Circular Approaches to Solid Waste Management:

Reducing Methane Emissions for Low-Carbon and Climate-Resilient Cities

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Urban-Act Integrated Urban Climate Action for Low-Carbon & Resilient Cities

In the context of Urban-Act

The Integrated Urban Climate Action for Low-Carbon and Resilient Cities (Urban-Act) is a regional project over the period April 2022 to December 2027. This regional project aims to support the transformation towards low-carbon and resilient urban development in Asia-Pacific while also contributing to countries' Nationally Determined Contributions (NDCs) and the advancement of the Sustainable Development Goals (SDGs). Urban-Act is implemented in China, India, Indonesia, the Philippines, and Thailand. Regional project partners include the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), the United Cities and Local Governments Asia-Pacific (UCLG ASPAC), the TU Dortmund and the University of Stuttgart, as well as national partners in each of the five partner countries.

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Abbreviations

3R	reduce, reuse, recycle
AI	artificial intelligence
CH_4	methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
EPA	Environmental Protection Agency
ESCAP	Economic and Social Commission for Asia and the Pacific
GHG	greenhouse gas
GIS	geographic information system
GMI	Global Methane Initiative
$GtCO_2e$	gigatons of carbon dioxide equivalent
IRRCs	Integrated Resource Recovery Centres
LFG	landfill gas
$MMTCO_2e$	million metric tons of carbon dioxide equivalent
MRF	Material Recovery Facilities
MRV	measurement, reporting, and verification
MSW	municipal solid waste
NAMAs	Nationally Appropriate Mitigation Actions
O&M	operation and maintenance
SDGs	Sustainable Development Goals
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
US$	United States Dollar
US EPA	United States Environmental Protection Agency

Executive Summary

Asia and the Pacific faces escalating challenges in solid waste management due to continued urbanization, with waste generation projected to reach 1.9 billion tons by 2050, marking a 56 per cent increase since 2016. Methane emissions from municipal solid waste are a key driver of climate change and currently account for 13 per cent of all global anthropogenic methane. This brief highlights the urgent need to transition from linear disposal to circular systems that prioritize waste prevention, material circularity, and regenerative resource use in order to curb methane emissions. Drawing on successful initiatives from across Asia and the Pacific, the recommendations underscore the role of policy innovation, infrastructure investment, and community engagement in transforming waste into resources. To accelerate progress, the brief calls for robust regulatory frameworks, financial incentives for organic waste diversion, regional knowledge-sharing, and alignment with global climate goals. By integrating circularity principles into solid waste management, cities can mitigate methane emissions and foster low-carbon and climate-resilient urban development across the region.

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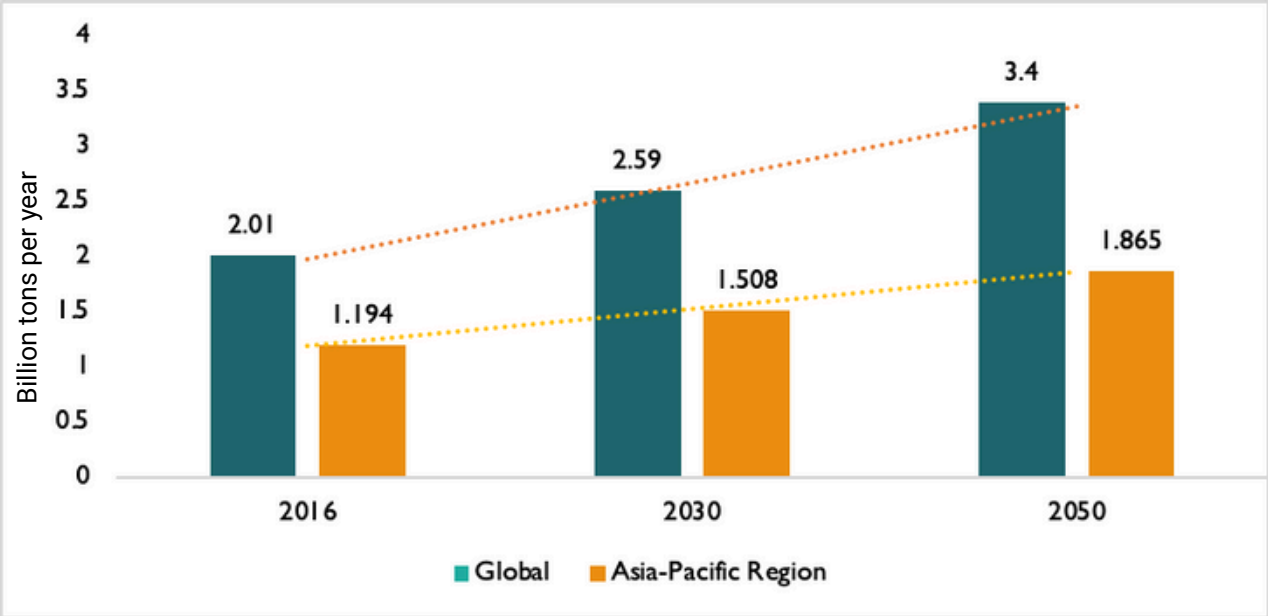
Waste generation trends in Asia and the Pacific

The Asia and the Pacific is experiencing rapid urbanization. The urban population has increased from 754 million in 2010 (ESCAP, 2013) to 2.48 billion in 2023 and is projected to reach 3.38 billion by 2050 (ESCAP and UN-Habitat, 2023). According to the World Cities Report 2024, 51.1 per cent of the total population of Asia was urban, and the figure is expected to rise to 56.7 per cent by 2030 (UN-Habitat, 2024).

One of the significant impacts of rapid urbanization is an increase in the generation of urban solid waste. According to a World Bank Study, 1.194 billion tons of municipal solid waste (MSW) were generated in Asia and the Pacific annually in 2016, and is projected to increase to 1.508 billion tons by 2030 and to 1.865 billion tons by 2050 (Kaza and others, 2018). Figure 1 illustrates the projected global and regional waste generation.

