REPORT LAUNCH:

Asia Waste Methane Comparative Analysis

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REPORT LAUNCH:

Asia Waste Methane Comparative Analysis

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Webinar Agenda

Time	Agenda	Presenter
16:00 - 16:05 (5’)	**Introduction**	Emcee
16:05 – 16:15 (10’)	**Presentation: Chapter 2** **Insights from Country Profiles on Waste**	**Suyash Nandgaonkar** EPIC India
16:15 – 16:25 (10’)	**Presentation: Chapter 1&3** **Rationale and Key Takeaways from Comparative Analysis Study**	**Sanghyun Ma** Solutions for Our Climate
16:25 – 16:30 (5’)	**Presentation Q&A**	**Suyash Nandgaonkar**, **Sanghyun Ma**
16:30 – 17:20 (50’)	**Panel Discussion:** **What Makes Waste Methane Reduction Scalable?** **Enablers and Regional Collaboration** • Regional findings and requisites for collaboration • India Case and Scale-up Enablers • Finance Schemes and Access Pathways	Chair: **Miho Hayashi,** Institute for Global Environmental Strategies Panelists : **Ngoc-Bao Pham,** Institute for Global Environmental Strategies **Swarna Dutt,** EPIC India **Huma Qazi,** auctusESG
17:20 – 17:30 (10’)	**Q&A, Photo Session**	Emcee

