

Biomass Resources for Energy Generation in India

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Overview

Biomass is combustible organic material obtained from living plants and animals. The plant biomass is recognized as most commonly found form of biomass resources. Plants are grown through photosynthesis process using sunlight to metabolize the atmospheric carbon dioxide and water. Therefore, unlike the fossil fuels such as coal, gasoline etc. biomass does not take thousands of years to develop and it can reproduce, for that reason biomass considered as a *renewable* resource. As compared to fossil fuel, one may believe that biomass is “*carbon neutral*” because every day large amount of plant species simply known as biomass grows through photosynthesis process by absorbing atmospheric carbon dioxide, while after burning of biomass there is no additional carbon dioxide inventory in atmosphere. The use of organic waste material represents a potential source of clean, renewable energy, abundant, easily available, and carbon neutral, it has stoked interest throughout the world.

Biomass availability in India

In India, people are consuming nearly 32% primary energy obtained from biomass and almost 70% of people in the country are depending upon the energy derived from biomass. In developing countries like India, biomass has a huge potential and considered as inexpensive, carbon-neutral, and abundant source of energy. Mainly available biomass material from agriculture waste includes rice husk, bagasse, straw, soya husk, groundnut shell, sawdust, coffee waste etc. According to Ministry of New and Renewable Energy (MNRE), the current potential production of biomass in India is about 500 million metric tons per annum; among this only small fraction of biomass has been further utilized as an animal feedstuff, in small scale industrial application, and most commonly used as a domestic cooking fuel. Among the total available biomass, most of the biomass is remains unutilized known as surplus biomass nearly \approx 120-150 MT and however it creates a disposal related

problem. This surplus biomass quantity nearly equal to 25 Exajoule (EJ) of the total energy potential, which is about 10% of India's total primary energy requirement. Table 1 shows the grid and off-grid connected share of biomass-based power in India.

Sources of biomass for energy generation

The most commonly available biomass sources are agriculture waste and forest waste. Some biomass resources from animal waste, municipal solid waste, industrial waste, and floating plant waste etc. can be tested for energy generation. Different sources of biomass are shown in Fig. 1

- **Crop residue:** The agriculture residues including rice husk, sugarcane bagasse, cotton stalk, soya husk, groundnut shell, coffee waste, saw dust, jute waste etc. have been used for bioenergy generation.

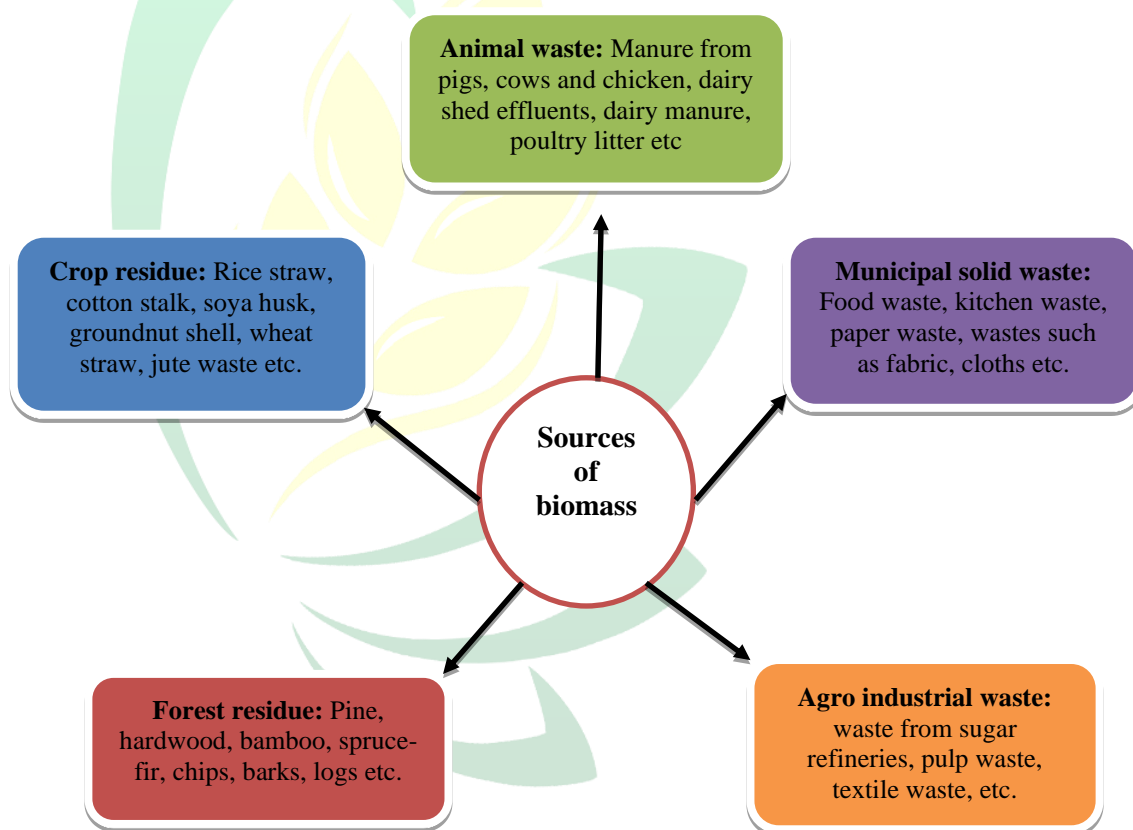


Fig. 1: Sources of Biomass

- **Forest residue:** Forest waste includes barks, timber slash, mill scrap, chips, logs, leaves, limbs, culled trees, tops and forest industry-based products sawdust etc, are considered as a feedstock for power generation.

