Bird Renewables

Inventor-Led Clean Energy & Waste-to-Value Innovation Platform

PROJECT REPORT

Municipal Waste to Carbon Coal Powder Plant

Scalable Solid Waste Processing, Segregation, Recycling, Drying, Carbonization, Powdering, IP Treatment and Fuel-Powder Packing System

Prepared for Government / Municipal Solid Waste Management Discussion

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1. Executive Summary

Tamil Nadu and many Indian cities face a growing challenge from daily municipal solid waste accumulation, road-side dumping, landfill pressure, odour, leachate, mixed waste handling, and poor visual hygiene. This project proposes a scalable waste-to-value processing plant that converts municipal waste streams into recyclable materials and treated carbon fuel powder suitable for controlled industrial energy applications after testing and approvals.

The proposed plant is designed as a complete integrated system: waste receiving, mechanical segregation, recyclable recovery, washing and packing, moisture removal, controlled thermal carbonization, powdering, proprietary IP material mixing, secondary chemical treatment, hot processing, noodle/pellet-like intermediate formation, agricultural waste powder blending, final carbon powder processing, packing, storage and dispatch.

The final product direction is a high-calorific treated carbon powder / RDF-coal substitute concept for large industrial users such as power plants, coal burners, cement plants, and approved thermal systems, subject to laboratory calorific value testing, emissions testing, ash analysis, chlorine/sulphur testing, heavy-metal screening, and statutory permissions.

Core Project Target

- Convert mixed municipal waste into value-added recovered materials and treated fuel powder.
- Reduce visible waste mountains, landfill burden, odour and open dumping pressure.
- Recover recyclable plastics, metals, glass and other usable streams.
- Dry high-moisture waste using controlled thermal drying up to approximately 380 degree Celsius process zone, subject to process design and safety validation.
- Produce treated carbon powder / coal-substitute fuel powder for industrial co-processing after certification.
- Scale the plant from smaller municipal modules to large capacity plants up to 1500 tons per day or more through modular expansion.

2. Need for the Project in Tamil Nadu and India

Solid waste management is an immediate civic, environmental and public-health priority. Tamil Nadu Pollution Control Board notes that Tamil Nadu's urban local bodies generate around 14,600 tonnes per day of solid waste, including a large share from Greater Chennai Corporation and other corporations, municipalities and town panchayats. This shows the need for scalable and scientific waste processing infrastructure.

The Solid Waste Management Rules, 2016 require proper segregation, processing and scientific disposal. The Rules also state that non-recyclable waste with calorific value of 1500 kcal/kg or more should not be landfilled and should be used for energy generation, RDF production, or co-processing, and that high-calorific waste should be used in cement or thermal power plants where suitable.

Recent Government of India communication on new solid waste rules also emphasizes the role of RDF produced by shredding and dehydrating high-calorific municipal waste and indicates future demand for RDF substitution in industrial solid-fuel users. This project aligns with the direction of waste segregation, recycling, RDF preparation, co-processing and landfill reduction.

Project Alignment

- Supports source-to-processing chain for municipal waste.
- Encourages recycling first, then treatment of non-recyclable combustible fraction.
- Reduces landfill disposal and road-side waste accumulation.
- Creates a structured fuel-powder product only after quality testing and compliance.
- Can support Urban Local Bodies, municipal corporations, town panchayats and rural waste clusters.

Important Note

This project report is a concept and preliminary technical proposal. Full implementation requires detailed DPR, environmental permissions, consent to establish/operate, fire safety, emissions control design, fuel-quality certification, public-health review, and applicable regulatory approvals.

3. Plant Concept and Capacity

The Municipal Waste to Carbon Coal Powder Plant is designed as a modular, scalable waste processing facility. The plant can start as a smaller city-level plant and scale to district-level or regional clusters. The user-indicated target is scalability up to 1500 tons per day, subject to land availability, waste composition, logistics, processing line count, power demand, dryer capacity, emission control and market linkage for recovered fuel powder.

