

5 MW Biomass Gasification to Power Plant

100 TPD Biomass Feedstock | Syngas-Driven Power Generation | Grid-Ready Output



Proposal Reference	VET/5MW-BIO/PROP/2026/001
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Submitted By	Medigreen Energy Pvt. Ltd
Submitted To	IPCL
Project Capacity	5 MW Power Plant

1. EXECUTIVE SUMMARY

The escalating demand for reliable, clean, and cost-competitive power — combined with the abundant availability of biomass residues across agricultural and industrial belts — presents a compelling opportunity in the Biomass-to-Power sector. Medigreen Energy Pvt. Ltd proposes a 5 MW Biomass Gasification Power Plant capable of processing 100 Tonnes Per Day (TPD) of biomass feedstock and delivering grid-ready electrical power through a syngas-driven prime mover system.

The proposed facility utilises the company's proprietary High Temperature Gasification technology to convert biomass briquettes into high-calorific syngas, which is subsequently combusted in a dedicated 5,000 kW Enertek Pulse Engine coupled to an alternator for power generation. The system is designed for continuous 24-hour operation and is fully instrumented with PLC-based automation and SCADA monitoring, ensuring operational reliability, safety, and performance consistency.

Key Project Highlights

Parameter	Value
Biomass Feed Capacity	100 TPD (4,200 kg/hr)
Syngas Production (Calorific Value)	9,000 kJ/kg
Power Generation Capacity	5,000 kW (5 MW) Rated
Maximum Power Output	5,200 kW
Minimum Stable Output	4,000 kW
Alternator Rating	5,000 kW / 5,500 kVA, 415V, 50 Hz, 3-Phase
Plant Operating Regime	24 Hours/Day, Continuous Operation
Technology Platform	High Temperature Biomass Gasification + Pulse Engine
Grid Synchronisation	ELM / DFD / PFC Compliant
Execution Period	24 – 28 Weeks from Order Confirmation

The plant is engineered to be scalable, modular, and adaptable for captive industrial power supply or grid-export configurations. Medigreen Energy Pvt. Ltd fully integrated scope covering gasification, gas cleaning, compression, power generation, and control systems ensures a single-point accountability model for technology, fabrication, and commissioning.

2. ABOUT THE TECHNOLOGY

High Temperature Biomass Gasification

Medigreen Energy Pvt. Ltd Biomass-to-Power system is built upon a proprietary High Temperature Gasification process, specifically engineered for the thermochemical conversion of lignocellulosic biomass — including agricultural residues, woody biomass, and biomass briquettes — into a combustible synthesis gas (syngas). Unlike conventional combustion, the gasification process converts biomass in a controlled, sub-stoichiometric (oxygen-limited) environment at temperatures exceeding 1,100°C, yielding a clean, high-energy syngas with minimal solid residue.

The syngas generated — comprising primarily hydrogen (H₂), carbon monoxide (CO), and methane (CH₄) — is subsequently fed into the Enertek Pulse Engine, a purpose-built prime mover for syngas combustion, which drives a 5,000 kW alternator for electrical power generation. This end-to-end integrated approach eliminates dependence on fossil fuels and provides a technically superior, environmentally compliant pathway for biomass utilisation.

Syngas Applications

The syngas produced by this plant is primarily channelled to the Enertek Pulse Engine for direct power generation. The technology platform is equally adaptable for:

- Captive industrial power supply for energy-intensive manufacturing plants
- Grid-connected renewable power export under applicable regulations
- Combined Heat and Power (CHP) configurations for process industries
- Hybrid renewable energy systems integrating solar or wind with biomass baseload

3. PROCESS DESCRIPTION / WORKING PRINCIPLE

Stage 1: Biomass Feed Preparation & Storage

Biomass feedstock— delivered in the form of briquettes meeting the specified quality parameters — is received and stored in a dedicated solid-waste feed hopper with a controlled discharge mechanism. The hopper, fabricated from SS 304 with a 6 m³ storage capacity and a copper-lined PLC-controlled sliding shuttering mechanism, ensures a metered and continuous feed rate of 4,200 kg/hr to the gasification reactor. Feed consistency in moisture content and particle size is maintained to ensure stable gasifier operation.