Figure 1: Projected waste generation (in billion tons per year)

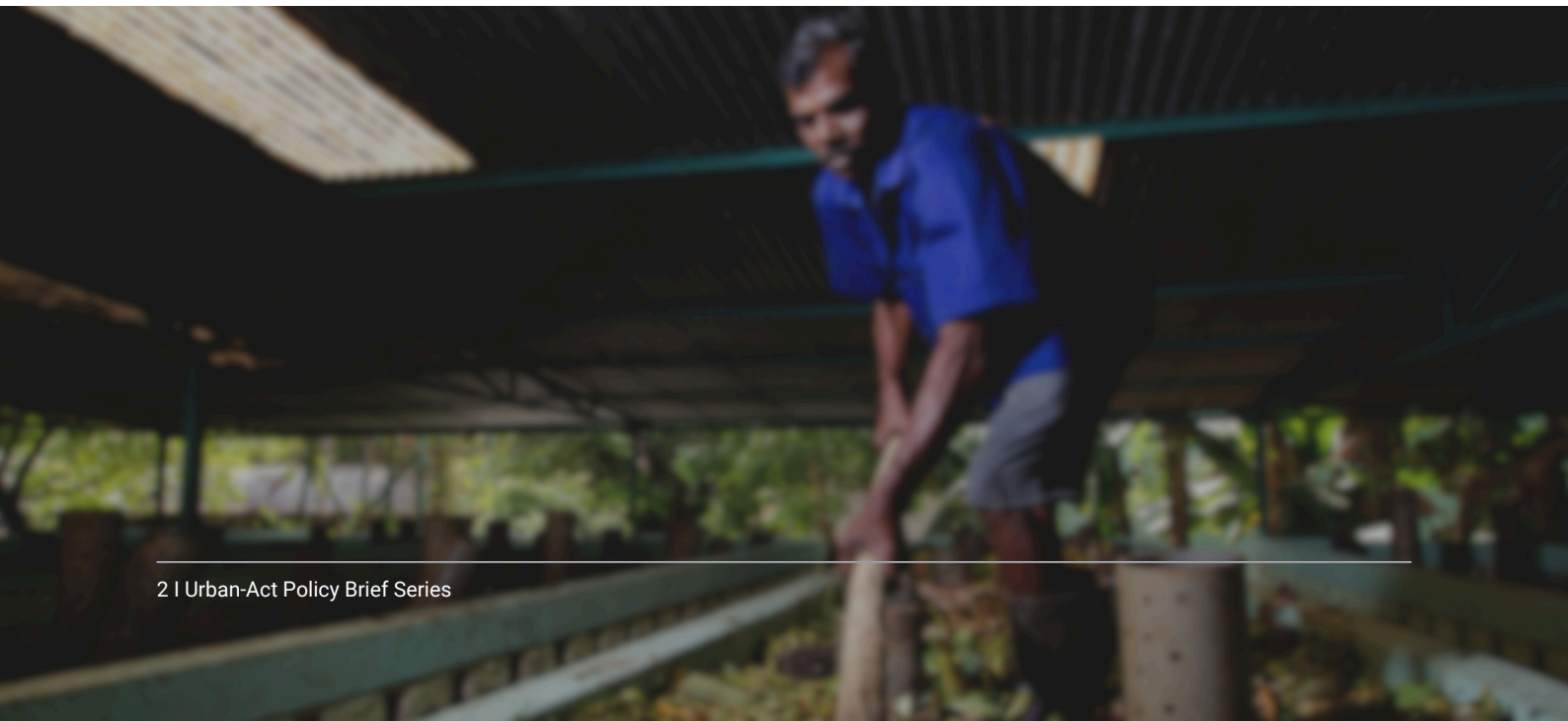


Source: S. Kaza, and others, What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050 (Washington, D.C.: World Bank, 2018). Available at https://doi.org/10.1596/978-1-4648-1329-0

With the rapid growth in waste generation in the region, there is increasing pressure on urban local government bodies to manage solid waste in an environmentally and socially responsible manner, utilizing appropriate and clean technologies. Currently, local government bodies in the region lack the resources and capacities for effective solid waste management. As a result, city governments implement short-term end–of–pipe solutions that involve partial collection (ranging from 50 to 60 per cent of the total urban waste), transportation and disposal into unsanitary dumpsites or landfills. This approach only spatially displaces waste, often outside cities, creating soil and water pollution, aggravating greenhouse gas emissions (GHG), and increasing the difficulty of final waste treatment. This linear path of disposal is both resource-intensive and inefficient and, for some cities in the region, accounts for up to 30 per cent of municipal expenditure (Gupta and Sachdeva, 2021). Furthermore, the global direct annual cost of solid waste management was estimated to be US$ 252 billion in 2020, and without urgent action on waste management, by 2050, this cost could increase to $640.3 billion (UNEP, 2024).

There is a lack of awareness about efficient waste recovery processes and minimization practices. This is often accompanied by inadequate or ineffective policies for solid waste management: waste producers are not tasked with the responsibility for waste separation, taxes for urban services such as waste collection and disposal are low, and local governments are constantly in need of capacity-building and financial resources to improve solid waste management.

Since population growth, urbanization and waste generation in Asia and the Pacific are unlikely to slow down, a fundamental shift is needed - one that encompasses appropriate policies, infrastructure and behavioural changes in the solid waste management sector. The region will need to transition from a linear, end-of-pipe consumption pattern toward a more sustainable, circular economy model. Waste should be viewed as a resource, with recycling being the preferred option over disposal.



Greenhouse gas (GHG) emissions from solid waste

The solid waste sector is a significant source of methane and black carbon emissions, which substantially contribute to climate change. Methane and black carbon are short-lived climate pollutants that remain in the atmosphere for a shorter time than carbon dioxide but have substantially higher global warming potential. The three major pollutants from the solid waste sector, in terms of their contribution to climate change, are:

Methane (CH_4), a potent GHG with a lifetime of 12 years, is 28 times more effective than carbon dioxide at trapping heat in the atmosphere over a 100-year period (U.S. EPA, 2023). Short-term effects[7] are even more significant, as methane has 84–86 times the global warming impact of carbon dioxide over a 20-year period (Ebun and others, 2022). This is evident in the fact that methane has contributed to approximately 30 per cent of global warming since preindustrial times. In the solid waste sector, methane emissions come from the anaerobic (oxygen-free) decomposition of organic waste in landfills.

Carbon dioxide (CO_2), a GHG, has an atmospheric lifetime of hundreds of years. Carbon dioxide emissions from the solid waste sector come from the use of fossil-fuelled vehicles and equipment, anaerobic decomposition of waste and burning of waste.

Black carbon is a particulate matter component formed by the incomplete combustion of fossil fuels, biofuels and biomass. Black carbon has an atmospheric lifetime of days to weeks. Although not a GHG, black carbon still has a substantial impact on the climate, with a warming effect that is 500 to 1,500 times that of carbon dioxide by mass (U.S. EPA, 2023). Black carbon is released from fossil-fuelled vehicles and equipment, as well as from burning waste.