Indicative Capacity Bands

Plant Module	Indicative Capacity	Suggested Use
Pilot / Demonstration	25 - 50 TPD	Technology demonstration, lab validation, waste stream study
Small Municipality	100 - 250 TPD	Town / cluster level processing
City Scale	500 - 750 TPD	Major municipal solid waste handling
Regional Scale	1000 - 1500 TPD	Large ULB / multi-municipality cluster plant

Design Philosophy

- Maximum segregation and recycling before thermal conversion.
- Moisture reduction before carbonization to improve process control.
- Controlled, enclosed processing instead of open burning.
- Dust, odour, leachate and fire control from the first stage itself.
- Fuel product quality control before supply to industrial users.

4. Overall Process Flow

The plant follows a step-by-step conversion pathway. Each stage is designed to reduce waste volume, recover value, remove moisture, improve fuel quality and prepare a controlled carbon powder product.

1. Waste Inlet & Weighbridge	2. Primary Segregation	3. Recyclables Washing & Packing
4. Moisture Waste Dryer	5. Controlled Half-Burning / Carbonization	6. Powder Making
7. IP Material Mixing	8. Chemical Treatment & Re-Mixing	9. Hot Processing & Noodle Formation
10. Agri Waste Powder Blending	11. Final Carbon Powder Packing	12. Dispatch to Approved Industrial Users

Key Output Streams

- Recyclable materials: plastics, metals, glass, paper/cardboard and other recoverable materials as per segregation quality.
- Organic / moisture fraction: treated separately through drying and controlled processing; compost/biogas option can be evaluated depending on composition.
- Non-recyclable combustible fraction: processed into treated carbon powder / RDF-coal substitute after drying, carbonization, powdering and treatment.
- Rejects and inert fraction: safely disposed only after minimizing recoverable and processable fractions.

5. Stage 1 - Waste Inlet Section

The waste inlet section is the control point of the plant. All municipal waste vehicles enter through a weighbridge, vehicle logging, RFID/GPS/manual register, waste stream classification, tipping area and contamination check. This stage creates accountability and ensures that hazardous or prohibited waste is not mixed into the normal processing line.

Major Equipment

- Weighbridge with vehicle entry and exit weight recording.
- Waste receiving shed with covered tipping floor.
- Drainage and leachate collection channel.
- Odour control misting / bio-filter system.
- Primary visual inspection platform.
- Fire points, CCTV, operator cabin and safety barricades.

Operational Controls

- Separate incoming municipal solid waste from biomedical, hazardous, construction, e-waste and industrial hazardous streams.
- Reject or divert non-permitted waste to authorized handlers.
- Record daily received quantity, waste source, moisture condition and approximate composition.
- Maintain covered receiving area to avoid rainwater mixing and leachate spread.

Safety Focus

Operators should use PPE, gloves, masks, safety shoes and reflector jackets. The receiving shed should have fire extinguishers, emergency wash point, drainage control and pest-management measures.

6. Stage 2 - Complete Waste Segregation

Segregation is the most important stage for plant success. Mixed municipal waste must be separated into recyclable, combustible, moisture-rich organic, inert and reject streams before any thermal process. Proper segregation improves product quality, reduces emissions risk and increases revenue from recovered materials.

Suggested Segregation Line

1. Bag opener / waste loosening system.
2. Trommel screen for size-based separation.
3. Manual sorting conveyor for visual removal of large recyclables.
4. Magnetic separator for ferrous metals.
5. Eddy current separator for non-ferrous metals where viable.
6. Air density separator for light combustible fraction.
7. Optical/manual sorting for plastics and paper stream where budget allows.
8. Inert and glass separation before fuel powder preparation.

Segregated Output Categories

Category	Action
Plastics	Separate by quality; wash, dry, bale or send to recycler; non-recyclable high-calorific fraction may move to fuel line.
Metals	Magnetic/non-magnetic recovery; sell to authorized recyclers.
Glass & Inert	Separate; use/recycle/dispose scientifically.
Wet / Organic	Drying, composting, biomethanation or controlled treatment depending on composition.
Combustible rejects	Drying, controlled carbonization, powdering and treatment for fuel product.

7. Stage 3 - Recycling Materials Washing and Packing

All usable recyclable materials must be recovered before fuel preparation. This improves plant economics and prevents unnecessary burning of recyclable resources. Recovered plastics, metals, glass, paper/cardboard and other recyclables should be washed, dried, graded and packed for sale to authorized recycling partners.