Stage 2: High Temperature Gasification

Pre-metered biomass is introduced into the double-wall reaction chamber — an 8 m³ vessel fabricated from SS 304 with temperature monitoring at every 0.5-metre interval and a pressure transducer monitoring system. The feed material undergoes thermochemical conversion in the presence of hydroxy burners, steam, and oxygen injection within the adjoining combustion chamber, which is constructed from SS 310 with ceramic and rock wool insulation to sustain operating temperatures of up to 1,100°C. The carbonaceous biomass is converted into raw syngas comprising carbon monoxide, hydrogen, methane, and trace quantities of carbon dioxide. Five hydroxy burners, each rated at 2,500 LPH, along with six oxygen and six steam injection nozzles, maintain optimal gasification conditions.

Stage 3: Tar Removal & Primary Gas Conditioning

Raw syngas exiting the reaction chamber is directed through a dedicated Tar and Oil Cleaning System — a 1.75 m diameter by 3 m length rotating drum unit (10 RPM) fabricated in SS 304 — which physically removes condensed tars and entrained heavy hydrocarbons before the gas enters the downstream cleaning train. Residual char and inert ash are continuously discharged from the reaction chamber via an SS 304 screw-type ash removal assembly (2.0 m length, 0.25 m diameter, 25 RPM) to prevent accumulation and blockage.

Stage 4: Multi-Stage Gas Cleaning & Purification

Partially cleaned syngas is processed through a multi-stage gas cleaning train. Primary cyclone separators (1.4 m diameter, 1.2 m length — two units in series) equipped with water circulation systems remove coarse particulates and reduce gas temperature. The gas then passes through a Gas Purification System comprising four GRP-lined wet scrubber vessels (2.0 m diameter, 2.5 m length each), designed to remove residual particulates, acidic components, and trace H₂S. A downstream H₂S Dry Scrubber provides final sulphur compound removal. A Sludge Filtration Unit incorporating multi-media filters handles the scrubber effluent stream. Five heavy-duty SS 304 blowers (2,000 CFM each, 500 mm WC) maintain gas flow through the cleaning train.

Stage 5: Gas Compression & Storage

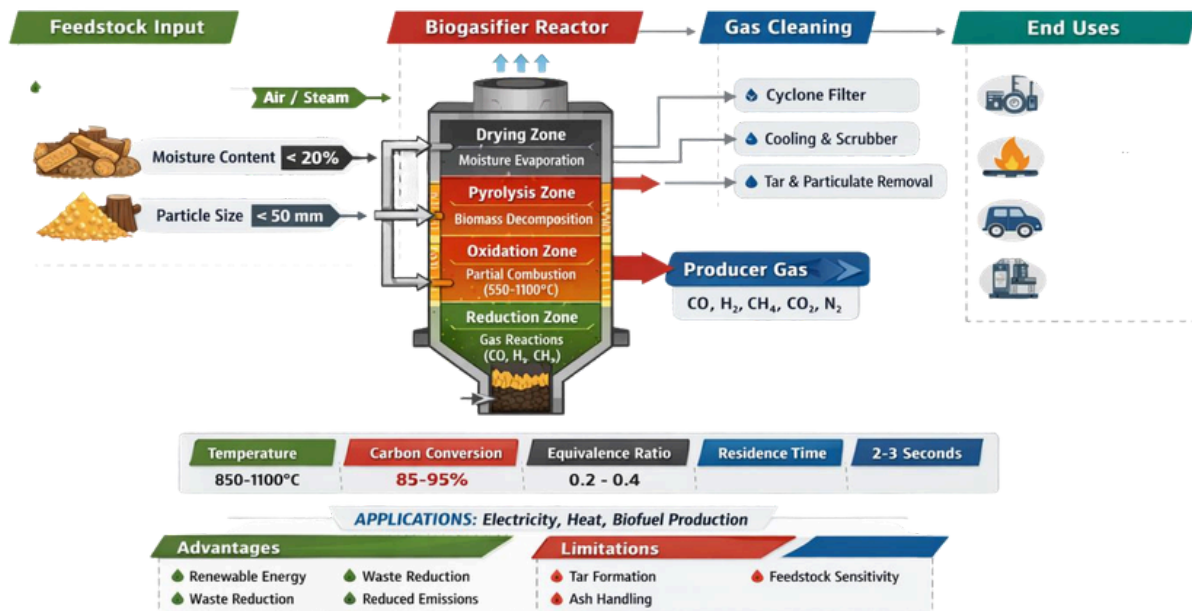
Cleaned and conditioned syngas is compressed from near-atmospheric pressure to 7–10 bar using a screw-type low-pressure compressor (inlet: 1,000 mm WC; outlet: 10 bar; capacity: 4,500 kg/hr). The compressor is equipped with inter-cooling and requires 415V, 3-phase electrical supply. Compressed syngas is buffered in mild steel storage cylinders (1 m diameter, 2 m length, rated to 10 bar) prior to delivery to the power generation module, ensuring supply continuity during minor process fluctuations.