Image 1: GHG emissions from solid waste

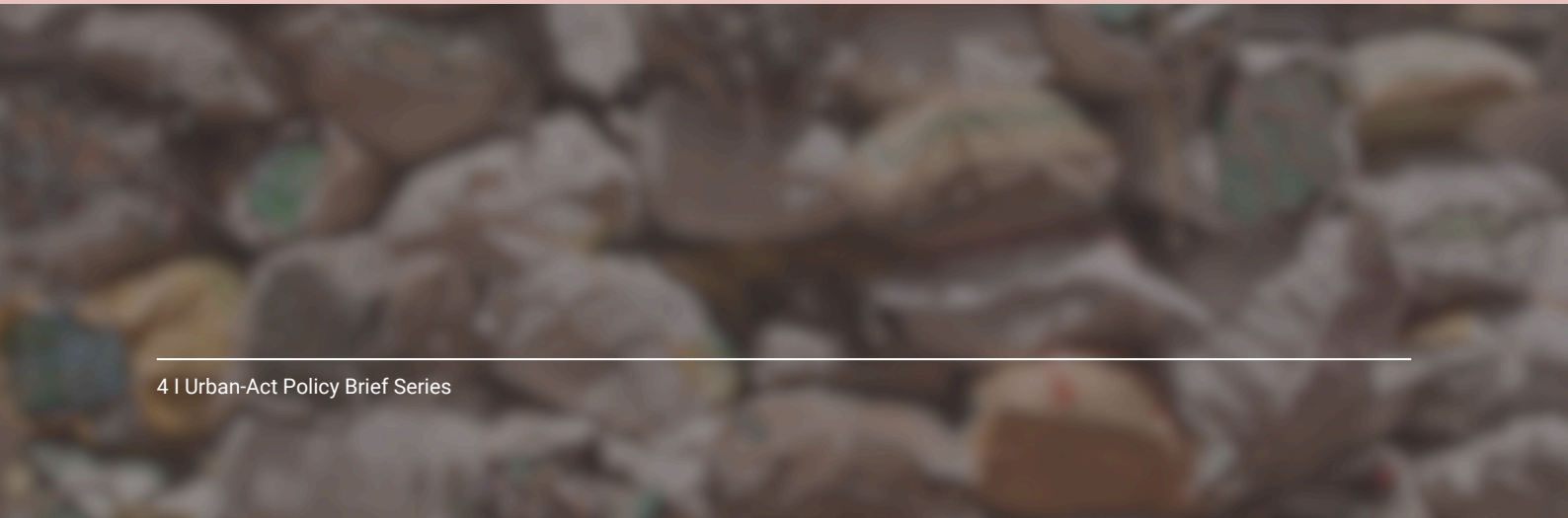
Source: ESCAP

Box 1: Urban innovation and climate action: Insights from the circular economy initiatives in the waste sector of India

Within the waste management hierarchy, reuse and recycle follow reduce and cumulatively form the 3Rs framework. In support of this approach, the Ministry of Housing and Urban Affairs encourages Indian cities to adopt scientific and formalized actions for resource recovery and promotes recycling of waste. However, waste recovery and recycling systems are yet to be 100 per cent formalized. In most cities, the informal sector takes care of the resource recovery from the solid waste management value chain and conducts its recycling operations.

In November 2023, the City Investments to Innovate, Integrate and Sustain (CITIIS) 2.0 programme was launched by the Government of India. This policy-level intervention promotes circular approaches to solid waste management in 18 pilot cities across India. The objective is to facilitate climate action with a focus on fostering a circular economy at the local and subnational/regional level. Designed on an integrated and innovation-driven strategy, CITIIS aligns the national priorities of India with global sustainability goals. This case study aligns the principles of the circular economy with the principles of integrated solid waste management and addresses the mitigation of GHGs through resource efficiency.

The programme follows a unique three-component approach supporting 18 competitively selected projects that promote circular economy practices with a focus on integrated waste management at the city level. It also advances climate-oriented reform actions in collaboration with 21 state governments across India, and promotes institutional strengthening and knowledge dissemination at the national level. The programme is funded through blended finance, comprising EUR 200 million in bilateral loans from the Agence Française de Dévelopement (AFD) and the German Development Bank (KfW), along with EUR 12 million as a technical assistance grant from the European Union. This is further supplemented by counterpart funding by subnational governments and private capital mobilized through public-private partnerships.



The 18 selected cities are receiving financial assistance of approximately EUR 12 million each to implement integrated and scientific waste management projects. These include interventions for infrastructure development, strengthening policies and processes, capacity-building, citizen participation and behaviour change communication. Each city is also provided with a dedicated expert-mentor who serves as a knowledge catalyst and supports in project design, preparation, maturation, implementation, monitoring, evaluation and capitalization.

These city level interventions are augmented with climate action and governance reforms driven by the imperative to address climate challenges at the subnational and regional levels.

It aligns with the theory of change approach by recognizing the drivers of change, implementing structured processes across different stages of change, and investing in capacity-building to support sustainable and impactful transformations in climate governance and action at the subnational level. Financial assistance of EUR 30 million has been specifically allocated for these climate reform initiatives.

Image 2: Informal sector recycling and recovery of solid waste

Source: ESCAP

The challenge: methane emissions from the urban solid waste management value chain

The following table displays the various GHG emissions from the solid waste management value chain.

Figure 2: GHG emissions from the solid waste management value chain

Solid waste management value chain	Challenges	Details	GHG emissions
Collection	Low collection coverage. 44 per cent in South Asia and 71 per cent in East Asia (Kaza and others, 2018). 53–56 per cent of waste in low, lower middle, and middle income countries is food and organic waste (Ibid.). Approximately 75 per cent of waste in South Asia is open-dumped, while 4 per cent is landfilled. In East Asia, 18 per cent is open dumped and 46 per cent is landfilled (Ibid.).	A large percentage of the population is not covered by regular waste collection services, resulting in the open dumping of waste, burning of waste, and disposal along roadsides and in water bodies.	CH_4 emission is from open dumping, and CO_2 and black carbon emissions are from open burning.

Transportation	Old collection vehicles are used in most cities of developing Asia	Solid waste is transported from collection points to disposal facilities using old diesel-fueled trucks and tractors Inefficient routing system of transportation	CO_2 and black carbon emissions from the inefficient collection and transport system.
Recycling	The informal sector mainly does recycling.	The informal sector plays a significant role in the collection and recycling of waste in developing countries. In most cases, informal recycling involves burning collected waste to extract raw materials.	The use of inefficient technology and the burning of waste produce CO_2 and black carbon.
Recovery	Risk of emissions from organic waste treatment	The treatment of organic waste through composting or anaerobic digestion has the potential for methane leakage when treatment plants are not properly operated and maintained. In many cases, organic waste treatment facilities have inadequate capacity to handle large volumes of organic waste.	The accumulation and decomposition of organic waste at these treatment locations can lead to CH_4 emissions.
Disposal	Analysis of global waste composition reveals that food and green waste are the largest components of the waste stream, regardless of income level, and represent a significant potential for methane generation from landfills.	When waste is disposed of at improperly managed landfills and open dumpsites, methane is not captured, resulting in the release of substantially greater amounts of landfill gas into the atmosphere. Even well-managed landfills with landfill gas capture systems typically capture 60 to 90 percent of the methane generated by the landfill during its operational lifetime (U.S. EPA, 2021). Additionally, black carbon and carbon dioxide are released due to fires and the use of compactors, loaders, and excavators, which are operated using diesel.	CH_4 and CO_2 emissions from landfill gas contribute to GHG emissions.

