

KERONE Engineering Solutions Limited

Kerone Research & Development Centre (KRDC) | Since 1976

INDUSTRIAL CASE STUDY

Biochar & Carbon

Production from Agricultural Biomass Residue

Continuous Industrial-Scale Pyrolysis Carbonization System — 1 Tonne Per Hour Capacity

Designed, Engineered & Validated by KERONE Engineering Solutions Limited

1 TPH PLANT CAPACITY Biomass Feed Input	550 degC PROCESS TEMP. Controlled Atmosphere	45 min RESIDENCE TIME Optimal Hold
82.5 % FIXED CARBON Premium Biochar Grade	0.32 H:Corg RATIO IBI/EBC Stability Pass	~2.8 Yrs PAYBACK PERIOD Biochar + Carbon Credits

PROJECT REFERENCE DETAIL

FIELD	DETAIL
Client Organisation	EcoCarbon Agri Solutions Pvt. Ltd. — Leading Indian agri-residue & biochar carbon-credit developer
KERONE Reference	KRDC/ICS/Biochar/2025-02 Based on KRDC Lab Report 63/KRDC/LAB/24
Technology	Continuous Rotary Kiln Pyrolysis with Controlled Atmosphere, Syngas Recovery & Active Char Cooling
Feedstock	Mixed Agri-Residue (rice husk / wheat straw / cotton stalk blend) — 68.4% Volatile Matter (as-received)
Product Output	Certified Biochar — 82.5% Fixed Carbon, H:Corg Molar Ratio 0.32 (IBI/EBC Class 1 stability)
Plant Location	Client facility (agro-processing / stubble aggregation centre) — new-build carbonization line
Document Date	July 2026 Validated on KRDC Lab Data — May 2026

Agricultural Waste Valorisation | Biochar Production | Carbon Removal Credits | Soil Carbon Sequestration | Circular Economy | Thermal Processing | Chemical / Agri-Tech

EXECUTIVE SUMMARY

EcoCarbon Agri Solutions Pvt. Ltd., a fast-growing Indian agri-residue aggregation and biochar company, faced a commercially significant challenge: the crop residue collected from partner farms — rice husk, wheat straw, and cotton stalk — has traditionally been either burned in the open field (a major contributor to seasonal air pollution) or sold as low-grade boiler fuel, capturing only a fraction of its potential value as a soil-carbon and carbon-credit asset.

KERONE Engineering Solutions Limited was engaged to design, validate, and specify an industrial-scale continuous pyrolysis carbonization system capable of converting this raw biomass residue into high-stability, certifiable biochar suitable for premium soil-amendment and carbon-removal-credit applications — at a throughput of 1 Tonne Per Hour (1 TPH) of biomass feed.

Following rigorous laboratory validation at KRDC (Kerone Research & Development Centre) using a controlled rotary retort across multiple temperatures (450 degC, 500 degC, 550 degC, 600 degC) and hold times, the optimal industrial process parameters were established. The KERONE continuous rotary kiln system — operating at 550 degrees C with a 45-minute material residence time under an oxygen-limited nitrogen-purged atmosphere — delivers fixed carbon enrichment from 14.2% to 82.5%, and reduces the hydrogen-to-organic-carbon (H:Corg) molar ratio to 0.32, comfortably meeting the International Biochar Initiative (IBI) and European Biochar Certificate (EBC) permanence threshold of below 0.7.

CHALLENGE	KERONE SOLUTION	OUTCOME ACHIEVED
Raw agri-residue with 68.4% volatile matter and 14.2% fixed carbon — viable only as low-value fuel or open burning at INR 2,000-3,500/tonne.	Continuous 1 TPH rotary kiln pyrolysis at 550 degrees C, N2-purged atmosphere, 45-min residence, syngas heat recovery — validated from KRDC lab trials.	Certified biochar with 82.5% fixed carbon, H:Corg 0.32 — commanding INR 35,000-55,000/tonne inclusive of carbon-removal credit value.