Asia Waste Methane Comparative Analysis - Chapter 2 Country Insights

Suyash Nandgaonkar
Senior Research and Policy Associate, EPIC India
05-Jun-2026

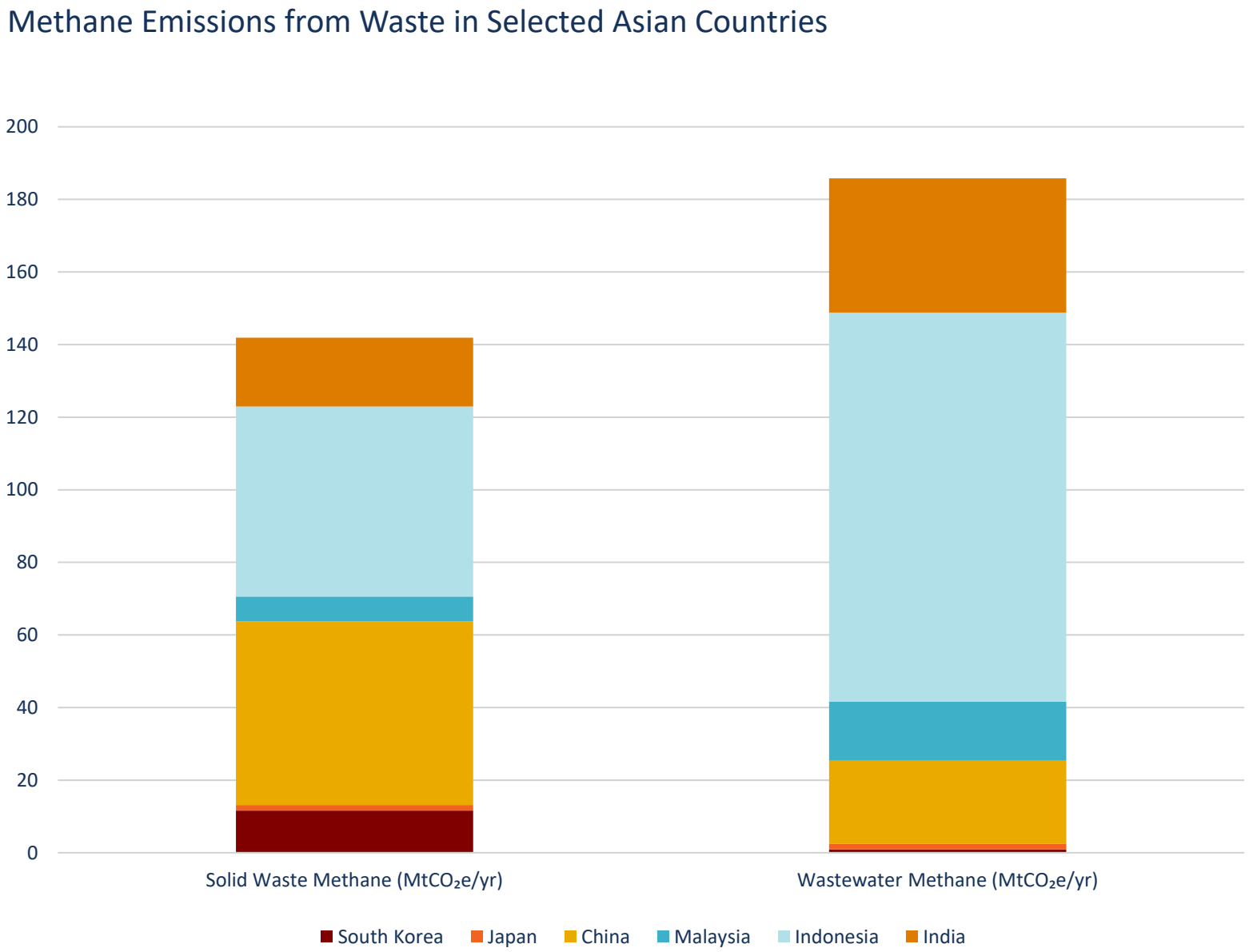
Scale of the problem

Wastewater methane is higher than solid waste

Trend similar across Asia

Country-specific factors like Palm Oil Mill Effluent in Malaysia, treatment gaps in Indonesia and India dominate wastewater-based methane

Rapid urbanisation and demographic pressure adds to solid waste methane challenge



*Note: Numbers are indicative and a from a mix of years from 2021-2025 (latest available official numbers for each country). Sourced from the report.

WHAT WORKS

- Pay As You Throw – PAYT. Incentive based collection *(South Korea)*
- City-level mandates, structural government led shift *(China)*
- Door to door collection and material recover. Labour intensive post collection segregation *(India/Indonesia)*
- Fukuoka method – Semi aerobic landfills. Engineering disposal methods *(Japan)*
- LFG to energy and biogas generation *(China/South Korea)*

WHAT DOESN'T WORK

- Segregation mandates unsupported by enforcement *(Malaysia/India)*
- Collection-disposal mismatch, food waste separation underdeveloped *(China/Japan)*
- Uneven performance across cities, funding challenges *(India)*
- Landfill operation in practice different from design, inventory assumptions incorrect *(South Korea)*
- Open and unsanitary dumping at high rates *(Malaysia/Indonesia)*

Solid Waste Management

Incentives coupled with the right technologies change systems. Mandates alone often don't.

The design-operation gap is central, infrastructure on paper does not equal practice.

Waste incineration is an increasing trend, reduces methane but not sustainable.

Waste Water Management

The technology exists, but the real challenge is the economics.

Industrial wastewater is an under-managed source, with potential to scale.

Expanding sewerage connections is necessary with dense urbanization. Decentralised low-density systems are the weak link.

WHAT WORKS

- Co-digestion with biogas recovery *(South Korea/China)*
- Industrial wastewater anaerobic digestion *(Japan)*
- Effluent biogas capture where implemented *(Malaysia/Indonesia)*
- 99% municipal wastewater treatment *(China)*

WHAT DOESN'T WORK

- Sewerage sludge incineration, non-urban biogas market too thin *(Japan)*
- Limited cost recovery from tariffs, intermittent facility operation *(India)*
- POME biogas non-competitive and access concerns *(Malaysia)*
- 1% households on centralised sewers *(Indonesia)*

Governance and Urbanisation Patterns

Centralised Targeting

China, Japan, Korea

Dense established urban cores with rural periphery, effective scaled-up collection

Nationally set standards with clear line from policy to municipal implementation

Methane officially targeted after sectoral capacity building

Challenges arise with administrative fragmentation

Decentralised Capacity Build-up

Malaysia, India, Indonesia

Rapid urbanisation with high informality, does not map to standard collection models

Centrally set plans with a high degree of regional autonomy in implementation

Sectoral infrastructure targets instead of methane-specific emission goals

Challenges with a wide spectrum of on-ground capacity, allows innovation but replication is weak

Challenges and Barriers

MRV

Site specific measurements lacking. Limits tech and finance potential

Institutional Fragmentation:

Policy coordination limited both vertically and horizontally

Financing Gap:

Blended finance limited. Cost recovery uncompetitive for gas.

