Policy Brief

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# Policy Lessons From India's Privatized Waste-to-Energy Models

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## Executive Summary

Waste-to-Energy (WTE) facilities have been promoted as a dual solution to India's mounting waste crisis and growing energy demands. However, after two decades of expansion and investment, these plants process less than 6% of the country's municipal solid waste while contributing only 0.1% of national electricity generation. Of the 30 plants constructed, 29 through public-private partnerships, half have become dysfunctional due to fundamental challenges with waste quality and economic viability.

The policy response has focused on creating more favourable conditions for private operators through subsidies, concessional loans, and guaranteed revenue streams. This approach has compromised environmental standards, shifted financial risks to the public sector while privatizing benefits, and undermined both waste reduction efforts and the livelihoods of informal recycling workers. The current trajectory neither aligns with circular economy principles nor justifies WTE's promotion as clean energy.

Moving forward requires treating WTE as a public service of last resort, restricted to burning only residual waste that cannot be recycled or composted. This must be accompanied by stronger environmental regulations, elimination of profit-driven incentives that encourage waste generation, and prioritization of community-based recycling and composting systems.


## The Global Context and India's Experience

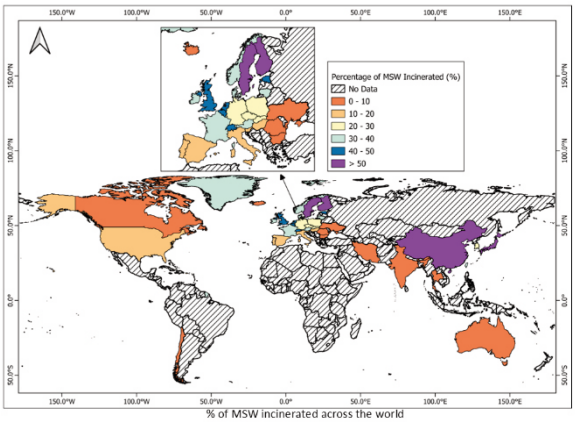
The global WTE market is projected to grow significantly, from USD 51.23 million in 2025 to USD 92.95 million by 2034, with incineration accounting for about 81% of market revenue. The technology first gained prominence in high-income countries like those in Europe, the United States, Japan, and Singapore, operating under conditions markedly different from India's context, including high-calorific value waste, low moisture content, strict environmental regulations, and established energy infrastructure.

Box 1 highlights country-wise trends in MSW incineration over the past three decades. Japan has consistently incinerated around 80% of its waste, though its recycling rates have stagnated. Northern and Western Europe, early adopters of incineration, have largely reached saturation. Denmark, for instance, has announced plans to reduce incineration capacity by 30% by 2030 and has already shut down seven plants to prioritize recycling. Sweden and the Netherlands now import waste to keep their incinerators running. In contrast, Southern and Eastern European countries are only beginning to expand incineration, which explains their stable levels around 25%. The United States remains heavily reliant on landfilling, with incineration stagnant at about 13%, a result of abundant land availability and public resistance to new facilities. In Asia, South Korea and China have embraced incineration, showing rapid growth in the past decade. Meanwhile, Singapore and Taiwan are moving in the opposite direction, scaling back incineration due to overcapacity and mounting environmental concerns.

India's experience contrasts sharply with this global trend (See Box 2). Yet this expansion has yielded minimal results, processing only 6% of municipal solid waste while contributing just 0.1% of national electricity generation. The fundamental issue lies in the mismatch between technology and India's waste characteristics, 40-70% of municipal solid waste consists of organic matter with high moisture content[5], creating operational challenges including insufficient combustible material, costly transport of refuse-derived fuel, and need for auxiliary fuels like diesel to maintain combustion. These technical challenges have translated into economic failures, with cumulative losses from failed ventures reaching approximately ₹2,000 crore. Despite this track record, 16 additional plants are under construction and 33 more are proposed.