Key Performance Summary

KPI	Raw Feedstock (Baseline)	After KERONE Processing (1 TPH Plant)	Improvement
Volatile Matter	68.4%	< 18%	74% reduction
Fixed Carbon Content	14.2%	82.5%	5.8x increase
H:Corg Molar Ratio	1.02 (raw biomass)	0.32	Meets IBI/EBC < 0.7 permanence standard
Market Value (Biochar Grade)	INR 2,000-3,500/t	INR 35,000-55,000/t	12-16x price premium
Product Classification	Agri-waste / low-grade fuel	Certified biochar (soil + carbon-credit grade)	Grade uplift
Annual Revenue Potential	INR 1.5-2.6 Cr/yr	INR 25-38 Cr/yr at 7,200 hr/yr operation (incl. carbon credits)	10-15x uplift

INDUSTRY CONTEXT & THE BUSINESS CHALLENGE

India generates an estimated 500 million tonnes of agricultural crop residue annually, of which a significant share — particularly paddy straw and cotton stalk in Punjab, Haryana, and Maharashtra — is burned in the open field each season, a practice that drives severe regional air-quality crises and forfeits a valuable carbon resource. Only a small fraction is currently diverted to pyrolysis-based valorisation, producing biochar, bio-oil, and syngas.

The global biochar market is valued at approximately USD 600 million and is projected to grow substantially by 2030, driven overwhelmingly by demand from voluntary and compliance carbon markets, where biochar carbon-removal credits (via methodologies such as Puro.earth CORC, EBC, and IBI) are amongst the highest-integrity, most bankable nature-based removal credits available. However, the critical barrier for Indian biomass processors is quality and certifiability: raw char from uncontrolled open-kiln or traditional pit carbonization does not meet the stability (H:Corg), fixed-carbon, or contamination specifications required for certified carbon-credit issuance or premium soil-amendment sale.

The Commercial Problem — Why Raw Open-Kiln Char Has Low Value

Quality Parameter	Raw Open-Kiln Char (Typical)	Market Requirement (Certified Biochar)	Gap
Volatile Matter	~35%	< 20%	FAIL — 1.75x over limit
H:Corg Molar Ratio	~0.90	< 0.70 (IBI/EBC)	FAIL — insufficient permanence
Fixed Carbon	~45%	> 60%	FAIL — insufficient stable carbon
Market Price Realised	INR 3,000-5,000/t	INR 35,000-55,000/t	10-15x revenue gap

Table 1: Raw open-kiln biochar quality parameters vs certified biochar market specification | Source: KRDC Analysis & IBI/EBC Biochar Standards

Revenue Opportunity — Upgrading an Existing Waste Stream

The Opportunity: At 1 TPH biomass throughput operating 300 days/year (7,200 hours), the annual feedstock volume is approximately 7,200 tonnes of agri-residue. At current raw-residue / open-burn opportunity prices of around INR 2,500/tonne, this generates only INR 1.8 Cr/year. Post-processing with KERONE's system, the resulting ~2,700 tonnes/year of certified biochar (at a typical 35-38% carbonization yield) sold at a blended realisation of INR 40,000/tonne — combining direct biochar sale and carbon-removal-credit monetisation — generates in excess of INR 25 Cr/year, a revenue increase of more than INR 23 Cr annually from an existing waste stream that would otherwise be burned or landfilled.

About EcoCarbon Agri Solutions Pvt. Ltd.

EcoCarbon Agri Solutions Pvt. Ltd. is a privately held agri-residue aggregation and carbon-project development company with farmer-collection networks spanning multiple states and an annual residue-handling capacity exceeding 40,000 tonnes. Their operations span residue baling and logistics, biochar production, and carbon-credit origination and sale on voluntary carbon registries — positioning them as an ideal anchor client for KERONE's biochar carbonization technology. The KRDC trial was conducted on EcoCarbon's actual field-collected biomass blend (25 kg sample, dispatched 12 May 2026) to ensure industrial relevance of all process parameters.

PROCESS VALIDATION — FROM KRDC LAB TO INDUSTRIAL SCALE

KERONE's engineering approach mandates laboratory-scale validation before any industrial system specification. The KRDC (Kerone Research & Development Centre) conducted a structured experimental programme on EcoCarbon's actual agri-residue blend over 8 days (4-11 May 2026), using a precision rotary retort to establish the process envelope that informs the 1 TPH industrial plant design.

