



Areca nut processing
(Downdraft: 20kg/hr)



Biomass gasifier based crematorium
(Downdraft: 100kg/hr)



Furnace for production of magnesium chloride
(Updraft: 150kg/hr)



Steel re-rolling
(Downdraft: 100kg/hr)

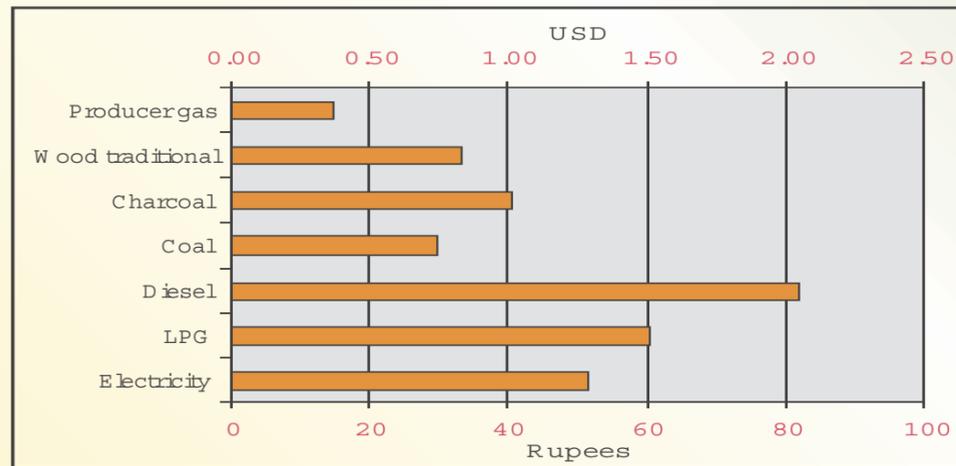


Institutional cooking (Natural draft: 5kg/hr)



Large cardamom curing (Updraft: 10kg/hr)

Comparative costs of thermal energy



(For useful heat of 10 000 kcal/hr) Calculated at 2006 prices

Uttam Urja stove

- Works on the principle of inverted downdraft gasifier
- Smokeless and complete combustion
- High efficiency
- Consumes very low power:
 - Family stove 2-4 Watt
 - Community 20 Watt
- Economically viable and easy to use
- Easy service and maintenance
- Convenient char/ash removal system
- Easy regulation of flame
- Provided with rechargeable battery, solar photovoltaic module, hand blower, inverter, and so on.



Power application: salient features

- High temperature is maintained because air is preheated for gasification, resulting in better quality and clean gas
- No external energy required even for start-up of the small capacity gasifier system (pedal-operated blower is used for starting the gasifier)
- Gasifier-based power generating systems can be used to operate:
 - Diesel engine on dual fuel mode to replace 80%-85% diesel
 - Gas engine (or modified diesel engine) on 100% producer gas mode
 - To run IC engines for mechanical shaft power, e.g. water pumps for irrigation
- Specific fuel consumption:
 - 1.5 kg fuel wood per kWh for 100% producer gas mode
 - 0.9 kg fuel wood and 90 ml diesel per kWh for dual fuel mode
- TERI gasifier systems have been developed for wide range of capacities:
 - Rural electrification (10-40 kWe)
 - Captive generation (50-250 kWe)



100 kWe power gasifier
(dual fuel mode), Thailand



10 kWe power gasifier
(100% gas mode), India



150 kWe power gasifier
(100% gas mode), Sri Lanka

For further information on Uttam Urja biomass gasifier, contact us at:

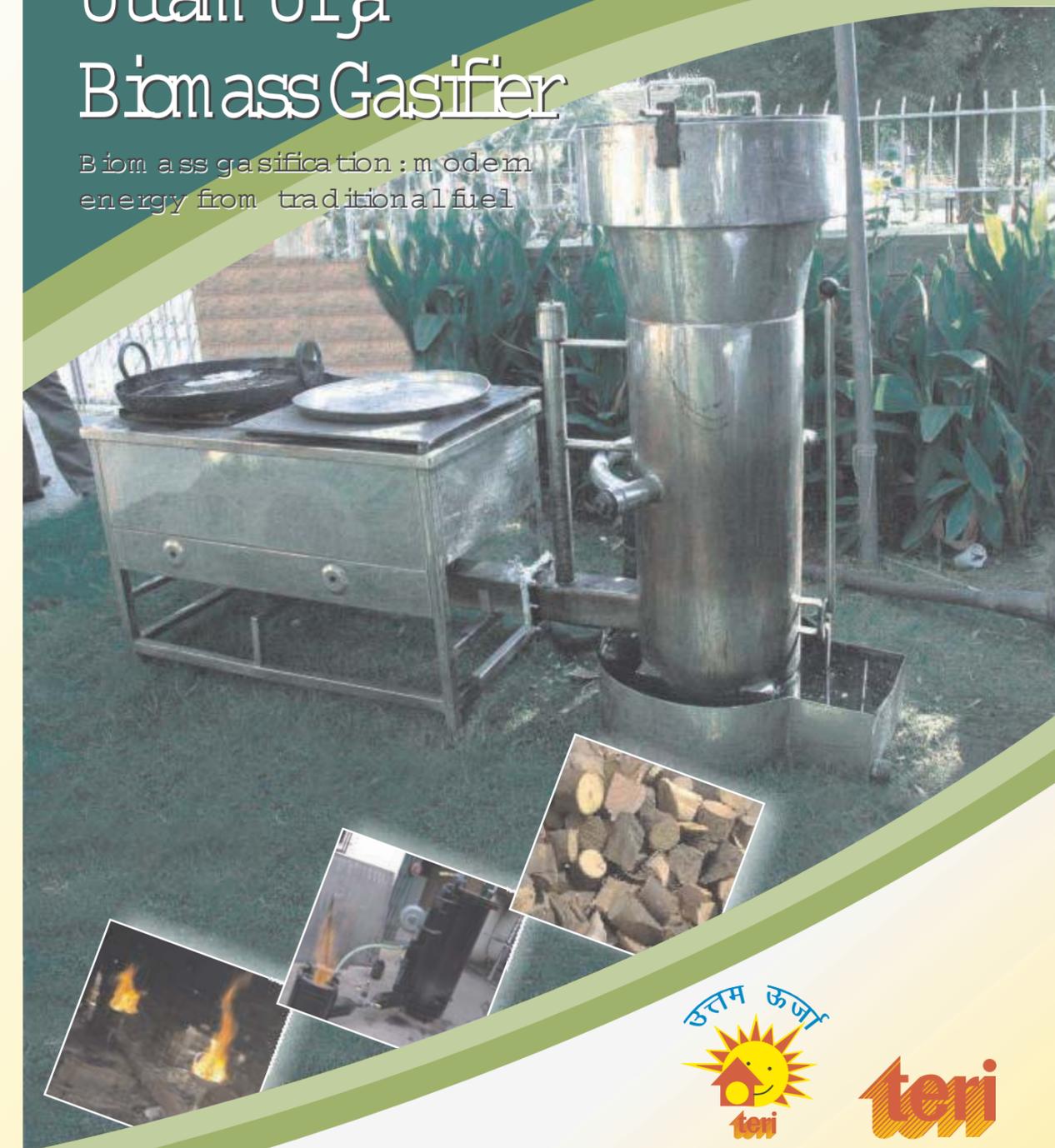
The Energy and Resources Institute

Darbari Seth Block
I H C Complex, Lodhi Road
New Delhi - 110 003 INDIA

Ph +91-11-2468 2100 / 4150 4900
Fax +91-11-2468 2144 / 2468 2145
E-mail dhingras@teri.res.in
Web www.teriin.org

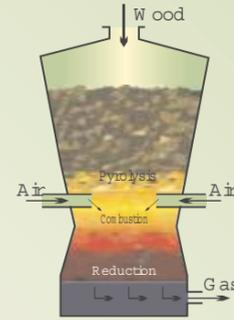
Uttam Urja Biomass Gasifier

Biomass gasification: modern energy from traditional fuel



Gasification

Biomass gasification is a process of converting solid biomass fuel into a gaseous combustible gas (called producer gas) through a sequence of thermo-chemical reactions. The gas is a low-heating value fuel, with a calorific value between 1000–1200 kcal/Nm³ (kilo calorie per normal cubic metre). Almost 2.5–3.0 Nm³ of gas can be obtained through gasification of about 1 kg of air-dried biomass.

