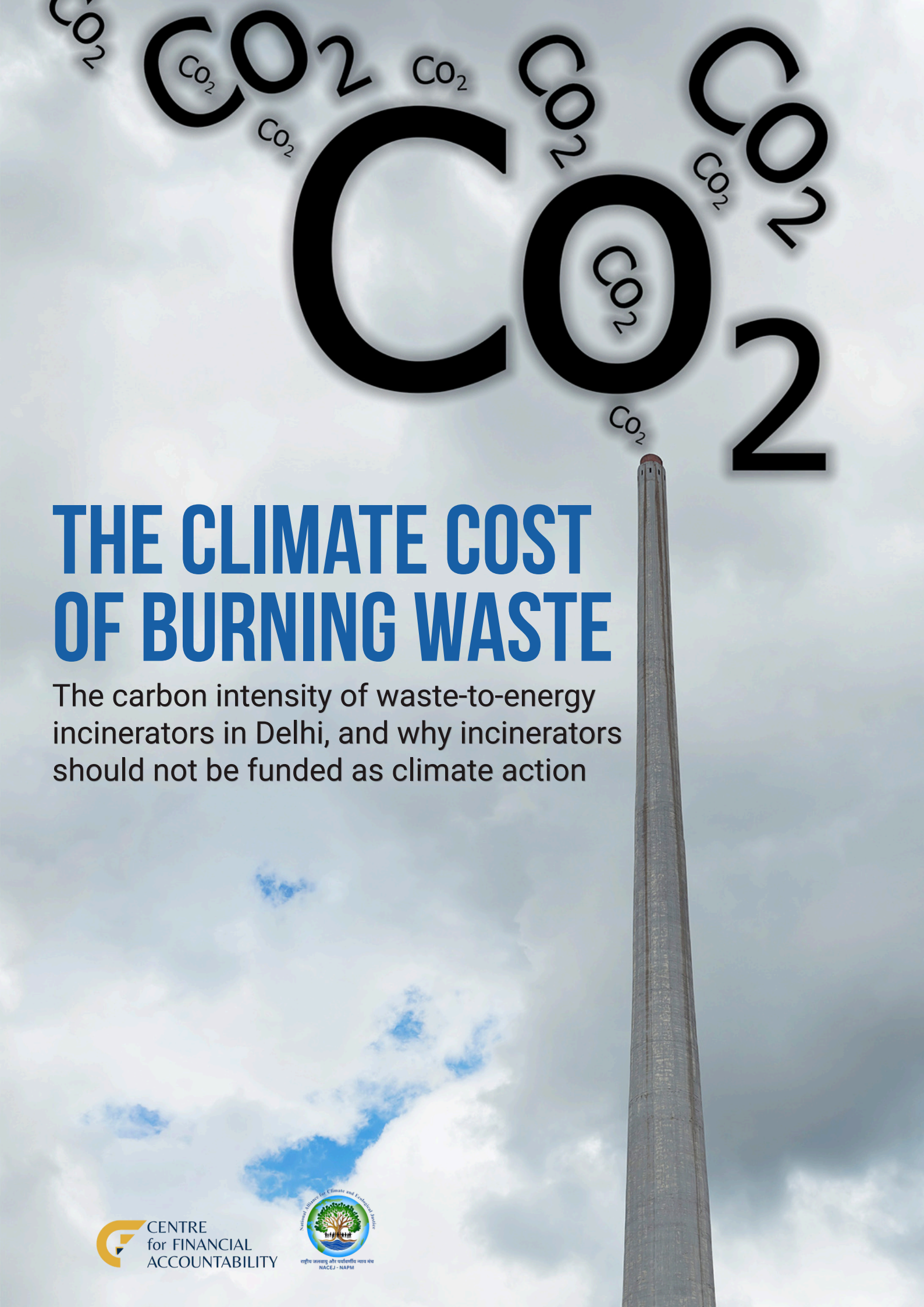




THE CLIMATE COST OF BURNING WASTE

The carbon intensity of waste-to-energy incinerators in Delhi, and why incinerators should not be funded as climate action

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October 2026



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Executive Summary

Waste-to-energy (WTE) incineration is increasingly promoted as a way to address three problems at once: reduce the volume of waste sent to landfills, generate electricity, and contribute to climate mitigation. This framing is particularly influential in the Global South, where growing waste volumes, pressure on urban landfills, and demand for infrastructure have created a market for large-scale incineration. Multilateral Development Banks (MDBs) and international climate finance are also increasingly financing WTE incineration¹ in the Global South countries even as the Global North countries such as the US, Germany, Netherlands, Denmark, Sweden and Japan are increasingly phasing out these incinerators²³. This report examines the climate credentials of WTE incinerators through a detailed case study of the four operational WTE incinerators in Delhi.

The major objective of the report is to uncover the real carbon intensity of the electricity produced from Delhi's WTE incinerators. Delhi provides an important case because its waste stream shares characteristics common to many Global South cities: it is heterogeneous and relatively moisture-rich, with limited source segregation and weak regulatory enforcement. Drawing on data from the Central Pollution Control Board (CPCB), Delhi Pollution Control Committee (DPCC), Delhi Electricity Regulatory Commission (DERC), waste-management records, UNEP-IPCC guidelines, and published scientific literature, this report estimates fossil-origin CO₂ emissions from plastics burned at Delhi's four WTE plants and compares these emissions with the electricity generated and exported by the facilities.

The central finding is the fossil carbon intensity of WTE plants producing electricity. The study estimates that combustion of the fossil-derived fraction of the waste in the WTE incinerators produces approximately 3.4kg of fossil-origin CO₂ for every kWh of net electricity exported by the plants. This is approximately 4.7 times the Central Electricity Authority's weighted-average emission factor for Indian grid electricity (0.727 kg CO₂/kWh in FY2023-24) and approximately 3.5 times the emission factor for coal (0.978 kg CO₂/kWh). The estimated net electricity exported by the four plants corresponds to approximately 198 kWh per tonne of raw municipal solid waste, which is less than one-third of yields reported in some Western WTE systems. Thus, Delhi demonstrates that while incineration has the highest carbon burden, it also produces a dismal amount of energy.

Furthermore, the study exposes a fundamental problem with describing mixed-waste incineration as renewable energy. In 2023, the four Delhi WTE plants burned approximately 735,840 tonnes of plastic⁴, with plastics constituting roughly 42% of the

¹ Climate Finance for Zero Waste [\[source\]](#)

² FACT SHEET: Trash Incinerator Closures 2000-2025 [\[source\]](#)

³ The EU is clear: Waste-To-Energy incineration has no place in the sustainability agenda [\[source\]](#)

⁴ Extended Producer Responsibility (EPR) for plastic packaging, Centre for Science and Environment, India. [\[Source\]](#)

estimated refuse-derived fuel (RDF) feed. Since plastics are predominantly fossil-derived, the report questions whether electricity generated by combusting such large amounts of plastics should receive the regulatory and financial advantages associated with renewable energy.

The report also identifies a “plastic paradox,” whereby India’s Extended Producer Responsibility (EPR) framework creates economic value for the downstream combustion of plastic, allowing producers to fulfil EPR obligations without necessarily reducing plastic production at the source or shifting towards reuse, refill, and better packaging.

These risks of incineration extend beyond greenhouse gas emissions to public health, environmental pollution, and livelihood disruption. The Okhla WTE plant, for example, recorded dioxin and furan emissions at nearly nine times permitted levels in a 2020 CPCB inspection⁵, while a recent New York Times investigation⁶ raised concerns about toxic heavy-metal exposure affecting more than one million residents living around the plant.

The report therefore recommends that municipal waste incineration should be excluded from climate finance; carbon crediting of municipal waste incineration should end; mixed-MSW incineration should be removed from renewable-energy and green-energy classifications; EPR systems should not reward plastic combustion; climate finance should prioritise demonstrable zero-waste systems; and public finance should support the safe closure, decommissioning and just transition of existing incinerators. Climate finance should be aligned with waste prevention, material circularity, protection of waste-worker livelihoods and genuine emissions reduction rather than with the expansion of infrastructure that depends on continued waste generation.

⁵ CPCB inspection report [[Source](#)]

⁶ New York Times Investigation [[Source](#)]

1. Introduction

1.1 Background

Waste-to-energy (WTE) incineration is the controlled, high-temperature burning of mixed or residual solid waste in purpose-built furnaces. The heat produced raises steam, which drives turbines to generate electricity or supplies heat to district heating and industry (see Figure 1). Incineration typically reduces waste volume by around 90% (subject to the intake and segregation of waste), but the process does not make waste disappear: roughly 30-40%⁷ of the original waste is left as fly and bottom ash, which must be handled as hazardous material and sent to specialised landfills. Modern plants rely on extensive flue-gas cleaning to control pollutants such as dioxins, heavy metals and particulates⁸.