Key Takeaways

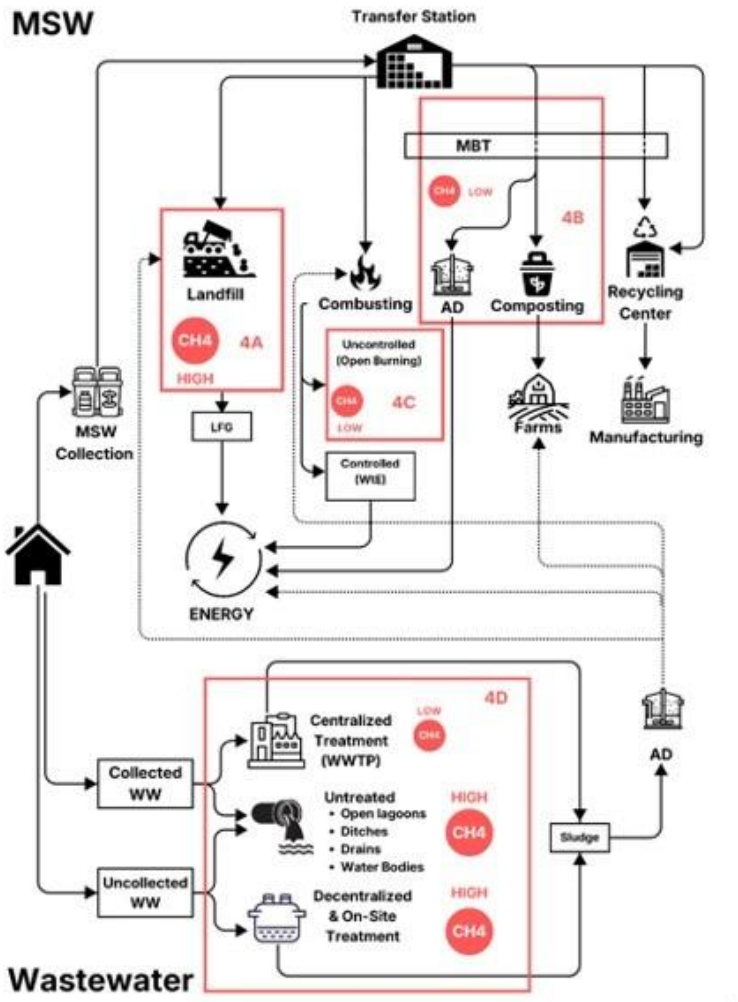
- Incentives matter more than mandates
- Policy design needs to account for operational gaps
- MRV is a binding constraint
- The region has models, what we need is the architecture to replicate

Rationale and Key Takeaways from Comparative Analysis

Date 5 June 2026 (Fri.)

Presenter Sanghyun Ma, Methane Team at Solutions for Our Climate

1 Background: Asia Waste Methane Landscape



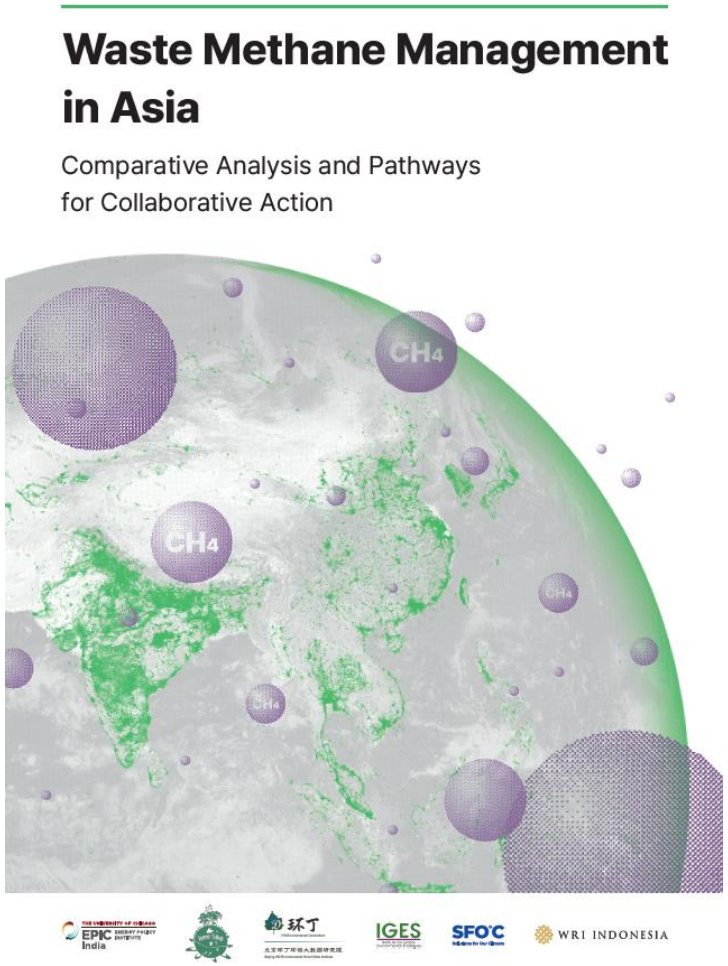
Design by author, Based on IPCC 2006 Guidelines