*The country's installed WTE capacity increased more than seven-fold from 43.45 MW in 2006 to 309.34 MW in 2025[4].*

**Box 1: Global MSW incineration at a glance**




% of MSW incinerated across the world

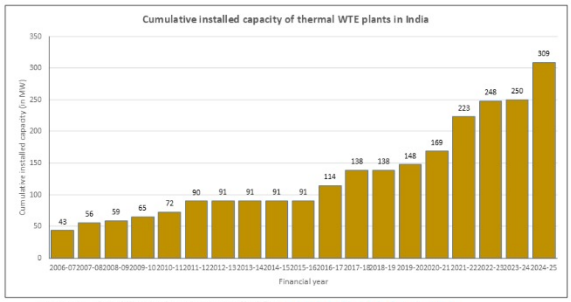
Source: Authors' illustration, data sources: Government reports/websites of different countries and academic journals

Global trend of WTE incineration over the past three decades

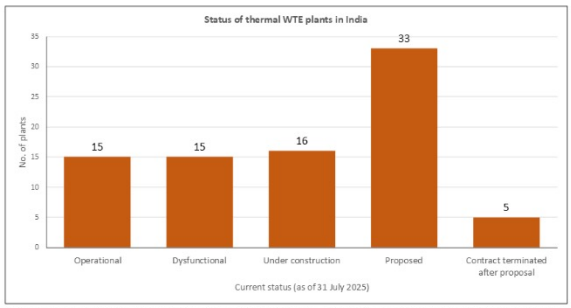
| | % of MSW incinerated | | | | |
|---|---|---|---|---|---|
| | 1995 | 2005 | 2015 | 2025 | Remarks |
| US | ≈12% | ≈13% | ≈13% | ≈13% | Incineration stagnant at ~12–13% since 1995 due to ample land availability for landfilling and strong public opposition due to pollution concerns. |
| Europe | 15% | 20% | 27% | ≈25% | Landfill ban (1999) and a conducive policy environment promoted WTE. Northern and Western Europe are now saturated, with some countries importing waste to keep plants operational, while current growth in incineration is driven by Southern and Eastern Europe |
| Japan | ≈77% | 77% | ≈83% | ≈80% | Stable at 77–80% for decades; linked to stagnant recycling rates. |
| South Korea | ≈4% | ≈20% | ≈26% | 24% | Increased from 4% (1995) to ~24% (post-2020). |
| China | ≈0% | 5% | 27% | ≈62% | Sharp rise from ~0% (1990s) to ~62% (2020s), driven by growing waste challenge, land scarcity and state subsidies. |
| Taiwan | 15% | ≈64% | 43% | ≈36% | |
| Singapore | 68% | 90% | 39% | ≈48% | Declining reliance; decommissioning plants to improve recycling. |
| India | 0% | 0% | 1% | 6% | Capacity has expanded, but only 6% of MSW is incinerated, reflecting repeated failures of installed plants. |

Source: Authors' compilation using government reports and academic literature

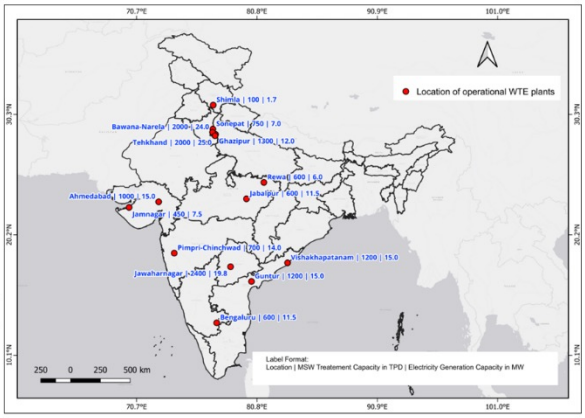
**Box 2: India's MSW incineration snapshot**




Source: Authors' illustration, data compiled from MNRE, 2025, Paulraj et al., 2019




Source: Authors' illustration adapted from Sambyal & Agarwal, 2019, data compiled from government and media reports

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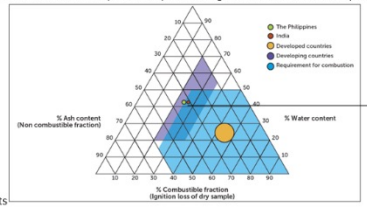



MSW in India is only marginally combustible compared to that of developed countries

Source: UNEP, 2019

## Environmental Performance Falls Short of Standards

India's WTE sector performs poorly compared to international environmental standards. A critical comparison reveals significant gaps in emission norms, with India's standards being considerably less stringent than those in Europe, the United States, and China.