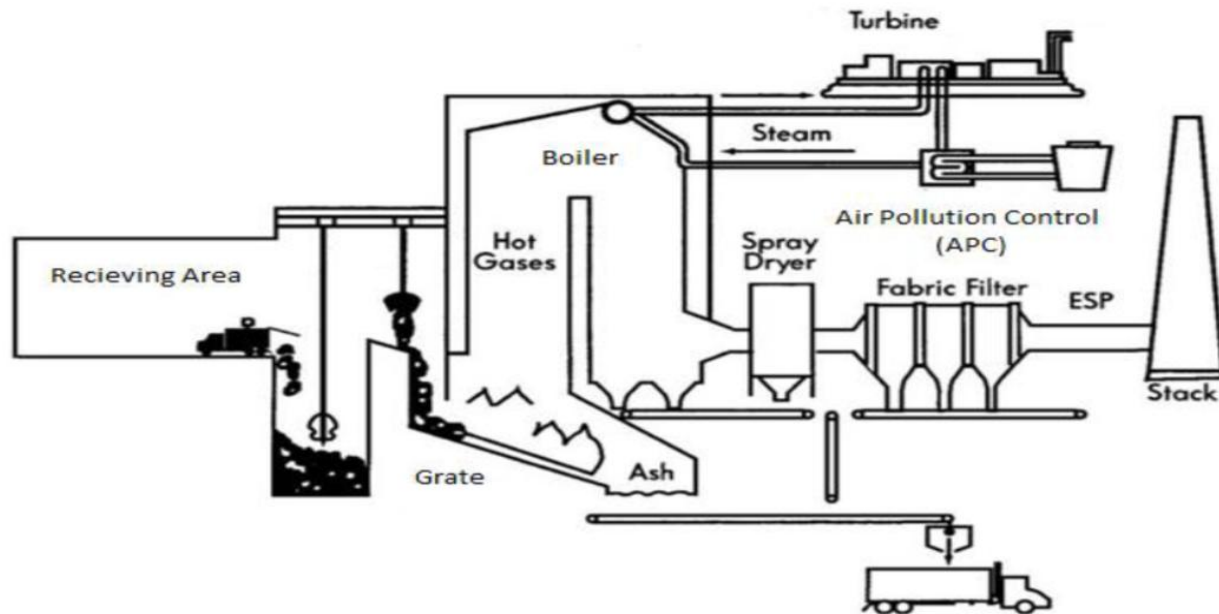


Figure 1: Schematic diagram of a WTE plant [Source]

WTE capacity has grown steadily, driven by rising waste volumes and shrinking landfill space. According to the German market research firm, Ecoprog, more than 3,100 thermal waste treatment plants were operating worldwide by the end of 2025, with combined capacity above 640 million tonnes per year. This was an increase from about 2,700 plants and roughly 530 million tonnes a few years earlier. Ecoprog expects around 3,300 plants with more than 770 million tonnes of capacity by 2034⁹.

⁷ GAIA fact-sheet about WTE incinerators [Source]

⁸ Why incineration doesn't support circularity- Resourcify [Source]

⁹ WTE Global Database [Source]

China has driven most of this growth, adding over 12 million tonnes of new capacity in 2025. However, its market is shrinking as many eastern seaboard cities now have enough or surplus capacity, and operators are struggling to secure waste as recycling expands^{10,11}. WTE incineration is increasingly seen as being at odds with climate mitigation in the Global North, as they have to import waste to keep the plants running, consequently increasing their carbon emissions¹². Meanwhile, Southeast Asia is emerging as a new growth region. In November 2025, Indonesia announced plans to begin building seven WTE plants in 2026. In Europe, the Waste Framework Directive is reorienting and trying to discourage incineration placing waste incineration below prevention, reuse and recycling in the waste hierarchy, while calling for incineration overcapacity to be avoided¹³.

1.2 The climate policy problem

The Government of India, over the years and more pertinently through the Solid Waste Management 2026 rules, has tried to present WTE incinerators as one of the key solutions to the waste problem and as a sustainable solution. It is important to note that beyond the considerable international downplaying of WTE, there are several contestations about the efficacy of WTEs from some of the government's own institutions, like CSIR-NEERI¹⁴. Nonetheless, Delhi's incinerators are still set to increase in both capacity and number over the next few years, with planned expansion at existing plants and new plants coming up at additional sites. There are four existing WTE plants running at Okhla, Ghazipur, Bawana, and Tehkhand. The reported expansion would add 1,000 tonnes per day of fresh waste-processing capacity at each of Tehkhand and Okhla, with Narela and Ghazipur expected to have their new WTE plants later, by November and December 2028¹⁵.

India's approach towards increasing its waste uptake follows the global narrative where WTE plants have been increasingly promoted as a single solution to three problems: (1) diverting waste from landfills, (2) generating local energy, and (3) cutting greenhouse gas emissions (i.e., climate mitigation). The climate argument rests mainly on avoiding methane. Industry groups leverage the reality that landfills emit significant quantities of methane, a far more potent greenhouse gas than CO₂ and they promote the idea that incinerating residual waste and harnessing its energy leads to "avoided emissions." Operators are also exploring carbon capture, claiming that incineration combined with carbon capture could be net-zero or even net-negative depending on the waste burnt. However, if we are to look at the international approaches, especially from the West, we can clearly see that this

¹⁰ China running out of rubbish to burn as waste power goes into overdrive [Source]

¹¹ Four years of waste sorting leaves China's incinerators short of fuel [Source]

¹² Denmark's realisation of WTE incineration as a hindrance to climate mitigation [Source]

¹³ EU Waste Hierarchy [source]

¹⁴ Waste to energy- smokescreen or solution (CSIR-NEERI) [Source]

¹⁵ Delhi plans to expand WTE plants by 2027 [Source]

climate framing is contested¹⁶. The EU left WTE incineration out of its sustainable finance taxonomy, the list of activities considered to substantially contribute to climate mitigation, and the European Investment Bank has likewise excluded it from financial support¹⁷. Moreover, there are plans to bring WTE plants under the EU-ETS cap, meaning that they will have to pay a carbon price for each tonne of CO₂ emitted¹⁸.

There is significant evidence that shows that WTEs are a significant source of greenhouse gas emissions. Critics cite a Zero Waste Europe findings' estimate that incineration emits 250-600 kg of CO₂ per tonne of waste depending on composition, comparable to burning coal, and argue that it competes with waste prevention and recycling¹⁹. Zero Waste Europe also estimates that the carbon intensity of incinerator energy is roughly twice the EU grid average and that EU incinerators released over **40 million tonnes of CO₂** in 2017²⁰. Most of these emissions come from burning fossil-derived materials such as plastics and synthetic fibres²¹. A peer-reviewed study in *PLOS Climate* found that incinerators emit more greenhouse gases per unit of electricity (1.7 kg CO₂e/kWh) than any other power source, about twice as much as coal, the next most polluting fuel²². In the United States, the United States Environmental Protection Agency estimated that incinerators released **20.2 million tonnes of CO₂** in 2019, equal to the annual emissions of about five coal-fired plants²³. As plastic makes up a growing share of the waste stream, especially in rapidly urbanising Global South cities, the climate cost of incineration is likely to rise.



¹⁶ Can carbon capture make incinerators a net-zero solution european operator [\[Source\]](#)

¹⁷ Waste to energy missing in EU-taxonomy [\[Source\]](#)

¹⁸ Plan to include WTE in the EU-ETS [\[Source\]](#)

¹⁹ WTE incineration has no place in sustainability agenda [\[Source\]](#)

²⁰ The impact of waste to energy incineration on climate [\[Source\]](#)

²¹ Plastic combustion may create surge in WTE plants' climate emissions [\[Source\]](#)

²² Waste incinerators undermine climate goal [\[Source\]](#)

²³ The EU is clear: WTEs have no place in sustainability agenda [\[Source\]](#)