Recycling Section Functions

- Manual and mechanical sorting of recyclable streams.
- Plastic washing line for selected plastic fractions.
- Drying and baling of recyclable materials.
- Metal separation, grading and packing.
- Storage bay with labelled material categories.
- Dispatch records and recycler linkage documentation.

Quality Controls

- Avoid food-contaminated wet fraction mixing with clean recyclables.
- Avoid PVC/chlorinated plastic entering fuel line due to chlorine/emissions risk.
- Maintain separate bins/bales for PET, HDPE, LDPE film, mixed plastic, metal, glass and paper.
- Use washing water treatment and recirculation to reduce water demand.

Revenue Potential

Recyclable recovery creates a stable revenue stream and reduces the quantity of waste entering the thermal line. A well-run segregation and recycling system also improves the final carbon powder quality by reducing inerts, glass, metals and chlorine-rich materials.

8. Stage 4 - Complete Moisture Waste Dryer

Municipal waste contains moisture, especially from food waste, market waste and mixed wet waste. Before carbonization or powdering, the moisture must be reduced. The proposed dryer section is designed as a controlled hot-air or indirect drying system, with process temperatures up to around 380 degree Celsius zone depending on waste type, residence time and safety design.

Drying Objectives

- Reduce moisture content for better calorific value.
- Reduce odour and biological activity before thermal processing.
- Improve material flow in conveyors, crushers and powdering machines.
- Prepare combustible fraction for controlled half-burning/carbonization.

Dryer Design Requirements

- Covered feed conveyors and metered feeding to prevent overloading.
- Temperature control, exhaust control and fire safety sensors.
- Dust cyclone / bag filter / scrubber as per emissions design.
- Moisture sensors before and after dryer.
- Emergency water mist/fire suppression where applicable.
- No open uncontrolled burning inside the dryer section.

Energy Integration

The dryer heat source can be designed using approved industrial burners, recovered heat, biomass/RDF-supported systems, or future clean-energy burner integration. Final heat design must follow fire, emissions and regulatory safety requirements.

9. Stage 5 - Controlled Half-Burning / Carbonization

After moisture reduction, the selected combustible fraction moves into a controlled carbonization section. The user's concept describes 'half burning' to convert waste into a coal-like carbon material. For professional implementation, this should be designed as controlled low-oxygen thermal carbonization / torrefaction / pyrolysis-type processing, not open burning.

Purpose of Carbonization

- Convert non-recyclable combustible waste into a stable carbon-rich fuel feedstock.
- Reduce odour and biological content.
- Increase fuel handling quality by creating a dry friable material.
- Prepare feedstock for powdering and proprietary treatment.

Process Safety

- Use enclosed reactor / rotary kiln / controlled chamber design.
- Maintain oxygen control to avoid uncontrolled fire.
- Use temperature sensors, pressure relief, emergency shutdown and fire suppression.
- Treat exhaust gas through afterburner/scrubber/bag filter/activated carbon as required.
- Test final char for ash, moisture, volatile matter, fixed carbon, sulphur, chlorine and heavy metals.

Important Compliance Note

The carbonization section is the highest risk area and must be designed only after detailed engineering, emissions modelling, environmental consent and fire-safety review. No uncontrolled open burning should be proposed or practiced.

10. Stage 6 - Waste Carbon Powder Making

The carbonized waste material is cooled and then processed into controlled powder form. Powder quality, particle size, moisture, ash content and calorific value directly affect industrial usability. Therefore, the powdering section should be designed with dust control, magnetic separation and particle-size control.

Powdering Line Equipment

- Cooling conveyor or cooling drum before milling.
- Magnetic separator to remove remaining metals.
- Crusher / hammer mill / pulverizer depending on feed material.
- Vibratory screen for particle-size grading.
- Dust collector and bag filter.
- Explosion venting / spark detection where fine dry combustible powder is handled.

Quality Targets

- Uniform powder particle size as required by burner or briquette/pellet process.
- Moisture reduction to acceptable fuel-handling levels.
- Reduced inert material and metal contamination.
- Controlled dust generation with safe enclosed handling.