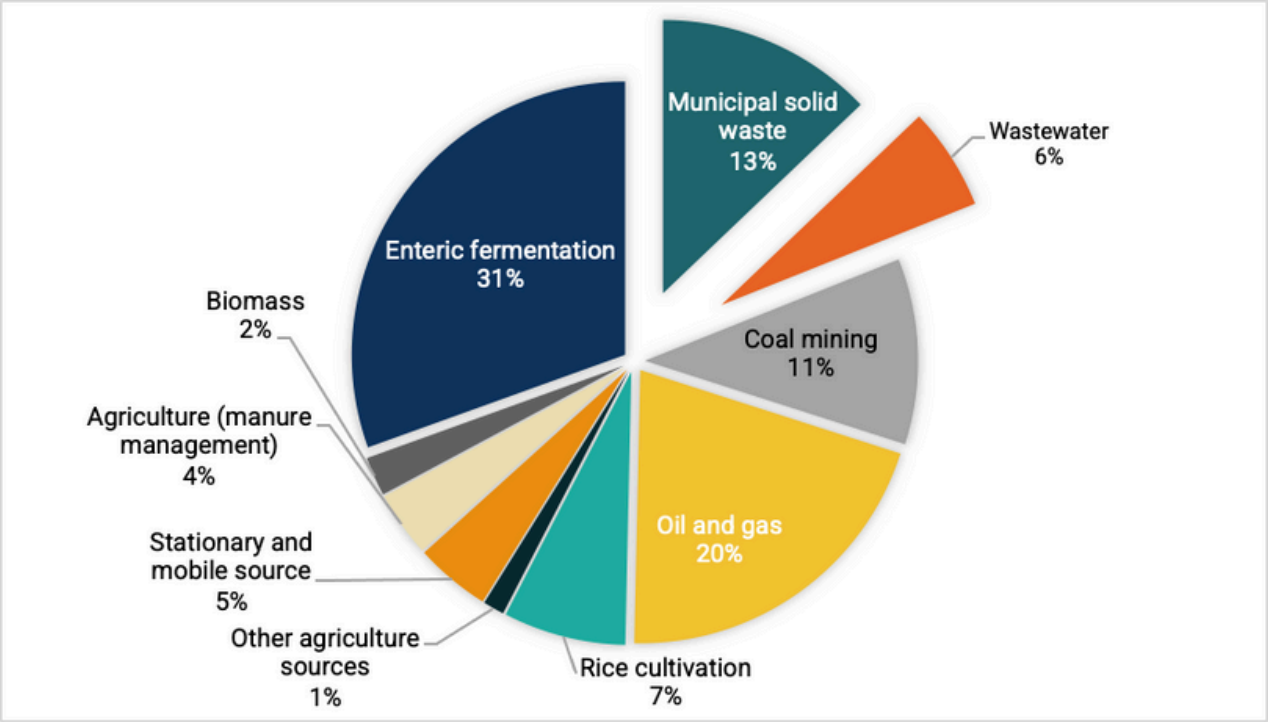
Source: ESCAP

Methane Emissions from Solid Waste

In 2023, total global GHG emissions were estimated at 57.1 Gt CO_2e, with the waste sector accounting for approximately 4% (UNEP, 2024). Within this, the waste sector, including both solid waste and wastewater, is responsible for 19% of global anthropogenic methane emissions. MSW alone contributes around 13%, as shown in Figure 4.

Methane is the second most abundant anthropogenic GHG after carbon dioxide, but it is significantly more potent in the short term — having 84–86 times the global warming potential (GWP) of CO_2 over a 20-year period (U.S. EPA, 2019). Despite its short atmospheric lifespan, methane has an outsized impact on near-term warming, making it a high-priority target for climate action.

Figure 3: Global anthropogenic methane emissions by source, 2025

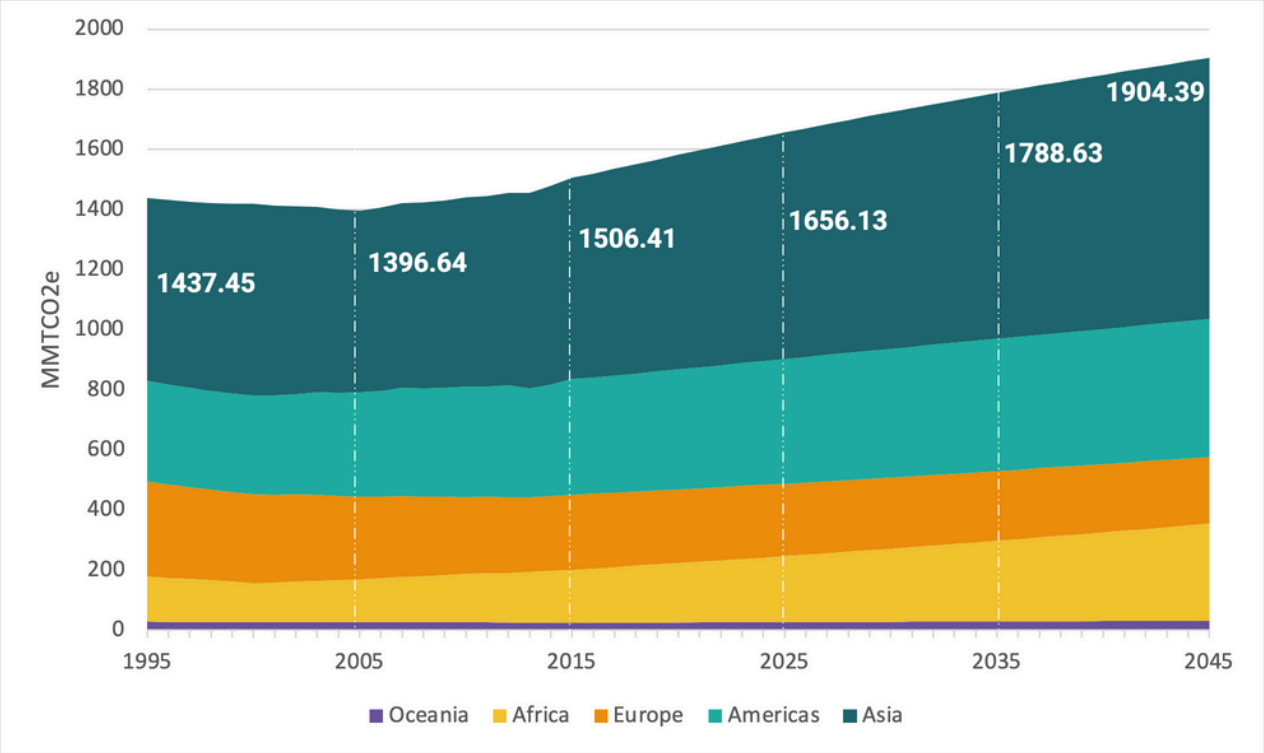


Source: United States Environmental Protection Agency (U.S. EPA), Global Non-CO_2 Greenhouse Gas Emission Projections & Mitigation Potential: 2015-2050 (Washington, D.C., September 2019). Available at https://www.epa.gov/global-mitigation-non-co2-greenhouse-gases/global-non-co2-greenhouse-gas-emission-projections

Recent satellite analyses have strengthened the ability to detect methane emissions at the source (Maasakkers, and others, 2022). Between January 2019 and June 2023, satellite data recorded 1,256 methane "super-emitter" events from waste dump sites globally. Countries such as Pakistan, India and Bangladesh accounted for the highest number of large-scale leaks, with countries like Uzbekistan following closely behind (Carrington and Clarke, 2024).