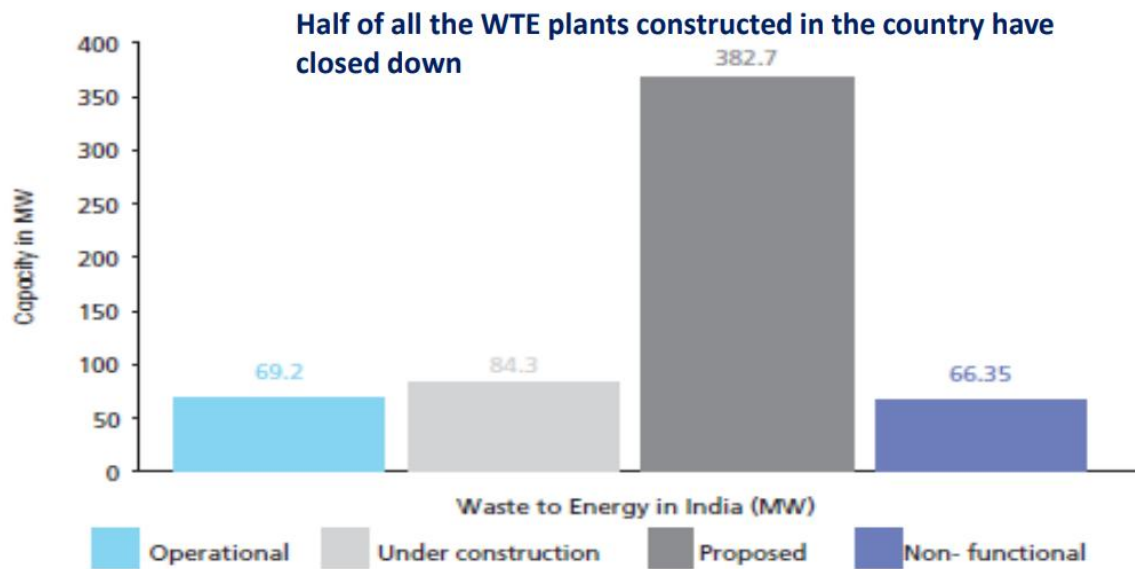


Figure 2: WTE plant performance in India as of 2018. Source: Centre for Science & Environment²⁴

Despite all the mounting evidence, there is still a strong national-level push in the sub-continent (see, e.g., Figure 2). The Government of India states that WTE facilities recover energy from dry, combustible waste such as municipal solid waste with a calorific value above 1,500kCal/kg through incineration, while emissions are controlled using pollution-control equipment, flue-gas treatment, temperature regulation in the combustion chamber, and online emission monitoring systems overseen by State Pollution Control Boards in line with the Solid Waste Management Rules, 2016. As of 28 February 2022, the country had 11MSW-based power plants with a combined installed capacity of 132.1MW, capable of processing roughly 11,000 tonnes of municipal solid waste per day for electricity generation²⁵. Despite the tall claims on the efficiency, protocols and minimising emissions or pollutants from the said plants, the real picture is somewhat dismal. There is strong on-the-ground evidence that shows how WTE plants pollute air, soil, and water through emissions and leachate, contribute to serious health problems in nearby communities, and create financial burdens for local and union governments. They also tend to produce some of the most expensive electricity, leave behind hazardous ash as a residue, undermine waste prevention, reuse, and recycling efforts, and can displace local recycling and waste-management economies²⁶.

²⁴ WTE plant performance in India in 2018 [Source]

²⁵ Waste to Energy plants in PIB [Source]

²⁶ India's waste to energy paradigm [Source]

1.3 Why Delhi?

Delhi's push for waste-to-energy is driven mainly by a widening gap between the waste it generates and what it can process. The city generates nearly 14,000 tonnes of MSW a day, but the Municipal Corporation of Delhi (MCD), handling about 90-95% of the city's waste, can process only 7,841 tonnes per day through its WTE incineration, leaving a daily shortfall of about 6,000 tonnes that ends up at landfills. That shortfall falls on three overburdened dumpsites at Bhalswa, Ghazipur and Okhla, which the MCD has committed to remediating and eliminating²⁷.

There are four operational WTE plants operated by Delhi. The plants at Bawana and Tehkhand have the maximum operational capacity of 2000 tonnes per day (TPD). On the other hand, the plants at Okhla and Ghazipur currently operate at 1950 TPD and 1300 TPD, respectively. In addition to this existing 7250 TPD of waste which can be incinerated, the MCD is currently undertaking the process of adding capacity for 5000 TPD through setting up two new facilities in Narela and Ghazipur²⁸. The push for WTE as a solution comes officially worded as an effort to manage legacy waste sites and handle a growing waste stream more efficiently, with the city generating over 14,000 tonnes of garbage daily²⁹. WTE facilities are seen as a vital tool to shrink towering landfill mountains, eliminate legacy waste, and generate supplementary electricity. It remains pertinent to note that despite the governments' push for WTE plants as a dual-benefit approach of getting rid of waste and adding to the supply side for India's much-needed energy demands, there are some serious considerations about the viability of this approach from all angles. India's approach to WTE has not been new, especially in Delhi, with the first plant operationalised in Timarpur, Delhi, in 1987. It was soon shut down after failing to provide the desired results. Since then, 14 more WTEs of 130 megawatt capacity have been installed, out of which only 7 are operational³⁰. So, this raises some critical questions: despite the historical failures of WTE in India, there is mounting evidence of environmentally damaging outcomes of WTE plants in villages like Bawana, alongside massive resistance across multiple villages³¹. Why are the governments still pushing for the same? More importantly, do we not have any better solutions or international experiences of handling waste?

Cities in the Global South share a distinctive waste profile: food and green waste make up 53% of waste in middle-income countries and 56% in low-income countries, compared with 32% in high-income countries³², and only 28% of waste is collected in low-income countries³³. Delhi reflects these conditions closely. Its waste has a moisture content of 43.8% and a calorific value of only 713 kCal/kg³⁴, and 50-60% of Indian municipal waste is organic³⁵. Governance is fragmented, with the MCD

²⁷ Delhi to expand biogas and waste processing capacity [\[Source\]](#)

²⁸ Delhi plans sixth WTE plant at Ghazipur [\[Source\]](#)

²⁹ City's average waste generation rises to nearly 13,000 MT [\[Source\]](#)

³⁰ Waste to Energy Presentation- CSE [\[Source\]](#)

³¹ Delhi WTE plant faces protest from Bawan residents on environmental concerns [\[Source\]](#)

³² What a waste 2.0 Global Snapshot of Solid Waste Management [\[Source\]](#)

³³ Global South is heading towards a waste tipping point [\[Source\]](#)

³⁴ Evaluation of cost benefit analysis of municipal solid waste management [\[Source\]](#)

³⁵ Recommendations for Long Term Action Plan for Solid Waste Management in Delhi [\[Source\]](#)

managing about 90-95% of the city's waste³⁶, while poor segregation, low public awareness and weak enforcement keep the problem going³⁷. Delhi also has more than three decades of experience with WTE incineration plants, as the first plant in Timarpur was closed because the waste's calorific value was too low.³⁸, and in 2017 Narela-Bawana opened as what was then India's largest WTE plant. Its organic-heavy waste, fragmented governance and long operating record makes Delhi a strong reference case for other Global South cities considering a WTE approach for waste management.

1.4 Objectives

The objectives of the study are as follows:

- a. To quantify the climate implications of electricity generation from municipal waste incineration in four operational WTE plants in Delhi using plant-specific operational and regulatory data.
- b. To assess the implications of the findings for waste policy, climate policy and international climate finance.

1.5 Scope and limitations

- i. This study focuses on the climate-relevant emissions from the incineration of **plastic** (fossil-origin) waste. Other fossil-containing fractions, including synthetic textiles, rubber and composite materials, also contribute additional fossil CO₂ but could not be quantified in the absence of complete plant-specific refuse-derived fuel (RDF) composition data.
- ii. This study strongly acknowledges the importance of biogenic CO₂ emissions from mixed waste incineration. However, the biogenic share of emissions could not be quantified because of the unavailability of plant-specific data on the mass, carbon content and biogenic fraction of the RDF. Consequently, the principal carbon-intensity estimate focuses on fossil-origin CO₂ and should not be interpreted as the total physical CO₂ released at the stack.
- iii. Under IPCC accounting, biogenic carbon emissions (i.e., CO₂ from burning paper, food and wood, etc) from WTE plants are tallied in the land use change sector rather than the power sector. That does not treat them as carbon neutral; it avoids double counting them.
- iv. The study is not a full life-cycle assessment. Upstream emissions associated with process of waste collection, transport, RDF production, auxiliary fuels, construction and infrastructure are not comprehensively modelled.

³⁶ Delhi to expand biogas and waste processing capacity [\[Source\]](#)

³⁷ State of Municipal Solid Waste Management in Delhi [\[Source\]](#)

³⁸ Technological options for Municipal Solid Waste Management plants [\[Source\]](#)

2. Methodology

In this section, we list the data sources and specifications of the four WTE plants, and the frameworks for quantifying the emissions from incineration.

2.1 Data sources

This study uses a combination of regulatory records and plant-specific operational data from the Central Pollution Control Board (CPCB) and the Delhi Pollution Control Committee (DPCC), electricity-sector records from the Delhi Electricity Regulatory Commission (DERC), waste-management data, international emissions guidelines such as the IPCC, and published scientific literature. The sources were selected to enable independent estimation and cross-checking of waste throughput, plastic content, electricity generation, and associated greenhouse gas emissions from the four operational WTE plants in Delhi.