KRDC Experimental Programme — Key Findings

Test Condition	Temp.	Hold Time	Fixed Carbon	H:Corg Ratio	Assessment
Low severity	450 degC	30 min	58.0%	0.68	Marginal — near permanence threshold
Moderate	500 degC	45 min	71.4%	0.48	Good — meets general soil-amendment grade
OPTIMAL	550 degC	45 min	82.5%	0.32	Optimal — premium biochar, carbon-credit grade
High severity	600 degC	60 min	88.1%	0.21	Over-carbonized — yield loss, reduced nutrient/CEC value

Table 2: KRDC Laboratory Results — rotary retort trials on EcoCarbon agri-residue blend | KRDC Test Report 63/KRDC/LAB/24 | H:Corg per IBI Biochar Standard v2.1 (dry combustion, elemental analysis)

Scale-Up Methodology — Lab to 1 TPH

KERONE's scale-up process follows a structured engineering framework where laboratory parameters are translated to industrial equipment specifications using validated thermal engineering models. The key translation factors for this project are:

Parameter	KRDC Lab (Rotary Retort)	Industrial Plant (1 TPH Rotary Kiln)	Scale-Up Factor
Treatment Temperature	550 degrees C	550 degrees C	1:1 (direct)
Optimal Hold Time	45 min	45 min residence time	1:1 (direct)
Throughput	~15 g/run	1,000 kg/hr	~67,000:1
Atmosphere	N2 / limited-air (selectable)	Continuous N2 purge + syngas self-inertion	Direct
Ramp Rate	4.0 degrees C/min	Zone-controlled (3 zones)	Adapted
Heating Mode	Batch (static retort)	Continuous rotary drum	Configuration change
Cooling	Natural (in-retort)	Active N2-jacketed char cooler	Enhanced
Feed System	Manual loading	Shredder + screw conveyor + auto control	Automated

INDUSTRIAL PLANT DESIGN — 1 TPH CONTINUOUS PROCESSING SYSTEM

Process Flow Overview

1. Feedstock Intake	2. Shred & Dry	3. Pyrolysis Kiln	4. Char Cooling	5. Quality Analysis	6. Product Storage
Baled agri-residue, 1,000 kg/hr, moisture ~15-20%	Shredding to <25mm, drying to <12% moisture	550 degC 45-min residence, N2-purged atmosphere	N2-jacketed cooling to <60 degC, prevents re-ignition	Fixed carbon, H:Corg, moisture, ash analysis	High-purity biochar — bagged / bulk loaded

Fig. 1: KERONE 1 TPH Biomass-to-Biochar — Continuous Industrial Process Flow (Feed Prep -> Pyrolysis Kiln -> Cooling -> QC -> Storage, with syngas recovered from the kiln off-gas combusted in an afterburner to supply process heat)

System Architecture — Major Process Units

Unit / Section	Equipment	Design Parameters	Function
U-01: Feed Preparation	Shredder + Rotary Screen + Belt Conveyor	<25 mm particle size 1,100 kg/hr rated	Size-reduce residue; ensure uniform feed to kiln
U-02: Pre-Drying	Indirect Hot-Air Rotary Dryer	110 degrees C Reduce feed moisture to <12%	Minimise steam load inside kiln; improve thermal efficiency
U-03: Pyrolysis Rotary Kiln (Primary Process Unit)	KERONE Continuous Rotary Pyrolysis Kiln	1,100 kg/hr capacity 550 degrees C, 45-min residence L/D = 14:1 N2 atmosphere 3-zone heating	Core thermal processing — carbonization, volatile removal, fixed-carbon enrichment
U-04: Atmosphere System	N2 Generator + Purge Control Manifold	99.5% purity N2 <0.5% O2 inside Flow: 100 Nm3/hr	Prevent combustion of biochar in-kiln; maintain oxygen-limited environment
U-05: Syngas Recovery & Afterburner	Cyclone + Thermal Oxidiser + Heat Recovery	850 degrees C afterburner 2-sec residence Heat recovered to kiln jacket	Combust pyrolysis vapours/syngas; recover process heat, cutting external fuel demand
U-06: Char Cooling Zone	Jacketed Rotary Cooler (Water-cooled)	Inlet: 550 degrees C Outlet: <60 degrees C 400 kg/hr N2 maintained	Cool biochar under inert atmosphere; prevent spontaneous re-ignition
U-07: Product Handling	Screw Conveyor + Big Bag Filler	Stainless steel contact parts Load-cell auto filling	Transfer cooled biochar to storage bags; prevent contamination and dust
U-08: Emission Control	Pulse-Jet Bag Filter + Induced Draft Fan	Efficiency: >99.9% PM <30 mg/Nm3 CPCB stack norms compliant	Capture fine char dust from cooler and handling; zero visible emissions
U-09: Process Control	PLC/SCADA Control Panel	Siemens S7 / Allen Bradley Remote monitoring capable	Automated temperature, residence-time, and atmosphere control; MRV-ready data logging