Stage 6: Power Generation via Enertek Pulse Engine

Compressed syngas at 7 bar is delivered to the Enertek Pulse Engine — a purpose-built prime mover with a 240-litre combustor volume — which operates across a speed range of 2,500 to 3,500 RPM with a 6:1 expansion ratio. The engine, coupled to the alternator via a 1:5 gear ratio, drives a 5,000 kW / 5,500 kVA alternator generating 415V, 50 Hz, 3-phase electrical power at 1,500 RPM. Air-to-fuel ratio is maintained by Enertek's proprietary flow control system.

4. PROCESS FLOW DIAGRAM

[Process Flow Diagram — to be inserted as per Vaigunth Enertek standard PFD]



5. PLANT CONFIGURATION & MAJOR EQUIPMENT

5.1 Gasification & Gas Generation Block

S. No.	Equipment	Key Specifications
1	Biomass Feed Hopper with Controlled Feeder	Capacity: 6 m ³ MOC: SS 304 Copper-lined sliding mechanism PLC-controlled Feed rate: 4,200 kg/hr
2	Double-Wall Reaction Chamber	Volume: 8 m ³ Size: 3.5 m H x 2.0 m Dia MOC: SS 304 Temp. monitoring at 0.5 m intervals Pressure transducers (0–1 bar) 3 gas collection points
3	Combustion Chamber with Burner Assembly	Size: 1.5 m H x 2.0 m Dia MOC: SS 310 Ceramic + rock wool insulation 5 x Hydroxy burners @ 2,500 LPH each 6 x O ₂ nozzles 6 x Steam nozzles Operating temp: 1,100°C PLC-based burner management
4	Tar and Oil Cleaning Unit	Size: 1.75 m Dia x 3.0 m L MOC: SS 304 Rotating drum at 10 RPM
5	Ash Removal Assembly	Size: 2.0 m L x 0.25 m Dia MOC: SS 304 Screw conveyor at 25 RPM Capacity: ~500 kg/hr