**Emission Standards Comparison:**

**Particulate Matter:** EU limit of 5 mg/Nm³ versus India's 50 mg/Nm³

**Sulfur Dioxide:** EU limit of 30 mg/Nm³ versus India's 200 mg/Nm³

**Nitrogen Oxides:** EU limit of 150 mg/Nm³ versus India's 400 mg/Nm³

**Mercury:** EU limit of 0.02 mg/Nm³ versus India's 0.05 mg/Nm³

**Dioxins/Furans:** EU limit of 0.06 ngTEQ/m³ versus India's 0.1 ngTEQ/m³

These weaker standards reflect the cost-focused approach to WTE development in India, where plants are built at roughly one-quarter to one-half the cost of European facilities (USD 2.5-3.1 million per MW compared to USD 4-10 million per MW in Europe). However, this cost advantage comes at the expense of advanced air pollution control systems. Indian plants have been found to emit up to a hundred times higher levels of particulate matter than EU facilities[6].

Transparency remains problematic, with only three of 15 operational plants providing publicly accessible emissions data despite mandatory disclosure requirements. Many facilities don't monitor highly toxic pollutants like dioxins, furans, and heavy metals, or don't report results publicly. Compliance with even India's weaker standards is poor, at least six operational plants have faced litigation for pollution violations, and Central Pollution Control Board (CPCB)[7] documented that three of four local WTE plants in Delhi exceeded permissible emission limits.

Recent policy changes have further weakened oversight, with plants below 15 MW no longer requiring environmental clearance[8] and WTE incinerators reclassified from "Red" (highly polluting) to "Blue" category. Most concerning is the misrepresentation of incineration as renewable energy when studies show it can emit more $CO_2$ than coal-fired plants, especially when burning high-moisture waste[9] typical of Indian cities.

## Economic Model: Public Risk, Private Profit


India's WTE sector exemplifies problematic economics where public resources subsidize private profits while taxpayers bear financial risks. Despite being framed as public-private partnerships, these projects rely overwhelmingly on public funding through capital grants, tax exemptions, and concessional loans. For instance, the Power Finance Cooperation, operating under Ministry of Power has provided ₹2,000 crore in loans to 13 waste-to-energy projects[10].

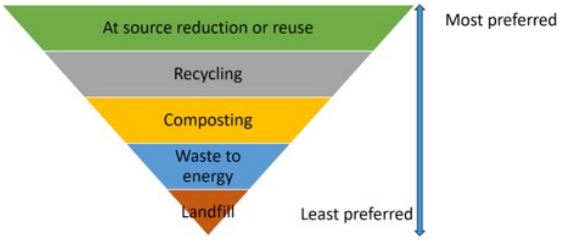
The revenue model creates perverse incentives through tipping fees, payments per ton of waste delivered, which remain the principal guaranteed revenue stream. This encourages operators to maximize waste volumes regardless of quality, since more waste equals more revenue. Projects typically include 20-30 year waste supply agreements with "deliver-or-pay" clauses requiring municipalities to provide fixed annual waste volumes or face penalties.

WTE projects are highly capital-intensive, costing ₹12-40 crore per MW with equally high operational expenses. The electricity they generate is expensive at ₹6.2-7.07 per unit, significantly higher than other energy sources. When projects fail, as half have done, private operators often default on loans or abandon facilities, leaving public institutions with losses while "successful" projects burden consumers with expensive electricity.

This structure directly contradicts circular economy principles by incentivizing waste generation over reduction. Cities face penalties for successful recycling efforts that reduce waste volumes, creating long-term lock-in effects that make transitioning to sustainable waste management strategies politically and economically difficult.


## Undermining Circular Economy and Waste Hierarchy

The waste hierarchy prioritizes reduction, reuse, recycling, and composting over incineration and landfilling, a principle recognized in India's Solid Waste Management Rules 2016. However, incineration-based WTE systems fundamentally threaten this hierarchy's implementation.




**The Waste Hierarchy:**

**Reduce/ reuse** - Minimize waste generation by reducing consumption or reusing items multiple times

**Recycle** - Process materials into new products (including composting)

**Recover Energy** - Extract energy from waste

**Dispose** - Landfill as last resort

While regulations specify that only non-recyclable, combustible waste should be incinerated, practice diverges significantly. The Jabalpur case study demonstrates this clearly: rather than following the hierarchy, the facility received and burned large quantities of organic waste suitable for composting and recyclable materials including paper and plastics that could have been recycled.