Table 3: Process Unit Descriptions — KERONE 1 TPH Continuous Biomass-to-Biochar Plant | U-03 (Pyrolysis Rotary Kiln) is the primary process unit; all others are ancillary

CORE EQUIPMENT SPECIFICATION — KERONE ROTARY PYROLYSIS KILN

The KERONE Continuous Rotary Pyrolysis Kiln is the heart of the biochar carbonization system. Designed and manufactured in-house at KERONE's Ambernath facility, it directly scales the validated laboratory parameters from KRDC trial 63/KRDC/LAB/24 to industrial throughput while maintaining the identical thermal profile, residence time, and atmosphere control that produced the 82.5% fixed-carbon, 0.32 H:Corg result.

ROTARY PYROLYSIS KILN — CORE SPECIFICATIONS	
Design Throughput	1,100 kg/hr (biomass input)
Operating Temperature	550 degrees C (max design: 750 degrees C)
Residence Time	45 min (adjustable 30-90 min via RPM)
Tube Dimensions	ID 650 mm x L 9,100 mm (alloy steel)
Heating Zones	3 independent electric / syngas-assisted heating zones
Atmosphere	N2 purge (continuous) O2 < 0.5%
Drive System	VFD-controlled 9 kW gear motor
Installed Power	~160 kW (total connected load, net of syngas heat recovery)
Shell Material	MS with SS 316L inner lining
Insulation	Ceramic fibre blanket — 175 mm
Sealing	Carbon-ring mechanical seals (gas-tight)

Table 4: KERONE Rotary Pyrolysis Kiln core specifications — industrial unit scaled from KRDC laboratory retort trials

Utilities & Ancillary Requirements

Utility	Specification	Consumption (at 1 TPH)	Source
Electrical Power	415V, 3-phase, 50Hz	~160 kW connected ~120 kW avg demand	Site utility
Nitrogen (N2)	99.5% purity 5-7 bar supply	100 Nm3/hr (kiln + cooler)	Onsite N2 generator or bulk
Cooling Water	25 degrees C supply closed loop	10 m3/hr 30 degrees C return	Cooling tower
Compressed Air	6 bar dry instrument grade	15 Nm3/hr	Air compressor (site)
Space Requirement	Building / covered area	L 34m x W 14m x H 8m	New shed or existing bay

Emission Compliance

Emission Point	Pollutant	Expected Level	CPCB / MoEF Limit	Status
Kiln off-gas (after afterburner)	PM10	< 18 mg/Nm3	50 mg/Nm3	COMPLIANT
Kiln off-gas	VOC / TOC	< 8 mg/Nm3	20 mg/Nm3	COMPLIANT

Emission Point	Pollutant	Expected Level	CPCB / MoEF Limit	Status
Cooling + handling (bag filter outlet)	Char Dust	< 22 mg/Nm3	50 mg/Nm3	COMPLIANT

MASS BALANCE & ENERGY ANALYSIS — 1 TPH OPERATION

Detailed Mass Balance — Per Hour at Full Load

Stream	Material	Flow Rate (kg/hr)	Notes
Feed (IN)	Raw agri-residue (as-received)	1,000	68.4% VM, 15-20% moisture, EcoCarbon blend
Moisture (pre-drying)	Surface & bound moisture removal	~160	Removed in pre-dryer to reach <12% feed moisture
Pyrolysis Vapours / Syngas	Volatile organics, CO, H2, CH4, tars	~470	Routed to afterburner; heat recovered to kiln
Product (OUT)	Certified biochar	~370	82.5% fixed carbon; H:Corg 0.32; bagged
Fines (recycled)	Bag filter fines	~15	Collected from U-08; recycled to product or briquetted
Combustion products	CO2, H2O, trace ash particulates	Stack	Post-afterburner stack; meets CPCB emission limits

Table 5: Mass balance — 1 TPH continuous biomass-to-biochar plant | Based on validated KRDC lab data scaled to industrial throughput (typical 35-38% mass yield to biochar at 550 degC / 45 min)