- Asia faces rapid urbanization, which causes rising waste generation and growing methane emissions from municipal solid waste (MSW) and wastewater.
- The feasibility and scale of waste methane mitigation across Asian cities differ due to factors such as finance, governance, implementation capacity.

Methane Source	How is Methane emitted?	Methane emissions in Asia Pacific (Source: UN ESCAP Report*)
Solid Waste	• Anaerobic decomposition of organic waste from dumpsites or poorly managed landfills	8.4 $MtCH_4$
Wastewater	• Anaerobic decomposition of organic matter from untreated or inadequately treated sewage	15.5 $MtCH_4$

* UN ESCAP Technical Paper | Mitigating Urban Methane Emissions: Strategies and Actions in Asia and the Pacific

1 Rationale: Asia Waste Methane Comparative Analysis



- Conducted a comparative study on six countries: China, India, Indonesia, Japan, Malaysia, South Korea
- Aim: To understand how various Asian countries are addressing waste methane, especially highlighting different contexts, capacities and conditions
- These country selections could not represent the complexities and challenges on waste methane across the Asia region
- Based on individual country contexts, aim to outline a preliminary framework to regional collaboration

2 Methodology: Waste Methane Mitigation Country Comparisons

- Each co-author of the Comparative Analysis study qualitatively evaluated waste management implementation based on a traffic light system (See table for criteria).

- Categories for evaluation based on waste life cycle: Waste Segregation and Collection, Landfill (MSW) Management, Waste Processing and Recovery, Wastewater

Traffic Light	Description
	The practice is widely implemented at scale, supported by strong policy and institutional frameworks, and demonstrates consistent, measurable, and effective outcomes.
	The practice is partially implemented or in early stages of scaling, often through pilot projects or limited regional rollouts. While policy support or investment may exist, effectiveness remains uneven, and key challenges persist (e.g., financing, institutional capacity, enforcement).
	The practice is largely absent or ineffective, with weak or missing regulation, limited infrastructure, or major implementation failures. This represents a significant barrier to methane mitigation due to governance, financing, technical, or social constraints.
N/A	The practice is not relevant given the country's waste management system structure, level of infrastructure development, or policy context.

2 Results: Waste Methane Mitigation Country Comparisons

Waste Segregation & Collection

Waste Life Cycle	Practice (Example)	South Korea	Japan	China	Malay-sia	Indo-nesia	India
Waste Segregation & Collection	Household source separation	🟢	🟢 (Food waste: 🔴)	🟢	🔴	🔴	🟠
	Door-to-door collection	🟢	🟢	N/A	🟢	🟠	🟢
	Integration of informal workers/ cooperative	N/A	N/A	🟢	🔴	🟠	🟠

(Green Light)

- Household source separation is integrated into broader waste management frameworks
- Collection systems are structured and led by municipalities
- Some country-specific constraints remain on how waste collection and segregation are maintained in practice

(Orange or Red Light)

- Source separation exists, but implementation is uneven
- Public participation, enforcement, and collection systems vary widely
- Community-based or city-level initiatives play an important role
- The main challenge is expanding these practices more consistently across the system

2 Results: Waste Methane Mitigation Country Comparisons

Landfill Management

Waste Life Cycle	Practice (Example)	South Korea	Japan	China	Malay-sia	Indo-nesia	India
Landfill Management	Sanitary landfill development	🟢	🟢	🟢	🟠	🟠	🟠
	Semi-aerobic landfill	🟠	🟢	N/A	🔴	🔴	🔴

(Green Light)

- Disposal sites have been upgraded to sanitary landfills, with engineered approaches
- Sanitary landfills operate under semi-aerobic conditions (e.g., Japan)
- Variation of landfill performance exists, dictated by on-site conditions