- **Agro industrial waste:** Agro industrial waste includes molasses from sugar refineries, waste from paper mills, textile fiber waste, pulp waste from food processing industries, and agro industrial waste from different agriculture crops etc.
- **Municipal solid waste:** Municipal solid waste (MSW) is recognized a main source of waste biomass which includes sewage sludge, food waste, liquid waste, refuse derived fuel (RFD), yard clippings, and waste paper etc.
- **Animal waste:** Animal waste or livestock waste includes animal manure, manure from pigs, cows and chicken, dairy shed effluents, dairy manure, and poultry litter etc is one of the important organic wastes which will be harmful to environment if they are not utilized appropriately.
- **Aquatic waste:** Aquatic biomass is coming under the biological waste and invented from aquatic plant species; some of them gives benefits to environment, while most of species shows adverse effects due to their invasive behavior and profuse vegetation.

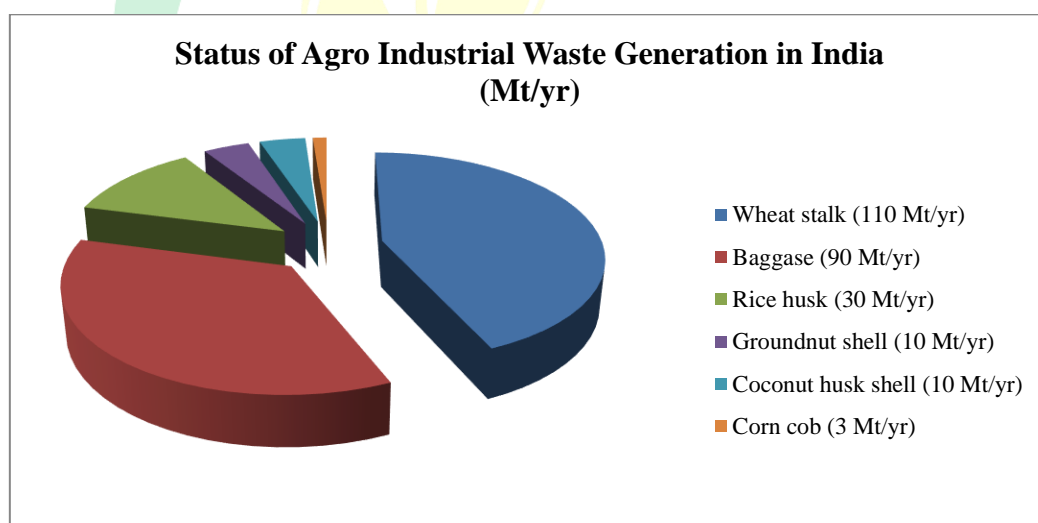


Fig.2: Status of agro industrial waste generation in India

Table 1: Grid and off-grid connected share of biomass-based power in India (Source: MNRE Report)

Sector	Installed capacity (MW)
I. grid connected power (MW)	

Biomass power (Combustion, gasification, and bagasse cogeneration)	4831.33
Waste to power	115.08
Subtotal grid interactive	4946.41
II. Off-grid power (MWe)	
Biomass (non-bagasse) cogeneration	651.91
Biomass gasifiers	
Rural	18
Industrial	164.24
Waste to energy	160.16
Subtotal off-grid	994.46
Total biomass based power	5940.87

Merits and demerits of biomass as an energy source

Some of the major advantages and disadvantages of biomass related to its composition, properties and its applications has been listed as follow;

Merits of biomass

- ❖ Biomass is carbon dioxide neutral renewable energy source
- ❖ Less percentage of ash and Sulphur present in biomass
- ❖ The concentration of Ca, H, volatile matter, Mg and P is high.
- ❖ Very well reactivity with a low ignition as well as combustion temperature.
- ❖ Cheap resource for generation of thermal energy, electricity, biofuels, fertilizers, sorbents etc.
- ❖ Minimum CO₂, SO_x, NO_x emission
- ❖ It reduces dependency of fossil fuels

Demerits of biomass

- ❖ Low bulk density, energy density, and calorific value
- ❖ Low ash fusion temperature, and pH
- ❖ Odour, leaching of harmful components, emission
- ❖ More cost required for collection, harvesting, separation, transportation and storage
- ❖ Required pre-treatment cost for further utilization

- ❖ Bioenergy is not efficient as fossil fuels
- ❖ It is not completely clean source of energy
- ❖ Seasonal availability

Conclusion

In India, biomass has significant energy benefits and potential to generate bioenergy. Biomass has ability for acting as consistent source of renewable energy due to its abundant availability and storability. However, we organized supply chain and market structure has been hindered the progress of biomass conversion technologies.

References:

Ministry of new renewable energy, Govt. of India, <https://mnre.gov.in/biomass-powercogen>
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