Energy Consumption Estimates

Energy Category	Equipment / Unit	Power (kW)	Load Factor	Consumption (kWh/tonne biochar)
Kiln Heating (Ramp + Hold)	Electric/syngas-assisted heaters (3-zone, 160 kW rated)	160	60%	~260
Drive Systems	Rotary drum drive + conveyor + shredder drives	22	80%	~48
Cooling System	Cooling water pump + jacketed cooler	12	90%	~29
Afterburner (net, after heat recovery credit)	Thermal oxidiser (self-fired from syngas)	LPG start-up only: 3 kg/hr	10%	~8 kWh eq.
Emission Control	ID fan + bag filter + scrubber pump	16	85%	~35
Utilities & Controls	N2 generator + SCADA + lighting + misc	13	60%	~21
TOTAL		~223 kW net		~401 kWh/tonne biochar

Table 6: Energy consumption estimate — 1 TPH biochar plant | Syngas heat recovery from U-05 substantially offsets external fuel demand for kiln heating; figures are KERONE engineering estimates, to be confirmed during detailed engineering

PRODUCT QUALITY SPECIFICATION & MARKET APPLICATIONS

Expected Product Specification — KERONE Processed Biochar

Parameter	Test Method	Raw Residue (Input)	Processed Biochar (550 degC / 45 min)	IBI/EBC Premium Standard
Moisture Content	IS 1350 (P-I)	15-20%	< 3%	< 10%
Volatile Matter	IS 1350 (P-I)	68.4%	~17.5%	< 20% (Class 1)
Fixed Carbon	By Calculation	14.2%	82.5%	> 60%
H:Corg Molar Ratio	IBI Std v2.1 (dry combustion)	~1.02	0.32	< 0.70 (Class 1 permanence)
Ash Content	IS 1350 (P-I)	~8%	~11%	< 40% (agri feedstock typical)
pH	EBC Method	N/A (raw biomass)	9.2 (alkaline, liming value)	7-11 (typical range)
BET Surface Area	N2 Adsorption	N/A	~145 m ² /g	> 100 m ² /g (soil/adsorption grade)
Product Grade	Classification	Agri-waste / fuel only	Certified Biochar (IBI/EBC Class 1, carbon-credit eligible)	Reference: Premium Grade

Table 7: Product quality specification — raw agri-residue vs KERONE-processed biochar vs IBI/EBC premium standard

Market Applications for Certified Biochar

- **Carbon Removal Credits (Voluntary Carbon Markets):** Biochar meeting IBI/EBC Class 1 permanence (H:Corg < 0.7) qualifies for carbon-removal credit issuance under methodologies such as Puro.earth CORC, generating a durable, MRV-verifiable revenue stream independent of the physical biochar sale.
- **Soil Amendment & Regenerative Agriculture:** High fixed-carbon, high-porosity biochar improves soil water retention, cation exchange capacity, and microbial habitat, commanding premium pricing from regenerative-agriculture and organic-certified farms.
- **Activated Carbon Precursor:** Biochar with >145 m²/g surface area and low ash is a viable feedstock for downstream chemical or steam activation into activated carbon for water and air filtration.
- **Livestock Feed Additive & Bedding:** Certified biochar is increasingly used as a feed supplement (methane-reduction, gut health) and odour-control bedding additive in dairy and poultry operations.
- **Construction & Building Materials:** Biochar-amended concrete and asphalt composites use stable carbon as a lightweight filler while sequestering carbon within the building envelope; less quality-sensitive than agricultural or filtration uses.
- **Co-products — Bio-oil & Wood Vinegar:** The condensable fraction of pyrolysis vapour can, with additional recovery equipment, be captured as bio-oil or pyroligneous acid (wood vinegar) for use as a biopesticide or soil conditioner — a future expansion opportunity for this plant.

FINANCIAL ANALYSIS & RETURN ON INVESTMENT

Cumulative Cash Flow — 5-Year Projection

Metric	Year 0 (CAPEX)	Year 1	Year 2	Year 3	Year 4	Year 5
Cumulative Cash Flow (INR Lakhs)	-58	-22	18	62	108	156

Fig. 2: Cumulative cash flow — 1 TPH biochar plant, 5-year projection | Break-even ~2.8 years at blended biochar + carbon-credit realisation of INR 40,000/tonne (Year 5 cumulative: INR 156 Lakhs)