Figure 5 presents global methane emissions from the waste sector, followed by emissions from the solid waste sector specifically in the ESCAP region.

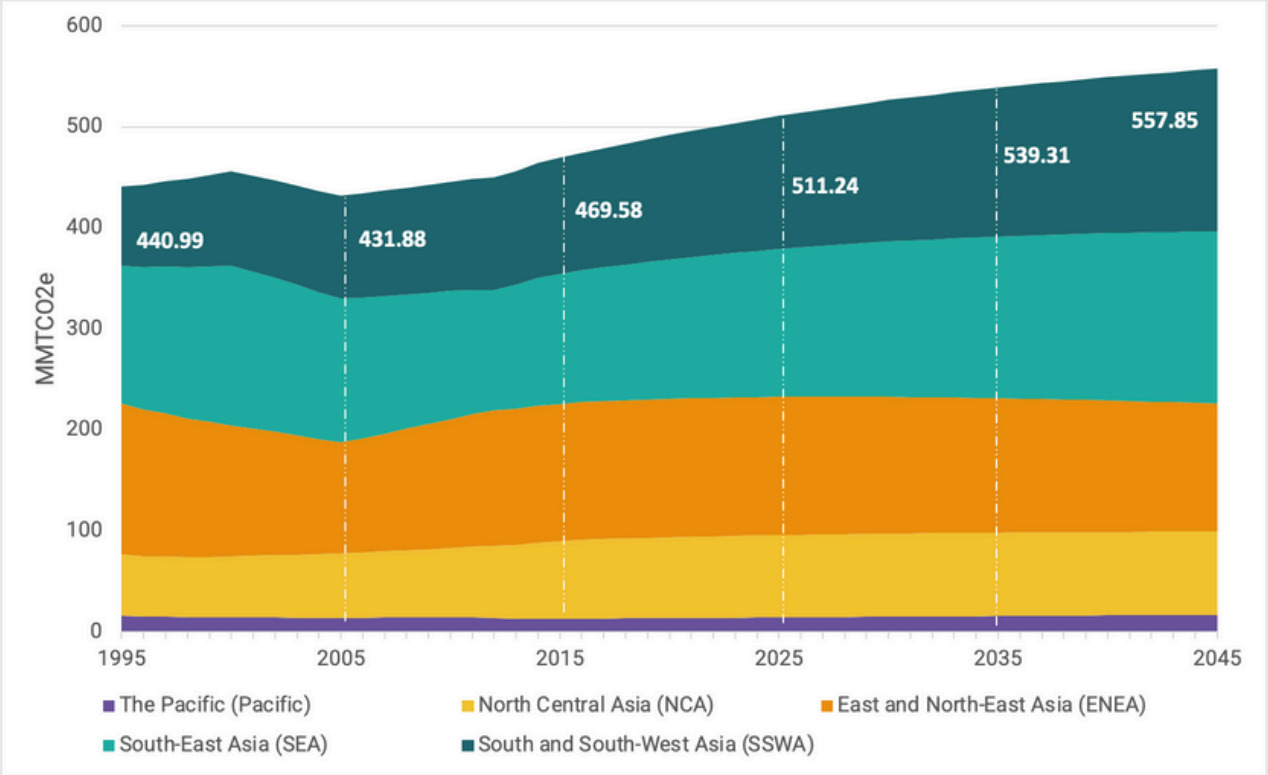
Figure 4: Global methane emissions from the waste sector from 1995 and projected till 2045



Source: United States Environmental Protection Agency (U.S. EPA) (2019). Global Non-CO_2 Greenhouse Gas Emission Projections & Mitigation Potential: 2015-2050 (Washington, D.C., September 2019). Available at: https://www.epa.gov/global-mitigation-non-co2-greenhouse-gases/global-non-co2-greenhouse-gas-emission-projections

Note: Data on methane emissions for the ESCAP region was not available for the following countries: Hong Kong, China; Macao, China; American Samoa; Cook Islands; French Polynesia; Guam; New Caledonia; New Zealand; Niue and Northern Mariana Islands.

Figure 5: Methane emissions from solid waste from 1995 and projected till 2045 in Asia and the Pacific



Source: United Nations Environmental Protection Agency (U.S EPA) (2019). Global Non-CO_2 Greenhouse Gas Emission Projections & Mitigation Potential: 2015-2050 (Washington, D.C., September 2019). Available at: https://www.epa.gov/global-mitigation-non-co2-greenhouse-gases/global-non-co2-greenhouse-gas-emission-projections

As methane concentrations continue to rise, rapid reductions in methane emissions will be essential to meet the 1.5°C climate target over this decisive decade. Achieving the Global Methane Pledge alone, which aims to reduce global methane emissions by at least 30 per cent of the 2020 levels by 2030, would eliminate over 0.2°C of warming by 2050 (Global Methane Pledge, 2023). Moreover, with global waste generation increasing, targeted mitigation in the waste sector offers an impactful and immediate opportunity to support this effort.

Box 2: Recycling and recovery through the community-based "Trash-to-Cash" programme in Bacolod City, the Philippines.

GIZ, in collaboration with the Local Government Unit (LGU) of Bacolod City has implemented several waste management initiatives, such as Black Soldier Fly (BSF) farming, a community-based Trash-to-Cash programme, and the strengthening of Solid Waste Management Planning. These efforts aim to promote green jobs and reduce carbon emissions.

As part of the EU–Philippines Green Economy Partnership, under Specific Objectives 1 (SO1): Policy and Alliances, co-led by GIZ and the Department of Environment and Natural Resources (DENR), and funded by the European Union and BMWK, GIZ will further its collaboration with the Bacolod LGU. The focus will be to enhance the livelihoods of local communities and the informal waste sector by promoting value-added products derived from organic waste treatment hubs, including BSF farming and vermicomposting. In addition, GIZ is supporting the integration of the principles of circular economy into Bacolod's Comprehensive Land Use Plan (CLUP) and Comprehensive Development Plan (CDP), reinforcing the city's commitment to sustainable urban development.