(Orange or Red Light)

- Sanitary landfill sites exist at select sites, but coverage is limited compared to total disposal facilities
- Legacy dumpsites and open burning of waste are largely present – shaped by infrastructure and technical constraints
- Integrated waste management systems are being explored at multiple landfill sites

2 Results: Waste Methane Mitigation Country Comparisons

Waste Processing & Recovery

Waste Life Cycle	Practice (Example)	South Korea	Japan	China	Malay-sia	Indo-nesia	India
Waste Processing and Recovery	Recycling	🟢	🟢	🟢	🟠	🟠	🟠
	Composting	🟢	🔴	🟠	🔴	🟠	🟠
	Incineration with energy recovery	🟢	🟢	🟢	🟠	🟠	🟠
	Landfill Gas capture	🟠	🔴	🟠	🟠	🔴	🟠
	Biogas generation	🟠	🟠	🟢	🟠	🟠	🟠

(Green Light)

- Waste recycling and composting are system-embedded and organized through structured municipal frameworks
- Gas capture, energy recovery are implemented in scale

(Orange or Red Light)

- Recycling, composting operates variously by different jurisdictions – in select facilities or initiatives
- Limited capacity on gas capture, biogas generation.
- In some cases, gas capture and biogas generation may not be actively promoted because of low methane generation from landfills and high rates of waste incineration.

2 Results: Waste Methane Mitigation Country Comparisons

Wastewater

Waste Life Cycle	Practice (Example)	South Korea	Japan	China	Malay-sia	Indo-nesia	India
Wastewater	Wastewater Treatment						
	Sludge Digestion						
	Methane Capture						
	Biogas Generation						

(Green Light)

- Domestic/regional wastewater treatment operations are well-connected with centralized treatment infrastructure
- Sludge digestion is well-positioned to become an energy source (energy recovery)

(Orange or Red Light)

- Wastewater treatment, methane capture and biogas vary across different municipalities
- Upgrading decentralized wastewater management systems require substantial municipal expenditures

3 Opportunities for Collaboration on Waste Methane

National-level Implementation

- Create robust national-level waste regulatory frameworks, MRV systems, waste methane reduction roadmaps
- Inter-governmental collaboration platforms

Knowledge-sharing

- Involvement of local communities in decision making processes
- Engagement platforms involving citizens and local governments
- Awareness-building: Prioritize behavioral change: programs on **waste prevention and/or separation**, **waste recycling**

Capacity-building

- Optimize funding initiatives (e.g., private finance, ODA) to fund waste infrastructure projects, train staff
- Develop pilot projects that could be scaled-up in the future
- Potentially utilize carbon markets

3 Pathways for Collaboration on Waste Methane

Awareness Building

- Integrate diverse stakeholders to ensure that cooperation is inclusive to all involved
- Include locally embedded systems (e.g., informal waste networks, community)

Knowledge Sharing & Capacity-building

- Structured exchange platforms and knowledge transfer on waste methane mitigation from subnational and national levels

Joint Pilot Projects

- Innovative funding arrangements (e.g., blended finance)
- Public-private partnerships for waste methane mitigation initiatives/projects

Standardization & National Level Implementation

- Based on successful pilot projects, rules and requirement setting to enable policy implementation
- Align with climate governance frameworks

Scaled Implementation

- Apply effective strategies, policies, projects in a national scale
- Linkages between national and subnational contexts

Monitoring and Verification

- Strengthen GHG monitoring and verification capacity
- Integrity of national GHG inventories

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The Comparative Analysis Report is now Live!

The same report is also available on our co-author organizations' (IGES, EPIC India) publications web sites

Panel Discussion:

What Makes Waste Methane Reduction Scalable? Enablers and Regional Collaboration

Chair

Miho Hayashi

Programme Manager,
Institute for Global Environmental Strategies (IGES)-CCET

Pham Ngoc Bao

Research Director, Sustainable Consumption and Production,
Institute for Global Environmental Strategies (IGES)

Swarna Dutt

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Huma Saif Qazi

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Waste Methane Management in India

Swarna Dutt
Energy Policy Institute at the University of Chicago (EPIC India)

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Energy Access

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We work closely with government and industry partners to develop and test ideas that could address India's most pressing energy and environmental challenges using a research-led approach.