Organisations	Functions and Data Sources
International Panel on Climate Change (IPCC) guidelines and studies	IPCC guidance provides the principal methodological basis for the carbon-accounting framework, including the distinction between fossil and biogenic carbon, carbon content, dry matter, fossil-carbon fraction, oxidation, and conversion of carbon to CO ₂ . The study applies the relevant IPCC approach to estimate fossil CO ₂ emissions from plastics and other fossil-carbon-containing components of municipal solid waste.
Central Pollution Control Board (CPCB), India	CPCB inspection and compliance reports were used as a key source of plant-specific operational and environmental information. These reports provide data on installed processing capacity, authorised power-generation capacity, actual power generation during inspection periods, refuse-derived fuel (RDF) production and feed rates, process flow, pollution-control systems, stack-emission monitoring, ash generation, and other aspects of plant operation.
Delhi Pollution Control Committee (DPCC)	DPCC records, including consent and authorisation documents referenced in the CPCB inspection reports, were used to establish consented waste-processing capacities and authorised operating conditions of the plants. DPCC also participated in joint inspections with CPCB and therefore provides regulatory verification of

	plant-level operating and environmental information.
CPCB Extended Producer Responsibility (EPR) Portal	Data reported through the CPCB's plastic EPR system were used to estimate the quantity of plastic processed by the four WTE facilities. The report also relied on the EPR Portal insights report by the Centre for Science and Environment (CSE), which is again based on the CPCB EPR portal. These data provide plant-level quantities of plastic incinerated under the EPR framework and were used as the basis for estimating the fossil-carbon contribution of plastics in the waste stream.
Delhi Electricity Regulatory Commission (DERC) records	Electricity generation and net electricity exported were obtained from Delhi Electricity Regulatory Commission (DERC) orders and related records of the Delhi distribution companies (DISCOMs). These data were used to distinguish between electricity generated by the plants and electricity exported/sold to the grid and to estimate plant-level gross generation where only net electricity purchases were available.
Central Electricity Regulatory Commission (CERC)	CERC regulations and tariff-related documents were used for electricity-generation parameters where plant-specific data were not consistently available, including the normative auxiliary electricity consumption assumption applied in the calculations. The 15% auxiliary-consumption factor used in this study is therefore treated as a regulatory assumption rather than a measurement of actual auxiliary consumption at each Delhi plant.

Wherever possible, plant-specific values were cross-checked across regulatory inspection reports, electricity-sector records, and reported operational data.

2.2 WTE plant-level specifications

In this section, the greenhouse gas emissions specifically from the **plastic waste** for the four currently operational Delhi-based WTE plants located in **Bawana, Ghazipur, Okhla, and Tehkhand** are calculated. Each plant's installed processing capacity, measured in tonnes per day (TPD) and authorised power generation capacity or rated capacity (measured in MW) are listed in Table 1. The total power generation capacity of the four plants is 84 MW^{39,40}. The total amount of municipal solid waste (MSW), including biogenic and fossil-origin, collected in the plants is calculated using the

³⁹ Draft EIA report for Tehkhand [Source]

⁴⁰ CPCB inspection report [Source]

average TPD reported by the Delhi Solid Waste Monitoring Committee⁴¹, multiplied by 365 (days in 2023). The MSW is then drained of moisture, leading to the formation of refuse-derived fuel (RDF), which is finally used for incineration. As per the CPCB inspection report, 1 tonne of MSW generates around 700 kg of RDF (70%). In this report, when we consider the total amount of waste incinerated, we use the RDF value. The total capacity of the 4 WTE plants is ~7000 TPD. Although the Bawana WTE incineration plant has a reported nominal processing capacity of 2,000 TPD, monthly reported throughput occasionally exceeds this figure by up to 18%, representing operation above nominal design throughput within a potentially variable operating envelope.

The data on the amount of plastics processed (incinerated) in the 4 WTEs of Delhi in 2023, as obtained from the Extended Producer Responsibility (EPR) portal of the Central Pollution Control Board (CPCB) reported by the Centre for Science and Environment, India⁴², is provided in Table 1. The total plastic waste processed consists of three categories of plastics: CAT-I (rigid plastic packaging), CAT-II (flexible plastic packaging of single or multilayer containing different types of plastic), and CAT-III (multilayered plastic packaging mixed with at least one layer of plastic and one layer of non-plastic material)⁴³. In 2023, the total amount of plastic incinerated by the 4 plants is 735,840 tonnes.

WTE plant -->	Bawana	Ghazipur	Okhla	Tehkhand
Maximum capacity [tonne/y]	730000	474500	711750	730000
Capacity used [tonne/y]	862495	339341	656124	673425
Capacity utilisation %	118	72	92	92
Plastic waste [tonne/y]	210240	105120	201480	219000
Yearly total RDF (0.7x MSW) [tonne/y]	603746.5	237538.7	459286.8	471397.5
Fossil origin fraction (plastic waste/RDF)	0.35	0.44	0.44	0.46

Table 1. The maximum and average processing capacity of the plants are obtained from the CPCB Compliance Report of WTE plants in Delhi (footnote 40), and the percentage of the capacity utilisation is reported. The amount of plastics (tonne/year) processed by the four WTE plants in Delhi (Bawana, Ghazipur, Okhla, and Tehkhand) in the financial year 2023 is reported (footnote 4). The amount of yearly processed MSW is the refuse-derived fuel (RDF) weighing 70% of MSW (without moisture), estimated using the average TPD. The fossil-origin waste fraction (amount of

⁴¹ Solid Waste Monitoring Committee, Delhi Pollution Control Committee, Department of Environment, Delhi. [Source]

⁴² Extended Producer Responsibility (EPR) for plastic packaging, Centre for Science and Environment, India. [Source]

⁴³ Registration of PIBO /PWP as per EPR Guidelines Notified by MoEF&CC, CPCB. [Source]

plastics processed/total RDF processed) is also provided. The rated power generation capacity (footnotes 39, 40) is also listed for the 4 WTE plants.

Note: We use megagrams [Mg] and metric tonne [tonne] interchangeably, as the former is used for scientific calculations.

2.3 Estimation of WTE emissions from selected plastic origin waste in Delhi

The calculations in this section are based on the guidelines of the IPCC report on Emissions from Waste Incineration [IPCC Doc 1, hereafter]⁴⁴. Note, in this study, we quantify the fossil-origin emissions from plastic waste alone. Hence, the waste of other kinds and the total MSW (although estimated) do not enter the calculations below.

Incineration of waste in WTE emits climate-relevant gases such as carbon dioxide (CO₂), nitrous oxide (N₂O), nitrogen oxides (NO_x), ammonia (NH₃), and non-methane volatile organic compounds (NMVOCs/TOC), many of which have high global warming potential. In addition to estimating direct fossil CO₂ emissions from incineration, we calculate an energy credit associated with electricity exported from the WTE plants. The energy credit is calculated for the use of waste as a substitute for fossil fuel. This provides a complementary net-emissions metric based on the fossil CO₂ emissions assumed to be avoided through displacement of grid electricity. However, it is worth noting that, given chronic power shortages, it is not necessarily a realistic assessment. In other words, if the WTE did not supply any electricity, it is unclear that other renewable sources plan to increase their production to compensate. The result might just be lower electricity supply and lower emissions.

Two results are reported separately: (1) direct CO₂ emissions from combustion of plastic, expressed per tonne of waste and/or per kWh of electricity generated or exported; and (2) net emissions after energy substitution, calculated as direct emissions minus the estimated emissions from displaced electricity generation.

The amount of the emission of each compound with global warming potential can be quantified as follows:

$$\text{Emission}_i \text{ [Mg]} = \text{emission_concentration}_i \text{ [Mg} \cdot 10^{-9} \text{ /m}^3\text{]} \times \text{exhaust_gas_volume [m}^3\text{/Mg waste]} \times \text{amount_waste_incinerated [Mg waste]},$$

(Eq. 1.1)

⁴⁴ Johnke, B. (2001). *Emissions from Waste Incineration*. In *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Intergovernmental Panel on Climate Change (IPCC) [Source]

where i is the chemical compound, e.g., $\text{CO}_2, \text{CO}, \text{N}_2\text{O}, \text{NO}_x$, etc, the *emission_concentration_i* depends on the chemical compound; *exhaust_gas_volume* is $5500\text{m}^3/\text{Mg}$ waste for standard MSW incineration plants; and *amount_waste_incinerated* is the total heterogenous waste incinerated. In this report, we will use the amount of plastic instead of the total heterogenous waste.

If the actual amount of plastic incinerated is known, we can employ equation 5.1 of IPCC Guidelines for National Greenhouse Gas Inventories⁴⁵ (IPCC Doc 2, hereafter) to obtain *Emission_CO2* more accurately as:

$$\text{Emission_CO2 [Mg]} = \text{SW [Mg Waste]} \times \text{dm} \times \text{CF} \times \text{FCF} \times \text{OF} \times 44/12, \text{ (Eq. 1.2)}$$

where, *Emission_CO2* = CO_2 emissions in inventory year (Mg/yr), *SW* = total amount of solid waste type incinerated (plastic in this case) (Mg/yr), *dm* = dry matter content in the waste, 100% for plastic, *CF* = fraction of carbon in the dry matter (total carbon content), ~75%⁴⁶ by dry weight for plastic, *FCF* = fraction of fossil carbon in the total carbon, 100% for purely fossil waste like plastic, *OF* = oxidation factor, 100% as per the standard base case as per IPCC guidelines, and $44/12$ = conversion factor from C to CO_2 .

