



Biomass Energy



Biomass is used for facility heating, electric power generation, and combined heat and power. The term biomass encompasses a large variety of materials, including wood from various sources, agricultural residues, and animal and human waste.

Biomass can be converted into electric power through several methods:



Direct combustion of biomass material, such as agricultural waste or woody materials.



Gasification produces a synthesis gas with usable energy content by heating the biomass with insufficient oxygen.



Pyrolysis yields biooil by rapidly heating the biomass in the absence of oxygen.



Anaerobic digestion (AD) produces a renewable natural gas when organic matter is decomposed by bacteria in the absence of oxygen.

AD produces biogas, a methane-rich gas that can be used as a fuel and digestate, a source of nutrients that can be used as a fertiliser. Increasingly AD is being used to make the most of out of waste by turning it into renewable energy and has multiple applications for buildings.

Suitability of AD for buildings

- Highly suitable in Indian context, high organic waste content, opportunities for on-site utilization of biogas
- Applicable for commercial and residential buildings

Commercial feasibility

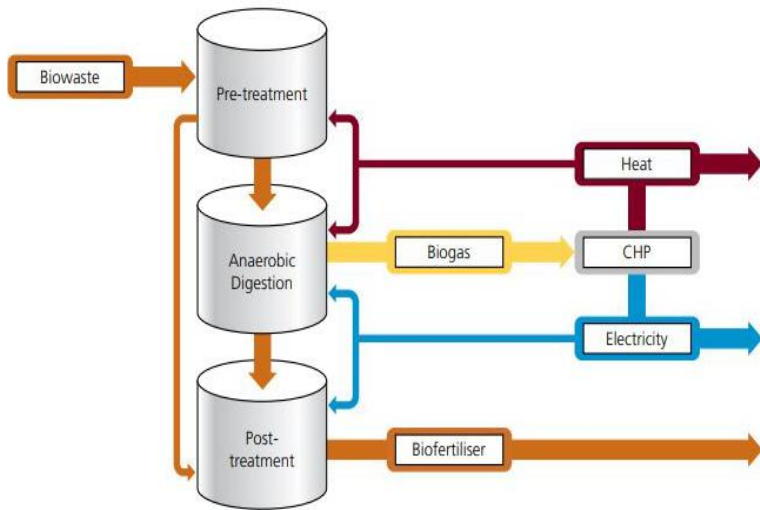
- Commercially viable technologies and multiple players
- High efficiency

How Does the Anaerobic Digestion Process Work?

The process takes place inside an anaerobic digester; a large, sealed tank which is void of oxygen. The air supply is restricted to stimulate 'anaerobic' decomposition (as opposed to composting, which takes place in the presence of air). After 20 to 60 days, depending on the configuration and internal temperature of the digester, a methane-rich 'bio-gas' and a residual co-product, an odour-free 'digestate' is produced.

This gas is commonly used for electricity and heat generation and may also be upgraded for other applications.

The digestate is rich in plant-available N, P and K and may be directly spread on the land as a fertiliser. Alternatively, digestate may be further separated or "dewatered" into a solid fraction (typically 25-35% dry matter, enriched in tP) which can be used as a soil improver, and a liquid biofertiliser containing much of the ammonium and potassium that can be pumped or transported for land-spreading.