Dust Safety

Fine carbon powder may be combustible and dusty. The powdering section should use earthing, anti-static design, controlled ventilation, spark detection, fire suppression, dust collection and housekeeping procedures.

11. Stage 7 - Proprietary IP Materials Mixing

After powder preparation, the carbon powder is mixed with Bird Renewables' proprietary IP materials. The exact chemical or material composition should not be disclosed publicly in the government concept note. It can be disclosed only under confidentiality and technical due diligence, if required.

Purpose of IP Mixing

- Improve fuel handling behaviour.
- Support better calorific value stability.
- Reduce dusting and improve powder binding where required.
- Support controlled burning behaviour in approved industrial burners.
- Improve final product consistency and storage stability.

Mixing System

- Closed mixer with dust extraction.
- Dosing system for proprietary additives.
- Batch or continuous mixer depending on plant capacity.
- Moisture monitoring and temperature monitoring.
- Quality sampling point after every batch.

IP Protection Note

This stage is treated as inventor IP. The report may mention function and purpose, but exact formula, ratios and process parameters should be protected through patent filing, trade-secret controls and non-disclosure agreements.

12. Stage 8 - Secondary Chemical Treatment and Re-Mixing

The treated powder undergoes a secondary mixing and conditioning stage. This stage is designed to improve consistency, stabilize moisture, bind fine particles, and prepare the material for hot processing. The treatment must use safe, approved chemicals/materials and should not introduce hazardous characteristics.

Objectives

- Uniform additive distribution.
- Fuel quality stabilization.
- Dust suppression and binding support.
- Improved storage and packing behaviour.
- Preparation for hot noodle/pellet-like intermediate formation.

Control Parameters

- Mixer residence time.
- Powder moisture level.
- Binder / additive dosing rate.
- Temperature before hot processing.
- Batch sampling and lab testing.
- Odour and VOC monitoring where applicable.

Safety Note

Chemical treatment should be reviewed by a qualified chemical engineer/environmental consultant. Chemicals must have SDS sheets, safe storage, PPE protocols and environmental approval where required.

13. Stage 9 - Hot Processing and Noodle / Pellet-Like Formation

The treated waste powder is heated and processed into a noodle-like or pellet-like intermediate form. This process supports handling, drying, uniformity and downstream powder/fuel preparation. The exact shape can be optimized based on buyer requirement: powder, granules, pellets, briquettes or noodle-like strands.

Possible Equipment

- Hot mixer or thermal conditioner.
- Extruder / noodle-making die system / pelletizer depending on final format.
- Cooling conveyor.
- Drying/cooling tunnel.
- Dust collection and air handling.

Why This Stage Helps

- Improves material handling and reduces fine dust.
- Allows uniform heating and conditioning.
- Helps combine additives and powder under controlled thermal action.
- Supports standardized final product for packing and transport.

Final Product Options

- Carbon fuel powder.
- RDF/carbon granules.
- Pelletized fuel material.
- Briquette feedstock.
- Power-plant/cement-plant co-processing fuel after buyer approval.

14. Stage 10 - Agricultural Waste Powder Mixing

Agricultural waste powder blending can improve biomass content, calorific balance and burning behaviour of the final fuel product. Suitable agricultural residues may include husk, stalk, bagasse, shell powder, dry biomass residues or other approved clean biomass feedstock depending on local availability.

Benefits of Agri Waste Blending

- Improves renewable biomass fraction of the fuel product.
- Can help manage ash and combustion behaviour depending on material.
- Creates a local market for agricultural residues.
- Supports circular economy between municipal waste and rural biomass streams.

Quality Requirements

- Agri waste should be dry and free from soil, stones and hazardous contamination.
- Moisture and ash should be tested.
- Feedstock should be screened and powdered before mixing.
- Blending percentage must be optimized based on calorific value and emissions test results.

Suggested Testing

Before scale-up, different blends should be tested for calorific value, ash fusion behaviour, chlorine, sulphur, moisture, volatile matter, fixed carbon, bulk density and combustion suitability.

15. Stage 11 - Final Carbon Powder Product and Packing

The final product is a treated carbon powder / RDF-coal substitute concept intended for approved industrial users. The product can be packed in bulk bags, jumbo bags, tanker/bulk transport, or industrial sacks depending on buyer requirement and dust-safety design.