Note, *CF* varies widely depending upon the type of plastic. Except PVC, PET, Polyamides, most other commonly used plastics like PE, PP, PS etc have much higher CF by mass⁴⁷. We apply equation 1.1 for calculating the emission of gases other than CO_2 , and equation 1.2 specifically for CO_2 emissions from the incineration of plastic.

To standardise the climate-relevant contributions, greenhouse gas emissions are converted to CO_2 -equivalent emissions using their Global Warming Potential (GWP). The CO_2 -equivalent emission of greenhouse compounds is computed as follows:

$$\text{Emission_i in CO2-equivalent [Mg CO2]} = \text{Emission_i [Mg emission]} \times \text{GWP_i [Mg CO2/Mg emission]}, \text{ (Eq. 2)}$$

where *Emission_i* is the total emission of greenhouse component i , and *GWP_i* is the GWP of that greenhouse gas. GWP values are aligned with Table 2 of the IPCC Doc 1⁴⁸.

The net emissions after energy substitution are computed as follows:

$$\text{Total emission_i_cor [Mg emission]} = \text{Emission_i [Mg emission]} - \text{usable/used energy [kWh]} \times \text{emission factor (power plant mix) [Mg emission} \times 10^{-9}/\text{kWh]}, \text{ (Eq. 3)}$$

⁴⁵ IPCC 2006 Guidelines for National Greenhouse Gas Inventories, Volume 5: Waste, Chapter 5, Equation 5.1. [Source]

⁴⁶ IPCC 2006 Guidelines for National Greenhouse Gas Inventories, Volume 5: Waste, Chapter 2, Table 2.4. [Source]

⁴⁷ Smeaton 2021, Augmentation of global marine sedimentary carbon storage in the age of plastic [Source]

⁴⁸ Johnke, B. (2001). *Emissions from Waste Incineration*. In *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Intergovernmental Panel on Climate Change (IPCC) [Source]

where $Emission_i$ is from Eq.1.1, *usable/used energy* is country-specific, and the *emission factor* values are aligned with Table 2 of the IPCC Doc 1.

The CO₂ equivalent of the corrected emission is given by:

$$Total\ emission\ CO2-equivalent_i_{cor} [Mg\ CO2] = Total\ emission_i_{cor} [Mg\ emission] \times GWP [Mg\ CO2/Mg\ emission], (Eq. 4)$$

where $Total\ emission\ CO2-equivalent_i_{cor} [Mg\ CO2]$ and $Total\ emission_i_{cor} [Mg\ emission]$ are from Eq. 3, and GWP values are the same as in Eq. 2.

Emissions from the use of auxiliary fuel (diesel or light diesel oil)

WTE is not entirely “self-sustaining” with just MSW. A WTE company's filing with the Central Electricity Regulatory Commission (CERC) admits continued auxiliary fuel dependence for temperature maintenance and regulatory compliance. It is generally 2 - 4 L of diesel or light diesel oil per tonne of MSW incinerated⁴⁹, and the equivalent fossil emissions are to be considered approximately 1 L diesel $\approx$ 2.6 kg CO₂ e stack emissions⁵⁰. So, we add this contribution to emissions to Eq. 4.

2.4 Electricity generation methodology

The gross (total) electricity generated per year by a plant is calculated as:

$$Gross\ electricity = rated\ capacity [MW] \times 24 [hours] \times 365 [days] \times PLF, (Eq. 5)$$

where rated capacity is the maximum power the plant can produce, and PLF is the Plant Load Factor, which determines the plant capacity utilisation in a given period of time. i.e., how much electricity a plant actually generated compared to the maximum it could have generated if it operated at rated capacity for the entire period.

The net electricity exported by the plants is calculated as follows:

$$Net\ exported\ electricity = Gross\ electricity \times (1 - auxiliary\ use\ fraction), (Eq. 6)$$

where *net exported electricity* is reported by the plants as the amount of electricity purchased by Distribution Companies (DISCOMs), and the *auxiliary use fraction* is the amount used for the functioning of the plant itself. A 15% is a normative assumption used for the *auxiliary use fraction* from the CERC's 2024 tariff regulations⁵¹ for RDF-based MSW projects; it is not a measured auxiliary-use rate for any Delhi plant.

⁴⁹ EU Commission Staff Working Document Impact Assessment [Source]

⁵⁰ Carbon footprint of burning diesel [Source]

⁵¹ CERC's 2024 tariff regulations [Source]

3. Results

This section presents the quantification of various indicators of climate impacts of waste incineration in Delhi in 2023. The calculations can be openly accessed on our [GitHub](#)⁵².

The MSW is a heterogeneous mixture of wastes, whose components are distinguished based on the source of the carbon, whether biogenic (produced by living organisms or biological processes, e.g., wood, paper, etc.) or of fossil origin (produced from carbon stored over geological timescales in the Earth's crust, e.g., plastic). Under IPCC guidelines, **only fossil-origin CO₂ is accounted** from waste incineration in national GHG inventories as it claims biogenic carbon emissions (i.e., CO₂ from burning paper, food and wood, etc) from the power sector should be tallied in the land use change sector to avoid double counting⁵³.

Because of limited data availability, we could only calculate the plastic fossil CO₂ emissions, however, the total emissions from MSW incineration are significantly higher (also highlighted in Section 1.5). This is particularly true for NO_x which is mostly generated by food waste/biomass^{54,55}. In addition, burning biomass often produces more CO₂ per unit of energy than coal or natural gas because biomass is less energy-dense, and this is an additional emission to the atmospheric CO₂⁵⁶. As we do not have the exact quantity of heterogeneous waste incinerated, we continue with the estimation of only the fossil-origin CO₂ emissions from plastic waste from the Delhi WTE plants.

3.1 Fossil-origin CO₂ emissions

The IPCC Doc 1 states that the incineration of 1Mg of MSW can release about 0.7 to 1.2 Mg of CO₂. Given that these emissions come from standard heterogeneous MSW, they suggest 1Mg of waste contributes ~0.33 Mg CO₂e from fossil origin, which is climate-relevant, and ~0.67 Mg CO₂e from biogenic origin, which is not accounted for. The average climate-relevant CO₂ emission is reported to be 0.415 Mg CO₂ per 1 Mg of waste without any further justification. However, studies have reported fossil CO₂ in the range 41-52%^{57,58} of the total emission in countries like Switzerland and UK, whereas, the value is as low as 21% in Japan⁵⁹. The UK Without Incineration Network's study reports an average 13% higher predicted emissions from the biogenic waste than

⁵² GitHub repository with the calculations of this study [\[Source\]](#)

⁵³ Misunderstanding of IPCC's accounting of emissions from non-fossil-origin waste incineration [\[Source\]](#)

⁵⁴ Waste Incinerators undermine clean energy goals, Neil Tangri. [\[Source\]](#)

⁵⁵ Questions and answers on Biogenic carbon in Waste and Climate Change, Neil Tangri, GAIA. [\[Source\]](#)

⁵⁶ Energy Justice Network. Comparison of Most Relevant Air Emissions: Fossil Fuels to Wood Burning Biomass and "Construction and Demolition Debris." [\[Source\]](#)

⁵⁷ Mohn et al., 2012, Yearlong radiocarbon study on fossil and biogenic CO₂ [\[Source\]](#)

⁵⁸ Muir et al., 2015, Determining the biomass fraction of mixed waste fuels [\[Source\]](#)

⁵⁹ Tabata et al., 2013, Waste-to-energy incineration plants as greenhouse gas reducers: A case study of seven Japanese metropolises [\[Source\]](#)

reported⁶⁰. This is because the municipal solid waste is inherently heterogeneous, and its composition varies continuously over time and across locations. Any MSW characterisation, therefore, yields only site- and time-specific estimates, not generalisable emission factors. Our estimates (see Table 1) points to the percentage of fossil CO₂ emissions in a typical Indian metropolis to be 35-46% as per the Delhi data.

Fortunately, for our study, we have the actual amounts of plastic (fossil-origin) waste incinerated in the Delhi WTE plants. Hence, we calculate the emissions from just one particular waste component. Using the methodology in Section 2.3, the **total CO₂ emissions** from the 4 Delhi-based WTE plants (only from plastic) are **2.1 megatonnes** (1.7 million tonnes, applying energy credit correction) in 2023. The fossil-origin CO₂ **emissions per tonne of RDF** for the plastic waste burnt are **0.96 tonnes** (Bawana), **1.22 tonnes** (Ghazipur), **1.2 tonnes** (Okhla) and **1.3 tonnes** (Tehkhand). For comparison, as per the UK national pollution inventory⁶¹, incineration of 1 tonne of MSW produces 0.7 to 1.7 tonnes of CO₂.

