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# Building Bankable Waste-to-Energy (WtE) Projects in India

Despite policy support, Waste-to-Energy (WtE) projects in India have seen limited success. Only a small set of plants across MSW-to-Power and Compressed Biogas (CBG) have demonstrated sustained technical, financial, and environmental viability.

D&B India has appraised over 100 mandates across WtE power plant projects, Compressed Biogas (CBG) projects, Feedstock Assessment surveys, Waste Characterisation & Quantification surveys, with varied feedstock such as Municipal Solid Waste (MSW) and Agri-waste (paddy straw, press mud, cow dung, animal litter, Nappier grass etc.).

These successes are not accidental; they reflect disciplined execution across governance, feedstock security, technology choice, commercial structuring, environmental management, and operations.

This analysis distils the core factors observed in India's few successful WtE projects (focuses more on WtE power plant projects), offering a decision-useful framework for future project development and appraisal.

# Six Pillars of Waste-to-Energy Success

| | Success Pillar | Core Objective |
|---|---|---|
| 1 | Governance & PPP Structure | Strong institutional ownership and clear risk allocation |
| 2 | Feedstock Security | Guaranteed quality and quantity through segregation and contracts |
| 3 | Technology & Design | Proven, adapted, and right-sized systems |
| 4 | Commercial Model | Multi-revenue, bankable contracts |
| 5 | Environmental & Social License | Compliance, transparency, and community acceptance |
| 6 | Operations & Performance | Professional O&M with KPI-driven optimisation |

# 1. Governance and Institutional Commitment

Successful WtE projects in India are anchored by strong institutional frameworks, typically led by empowered urban local bodies or state agencies. These projects are treated as critical civic infrastructure rather than isolated contractor-driven facilities. Clear public–private partnership models define responsibilities for waste supply, performance, regulatory compliance, and risk mitigation. Senior-level political and administrative commitment ensures enforcement of segregation, timely payments, and resilience against public or legal challenges.

For example, a municipal corporation made the Bio-CNG plant a flagship endeavour, underpinned by the city's clean city ethos. It ensured 100% segregation citywide and provided land and viability gap funding to kickstart the Bio-CNG project. The city's top officials actively monitor the plant's performance as part of the city's cleanliness drive. Similarly, **another project, State Government** backed its WtE plant at the highest level – the project was commissioned under the city's waste disposal plan with full support of the civic administration. The municipal corporation's leadership regularly publicises the plant's achievements to build public and political support. This kind of political will not only expedites approvals and funding, but also helps withstand any pushback by keeping the project a project a priority.

For ***MSW-to-Power WtE plants***, strong municipal support is critical because the municipality is both the waste provider and often the power offtaker (or at least influencer of the PPA with the state utility). A city's commitment can be seen in actions like enforcing bylaws for waste segregation, bearing waste transport costs to the plant, and honouring tipping fee payments even during fiscal crunches. Projects in cities like ***Delhi and Hyderabad***, which have multiple WtE plants, benefited from continued municipal backing despite initial public criticism – their governments defended the projects in court and invested in technology upgrades to meet pollution norms.