Final Product Claims - Safe Wording

- Designed to achieve high-calorific fuel value after drying and treatment.
- Designed as a coal-support / coal-substitute fuel powder for approved industrial burners.
- Designed to reduce landfill dependency by converting non-recyclable waste into useful fuel feedstock.
- Designed for supply only after laboratory testing, environmental compliance and buyer approval.

Packing Options

- 25 kg / 50 kg bags for pilot supply.
- 1 ton jumbo bags for industrial trial supply.
- Covered bulk transport for high-volume supply.
- Moisture-proof packing and storage under covered shed.

Mandatory Quality Testing

- Gross calorific value / net calorific value.
- Moisture content.
- Ash content and ash composition.
- Sulphur and chlorine.
- Heavy metals and hazardous contaminants.
- Bulk density and particle size.
- Emission behaviour during combustion trial.

16. Plant Infrastructure, Utilities and Layout

The plant requires a well-planned layout separating dirty, wet, dry, thermal, fuel-powder, recycling, packing, laboratory, vehicle movement and administrative zones.

Key Plant Zones

- Vehicle entry, weighbridge and security.
- Covered waste receiving and primary segregation shed.
- Recyclables washing, drying, baling and storage area.
- Moisture waste dryer and air pollution control system.
- Controlled carbonization / thermal conversion section.
- Powdering, mixing, IP treatment and hot processing section.
- Final product packing and storage warehouse.
- Laboratory and quality control room.
- Leachate collection and wastewater treatment plant.
- Fire water tank, hydrant line and emergency response zone.

Utilities Required

- Electrical power connection and DG/backup system.
- Water supply and recycling system.
- Effluent treatment and leachate management.
- Compressed air, hydraulic/pneumatic systems.
- Material handling equipment such as loaders, forklifts and conveyors.
- CCTV, SCADA/PLC control and data logging for large plants.

Indicative Land

Land requirement depends on capacity, storage time, waste receipt pattern, road width, buffer distance and environmental norms. A 1500 TPD plant requires a detailed layout study and government-approved land selection.

17. Safety, Environmental Control and Compliance

Municipal waste processing has safety and environmental risks. The project must be designed with strong compliance systems from day one.

Major Risk Areas

- Odour, flies, pests and public nuisance at waste receiving area.
- Leachate leakage and groundwater contamination.
- Fire risk from dry waste, plastics and carbon powder.
- Dust explosion risk in fine powder handling.
- Emissions from drying and thermal carbonization.
- Worker exposure to pathogens, sharp waste and dust.
- Traffic congestion and waste vehicle movement.

Control Measures

- Covered waste receiving and negative ventilation/odour control where required.
- Leachate collection, treatment and reuse system.
- Fire detection, hydrants, sprinklers, misting and emergency shutdown.
- Bag filters, cyclones, scrubbers, afterburner/oxidizer and emissions stack monitoring as applicable.
- PPE, vaccination, medical checkup and worker hygiene facilities.
- Daily housekeeping and dust-control schedule.
- Quality testing before product dispatch.

Regulatory Pathway

- Detailed Project Report and site feasibility.
- Consent to Establish and Consent to Operate from pollution control authority.
- Environmental permissions if applicable by plant scale and process type.
- Fire and factory safety approvals.
- Municipal agreement / PPP / concession agreement.
- Fuel product testing and buyer acceptance documentation.

18. Automation, Monitoring and Quality Control

A scalable plant should use digital monitoring to ensure waste quantity, material recovery, moisture, temperature, emissions, product quality and dispatch are transparent. This is important for government reporting and buyer confidence.

Recommended Monitoring

- Daily waste received by source and vehicle.
- Segregated recyclable quantity and revenue.
- Moisture before and after dryer.
- Dryer temperature, exhaust temperature and fuel use.
- Carbonization temperature profile and residence time.
- Powder particle size, moisture and bulk density.
- Final product calorific value and ash.
- Emission control equipment status.
- Fire/smoke/temperature alarms.

Laboratory Setup

- Moisture analyser.
- Bomb calorimeter through in-house or third-party lab.
- Ash testing furnace / third-party analysis.
- Chlorine, sulphur and heavy-metal testing through authorized labs.
- Sample retention room and batch traceability.