5.2 Gas Cleaning & Conditioning Block

S. No.	Equipment	Key Specifications
6	Cyclone Separators with Water Circulation	Size: 1.4 m Dia x 1.2 m L each MOC: SS 304 3 temp. monitoring points Pressurised water cooling
7	Heavy-Duty Gas Blowers	Capacity: 2,000 CFM each Static pressure: 500 mm WC MOC: SS 304 and MS
8	Gas Purification System (Wet Scrubbers)	Size: 2.0 m Dia x 2.5 m L each MOC: GRP with Aluploy filler Capacity: 4,500 kg/hr 4 temp. + 4 pressure monitoring points
9	Sludge Filtration Unit	Size: 2.0 m Dia x 2.5 m L MOC: GRP with Aluploy Multi-media filter type
10	H ₂ S Dry Scrubber	For final hydrogen sulphide removal from conditioned syngas
11	RO Water Treatment System	Capacity: 5,000 L/day For scrubber makeup water generation
12	Hydroxy Generation Unit	Capacity: 20,000 L/hr MOC: SS 316, MS, Copper, Aluploy FRP closed cabin Shell & tube water-cooled PLC-controlled
13	Oxygen Supply Unit	Technology: Absorption type Capacity: 300 kg/hr Purity: 90% Outlet pressure: 500 mm WC
14	Low-Pressure Syngas Compressor	Type: Screw compressor with inter-cooling Capacity: 4,500 kg/hr Inlet: 1,000 mm WC Outlet: 10 bar Power: 3-phase, 415 V
15	Syngas Storage Cylinders	Size: 1.0 m Dia x 2.0 m L each MOC: MS Rated pressure: 10 bar Volume: 3 m ³ each

5.3 Power Generation & Electrical Block

S. No.	Equipment	Key Specifications
16	Enertek Pulse Engine	Rated Power: 5,000 kW Max: 5,200 kW Min: 4,000 kW Combustor volume: 240 L Speed: 2,500–3,500 RPM Syngas consumption @ rated: 5,000 kg/hr Air consumption @ rated: 10,000 kg/hr Gas inlet pressure: 7 bar Air inlet pressure: 7 bar Gear ratio: 1:5 Lube oil interval: 2,000 hrs Overall dimensions: 5.0 m x 2.2 m x 2.0 m
17	Alternator	Rating: 5,000 kW / 5,500 kVA Voltage: 415 V Frequency: 50 Hz Speed: 1,500 RPM Phases: 3-Phase, 4-Wire Power Factor: 0.8 lag Ambient: 40°C Insulation: Class H Temperature Rise: Class H
18	Grid Synchronisation Panel	ELM / DFD / PFC compliant grid sync interface
19	PLC & SCADA Control System	Stoichiometric gas ratio control Gas analyser unit Gate valve automation Flow, temp. & pressure transmitters with data logger Gasifier reactor control SCADA visualisation with operator workstation

6. TECHNICAL SPECIFICATIONS

6.1 Plant Capacity & Performance

Biomass Feed Rate	100 TPD (4,200 kg/hr)
Plant Operating Regime	24 Hours/Day, Continuous
Rated Power Output	5,000 kW (5 MW)
Maximum Power Output	5,200 kW
Minimum Stable Output	4,000 kW
Syngas Calorific Value	9,000 kJ/kg
Syngas Consumption at Rated Load	5,000 kg/hr
Plant Availability (Design)	>90% (Subject to feedstock consistency)

6.2 Biomass Feedstock Specifications

Acceptable Feedstock	Biomass Briquettes (Agricultural / Woody Residue Origin)
Organic Content	75 – 80% (by weight)
Moisture Content	≤ 10%
Briquette Bulk Density	350 kg/m ³
Gross Calorific Value	15,000 kJ/kg (approx. 3,580 kcal/kg)
Feed Rate (Continuous)	4,200 kg/hr
Feed System	PLC-controlled hopper with sliding shuttering mechanism

6.3 Gasification System Technical Data

Gasifier Type	High Temperature Dual-Chamber Gasifier (Reaction + Combustion)
Reaction Chamber Volume	8 m ³ (3.5 m H x 2.0 m Dia)
Combustion Chamber Volume	~4.7 m ³ (1.5 m H x 2.0 m Dia)
Operating Temperature (Combustion Zone)	1,100°C
Operating Pressure	Near Atmospheric to Slightly Positive
Reaction Chamber MOC	SS 304
Combustion Chamber MOC	SS 310 with Ceramic + Rock Wool Insulation
Hydroxy Burners	5 Nos. @ 2,500 LPH each
Oxygen Injection Nozzles	6 Nos.
Steam Injection Nozzles	6 Nos.
Temperature Monitoring (Reaction Chamber)	At every 0.5 m interval
Ash Discharge Capacity	~500 kg/hr (automatic screw conveyor)