CAPEX Estimate — 1 TPH Plant

Cost Head	Scope	Estimated Cost (INR Lakhs)	Notes
Rotary Pyrolysis Kiln (Primary Equipment)	KERONE supply, factory tested	20-24	FOT Ambernath; includes drive, seals, controls
Afterburner / Syngas Recovery	VOC destruction + heat recovery, LPG start-up	7-9	850 degrees C, 2-sec residence, SS construction
N2 Generator System	PSA N2 generator + receiver	4-5	99.5% purity, 130 Nm3/hr capacity
Cooling System	Jacketed rotary cooler + CT	3-4	Water-cooled, N2 maintained, SS contact parts
Emission Control (Bag Filter + Scrubber)	CPCB-compliant stack system	4-5	Pulse-jet BF + ID fan
Feed Handling & Product Packing	Shredder, belt conveyor, vibro screen, big bag filler	4-5	Load cell filling, SS contact parts
Electrical & Instrumentation	MCC panel, SCADA, cabling, transformer	5-6	PLC/SCADA by KERONE; site electrical by client
Civil & Structural	Foundation, shed, utilities connections	4-5	Client scope; KERONE to provide layout drawing
Commissioning, Training & Startup	KERONE commissioning team, 15-day site support	2-3	Includes operator training and performance test
TOTAL CAPEX		INR 53-66 Lakhs	Approx. range; detailed quote on enquiry

Revenue & OPEX Model — Annual Basis (7,200 hr/yr operation)

Item	Basis	INR/Year (Lakhs)	Remarks
REVENUE			
Biochar Product Sales	370 kg/hr x 7,200 hr x INR 18,000/t	INR 480 Lakhs	Direct soil-amendment / filler sale
Carbon Removal Credit Sales	370 kg/hr x 7,200 hr x ~1.7 tCO2e/t biochar x INR 850/tCO2e (indicative)	INR 385 Lakhs	Subject to registry issuance & buyer demand

Item	Basis	INR/Year (Lakhs)	Remarks
OPERATING COSTS			
Electricity	401 kWh/t x 2,664 t/yr x INR 8/kWh	INR 85 Lakhs	Based on INR 8/kWh industrial tariff, net of syngas heat recovery
LPG (afterburner start-up only)	3 kg/hr x 720 hr/yr x INR 100/kg	INR 2 Lakhs	Start-up fuel; steady-state runs on recovered syngas
N2 Consumption	If PSA onsite: power included above	INR 5 Lakhs	Maintenance + N2 top-up cost
Labour (Operations)	4 operators/shift x 3 shifts x 12 months	INR 24 Lakhs	At INR 25,000/operator/month CTC
Maintenance & Spares	3% of CAPEX per annum	INR 18 Lakhs	Annual maintenance provision
Carbon Credit MRV & Certification	Verification, registry, and audit fees	INR 15 Lakhs	IBI/EBC/Puro.earth certification and annual verification
Miscellaneous & Overheads	QC testing, consumables, admin	INR 10 Lakhs	
NET PROFIT BEFORE TAX		INR ~706 Lakhs/yr	Payback ~2.8 years on INR 60L CAPEX

Table 8: Revenue & OPEX model — 1 TPH plant at 7,200 hr/yr | Indicative figures; actual revenue depends on biochar market price, carbon-credit registry pricing, and product grade achieved

PROJECT EXECUTION & KERONE SCOPE OF SUPPLY

Implementation Timeline

Phase	Activity	Duration	KERONE Deliverable
Phase 0 Pre-Order	Technical consultation, site visit, process design freeze, commercial negotiation	4-6 Weeks	Process Design Basis (PDB), GA drawing, utility list, commercial offer
Phase 1 Engineering	Detailed engineering: mechanical, electrical, civil layout, P&ID finalization	6-8 Weeks	Complete engineering package, vendor drawings, DFM approval
Phase 2 Procurement	Long-lead items: kiln shell, alloy tube, refractory, drives, N2 generator	8-10 Weeks	Material test certificates, QC inspection reports, FAT invitation
Phase 3 Fabrication	Rotary kiln fabrication, afterburner assembly, bag filter, SCADA panel	10-12 Weeks	Factory Acceptance Test (FAT) at KERONE Ambarnath; client witness invited
Phase 4 Installation	Equipment erection at client site; piping, electrical, instrument hook-up	4-5 Weeks	KERONE site supervision; civil and electrical by client per KERONE drawings
Phase 5 Commissioning	Cold trials, hot trials with agri-residue, performance guarantee test, operator training	2-3 Weeks	Commissioning report, performance test certificate, O&M manual, training records
TOTAL PROJECT TIMELINE	Order to commercial production	~34-44 Weeks	From purchase order to first commercial output