3.2 Fossil carbon intensity of electricity generation

In this section, we calculate the gross electricity generated by the plants and find the amount of CO₂ emissions per kWh of electricity generated. The latter quantity is measured in the unit of kg CO₂e/kWh.

To apply Eq. 5, we need to know the PLF of these plants (i.e., the quantity of electricity generated as a percentage of 365 days of uninterrupted generation at rated capacity) so that we can get an accurate estimate of the gross electricity exported over the year. As we did not find any direct number for PLF, we used the net electricity export data of the plants to make an estimate. Below is the information from two plants, Bawana and Okhla, whose net electricity export data is obtained from reliable sources. The data for the other two plants is limited and hence unreliable to be extrapolated for the whole year.

Bawana: The net recorded exported electricity is 40.26 + 57.70 + 32.96 + 7.02 = 137.94 GWh, purchased by TPDDL⁶², BRPL⁶³, BYPL⁶⁴, and NDMC⁶⁵, respectively. DERC allocates 100% of Bawana's power to these DISCOMs in the year 2022-2023. Accounting for auxiliary consumption in the plant (inverting Eq. 6), the gross electricity is 137.94 / 0.85 = 162.28 GWh/year.

⁶⁰ UKWIN's Good Practice Guidance for Assessing the GHG Impacts of Waste Incineration [Source]

⁶¹ Incineration activities: pollution inventory reporting, UK, 2024 [source]

⁶² Tata Power Delhi Distribution Limited (TPDDL) [Source]

⁶³ BSES Rajdhani Power Limited (BRPL) [Source]

⁶⁴ BSES YAMUNA Power Limited (BYPL) [Source]

⁶⁵ New Delhi Municipal Corporation (NDMC) [Source]

Okhla: The plant recorded Delhi DISCOM purchases of 48.77 (TPDDL) + 60.60 (BRPL) = 109.37 GWh in the year 2022-2023. DERC's allocation order assigns 76.65% of TOWMCL/Okhla⁶⁶ power to Delhi DISCOMs. So, the net export is $109.37 / 0.7665 = 142.69$ GWh, and the gross electricity generated is $142.69 / 0.85 = 167.87$ GWh/year.

We now estimate the PLF by reversing Eq.5, i.e., dividing our estimated values of gross electricity by rated power * 24 hours * 365 days. The derived PLF is 77% for Bawana and 83% for Okhla, which have reliable data. So, we assume a PLF of 80% for all plants.

Finally, using Eq. 5, the total estimated electricity generated by the 4 WTE plants in 2023 (summing over the maximum rated capacity of 84 MW) is **500371 MWh**.

Key findings:

- Using the Delhi WTE data and applying the energy credit corrections (Eq. 4 and 5), **1.7 megatonnes of RDF (~40% plastic) emitted 2.0 megatonnes of CO₂/yr (1.7 megatonnes with energy credit correction).**
- Dividing the total CO₂ emissions by the total electricity generated in 2023 results in emissions of **3.4 kg CO₂e per kWh** for only fossil-origin waste. For comparison, in FY 2022-2023, the emissions from Indian coal power plants were **0.73 kg CO₂e per kWh**⁶⁷.
- On average, **282.38 kWh** of net electricity is exported **per tonne of RDF** incinerated in Delhi.

We also compared this to the reported (observed) electricity exported, plant-wise, for Okhla and Bawana. Using the plant-specific CO₂ emissions (Section 3.1) and the net electricity produced (Section 3.2), the CO₂e emissions are 3.1 (Okhla) and 3.4 (Bawana)kg CO₂/kWh. The gross electricity generation data for Ghazipur and Tehkhand are unreliable due to limited data on the electricity exports by the plants. So, our estimated value is an upper limit, which agrees with plants like Okhla and Bawana, and might not reflect the other plants, which might have lower PLF.

3.3 Plant-level cross-check of the electricity generation data

As a plant-level cross-check of the electricity-generation estimates used in this study, we compared the annualised results of our model with data from the Central Pollution Control Board (CPCB) inspection⁶⁸ of the Okhla WTE plant on 21-22 September 2020. The CPCB inspection report provides hourly power-generation observations for the two monitoring days and records the plant's rated power-generation capacity as 23

⁶⁶ Timarpur-Okhla Waste Management Company Limited, a Part of Jindal group (TOWMCL) [Source]

⁶⁷ Central Electricity Authority's weighted-average emission factor [source]

⁶⁸ CPCB Inspection report of the Delhi WTEs [Source]

MW. The observed power-generation values were predominantly in the range of approximately 18.5-21.5 MW.

Using the hourly observations reported by CPCB, the average power generation during the two-day monitoring period was approximately 19.93 MW. For comparison, the 80% plant load factor (PLF) assumed in this study corresponds to an average gross generation of 18.4 MW for the 23 MW-rated Okhla plant ($23 \text{ MW} \times 80\%$). The similarity between these values provides a plant-level cross-check on the reasonableness of the assumed PLF.

To estimate net electricity export from the CPCB-observed generation, we apply the indicative auxiliary-use fraction of 18.75% derived from the same inspection report. This gives approximately 16.19MW of net electricity export, equivalent to approximately 141.8 GWh/year when annualised. By comparison, the net electricity export estimated for Okhla WTE in this study is 137.0 GWh/year. The difference is approximately 4,818 MWh/year, or a mere 3.4%.

This comparison provides an independent plant-level consistency check on the order of magnitude of the electricity-generation estimate used in this study. It should not, however, be interpreted as an independent verification of annual electricity generation. The CPCB data represent a limited monitoring period at Okhla for which data were available. Actual electricity generation and export can vary with RDF feed rate and quality, moisture content, calorific value, plant operating conditions, maintenance and other factors. The purpose of the comparison is therefore to assess whether the modelled electricity output is broadly consistent with observed plant-level operating data, rather than to derive a universal electricity-generation or auxiliary-consumption coefficient for WTE facilities.



4. Discussion and implications

4.1 What does the carbon intensity of WTE electricity mean?

The central finding of this study is that the electricity generated by Delhi's waste-to-energy (WTE) incinerators is extraordinarily carbon-intensive at about **3.4 kg CO₂ per kWh of electricity generated from the fossil fraction of the waste alone**. For comparison, the Central Electricity Authority's weighted-average emission factor⁶⁹ for Indian grid electricity was **0.727 kg CO₂/kWh in FY2023-24**, including renewable electricity. This emission factor is also falling every year as the percentage of non-carbon electricity production, like solar, wind, hydro, etc., is growing fast. Coal, which is the highest CO₂-emitting fuel used to produce electricity, has an emission factor of 0.978 kg CO₂/kWh. Against these benchmarks, the Delhi WTE plant's carbon intensity is about approximately **4.7 times the national grid average** and about **3.5 times that of coal**. The study estimates that combustion of plastics in the four incinerators generated approximately 2.1 million tonnes of fossil-origin CO₂ per annum from these incinerators, equivalent to the emission from about **1.44 million cars**⁷⁰.

The finding is especially significant because WTE electricity is frequently presented as a substitute for fossil-fuel generation; our results show that, on a direct fossil-CO₂ basis, the electricity produced from Delhi's mixed waste carries a much larger carbon burden per unit of electricity than the coal-heavy Indian power system it is supposedly helping to displace.

4.2 The problem with the “renewable energy” tag for incinerators and policy dilutions

The Ministry of New and Renewable Energy (MNRE) classifies WTE incinerators that burn MSW as a renewable energy source. Municipal solid waste is not itself a renewable fuel. It is a heterogeneous mixture containing both biogenic and fossil-origin materials.

The scale of the fossil component in Delhi's incinerators highlights the problem. The four operational WTEs incinerated about 735,840 tonnes of plastics in 2023, equivalent to around 2,016 tonnes every day. Our analysis estimates approximately 1.77 million tonnes of RDF generated annually from the four plants, and plastics constituted roughly 42% of the estimated RDF feed by mass. About 99% of all plastics⁷¹ are of fossil origin, and labelling the electricity generated from 42% fossil fuels as

⁶⁹ Central Electricity Authority's weighted-average emission factor [\[source\]](#)

⁷⁰ Car-equivalent emissions [\[source\]](#)

⁷¹ What do plastics have to do with climate change? [\[source\]](#)

“renewable” is therefore fundamentally flawed. In the FY 2017-18 the Okhla WTE plant reported the sale of Renewable Energy Certificates for ₹78,00,900⁷². Furthermore, under the REC regulation 2022,⁷³ municipal-solid-waste projects were assigned a Certificate Multiplier of 2, meaning eligible projects commissioned after the regulations came into force could receive two RECs for each MWh of eligible electricity generated and injected into the grid. Thus, renewable attribution to WTE incinerators is also monetised by these companies in the form of the sale of RECs.