Image 3: Trash-to-Cash programme, Bacolod City, the Philippines

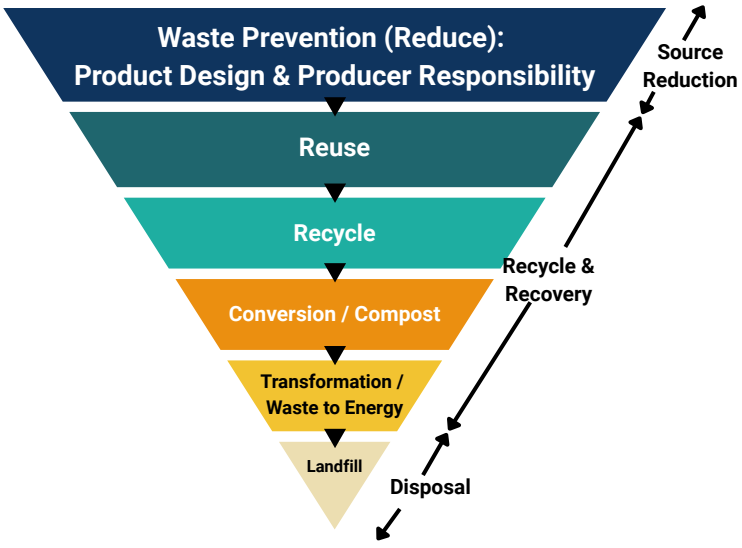
Source: GIZ Philippines

Strategies for improving solid waste management and reducing methane emissions

Reducing methane emissions from solid waste requires addressing the entire solid waste management chain, rather than focussing solely on landfills. In most cities across Asia and the Pacific, the current approach to managing waste relies on landfills and open dumps, with minimal consideration given to implementing alternative waste management methods. The preferred approach for managing solid waste is an integrated waste management system, which employs a holistic approach and a tiered set of alternatives, focusing on waste prevention, material circularity and regenerative resource. Within this framework, the most favourable option is waste prevention and reduction, followed by reuse, recycling recovery (including composting and waste-to-energy transformation), and disposal at landfills being the last resort. While this approach reduces reliance on landfills, nonetheless these facilities continue to play a crucial role in handling residual waste that cannot be managed through alternative methods. In this regard, technologies should be considered for landfill gas (LFG) capture for energy recovery and for reducing emissions from residual waste.

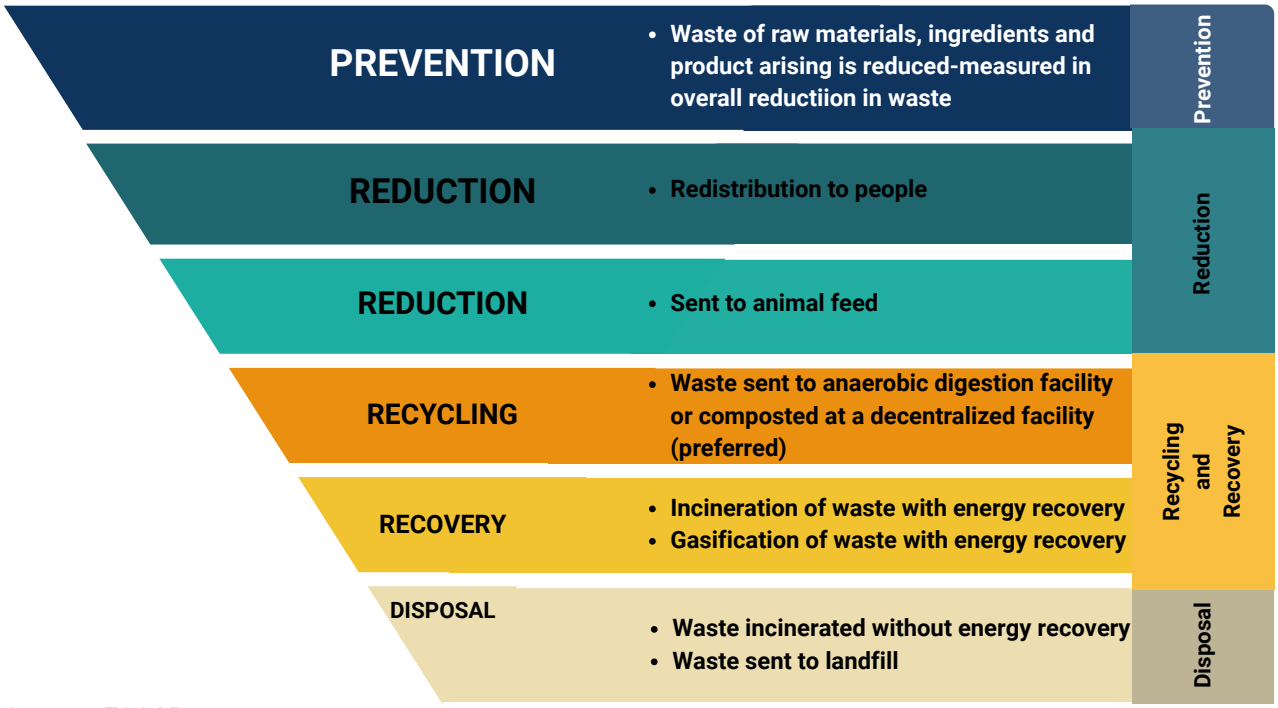
Since methane emissions are generated only from the organic part of waste disposals at landfills, it is crucial to prioritize organic waste management when applying the waste management hierarchy to reduce methane emissions. Figures 5-7 illustrate waste management and methane mitigation hierarchies focusing on the waste-to-resource approach.