CONTENTS

India’s Waste Methane Profile (Large, Growing – and not yet formally on India’s climate agenda)

Source: India BUR4, 2024 (MoEFCC)

Industrial Wastewater	Managed Waste Disposal on Land	Domestic & Commercial Wastewater
21 MT CO2 eq / yr	**19 MT** CO2 eq / yr	**16 MT** CO2 eq / yr

Combined: ~56 MT CO2eq/yr from waste, entirely from unmanaged or undertreated waste streams

Scale of the Challenge

- **55 Mt MSW** generated/yr; projected 165 Mt by 2030, 435 Mt by 2050 (MoHUA)
- **72,368 MLD** urban sewage daily; 72% untreated (BUR4, MoEFCC 2024)
- **2,474** legacy dumpsites holding ~250 Mt of accumulated waste pre-2014

The Policy Gap (what India has NOT done)

- India’s NDCs contain no explicit waste methane targets
- No direct methane measurement mandated at landfills, STPs, or septic systems
- MRV relies on IPCC Tier 1 defaults, not site-specific data (MoEFCC)

Policy & Regulatory Framework for Methane Mitigation

Solid Waste Management

SWM Rules 2026 (MoEFCC)

Mandatory 4-stream segregation; Extended Bulk Waste Generator Responsibility; targets for ULBs

Swachh Bharat Mission-Urban 2.0

30,700 TPD compost | 15,100 TPD biomethanation | 9,700 TPD WtE-electricity capacity

SATAT Scheme (MoPNG)

Voluntary bio-CNG offtake framework; guaranteed purchase price for compressed biogas from organic waste. 5,000 plants targeted nationally.

Wastewater & Sludge

AMRUT 2.0

592 sewerage projects (₹67,608 Cr) | 6,739 MLD new/augmented STP capacity | 18,000 km sewer network

Jal Hi Amrit Scheme (Oct 2024)

₹13 billion budget | Incentivise STPs to improve performance | 10,000 MLD recyclable water target

Liquid Waste Management Rules, 2025

Wastewater reuse targets: 20% by 2027–28, rising to 50% by 2030-31

Note: Policies structured as service-delivery goals with financial incentives. Execution sits with Urban Local Bodies. India's NDCs do not yet include explicit methane-specific targets.

Progress at Scale (Solid Waste Management)

Real methane reduction, as a consequence of urban infrastructure investment

National progress (MoHUA, Mar 2026)

97%
Wards with 100% door-to-door collection

81.2%
MSW now processed (from 16% in 2014)

48%
Legacy dumpsites remediated of 2,474

85%
Wards practicing source segregation

The methane reduction is real, but incidental

Processing 81.2% of MSW instead of 16% avoids significant landfill methane generation, even though that was never the stated objective of SBM-Urban.

City Case Study: Indore, India (Co-benefits in Practice)

City Ranked #1 in Swachh Survekshan 7 years running by Ministry of Housing and Urban Affairs, India, where the goal was clean city rankings, not methane

- Asia's largest municipal solid waste (MSW) based Bio-CNG plant (550 tonnes of daily wet waste into clean energy)
- Biomethanation plant processes wet waste to bio-CNG supplied to city buses under SATAT (MoPNG).
  - Motivation: energy revenue.
  - Outcome: methane captured instead of emitted
- Devguradiya dumpsite: trommelling & biomining of ~13 lakh MT legacy waste.
  - Motivation: land reclamation.
  - Outcome: legacy methane avoidance
- Model replicated in cities as small as with ~120,000 population, proving scalability independent of city size

Sources: MoHUA SBM-U Dashboard (Mar 2026); Swachh Survekshan 2023-24 (MoHUA); SATAT (MoPNG); BUR4 (MoEFCC, 2024)

Indore Landfill (Before and After)

YEAR: 2017

YEAR: 2018 (December)

YEAR: 2022

Indore Bio-CNG Plant (Largest in Asia)

Progress at Scale (Wastewater)

Real methane reduction, as a consequence of urban infrastructure investment

National progress (MoHUA, Mar 2026)

11,186 MLD
Total STP capacity created (AMRUT Ph1+2)

18,000 km
Sewerage network laid under AMRUT

3,530 MLD
Capacity earmarked for recycling & reuse

214 STPs
Completed of 313 initiated (AMRUT - 4,174 MLD)

The methane reduction is real, but incidental

Building 11,186 MLD of STP capacity means wastewater that previously decomposed in open drains, releasing methane uncontrolled, is now treated. That was never AMRUT's stated objective. Its goal was clean rivers and universal sewerage access.