# 2. Feedstock Quality, Quantity, and Security

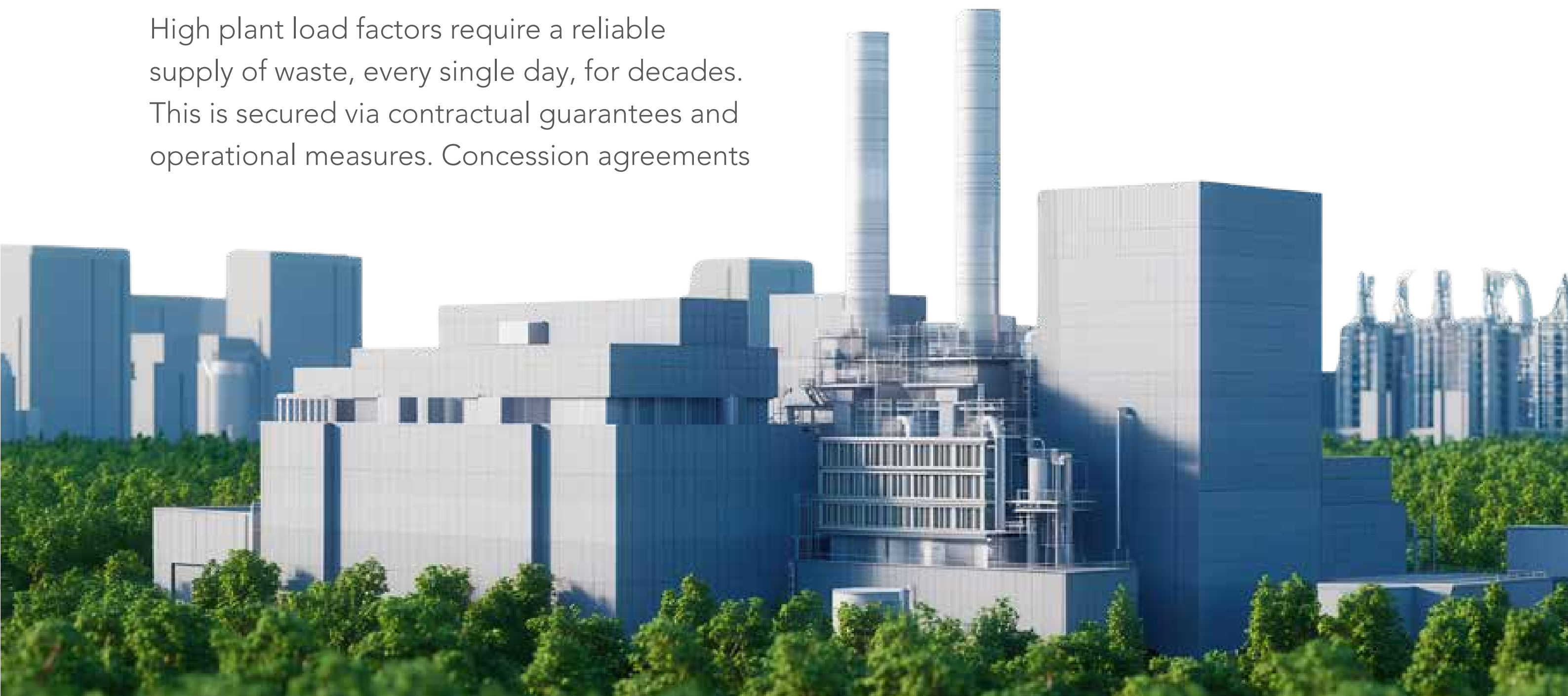
Feedstock quality and reliability are decisive determinants of WtE outcomes. Successful plants operate exclusively on segregated, purpose-fit waste streams. MSW-to-Power facilities rely on pre-processed, high-calorific RDF, while Bio-CNG plants use controlled organic or biomass inputs. Long-term contracts with minimum tonnage guarantees supported by audits and supply-chain control, ensure consistent plant loading and protect financial viability.

**Hyderabad WtE** is a case where feedstock preparation was key: the plant only incinerates the **refuse-derived fuel (RDF) portion** of MSW. A material recovery facility and compost plant were established alongside the WtE unit; all wet organic waste is diverted to biomethanation/composting, and recyclables are picked out, leaving mainly high-calorific dry waste for the WtE. The resulting RDF has much lower moisture and higher calorific value than raw mixed waste, enabling steady power generation. By contrast, early WtE attempts, plant failed because the MSW delivered had only ~600–800 kcal/kg (waterlogged food waste and soil) which was barely one-third of what an incinerator needs.

High plant load factors require a reliable supply of waste, every single day, for decades. This is secured via contractual guarantees and operational measures. Concession agreements for successful PPP projects bind the city (or waste supplier) to provide a minimum tonnage. For instance, a successful WtE has the municipal corporation obligated to supply ~450 TPD of MSW (±10%) for the plant's capacity. If the city fails to deliver that quantity, it could face penalties or the operator could be compensated.

***MSW-to-Power plants*** require waste high in calorific value and low in moisture/inerts – typically this is achieved by removing the wet organic fraction (which can be 50–60% of Indian MSW) and using the remaining dry waste as RDF. The best practice, therefore, is to pair incinerators with upstream segregation and RDF production facilities. Cities that have done this (Indore, PCMC, Delhi to some extent) have far better plant performance than those that attempt to burn raw mixed waste.

Additionally, MSW incinerators thrive in larger cities where waste generation is sufficient; a 15–25 MW WtE needs ~1000–2000 TPD of waste, only large cities or clusters can reliably furnish that.



