



Biomass Gasification in India: Trends and Progress



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Pramod Kumar
HP Green R&D Centre

☐ Abundant Biomass Resource

- India generates 750-800 million tonnes of biomass annually.
- Major sources: agricultural residues, forestry residues and energy crops

☐ Major Usage in India

- Power Generation
- Process Heat
- Gas Engine/Dual-fuel operation
- Cooking

Common Gasification Technologies Used in India

Gasifier Type	Technology Characteristics	Typical Scale in India	Key Strengths	Limitations
Fixed Bed (Updraft)	- Upward flow of gas - Simple design, low cost	10 KW – 2 MW (widely used for power and heat)	- Robust, suitable for high-ash fuels - Lower tar in gas (2-5 g/Nm3)	- Lower efficiency (65-75 %) - Not suitable for high moisture fuels
Fixed Bed (Downdraft)	- Gas flows downward with co-current movement - Good gas quality	10 KW – 5 MW (common for IC engine applications)	- Lower tar in gas (1-3 g/Nm3) - Better gas quality for engines	- Sensitive to fuel and moisture - Choking risk with high ash/fines
Fluidized Bed (Bubbling)	- Inert material (sand) fluidized by air - Good mixing and temperature control	100 KW – 20 MW (used for heat, power and process steam)	- Better efficiency (75-85 %) - Tolerant to high moisture and ash	- Higher CAPEX - More complex generation
Fluidized Bed (Circulating)	- High gas velocity, solids circulation with cyclone - High heat transfer	5-50 MWth (demonstration/ niche applications in India)	- High efficiency (80-90 %) - Uniform temperature and high stability	- Higher CAPEX and OPEX - More complex system

Major Gasification Projects in India

Project / Location	Implementing Agency/ Partner	Capacity & Technology	Application	Status/ Remarks
TERI – BHEL Gasifier Project (Various locations)	TERI in collaboration with BHEL	100 kW -1 MW Fixed bed (downdraft)	Power generation (ICE based)	Multiple plants installed at sugar mills, rice mills, institutions. Operational with varying PLF.
IIT Kanpur -CFBC Gasifier(Kanpur, UP)	IIT Kanpur	200 KWth Circulating Fluidized Bed (CFBC)	Process steam & power	Demonstration plant operational; technology validated.
Gearbox Gasifier Plants(Nashik, Maharashtra)	GEAR Energy Ltd.	10 MW (2 x 5 MW) CFBC	Power generation (boiler + turbine)	One of the largest biomass gasifier plants (operational since 2017). Uses agri-residues.
Godawari Power &Ispat Ltd.(Batavia, Chhattisgarh)	GPIL	9.5 MW CFBC	Power generation	Operational plant using biomass as primary fuel
Rice Mill / Sugar Mill Captive Power Plants(Multiple states)	Various millers / industries	100 kW - 2 MW Fixed bed (downdraft)	Captive power	Several installations across India; performance dependent on feedstock and operations.
MNRE / ISRO /ICFRE Projects(Various locations)	MNRE, ISRO, ICFRE & other institutions	10 kW - 500 kW Fixed bed / Fluidized bed	Power, heat, gas engine applications	R&D and demonstration projects for decentralized applications; limited commercial replication.

Challenges Limiting Scaleup of Biomass Gasification in India

Feedstock Supply
and Logistics

Technology and
Operational
Challenges

Economics and
Financial Viability

Reliability &
Technical Manpower

Policy & Competing
uses

❑ Deployment Scale

- Installed capacity likely to reach -250-400 MW equivalent by 2030 (mostly <5 MW plants)
- Growth in captive power, process heat and industrial applications

❑ Technology and Operational Challenges

- Rice mills, sugar mills, pulp & paper, food processing, textiles, brick & other SMEs
- Decentralized power/heat for rural industries, clusters and institutions

❑ Technology Outlook

- Improved gas cleaning and tar reduction technologies.
- Higher efficiency gasifiers and better system integration.
- More standardization and modular designs.

❑ Enablers for Scale-Up

- Reliable and low-cost biomass supply chains
- Access to affordable finance and VGF
- Supportive policies, viability gap support and recognition of firm & flexible biomass power.



Thank you