian policy makers should support the energy transformation away from exhaustible and polluting energy resources towards renewable and clean energy resources on the road to sustainable development.

Modern biomass technologies provide viable options for such an energy transformation, on the way to a sustainable energy system of the future

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