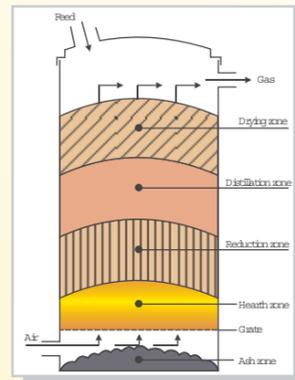


The gas can be efficiently used with a good degree of control to meet heat demands in oven/burners, boilers or kilns for thermal applications, or it can be cooled, cleaned, and fed into an engine to operate either on dual fuel or in a 100% producer gas mode to generate electricity.

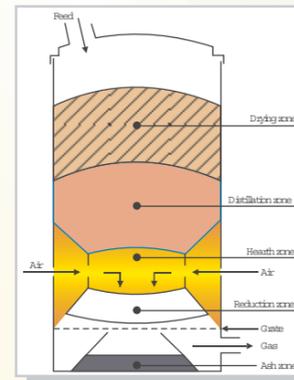
Typical composition of producer gas(%)	
Carbon monoxide (CO)	20–22
Hydrogen (H ₂)	15–20
Methane (CH ₄)	2–3
Carbon dioxide (CO ₂)	9–11
Nitrogen (N ₂)	45–54
Water vapour (H ₂ O)	10–15
Heavy hydrocarbon	0.2–0.4

Types of biomass gasifiers

- Updraft or counter-current gasifier
- Downdraft or co-current gasifier



Updraft



Downdraft

Normally, updraft gasifiers are less sensitive to fuel size and moisture content compared to downdraft gasifiers. Downdraft gasifiers give relatively cleaner gas (low tar content) and hence, are preferred for engine applications and for niche thermal applications, which demand clean gas.

Uttam Urja gasifiers: salient features

- Patented design
- Throat-less design
- Multi-fuel capability
- Better conversion (solid to gas) efficiency (>75%)
- Better control on burning
- Production of clean flue gases in the exhaust
- Available in downdraft and updraft (forced and natural) mode
- Can be tailor-made for a range of output ratings and used for variety of applications:
 - Thermal applications to meet process heat requirement
 - Power application for rural electrification and captive use
 - Shaft power
- Low initial investment
- Substantial fuelwood savings (>40%) and thus reduced deforestation
- Substantial reduction in diesel/kerosene/furnace oil cost (3–4 kg of biomass can replace 1 litre of petroleum fuel)
- Use of castable insulation material in the fire box capable of withstanding high temperatures (upto 1860 °C).
- Net zero CO₂ emission, as biomass is carbon neutral fuel



Uttam Urja gasifier range

- Downdraft gasifier (10–300kg/hr)
- Updraft gasifier
 - Natural draft mode (5–20kg/hr)
 - Forced draft mode (5–100kg/hr)

Biomass fuels for Uttam Urja gasifiers

- Pruned lops and tops of trees, rubber wood, gliricidia, and so on
- Wood wastes from timber harvesting and saw mill operations
- Coconut shells, areca nut shells, cashewnut shells, agri stalk, lantana, and so on
- Briquettes of agricultural residue and sawdust



Producer gas flames



Conical burner



Horizontal burner



Venturi burner



Multiple burner

Thermal applications

- **Dryers** Drying applications in farm products, food and spices industry (such as areca nut, tea, coffee, tobacco, large cardamom), rubber, and chemical products (temperature requirement: 60–130 °C)
- **Kilns** Baking of tiles, pottery, plaster of Paris, lime, and so on (temperature requirement: 700–1000 °C)
- **Furnaces** For melting metals and alloys such as copper, aluminum, lead, and stainless steel, and scrap melting/recycling (temperature requirement: 650–1100 °C)
- **Process heat** Process industries requiring low-pressure steam such as large-scale cooking, textiles, tyre retreading, and food processing units such as bakeries and namkin making
- **Water boilers** Institutional cooking, silk cocoon cooking, fabric dyeing, areca nut boiling, food processing, chemical products, and similar industries



Namkin making
(Downdraft: 20-40kg/hr)



Silk cocoon cooking oven
(Downdraft: 10kg/hr)



Bakery oven
(Downdraft: 20kg/hr)



Drying crumb rubber
(Downdraft: 100kg/hr)