City Case Study: Surat, India (Co-benefits in Practice)

Surat built STPs to clean the Tapi river and meet discharge standards, not to reduce methane.

- Operational STPs with anaerobic digesters recovering biogas (AMRUT, MoHUA)
  - Motivation: regulatory compliance on river discharge norms
  - Outcome: biogas captured from sludge digestion instead of venting to atmosphere
- Sewage sludge co-digestion generates electricity & heat on-site
  - Motivation: reduce STP operational energy costs
  - Outcome: closed-loop methane capture replacing grid power
- Recognised by MoHUA as a model ULB for wastewater management; AMRUT-funded expansion ongoing

Sources: MoHUA SBM-U Dashboard (Mar 2026); Swachh Survekshan 2023-24 (MoHUA); SATAT (MoPNG); BUR4 (MoEFCC, 2024)

SURAT STP PLANT

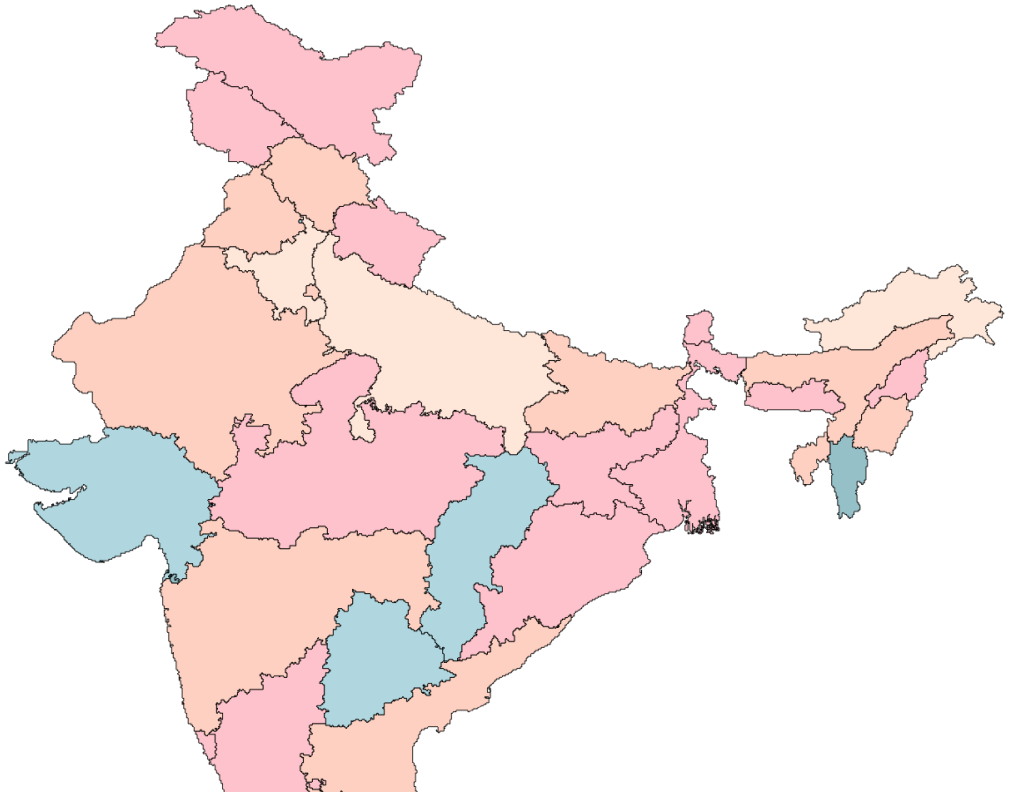
Legacy Waste Management | Solid Waste Management | SWM Plants | LWT Plants | Community & Public Toilets

Swachhatam

Swachh City

Swachhata Hi Seva

Dumpsite: India



Select State

India | Status of Dumpsites Profile

DRAP Dashboard

No. of Dumpsites: 2487 | No. of ULB: 2274 *

* Primarily dumpsites having legacy waste >= 1000 Tonne

Legacy Waste Qty.	Remediated Waste Qty	Waste to be Remediated
2,708	1,771 (65%)	937 (35%)

Area	Area Reclaimed	Area to be Reclaimed
14,995.66	9,367.33 (62%)	5,628 (38%)