Data Reporting

Monthly reports can show received waste, recycled materials, processed dry fraction, carbon powder production, reject disposal, emissions checks, product testing and buyer dispatch. This can support government oversight and public transparency.

19. Implementation Plan and Government Support Requested

The project can be implemented through a phased model to reduce technical and financial risk.

Phase 1 - Technical Feasibility and Sample Testing

- Collect municipal waste samples from selected Tamil Nadu ULBs.
- Study moisture, recyclable content, combustible fraction and inert percentage.
- Conduct lab trials for drying, carbonization, powdering, treatment and calorific value.
- Prepare emissions and ash testing report through third-party lab.

Phase 2 - Pilot Plant

- Set up 25 - 50 TPD demonstration plant.
- Operate under official observation for 90 - 180 days.
- Generate real data on yield, cost, emissions, product quality and buyer acceptance.

Phase 3 - Commercial Plant

- Scale to 100 - 250 TPD, then 500 TPD or above based on success.
- Develop power plant / cement plant / industrial buyer linkage.
- Create PPP or concession model with municipality.

Support Requested from Government

- Permission to present the technology concept and pilot model.
- Waste sample access for testing.
- Pilot land / shed support where possible.
- Institutional technical review and third-party testing facilitation.
- ULB linkage and buyer linkage for treated fuel powder trial.
- Guidance on approvals, pollution control, fire safety and public-private partnership model.

20. Expected Benefits and Conclusion

The proposed plant provides a practical waste-to-value approach. It is not just disposal; it is a recovery, recycling, drying, carbonization and fuel-product preparation system.

Expected Benefits

- Reduces visible municipal waste accumulation and landfill pressure.
- Improves recycling recovery and material value.
- Converts non-recyclable combustible waste into treated fuel powder after testing.
- Supports local employment, plant operations, logistics and recycling ecosystem.
- Supports circular economy by blending municipal carbon powder with agricultural waste powder.
- Creates a scalable model for Tamil Nadu and other Indian states.
- Supports RDF/co-processing policy direction after compliance and approvals.

Conclusion

Bird Renewables, led by Mr. Bealur Ramalingam Kaarthic, proposes this Municipal Waste to Carbon Coal Powder Plant as an inventor-developed waste-to-value project for Tamil Nadu and India. The concept can help address large municipal waste accumulation while creating recovered recyclables and a tested carbon fuel powder product for approved industrial users.

The project should move forward through a structured validation pathway: waste characterization, pilot demonstration, third-party laboratory testing, emissions control design, regulatory approval and industrial buyer trial. After successful pilot validation, the plant can be scaled up to larger municipal and regional capacities including 1500 tons per day or more through modular design.

Final Statement

Turning municipal waste mountains into managed resources, recovered recyclables and tested carbon fuel powder for a cleaner Tamil Nadu.

21. Disclaimer and References

Disclaimer

This report is a concept-level project proposal prepared from inventor-provided process notes and publicly available policy references. All process values, temperatures, product claims, calorific value expectations, carbon-reduction statements and plant capacity targets are indicative and subject to engineering design, pilot testing, third-party laboratory validation, environmental approvals, safety approvals, regulatory permissions and commercial feasibility assessment before implementation.

The proprietary IP material composition, treatment ratios and detailed operating parameters should be disclosed only under confidentiality agreement and proper IP protection. Hazardous, biomedical, e-waste and industrial hazardous waste streams must be excluded or handled only through authorized channels.

Key References Used

1. Tamil Nadu Pollution Control Board - Municipal Solid Waste page: Tamil Nadu urban solid waste generation data and segregation/recycling guidance.
2. Solid Waste Management Rules, 2016 - provisions for non-recyclable high-calorific waste, RDF and co-processing in cement/thermal power plants.
3. Tamil Nadu Urban Sanitation / Solid Waste Management page - SWM Rules 2016 and requirement for state policy and ULB solid waste management plans.
4. Government of India PIB release on new Solid Waste Management Rules, 2026 - RDF definition and industrial solid-fuel substitution direction.
5. Swachh Bharat Mission / GIZ guidance on RDF usage in various industries - RDF and co-processing reference framework.

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