# 3. Technology Selection and Plant Design

India's successful WtE projects avoid experimental technologies given the technology-performance risk. Instead, they deploy proven incineration and anaerobic digestion systems adapted to local waste characteristics. Plant capacity is conservatively sized to realistic waste availability, often through modular or phased deployment. Equally important is the inclusion of complete balance-of-plant systems—emissions control, residue management, automation, and safety to ensure sustained compliance and reliability.

A successful WtE project appraised by D&B India, uses a conventional **moving-grate incinerator** supplied by Hitachi Zosen, a company with dozens of WtE installations worldwide. The rest of the plant (boiler, flue gas treatment, turbine) follows standard designs that have been honed over decades. On the flip side, India's past is littered with tech experiments that went awry: e.g., a **plasma gasification pilot** which never worked on mixed waste; a **pyrolysis-based MSW plant** that was abandoned after the syngas yield was too low and tar accumulation clogged the system; or the early WtE plant which, despite being simplistic mass-burn, failed because it lacked preprocessing (technology was fine, but feed was wrong). The lesson incorporated by newer projects is to **match technology to the waste characteristics**. For incineration, that means choosing mass-burn or RDF combustion with heavy-duty feeding systems that can handle heterogeneous waste (unlike delicate gasifiers). Notably, the majority of MSW incineration projects in India use moving grate technology with international suppliers such as Hitachi Zosen, Keppel Seghers design, rather than unproven designs.

Projects that succeed often **start modestly and scale up**.

**Delhi**, for instance, has three WtE plants of ~12 MW, ~23 MW, and ~25 MW instead of a single 60 MW plant. This allows waste to be divided by catchment area and provides redundancy. **Hyderabad** similarly planned two adjacent plants of ~20 MW and ~14.5 MW capacity, planning them sequentially.

Technology is not just about the reactor or boiler; it's also the supporting systems that ensure environmental safety and reliability. Successful WtE projects invested in **full-fledged pollution control systems** from the start and integrated waste handling and residue management into the design. A successful project appraised by D&B has a fully integrated waste management complex: it includes a sorting line, composting units, the WtE furnace, and facilities to treat flue gas and leachate on-site. The flue gas treatment train there consists of a semi-dry scrubber, baghouse filter, and activated carbon injection, meeting emissions standards – a reason the plant has faced no major environmental hiccups. On the flip side, **several struggling plants had inadequate balance-of-plant**: for instance, a plant in India in its initial years (2012–2015) lacked proper dioxin control and had frequent duct corrosion; it had to retrofit activated carbon injectors and better gas cooling to comply with new norms. Now it operates more smoothly, but that retrofit cost time and money. Successful projects plan these elements upfront. Another example: **ash handling** – incineration yields 15–25% bottom ash which can be a disposal headache. The best WtE plants line up avenues for ash utilisation (e.g., sending bottom ash to a brick-making facility, and using it in road sub-base, thus minimising landfill needs).

***MSW-to-Power plants*** primarily deal with thermal technology. For them, the key design parameters are the combustion system and emission controls. A successful MSW incinerator in India often looks like a modified version of international plants but beefed up for local conditions: e.g., ***higher furnace temperatures*** (to burn wet waste better), ***more robust waste feeding grates*** (to handle occasional bulky items/inerts), and ***periodic soot removal*** (since Indian RDF can clog boilers faster due to high dust). Also, given that India's environmental regulations now demand stringent limits (for dioxins, NOx, etc.), many Indian WtEs have adopted ***baghouse filters and SNCR (selective non-catalytic reduction)*** for NOx, which were optional a few decades ago.

# 4. Commercial and Contractual Bankability

Financially viable WtE plants employ diversified revenue models that acknowledge both energy generation and waste-processing services. Long-term power purchase or gas offtake agreements are combined with tipping fees, capital support, and other incentives to ensure bankability. Robust contracts allocate key risks, provide safeguards for lenders, and align project cash flows with operational realities rather than idealised assumptions.