Policy and incentives for biogas systems

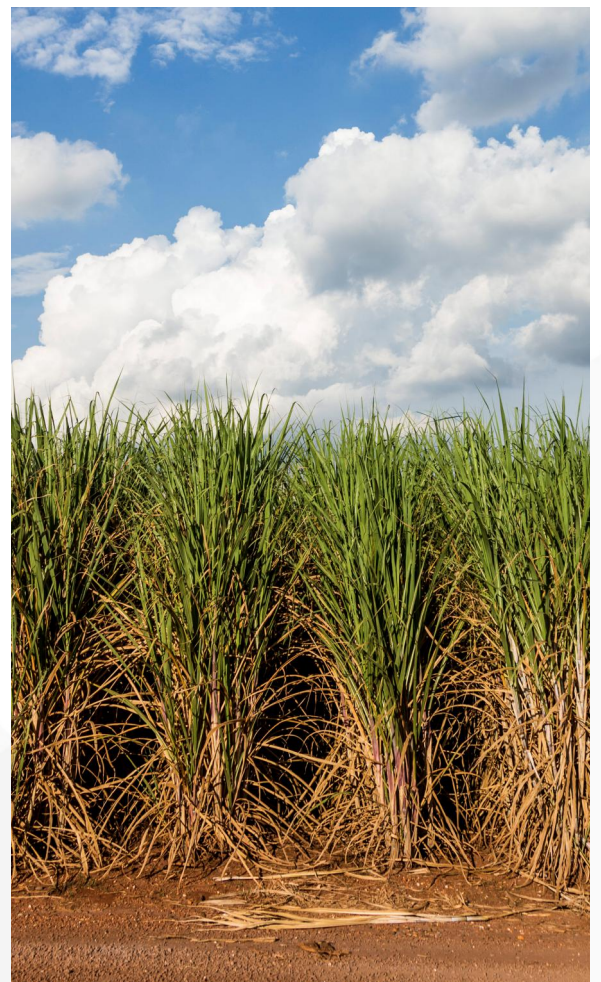
The Union Ministry of Environment, Forests and Climate Change (MoEF&CC) notified the new **Solid Waste Management Rules (SWM), 2016**. These have replaced the Municipal Solid Wastes (Management and Handling) Rules, 2000. The major highlights of the rules are segregation at source, collection, and disposal of sanitary waste, collect back scheme for packaging waste, waste processing and treatment and promoting use of compost. The rules mandate that all resident welfare, market associations and gated communities with an area of above 5,000 sq m will have to segregate waste at source by the generators or facilitate collection of segregated waste in separate streams and handover recyclable material to either the authorised waste pickers or authorised recyclers. The bio-degradable waste shall be processed, treated, and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by local government body. **A few states are also promoting waste to energy projects.** Thus, the waste can be sent to these plants as these plants generate energy in the form of electricity and/or heat from the primary treatment of waste, or the processing of waste into a fuel source.

Major Players in India

- Founded in 2011, GPS Renewables is a waste-to-energy technology company that is pioneering the development of clean and low-cost technology for waste management solutions. The product is called BioUrja Biomass.
- The Energy and Resource Institute (TERI) product is called TEAMdigestor.

Biomass Application and Potential End Use

Output energy	Application	Suitable Building type	Specific requirement
Gas	Electricity generation & fuel replacement for cooking	Residential societies, Multifamily apartments, Institutes & hotels	Continuous availability of biomass (preferably on site)

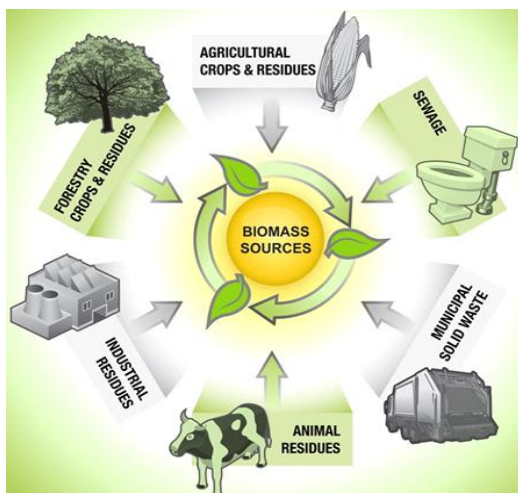


Case Study

Green Park Hotel, Hyderabad

The Green Park and Marigold Hotels is a 4-star hotel located at the Urban Hyderabad City. It is a 200-room hotel with one restaurant and a banquet hall. Hotel installed a biodigester for efficient and green processing of food waste while in turn getting Bio CNG as the output thereby replacing a significant portion of their fuel needs. The system layout was customized due to space constraints at the hotel. System components had to be designed and placed at different places in the compound at the back of the hotel and necessary piping had to be carried out to ensure optimal operation. The maximum level of waste addition was **400 kg/day** based on the kitchen's current LPG needs. The waste stream included both food preparation waste (uncut vegetables, etc) and cooked food waste. The energy generated from the BioUrja (name of the system) fuels 2 large burners, which are utilized for cooking. The performance statistics are summarized below. The hotel staff had been trained on O&M procedures. The high level of automation ensures that even unskilled personnel can carry out the basic operation procedure of feeding the waste in about 2-3 hours every day.

Waste Processing Capacity	Max. of 400 kg per day
Water Intake	NIL
Main Reactor	Base Area 6 sq m
Delivery Time	2 months
Operational since	March 2015
Daily Raw Gas Production	56 cu m of biogas
Daily LPG equivalent production	~28 kg per day Annual
Waste Processing Capacity	146 tons
Annual GHG mitigation	More than 170 tons of carbon dioxide equivalent
Operational Cost of generating	1 kg
LPG equivalent Gas	~Rs11
Net Present Value of the Project	>Rs60 lakhs
Rate of Return (IRR)	50%
Payback Period	<2 years



Biomass installations in buildings in India



Source: <http://www.greenpowersystems.co.in/case-studies/>