The attribution of the “renewable” label to WTE incinerators promotes burning of materials that could instead be prevented, reused or recovered. Once plastic enters an incinerator, its material value is destroyed, and its fossil carbon is converted into emissions. A circular-economy approach would instead seek to reduce unnecessary plastic production and retain materials in use through reuse and recycling.

In 2025, the Central Pollution Control Board (CPCB) introduced a separate “Blue Category” for Essential Environmental Services, which included WTE incineration. This reclassification provides regulatory advantages, including extended consent-to-operate validity, despite WTE previously being classified as a Red-category sector with a Pollution Index of 97.6. A separate assessment by the Centre for Financial Accountability, applying CPCB’s methodology to Delhi’s four WTE plants, estimated a Pollution Index of 100 out of 100⁷⁴. While this index measures pollution potential rather than climate emissions, the findings highlight the contradiction in treating incineration as an essential environmental service despite its substantial pollution burden and hazardous ash generation.

4.3 The plastic paradox: when burning plastics can generate EPR value

India’s Extended Producer Responsibility (EPR) framework⁷⁵ for plastic packaging was introduced to make Producers, Importers and Brand Owners (PIBOs) responsible for the management of the plastic packaging they place in the market. In principle, such a system should shift responsibility upstream, encourage better packaging design and reduce the production of single-use plastics. However, the same framework explicitly recognised WTE incinerators as Plastic Waste Processors and allowed them to generate EPR certificates equivalent to the quantity of plastics that these plants incinerate.

This produces what can be described as the plastic paradox: A regulatory architecture that was introduced to shift responsibility upstream has attached economic value to the act of burning plastics. Delhi alone accounted for 735,840 tonnes of plastic packaging waste reported as “processed” during the analysis period. Furthermore,

⁷² Okhla WTE Renewable Energy Certificate [\[source\]](#)

⁷³ REC regulation 2022 [\[source\]](#)

⁷⁴ 100/100 Pollution Index [\[source\]](#)

⁷⁵ CPCB EPR framework [\[source\]](#)

JITF Infralogistics, a major WTE operator in Delhi, reported generating ₹3.85 crore⁷⁶ in revenue by burning plastics and selling the EPR certificates.

This allows a plastic producer to continue placing large quantities of disposable plastic packaging on the market and fulfil its legal obligation by purchasing certificates associated with the processing of waste after consumption. The system does not necessarily require the producer to redesign the packaging, reduce its use of virgin plastic, introduce refill and reuse systems, or eliminate single-use plastic packaging.

4.4 Carbon credits and climate-accounting integrity

Issuance of carbon credits to incinerators presents a striking contradiction. The Okhla WTE plant in Delhi was registered under the UN Clean Development Mechanism (CDM) as a project intended to generate emissions reductions through waste treatment and energy generation and claimed annual emissions-reduction potential of **262,791 tonnes of CO₂ equivalent** for the project. Furthermore, **622,785 Certified Emission Reductions (CERs)** were issued across the monitoring periods by the UN⁷⁷.

Issuing carbon credits to the most carbon-intensive form of electricity raises a serious carbon-market integrity question. Furthermore, moving beyond the “carbon tunnel” vision, these incinerators have long-standing public health and environmental pollution concerns. For example, a 2020 CPCB inspection of the Okhla WTE plant found dioxin and furan emissions at Okhla at nearly nine times the permitted level. A recent New York Times investigation⁷⁸ on the same plant exposed over one million residents to toxic heavy-metal emissions while continuing to earn carbon credits.

4.5 The electricity-generation myth

WTE is attractive to policymakers partly because of the promise to convert a waste crisis into an energy resource. Yet the amount of electricity actually recovered from Delhi's mixed waste is dismal, to say the least.

Our calculations estimate 282.38 kWh of net electricity exported per tonne of RDF incinerated. Given the assumed conversion of one tonne of MSW into 700 kg of RDF, this is equivalent to only about 197.66 kWh of net electricity per tonne of raw MSW. Thus, the electricity generation myth also gets busted, as the report finds that together, these four WTE incinerators generate only less than 1.5% of the total electricity demand⁷⁹ of the city of Delhi.

This is the lowest energy yield from any electricity generation source. Furthermore, this is much lower than the commonly reported electricity and heat generation from

⁷⁶ JITF Infralogistics annual report [\[source\]](#)

⁷⁷ A UN-backed carbon offsetting project is poisoning my neighbourhood [\[source\]](#)

⁷⁸ Is a ‘Green’ Revolution Poisoning India’s Capital? [\[source\]](#)

⁷⁹ Delhi electricity demand [\[source\]](#)

waste in Western countries, which is up to 700kWh per tonne of waste incinerated, on top of about 1250 kWh/tonne for heat output to district heating⁸⁰. Delhi's estimated output of roughly 197.66 kWh per tonne of raw MSW is therefore less than one third of the electricity yield in the Western countries. This variation reflects the typical moisture-rich, poorly segregated and low calorific value in the Global South countries.

Delhi therefore demonstrates a difficult proposition for WTE: the technology may produce electricity, but under local waste conditions it produces abysmally little electricity from each tonne of raw waste while carrying a very high fossil-carbon burden for each unit of electricity generated.

4.6 From phase-down in the Global North to expansion in the Global South

While countries in the Global North are phasing out and phasing down WTE incinerators because of climate, financial and environmental costs, the technology continues to be sold to the Global South as a clean and climate-friendly waste management energy solution.

The EU has made WTE incineration ineligible⁸¹ for any funding in all the latest granting measures such as the Just Transition funds, the regional development and the cohesion fund or the EU taxonomy of sustainable finance. In September 2025, Zero Waste Europe and 155 other civil-society organisations called for an EU-wide moratorium on new incinerators⁸², as European incinerators already have at least 60 million tonnes per year more capacity than the amount of residual waste available to burn. Between 2000 and 2024, 54 incinerators the USA were shut down, and no new incinerators have been built on a new site since 1995⁸³. California, the richest state of the US, shut down its last incinerator in 2025 because of financial, environmental and climate concerns⁸⁴.

A 2023 Climate Policy Initiative assessment⁸⁵ of global methane-abatement finance found that, of the US\$4.1 billion per year tracked for the solid-waste subsector in 2021-22, 94% went to waste incineration. The pipeline of new WTE incinerators across Asia and the Pacific illustrates how this financing and policy model is being reproduced. In Bangladesh⁸⁶, the Asian Infrastructure Investment Bank approved US\$100 million in financing in 2025 for the North Dhaka WTE project, comprising four incineration lines and two 35 MW turbine-generator systems, designed to process more than 3,000 tonnes of waste per day. In the Philippines⁸⁷, a PHP4 billion project in New Clark City is being advanced as the country's first large-scale WTE facility, designed to process 600 tonnes of municipal waste per day and generate 12MW of

⁸⁰ Waste Management Options and Climate Change:European Commission [\[source\]](#)

⁸¹ GAIA Submission on the Asian Development Bank's DraftEnergy Policy 2021 [\[source\]](#)

⁸² Zero Waste Europe calls for moratorium on new incinerators [\[source\]](#)

⁸³ FACT SHEET: Trash Incinerator Closures 2000-2025 [\[source\]](#)

⁸⁴ Why California Moved Away from Waste Incineration [\[source\]](#)

⁸⁵ Climate Policy Initiative Assessment [\[source\]](#)

⁸⁶ WTE investment in Bangladesh [\[source\]](#)

⁸⁷ WTE investment in the Philippines [\[source\]](#)

electricity. In Malaysia⁸⁸, the 3,000-tonnes-per-day Jeram WTE facility was under advanced construction in 2025, with a planned electricity capacity of 52MW. In Indonesia⁸⁹, the government has accelerated a national PSEL programme, with 11WTE facilities projected to become operational in stages by 2028.

While the Global North is increasingly grappling with the consequences of its incineration infrastructure, the model is being exported and expanded across the Global South in the name of climate finance, becoming a classic case of environmental racism.

4.7 Alternatives: an actual zero-waste pathway

The Delhi experience does not imply that cities must choose between incineration and unmanaged dumping. A different pathway, a truly zero-waste one, is possible: one that treats waste as a resource to be prevented, reused, repaired, composted and recovered, rather than as fuel for a combustion plant.

The Green Chennai Initiative (GCI)⁹⁰ serves as a zero-waste roadmap for managing Chennai's approximately 7,600 tonnes of daily MSW. The plan envisages source segregation, decentralised organic waste management, material recovery, waste prevention, and the integration of waste workers. A zero waste system could create at least 6,356 new jobs and 286 green start-ups, generate approximately 339,012 tonnes of organic manure annually, reduce per-capita waste generation by at least 15%, and generate ₹277-388 crore in annual savings for the Greater Chennai Corporation. The document also estimates approximately 1.3 million tonnes of CO₂ emissions avoided annually through the model and identifies direct public-health benefits for approximately 2 million people.