* Waste Qty in Lakh Tonne
* Area in Acre

Remediation Status

Remediation Completed — (1209) No of Dumpsite

Legacy Waste Qty.	Remediated Waste Qty	Waste to be Remediated
928	925 (100%)	3 (0%)

Area	Area Reclaimed	Area to be Reclaimed

MeitY | Digital India Power To Empower | data.gov.in Open Government Data (OGD) Platform India | india.gov.in The national portal of India

Source for screenshot: https://sbmurban.org/swachh-bharat-mission-progress

Critical Enablers: Moving Beyond Pilots to Scale

- Centrally-Funded Mission Mode
- Linkage of Funding to Performance
- Regulatory Mandate Creating Feedstock
- Dedicated Monitoring Infrastructure
- Co-digestion Policy for Cross-sector Synergy
- Reuse Targets Creating Demand-Side Pull

Source for image: Swacchatam Portal (https://admin.sbmurban.org/u/login)

The Low-Hanging Fruits for India

The infrastructure exists. The institutional muscle exists. What is missing is the explicit methane lens.

What Already Exists

i. Mission-mode architecture (SBM-U, AMRUT) has proven to move implementation at scale

i. Waste processing scaled 16% to 81.2% in one-decade

ii. Biomethanation, composting, STP biogas recovery, operational in major cities

iii. SATAT offtake framework - a ready market for biomethane

iv. ULB-level data infrastructure exists

What Is Still Missing

i. Explicit methane targets in India's NDCs, currently absent

ii. Direct methane measurement at landfills, STPs, open drains - still Tier 1 defaults

iii. O&M cost recovery for STPs, only 20 - 30% recovered, limiting biogas investment

iv. Carbon credit pipeline - MRV quality insufficient for Article 6 or VCM access

The Low-Hanging Fruit

i. Pilot Tier 2+ measurement at 10-15 major urban waste facilities; integrate intonCPCB mandate

ii. Include waste methane targets in State Climate Action Plans, a near-term, subnational entry point

iii. Formalise co-digestion (MSW + sludge) across all STPs >10 MLD - SBM-U 2.0 already recommends it

iv. When NDCs are next revised, name the co-benefit as a target. The data to back it already exists.

India's Opportunity in Waste Methane

Waste methane is immediately actionable, unlike agriculture, it aligns with urban infrastructure goals already being funded

SBM-Urban & AMRUT have demonstrated that national missions can move implementation from 16% to 80% waste processing in a decade

India’s city-to-city diversity is a strength, successful ULBs (Indore, Surat, Pune) are live laboratories for the Asia region

The next frontier: connecting these infrastructure gains to explicit methane targets, bankable carbon finance, and regional knowledge exchange

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Financing Methane Reduction in Waste and Wastewater

Asia Waste Methane Comparative Analysis Webinar · 5 June 2026

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June 2026

Huma Saif Qazi| Lead Strategy and Advisory
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auctusESG

The Finance Gap: Why Scale Matters

Current financing falls far short of what the waste and wastewater sector needs to achieve meaningful methane abatement.

<1%

of global climate finance
reaches the waste sector

Source: CPI Global Landscape of Climate Finance, 2023

94%

of methane from waste
originates in
developing nations

Source: Landscape of Methane Abatement Finance, 2023

$8B+/yr

annual investment gap
to meet waste methane
reduction targets

Source: UNEP Global Methane Assessment, 2021

Key Financing Mechanisms: Asia Focus

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USD 1.5B+

ADB / ACWA Programme

Multi-country sovereign loans for municipal solid waste and wastewater infrastructure. Active in Vietnam, Indonesia, India, Philippines.

USD 50B target

AIIB Climate Finance

Green bond framework leverages capital markets to finance urban sanitation and landfill gas capture across Asia.

USD 200M+

World Bank / GEF Blended

Results-based grants combined with concessional loans for waste methane capture projects (Côte d'I voire, Malawi and beyond).

30:1 leverage

IFC Blended Finance

USD 1 of concessional capital mobilises USD 30 from private investors. Targets bankable waste-to-energy and landfill gas projects.

USD 20M

Korea-ASEAN AKCMM

Sovereign bilateral fund launched May 2026. Low-interest concessional loans for methane abatement across ASEAN member states.

USD 7.7M+

Japan / Fukuoka Method

Technology transfer plus Finance Sprint contributions. Semi-aerobic landfill replication scaled across Southeast and South Asia.

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