Tar Removal	Dedicated rotating drum unit (10 RPM)
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6.4 Power Generation System Technical Data

Prime Mover	Enertek Pulse Engine — Syngas Dedicated
Rated Power	5,000 kW
Maximum Rating	5,200 kW
Minimum Rating	4,000 kW
Expansion Ratio	6:1
Engine Speed Range	2,500 – 3,500 RPM
Shaft Rotation	Counter-clockwise
Combustor Volume	240 Litres
Gas Inlet Pressure	7 Bar
Air Inlet Pressure	7 Bar
Air/Fuel Ratio Control	Proprietary Enertek Flow Control System
Gear Ratio (Engine to Alternator)	1:5
Lube Oil Change Interval	2,000 Hours
Engine Dimensions (L x W x H)	5.0 m x 2.2 m x 2.0 m
Alternator Rating	5,000 kW / 5,500 kVA
Alternator Voltage	415 V, 3-Phase, 4-Wire, 50 Hz
Alternator Speed	1,500 RPM
Power Factor	0.8 lag
Insulation Class	Class H (both winding and temperature rise)
Ambient Temperature Design	40°C
Grid Synchronisation Standard	ELM / DFD / PFC Compliant

7. UTILITY REQUIREMENTS

The following utilities are to be arranged by the client at the plant battery limits prior to commissioning of the 100 TPD Biomass Gasification to 5 MW Power Plant. Detailed utility consumption data will be provided during the Basic Engineering phase.

Utility	Requirement
Electrical Power Supply (Startup / Auxiliary)	415V, 3-Phase, 50 Hz Estimated auxiliary load: 300–400 kW (connected)
Water Supply (Process)	~15,000 Litres/Day
RO-Treated Water	~5,000 Litres/Day (provided by plant's internal RO system)
Compressed Air	6–8 bar ~80 Nm ³ /hr
Plant Area (Civil)	Minimum 2,500 Sq. Metres (combined covered + open)
Foundation & Civil Works	As per Medigreen Energy Pvt. Ltd foundation design and GA drawings
Biomass Feedstock Logistics	Continuous tipper / conveyor arrangement for 4,200 kg/hr feed supply
Grid Interconnection (HT)	As per local DISCOM / utility requirements
DG Set / Power Backup	Recommended minimum 200 kVA standby DG set
Communication Infrastructure	Ethernet / Fibre connectivity for SCADA remote access
Fire Protection System	As per local statutory requirements and NFPA / TAC standards

8. COMMERCIAL TERMS & CONDITIONS

Pricing Summary

S. No.	Description	Qty	Unit Price (INR Crores)	Total Cost (INR Crores)
1	Enertek High Temperature Gasification Unit — 100 TPD Biomass	1 Set	100.00	100.00
2	Enertek HyOrc Generator — 5 MW Power Generation Module	1 Set	45.00	45.00
3	Installation & Commissioning	1 Lot	2.50	2.50
TOTAL (Ex-Works, Excl. GST)				INR147.50 Crores

Note: The above prices are on an ex-works basis at Medigreen Energy Pvt. Ltd manufacturing facility in Kanyakumari, Tamil Nadu. Freight, packing, insurance, taxes, and duties are payable additionally at actuals.