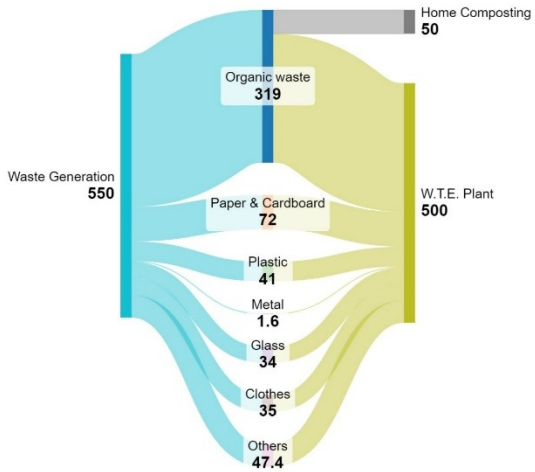



**Figure: Waste Flow Analysis in Jabalpur** *Analysis of Jabalpur's WTE facility reveals that 89% of collected organic waste (279 TPD out of 313 TPD) and nearly 100% of recyclable materials including plastics (41 TPD), paper and cardboard (72 TPD) were diverted into incineration rather than recycling or composting.*

Plants require constant waste flow to remain viable, creating structural pressure to maintain waste generation rather than pursue reduction strategies. This "burn-and-forget" model discourages source segregation as incineration appears to offer convenient handling of unsegregated mixed waste. Cities avoid upfront costs for public education and segregation infrastructure, but this convenience undermines longer-term sustainability goals.

International experience reinforces these concerns. Sweden now imports millions of tons of waste annually to keep incinerators running[11], the opposite of waste reduction goals. Japan's heavy incineration dependence correlates with stagnant recycling rates[9]. These cases show how large-scale incineration creates path dependence that makes transitioning to sustainable strategies difficult once long-term contracts lock in waste-intensive systems.

## Social Impact and Environmental Justice

India's waste management depends on approximately 4 million informal waste workers who recover 15-20% of municipal solid waste, saving local governments roughly $13,700 daily in avoided disposal costs[12]. These workers possess essential knowledge and networks for circular economy transitions, sorting materials back into productive use despite lacking formal employment protection.

WTE projects systematically undermine rather than integrate this sector. In Delhi, facilities have barred waste pickers from residential areas, confining them to public bins and roadsides, causing significant income losses[13]. Diverting recyclable materials into incineration eliminates raw materials these workers depend on, pushing families deeper into poverty without alternative employment.

The spatial distribution raises environmental justice concerns. Studies from the UK show incinerators disproportionately located in the poorest areas[14], a pattern also visible in India where most existing and proposed facilities site in city peripheries. This concentrates environmental and health risks among already marginalized communities who receive few facility benefits.

## Policy Recommendations for Sustainable Transition

Addressing these systemic problems requires fundamental reform across multiple dimensions. First, WTE infrastructure should be repositioned as publicly owned disposal facility rather than profit-generating enterprise. This eliminates perverse incentives to maximize waste volumes and allows cities to prioritize waste minimization without contractual penalties.

Environmental safeguards need substantial strengthening. India should adopt emission norms matching international best practices, supported by mandatory continuous monitoring with real-time public disclosure. The weakening of environmental clearance requirements should be reversed, and reclassification of high-emission incineration as "essential service" reconsidered.

Strict enforcement of waste hierarchy principles requires limiting incineration to truly non-recyclable, combustible residues through institutional reform including state-level coordination bodies overseeing cluster-based approaches where multiple municipalities share facilities. Problematic tipping fee dependence should be eliminated, with necessary facilities funded as essential public infrastructure rather than quasi-markets sustained by subsidies.

Greater emphasis on decentralized, community-driven solutions, especially ward-level composting, bio-methanation, and material recovery facilities, would reduce pressure on centralized plants while formally integrating informal workers. This should go beyond tokenistic inclusion by recognizing their knowledge and expertise, improving working conditions, and investing in capacity building. Such an approach strengthens material recovery and creates more inclusive employment opportunities.

Finally, stronger institutional capacity for transparent governance is essential. Regulatory bodies must enforce norms, mandate real-time monitoring, and conduct comprehensive life-cycle assessments. Transparent public consultation and formal inclusion of informal workers in policymaking ensures equitable outcomes consistent with just transition frameworks.

## Conclusion

India's incineration-based WTE experience demonstrates the risks of adopting capital-intensive technologies without adequate consideration of local conditions and sustainability goals. Despite significant public investment, these facilities contribute minimally to waste management or energy generation while creating environmental, economic, and social problems undermining circular economy objectives.

The path forward requires recognizing WTE's limited role within integrated systems focused on reduction, reuse, and recycling. Where residual waste treatment is necessary, facilities should operate as public services with strict environmental safeguards rather than profit-driven enterprises. Simultaneously, prioritizing investment in decentralized, community-based solutions would better serve environmental goals and social equity, enabling waste management systems that support an inclusive and sustainable development pathway.

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