Figure 6: Waste management hierarchies based on the circular approach



Source: ESCAP

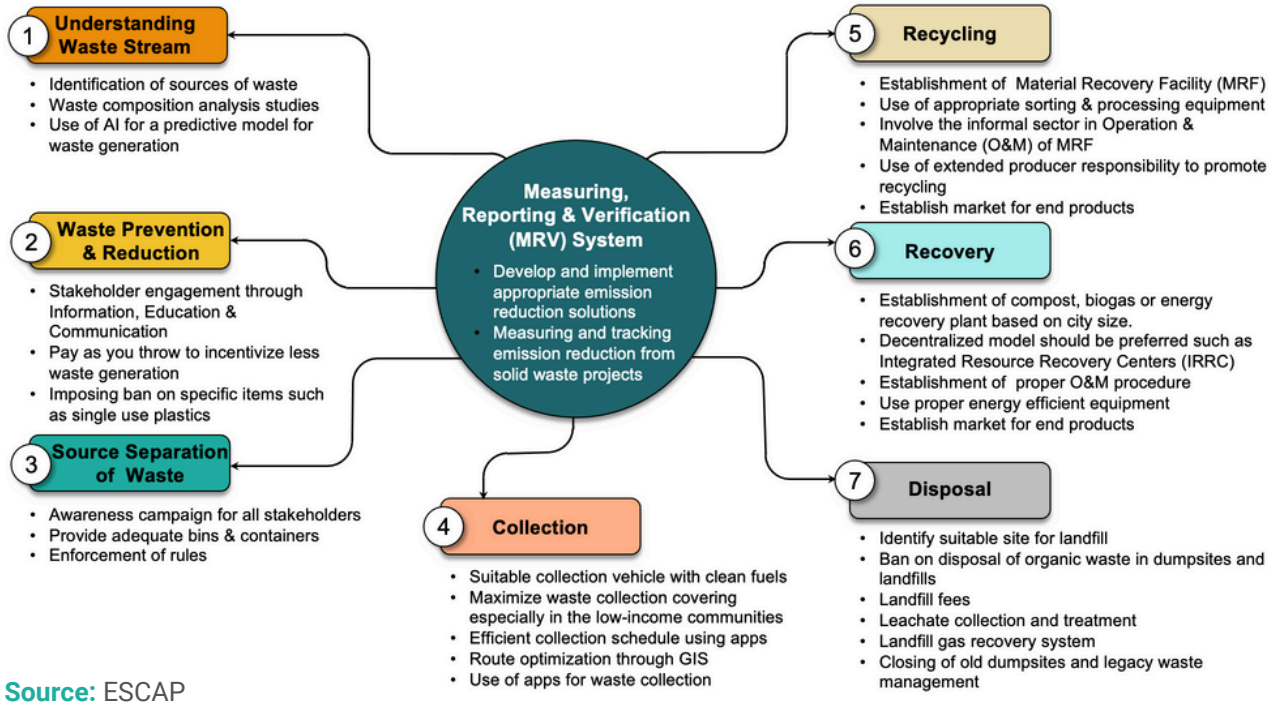
Figure 7: Food and organic waste management hierarchies based on the circular approach



Source: ESCAP

To reduce methane and other GHG emissions from the solid waste sector, national and local governments can follow the steps mentioned in the following figure. Case study examples are included as well.

Figure 8: Strategies for methane and other GHG emission reduction from solid waste management based on circular approach of waste management



Source: ESCAP

Box 3: Recovery through RA-X large-scale composting and su-re.co small-scale biogas digesters in Bali, Indonesia

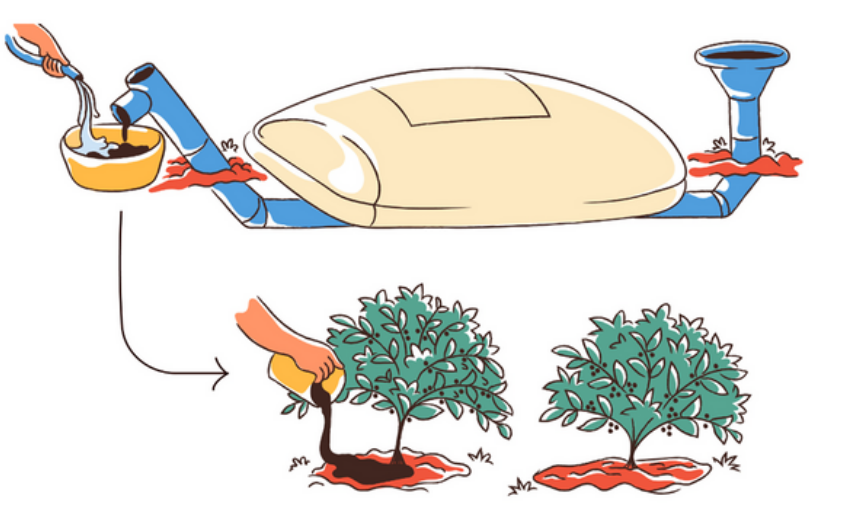
The RA-X composting system and su-re.co's small-scale biogas digesters both offer innovative, circular solutions for organic waste recovery and for reducing methane emissions in Indonesia, providing significant environmental, social and economic benefits.

The RA-X system, installed in Bali in collaboration with su-re.co[a] and Ishibashi Ltd Japan, processes organic waste at the TPST Mengwitani facility in Badung. Since its installation in October 2024, RA-X has diverted 646.6 tons of organic waste from landfills, significantly reducing methane emissions by operating in an aerobic, high-temperature environment (around 70°C). This process has resulted in the production of 95.4 tons of nutrient-rich compost in just six months, which has been used to restore degraded landscapes across Bali. The compost improves soil fertility, water retention and carbon sequestration.

Preliminary calculations show a 26.5 $MtCO_2e$ reduction in emissions compared to traditional landfill disposal methods, a reduction equivalent to eight times the annual per capita emissions of Indonesia.[b] Additionally, the system has motivated at least five TPS3R communities to separate their waste, spurring broader acceptance of circular waste management practices. By reducing open dumping and pests, local residents benefit from better health outcomes, such as fewer respiratory issues and reduced risk of vector-borne diseases.

On the other hand, su-re.co's small-scale biogas digesters, launched in 2018, offer an effective waste-to-energy solution for households across Indonesia. With 130 units currently installed, each $1m^3$ digester processes food waste into biogas, providing enough cooking fuel for 1-2 hours per day.

Figure 12: Small-scale biogas digesters producing cooking gas and nutrient-rich fertilizer



Source: su-re.co (Sustainability & Resilience)

These biogas digesters reduce reliance on LPG and prevents methane emissions from decomposing organic waste in landfills. Each biogas unit reduces 1 ton of CO_2e emissions annually. The digesters also produce bioslurry, a nutrient-rich organic fertilizer that enhances soil fertility, improves water retention, and supports household farms, contributing to local food security and regenerative agriculture. By creating shared community goals of waste reduction and cleaner cooking, these digesters foster collective action, with neighbourhoods exchanging knowledge on sustainable waste practices.

Both the RA-X composting system and su-re.co's biogas digesters are exemplary models of decentralized, community-driven solutions. They reduce the environmental burden of waste disposal, provide valuable resources like compost and biogas, and improve local livelihoods by engaging residents in sustainable practices. These technologies offer scalable, low-cost and impactful approaches to waste recovery that contribute to healthier, more resilient communities across Indonesia.