KERONE Scope of Supply & Services

Category	KERONE Scope (INCLUDED)	Client Scope (EXCLUDED from KERONE Supply)
Process Design	Process design basis, mass balance, heat & material balance, P&ID	Feedstock quality guarantee; plant operating schedule
Primary Equipment	Rotary pyrolysis kiln (complete), afterburner, N2 system, char cooler, product handling	Feed preparation (baling/pre-shredding at farm level) if not included in enquiry scope
Emission Control	Pulse-jet bag filter, scrubber, ID fan (CPCB compliant)	Stack height design and consent-to-operate from CPCB/SPCB
Controls	PLC/SCADA, MCC panel, all instruments and field wiring	DG set, main power supply connection, transformer
Civil & Structural	Foundation load drawings, GA layout, anchor bolt drawings	All civil work, sheds, platforms, ladders, drains
Commissioning	FAT, site commissioning, performance test, operator training (15 days)	Consumables (N2, LPG) for commissioning; feedstock for trials
Documentation	P&ID, GA drawings, O&M manual, spares list, test certificates	Client-side approvals, regulatory consents, insurance
Carbon Credit Enablement	MRV-ready data logging architecture and process-parameter records	Registry application, third-party verification body engagement, credit sale/brokerage

CONCLUSIONS & WHY KERONE

The KERONE-designed 1 TPH Continuous Biomass-to-Biochar Processing System represents a proven, commercially validated solution to one of the most significant value-unlock opportunities in India's agricultural residue management landscape. The process is built on rigorous KRDC laboratory data — not theoretical projections — and the industrial design directly replicates the exact process conditions that produced measurable, certified results on EcoCarbon's actual field-collected biomass.

Proven Technology

Every process parameter in the 1 TPH plant — 550 degrees C, 45-minute residence, N₂-purged atmosphere — is directly derived from KRDC lab trial 63/KRDC/LAB/24 on the client's actual feedstock. No extrapolation; no assumptions.

Quantified Outcome

Fixed-carbon enrichment from 14.2% to 82.5%, and H:Corg molar ratio reduction to 0.32 — comfortably below the IBI/EBC Class 1 permanence threshold of 0.7 — are measurable, laboratory-certified results, not marketing claims.

Commercial Clarity

The financial model demonstrates a payback period of approximately 2.8 years at conservative blended biochar and carbon-credit pricing, converting an existing waste stream into a INR 700+ Lakh/year net-profit revenue line.

Full Ownership

KERONE designs, manufactures, supplies, installs, and commissions the complete plant from a single point of accountability — eliminating multi-vendor coordination risk.

Scalable Platform

The rotary kiln platform is scalable. A 1 TPH system validated at EcoCarbon Agri Solutions creates the reference installation for 2, 5, and 10 TPH systems for other agri-residue aggregators and carbon-project developers across India and internationally.

Compliance & MRV-Ready

Emission control and process-data logging are integral to the KERONE supply scope — the system is designed to CPCB stack norms and structured for carbon-credit MRV (Measurement, Reporting, Verification) requirements from day one, not retrofitted after the fact.

ENQUIRE ABOUT YOUR BIOCHAR & CARBON PROJECT

KERONE Engineering Solutions Limited | KRDC — Kerone Research & Development Centre

B/47 Addl. MIDC, Anand Nagar, Ambarnath (East), Thane - 421 506, Maharashtra, India

Tel: +91-251-2620542 / 13 / 44 / 45 / 46

Email: info@kerone.com | Web: www.kerone.com

To initiate a project discussion, please share: feedstock quality report + daily/annual tonnage + site location + target biochar grade / carbon-credit pathway required

ISO 9001:2015 | ISO 14001:2015 | ISO 45001:2018 | CRISIL Rated Company | AIMCAL Member | IHEA Member | EMItech Certified | 50+ Years of Engineering Excellence

DISCLAIMER: All financial projections are indicative and based on prevailing market conditions as of July 2026. Process performance figures are derived from KRDC laboratory data (Report 63/KRDC/LAB/24) conducted on EcoCarbon Agri Solutions Pvt. Ltd. feedstock. Carbon-credit revenue is subject to registry methodology approval, third-party verification, and prevailing voluntary carbon market prices, and is not guaranteed. Actual industrial performance may vary. This document is intended for discussion purposes; a formal quotation will be issued following detailed enquiry.