For ***MSW-to-Power projects***, the interplay with government policy is strong. They often rely on state electricity regulators to approve higher tariffs or on urban bodies to provide viability gap funding. To attract private players, many states have introduced incentives: e.g., some offer land at token rent, or exempt WtE electricity from certain charges. Some WtEs benefit from being treated as "must-run" plants (grid must take their power) due to an order by the power regulator citing public interest. Financially, MSW WtEs need more support because the product (electricity) is cheap and commodity-like, whereas the service (waste treatment) is the real value they provide to the city. Thus, contracts tilt towards municipal payments (tipping fees, minimum guaranteed tonnage).

# 5. Environmental Compliance and Social Acceptance

Environmental credibility underpins the longevity of WtE projects in India. Successful plants invest in advanced pollution control, continuous monitoring, and transparent disclosure to regulators and communities. Proactive engagement, mitigation of secondary impacts, and visible local benefits help secure a social license to operate, reducing litigation and operational disruptions.

For instance, **a successful WtE** project runs a continuous emissions monitoring system (CEMS) that reports data in real-time to the state pollution control board in line with the norms. The design values for pollutants like particulate matter, $SO_2$ and $NO_x$ are within the limits, and the plant voluntarily conducted a dioxin-furan test after start-up which showed compliance, helping allay public concerns. The operator also publishes simplified results occasionally (through press notes etc.) which has made local stakeholders more comfortable.

Successful WtE projects don't operate in isolation; they actively engage the community and deliver local benefits to gain acceptance. Many have **information centres or guided tours** for students, researchers, and resident groups to demystify operations.

In India, WtE projects often face legal challenges from activists or residents citing pollution. Successful projects have navigated these by cooperating with regulators and courts rather than being adversarial. For example, a WtE plant was under litigation, the operator agreed to several court-monitored measures: continuous ambient air monitoring around the plant, creating a green belt, installing a solar cover over waste conveyors, and setting up a grievance redressal for complaints. Compliance with these measures over time led to allow continued operation, and gradually local resistance waned as emissions data showed improvement.

Similarly, another project faced initial NGO agitation given the past WtE failure; the company invited local environmentalists during trial runs and demonstrated the flue gas results met standards and also agreed to set aside a small percentage of revenue for local development – this helped avoid a legal standoff.

***MSW incinerators*** have historically been more controversial due to fears of toxic emissions and ash. So, WtE power plants must work extra hard to show they are safe: continuous emissions data, third-party audits, and sometimes ***hosting community advisory panels*** (some plants abroad do this; in India it's nascent but could be adopted)

# 6. Operations and Performance Management

Operational excellence distinguishes enduring WtE facilities from failed ones. Successful projects are run by experienced operators with sector expertise, supported by trained staff, preventive maintenance regimes, and data-driven KPIs. Continuous optimisation of feedstock handling, process efficiency, and equipment reliability ensures high availability, cost control, and compliance over the plant lifecycle.

Many successful projects in India are operated by companies that specialise in waste management or energy. For example, ***a successful WtE project***, is an arm of a leading solid waste company and brought in technical partners for incinerator know-how. Their staff have prior experience in running waste processing sites and could be trained on the specifics of incineration technology. ***Few other successful examples are*** companies which run multiple WtEs and have built an internal talent pool of engineers and managers who rotate among projects to share best practices.

# Conclusion: A Replicable Blueprint

India's limited but credible WtE successes demonstrate that the sector is viable when executed with discipline and realism. Success depends on aligning governance, feedstock, technology, finance, environmental stewardship, and operations from the outset. Projects that meet all six success pillars transition WtE from a policy aspiration into a durable infrastructure solution delivering urban sanitation, clean energy, and financial sustainability.

# About the Authors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Mr. Akhilesh Naik is a seasoned project finance and advisory professional with nearly two decades of experience in project appraisal, project finance, and risk assessment. As Head of Project Appraisal Solutions at Dun & Bradstreet India, he leads advisory engagements across the project lifecycle, including project assessment, financing support, disbursement monitoring, and performance oversight. His expertise spans technical feasibility, commercial viability, financial sustainability, and risk evaluation of infrastructure and industrial projects, enabling informed decision-making for lenders, investors, and project sponsors.


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### Co-authors' Perspective

Combining deep technical expertise in waste management and renewable energy with extensive experience in project finance and appraisal, the co-authors bring a holistic perspective on the Waste-to-Energy sector. Their collective insights explore the industry's opportunities, challenges, risks, and investment considerations, offering valuable guidance to project developers, investors, lenders, and policymakers.

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