Pune provides an excellent example of the integration of informal waste pickers into a functioning municipal waste system. SWaCH, a workers' cooperative of waste pickers, currently integrates more than 4,000 waste pickers, serves around 1 million properties, and reports recycling or diverting more than 82,000 tonnes of waste annually⁹¹. Similarly, Hasiru Dala in Bengaluru has worked to integrate informal waste pickers into the city's solid waste management system. A study by Hasiru Dala estimated that around 15,000 waste pickers in Bengaluru recover approximately 1,050 tonnes of waste every day, generating an estimated ₹84crore in annual savings⁹² for the municipal corporation through avoided collection and transportation costs.

A meta-analysis⁹³ of 36 studies spanning 16 countries that examined the job creation potential of various waste management strategies found that a zero-waste system involving the waste pickers, aggregators and recyclers creates around 70 times as

⁸⁸ WTE investment in Malaysia [\[source\]](#)

⁸⁹ WTE investment in Indonesia [\[source\]](#)

⁹⁰ Green Chennai Initiative [\[source\]](#)

⁹¹ SWaCH cooperative [\[source\]](#)

⁹² Hasiru Dala study [\[source\]](#)

⁹³ Zero Waste and Economic Recovery [\[source\]](#)

many jobs as WTE incinerators. “These centralized WTE incinerators not only steal the livelihoods of the waste pickers but also impact their health severely because they are often located near the existing dumpyards where these people live”, says Kabir Arora, General Secretary of the International Alliance of Waste Pickers (IAWP)

A metropolitan city of the global south handling thousands of tonnes of waste every day can use the same material stream to create employment, produce compost and biogas, recover recyclable materials, reduce waste generation and lower municipal expenditure, rather than committing itself to decades of feeding a capital-intensive incinerator which has climate, environmental, public health and livelihood harms.

4.8 The "methane avoided" comparison is not the right benchmark

WTE projects are also frequently justified by claiming that incineration prevents methane emissions that would otherwise arise from landfilling⁹⁴. While there is a real methane problem associated with poorly managed landfills, using this argument as the principal justification for building WTE incinerators creates a much worse problem.

The Indian Solid Waste Management Rules, 2026⁹⁵, mandate waste segregation into wet, dry, sanitary and special-care streams. The segregated wet waste is intended for composting or biomethanation at the nearest appropriate facility, and dry waste, including plastic, paper, metal and glass, is to be channelled to material recovery facilities for sorting and recycling.

However, in the case of Delhi, it already incinerates about 7,250 tonnes of municipal solid waste, or about 70 per cent of its total MSW, every day. Plans are also afoot to incinerate an additional 6,402 tonnes of waste using new incinerators, thus effectively pushing for 100% incineration of all its waste by 2027⁹⁶. Almost all of the new WTE plants proposed in the Global South advocate for indiscriminate burning of unsegregated waste, thwarting existing policies that place prevention, reuse and recycling above energy recovery in the waste hierarchy, which have a higher potential to reduce greenhouse gas emissions than incineration-based approaches.

The United Nations' own guidance framework specifically cautions against using WTE incinerators as a stand-alone solution, especially in the Global South countries. UNEP also explicitly states that waste prevention and the 3Rs—reduce, reuse and recycle—should be the top priorities and warns that WTE can create technological lock-in by removing incentives to reduce waste generation⁹⁷.

⁹⁴ Landfill Vs Waste to Energy plant [\[source\]](#)

⁹⁵ Solid Waste Management Rules 2026 [\[source\]](#)

⁹⁶ Solid Waste Monitoring Committee [\[source\]](#)

⁹⁷ UNEP Waste to Energy [\[source\]](#)

5. Recommendations

As municipal waste incineration continues to be promoted as a climate, waste and an energy solution, this report has highlighted how WTE incinerators have the highest climate emissions for electricity generation. The financial, regulatory and carbon-accounting systems have supported WTE incinerators by incentivising plastic combustion, undermine waste prevention and recycling, and obscure the climate impacts of incineration. Removing these systemic incentives is therefore essential to align waste management with the waste hierarchy and ensure that climate finance supports genuinely low-carbon, resource-efficient and socially just zero-waste systems. The following recommendations set out key measures to achieve this-

Exclude municipal waste incineration from climate finance

Multilateral, bilateral and national climate-finance institutions should formally exclude new and expanded municipal waste incineration, including RDF-based mass combustion, co-processing, etc., from climate mitigation finance, including loans, grants, technical assistance, viability-gap support, green bonds, etc.

End carbon crediting of municipal waste incineration

Generating climate credits from municipal waste incineration should be stopped, and a mechanism should be developed for cancellation or withdrawal of carbon credits issued under the CDM mechanism to waste incinerators.

Remove waste incineration from renewable/green-energy classifications

Mixed-MSW incineration should be excluded from renewable-energy classifications and associated renewable-energy incentives. Furthermore, climate and energy policies should distinguish genuinely renewable biogas systems from electricity generated through combustion of mixed waste containing fossil-derived materials.

Stop Extended Producer Responsibility (EPR) from rewarding plastic incineration

EPR systems should prioritise reduction, reuse, refill, redesign, collection and material recycling, and should not provide plastic credits or EPR credits for the combustion of plastic waste.

Withdraw WTE incineration from the Blue Category

The CPCB should withdraw municipal waste incineration from the Blue Category of Essential Environmental Services and ensure that its pollution classification, consent-to-operate requirements, inspections and environmental surveillance adequately reflect the sector's pollution potential and hazardous waste generation.

Make the actual zero-waste pathway a condition of climate finance

Climate finance should be provided only for “Zero waste” systems that demonstrate waste prevention, reuse, source segregation, material recovery, recycling and biological treatment including formal integration of waste pickers.

End the “methane avoided” loophole in climate accounting

Climate-finance and carbon-credit methodologies should not treat the diversion of municipal waste from landfill, by itself, as evidence that incineration delivers a climate benefit. A methodology that credits incineration for “avoiding” landfill methane without fully accounting for the CO₂ released through combustion can therefore overstate the climate benefit of burning mixed municipal waste. Instead, baseline scenarios should reflect realistic, policy-compliant and higher-value waste-management pathways suited for the local context.

Support closure and decommissioning of existing incinerators

Public finance should support the safe closure and decommissioning of existing incinerators, along with remediation and a just transition plan towards less carbon-intensive waste management.



6. Conclusion

Incinerators are often promoted as a single solution that reduces waste, generates electricity, avoids landfill methane, and helps mitigate climate change. Our analysis of Delhi's four operational waste-to-energy (WTE) plants tells a different story. Electricity generated from the fossil fraction of municipal waste has a carbon intensity of about 3.4kg CO₂ per kWh, making it the most carbon-intensive electricity in India and, by extension, the world.

This report quantifies the problem. In 2023, the four plants burnt roughly 735,840 tonnes of plastic, yet recovered only about 197.66 kWh of net electricity per tonne of raw municipal solid waste (MSW). Large volumes of fossil material are burnt for very little energy, which explains the extreme carbon intensity.

Furthermore, incineration destroys materials such as plastics and organics that could otherwise be reduced, reused or recovered. If electricity generated from mixed municipal waste can have a carbon intensity several times higher than the electricity system it is supposedly helping to decarbonise, the classification of such electricity as renewable energy illustrates how climate accounting obscures rather than resolves the climate implications of waste combustion.

By technicalising the waste crisis, policy can reduce a socio-politico-economic problem to a mere question of finding the right technology to process an ever-growing quantity of waste. This shifts attention away from the forces that generate waste, particularly the production of short-lived plastics and unsustainable consumption patterns, and away from the people and systems that already recover value from discarded materials. No technological intervention can resolve the waste crisis without addressing the production of waste itself and recognising the existing ecosystem of waste pickers, workers, aggregators, sorters and recyclers.

The implications of this research extend beyond Delhi and India, particularly to countries in the Global South that share similar waste characteristics and waste-management conditions including high organic and moisture content, relatively low calorific value, inadequate source segregation, and the significant role of waste pickers/workers and informal and decentralised material-recovery systems. While countries in the Global North are increasingly moving away from incineration, it continues to be promoted across the Global South as an advanced waste-management and climate solution. There is an urgent need for the Global South to avoid replicating an incineration pathway and leapfrog instead towards zero-waste systems that many communities and municipalities are already demonstrating.

Today's planetary crisis requires us to move beyond a narrow "carbon-accounting lens" and recognise the broader environmental, social, livelihoods and financial implications of waste incineration. Climate finance should not be used as a tool to reinforce waste colonialism but should instead invoke climate justice and support

systems that prevent waste at the source, retain materials in use, protect and strengthen waste workers, and deliver genuine climate benefits.