Terms & Conditions

Description	Details
Payment Terms	50% Advance along with PO 50% Against readiness of unit before dispatch
Packing & Forwarding Charges	Extra at actuals
GST	Extra as applicable
Road Permit Form	To be provided by the client (if applicable in the client's state) along with the Purchase Order
Engineer's Travel & Stay	To & fro travel charges, boarding & lodging, and local conveyance for the engineer borne by the client
Delivery	Within 4 months
Validity of the Offer	30 days from the date of offer, subject to statutory variations
Freight	All freight and related charges shall be to the buyer's account
Taxes, Duties and New Taxes	GST, SGST or other taxes/levies (present/future) imposed by government to buyer's account. Invoices show applicable charges.
Client/End User's Scope	Electrical installation, civil works, unloading/lifting/shifting, structural frame and shed, installation/testing/commissioning, piping/insulation, transportation, water/electrical for commissioning, safety controls, automatic control
Warranty Period	12 months from installation or 15 months from dispatch (whichever earlier). Covers defective material/design/workmanship only. Excludes damage due to misuse/incorrect application. All claims via manufacturer. Excludes motors, switch gears, glass. No coverage for wear and tear. Void if unauthorized repair/alteration or plant not made available for repair.

<i>Description</i>	<i>Details</i>
<i>Delivery Period</i>	18-24 weeks from release of purchase order and advance payment
<i>Detailed Engineering</i>	Shop floor drawings and engineering completed within 7-10 days from PO or advance, whichever is later
<i>AMC Terms</i>	AMC (Annual Maintenance Contract) is 12% of total quotation value with 10% yearly escalation plus taxes
<i>Order Cancellation</i>	Cancelling order/part order incurs up to 50% charge on cancelled portion plus actual expenses (piping, erection, transport, site visits, taxes)
<i>Payment Mode</i>	All payments through wire transfer only

9. LIST OF EXCLUSIONS

S. No.	Exclusion Item
1	Biomass feedstock procurement, briquetting, storage, and logistics to plant hopper
2	All civil construction works — plant building, equipment foundations, roads, drainage, boundary wall, and compound fencing
3	HT/LT electrical infrastructure — grid interconnection cabling, HT metering, transformer, and DISCOM liaisoning
4	Grid connectivity approval, power purchase agreement (PPA), and renewable energy certificates
5	Site fire hydrant system, fire extinguishers, and fire detection & alarm system
6	Utility supply to battery limit — grid power for auxiliaries, water supply, compressed air header
7	Standby DG set and associated changeover panel
8	Freight, insurance, and transportation from ex-works to project site
9	GST, customs duties, port charges, and all applicable taxes and levies
10	Statutory clearances — environmental impact assessment (EIA), consent to establish (CTE), consent to operate (CTO), factory licence, and all regulatory approvals
11	Site labour, scaffolding, cranes, and erection equipment for installation activities
12	Control room building, air conditioning, and IT infrastructure for SCADA workstation
13	Any third-party inspection or certification fees beyond Vaigunth Green Infra Enertech Private Limited's standard factory testing
14	Performance guarantee bond, bank guarantee charges, or insurance premium costs
15	Operations & maintenance (O&M) contracts post-commissioning unless separately agreed

10. CONCLUSION

The 5 MW Biomass Gasification Power Plant proposed by Medigreen Energy Pvt. Ltd represents a technically mature, commercially viable, and environmentally responsible solution for decentralised renewable power generation from agricultural and industrial biomass residues.

By leveraging the company's proprietary High Temperature Gasification technology and the purpose-built Enertek Pulse Engine, this project delivers a highly integrated and automated power generation facility capable of converting 100 TPD of biomass briquettes into 5 MW of continuous, grid-ready electrical power.

Medigreen Energy Pvt. Ltd brings to this project a combination of proprietary technology, in-house fabrication capability, and demonstrated engineering expertise in high-temperature gasification systems. The company is committed to delivering a performance-guaranteed, client-ready plant within the agreed timelines, with full engineering documentation, commissioning support, and post-installation technical assistance.

We look forward to the opportunity to discuss this proposal further and to provide any additional technical or commercial clarifications required. Medigreen Energy Pvt. Ltd team remains available for a detailed technical presentation, site visit discussions, or a factory tour of our manufacturing facility at Kanyakumari.