[a] su-re.co (Sustainability & Resilience), "Homepage", 2024. Available at https://www.su-re.co/

[b] Rum, I. A., and others, "Exploring carbon footprints and carbon intensities of Indonesian provinces in a domestic and global context", Frontiers in Environmental Science, vol.12 (October 2024). Available at https://doi.org/10.3389/fenvs.2024.1325089

Box 4: Methane emissions reductions through the Carbon Credit Aggregator model in Indore, India

The relationship between waste management and GHG emissions is well established. GHGs can be avoided by following the principles of integrated solid waste management and improving existing waste management practices. However, aspects related to climate change and the intangible benefits of scientific waste management are yet to be clearly spelt in the 'Swachh Survekshan', the world's largest sanitation survey conducted by Government of India under the Swachh Bharat Mission (urban). Being more output oriented, the Swachh Survekshan indicators, focus on visible improvements on ground and innovation practices. According to a study by TERI on the quantification of GHG mitigation potential of the various development initiatives undertaken by the Ministry of Housing and Urban Affairs, the implementation of Swachh Bharat Mission is projected to result in the mitigation of 19 million tons of CO_2 equivalent GHG by 2031.

Indore, a metropolitan city in central India has established itself as the epitome of city-wide cleanliness and innovative initiatives. The city has consistently won the award for being India's cleanest city for several consecutive years. One of the successful initiatives is the 'Carbon Credit Aggregator Model' through which carbon credit finance mechanisms can catalyze environmentally sustainable and financially viable waste management practices. The city holds the distinction of being the first city in South Asia to leverage carbon financing. As a pilot initiative, the city opted to start on a small scale and began by registering only 3 projects: a bio-methanation plant of 35 TPD capacity (Chhoithram and Kabitkhedi); a 600 tons per day compost plant; and a 1.5 MW solar plant, under the Verified Carbon Standard (VCS) program of the United Nations Framework Convention on Climate Change (UNFCCC). Under the VCS mechanism, along with validation, audit, verification processes, carbon credits were generated between 12 October 2017 to 31 December 2022 and total revenue of approximately $1 million was released from the generated credits.

Indore's Carbon Credit Aggregator model is now being sought by other urban local administrative bodies. In addition to creating environmental benefits by saving carbon, the model was also able to generate revenue for future projects. While it may take some time to recover the initial investment cost, carbon credits are ongoing. Carbon credit projects not only contributed significantly to cleaning the city, but also provided financial incentives to the administration of Indore to pursue other green projects.

Opportunities and recommendations

With growing waste generation and rising methane emissions from organic waste in the region, cities have both an urgent and substantial opportunity to reduce emissions and limit global warming to the 1.5°C target through improved solid waste management. In fact, studies indicate that utilizing existing, technically feasible strategies could already cut landfill methane emissions by up to 80 per cent by 2030 (Ocko and others, 2021). A key principle in this approach involves prioritizing food waste prevention, especially in regions with inadequate waste management systems, which offers a cost-effective and impactful starting point for action.

The following recommendations outline actionable pathways across several thematic areas to adopt circular solid waste management and reduce methane emissions for low-carbon and resilient cities.

Regulatory and financial incentives

Most developing countries in Asia and the Pacific lack comprehensive regulatory frameworks for managing solid waste. To promote circular approaches to waste management, Governments in the region should prioritize sustainable solid waste management in broader socioeconomic development policies, specifically supporting waste-to-resource initiatives through targeted policies and financial mechanisms that address. These include:

- Developing national waste policies that support waste-to-resource initiatives by adopting circular principles and integrating them into broader socioeconomic and climate policies.
- Promoting fiscal incentives (e.g., direct loans, tax breaks, grants and public-private partnerships) and market-based instruments to attract private sector investment in organic waste diversion projects such as composting and biogas.
- Leveraging international climate finance mechanisms, such as Nationally Appropriate Mitigation Actions (NAMAs), to fund methane reduction projects, recognizing their eligibility as climate mitigation efforts.
- Introducing fees or levies on landfill use to incentivize alternatives, ensuring these measures do not create undue burdens on disadvantaged communities.
- Reducing market distortions against compost and biogas by creating a level playing field for recycled products.

Infrastructure and technology investment

Local governments in developing Asia often lack the financial and technical capacity to manage growing waste generation, often resorting to inefficient linear disposal methods. National governments must prioritize investments in circular infrastructure and adopt scalable technologies for organic waste diversion and recovery by:

- Allocating national funds for waste-to-resource projects, focusing on organic waste diversion through source separation, material recovery facilities (MRFs), and technologies for the recovery of organics (e.g., composting, anaerobic digestion).
- Rehabilitating open dumps into sanitary landfills with landfill gas (LFG) capture systems, leachate management, and environmental controls.
- Implementing best practices in landfill design and operations to optimize LFG capture and minimize methane leakage.
- Investing in modern waste collection and transport systems to replace outdated, fossil-fuel intensive vehicles and improve routing efficiency using geographic information systems (GIS) and other software.
- Supporting pilot projects for decentralized solutions (e.g., community composting, biogas digesters) to reduce reliance on landfills.

Regional collaboration and knowledge-sharing

Regional collaboration and knowledge-sharing on successful waste-to-resource projects are crucial for replicating and scaling up best practices in Asia and the Pacific. Cities can learn from peers to avoid reinventing solutions, accelerate progress toward circular waste management and reduce methane emissions by:

- Facilitating city-to-city exchange programs and regional platforms to share best practices, for example Bacolod's Trash-to-Cash program or RA-X composting in Bali.
- Promoting online training to build technical capacity among municipal staff. For example, the World Bank, in partnership with the Government of the Republic of Korea, has an online course entitled Solid Waste Management (SWM) as part of the open learning campus (World Bank Group, 2025). Moreover, EAWAG also has a course on solid waste management focusing on organic waste treatment (Coursera, 2025).
- Developing case studies on scalable models like CITIIS program in India or Indore's Carbon Credit Aggregator model to guide policy and investment.
- Aligning regional strategies with global climate goals, like the Paris Agreement and the Sustainable Development Goals, to ensure coherence in methane mitigation efforts.

Alignment with international agreements

Circular waste management directly contributes to global climate and sustainability agendas. The updated 2025 NDCs 3.0 now include all GHGs across all sectors, including methane emissions from the waste sector, as part of their emission reduction targets. This presents a critical opportunity to leverage the waste sector's untapped mitigation potential by:

- Integrating waste-sector methane reductions into updated NDCs, ensuring alignment with the outcomes of the Global Stocktake of the Paris Agreement.
- Mainstreaming circular economy principles into subnational and local policies, linking waste management to climate resilience, SDG 11 (Sustainable Cities), and national development plans.
- Decentralizing fiscal and administrative authority to local governments to build capacity for sustainable waste management (e.g., city-level composting incentives, MRF subsidies) and adopting a participative and decentralized model of urban waste management. Emphasis should be placed on community-led composting hubs or the integration of the informal sector ensuring both inclusivity and scalability of waste management solutions.
- Strengthening transboundary cooperation for waste management in shared ecosystems (e.g., river basins, coastal zones) to address regional methane hotspots and harmonize standards.

Measuring, reporting and verification (MRV)

Measuring and tracking emissions and emissions reductions from solid waste projects can help decision makers implement appropriate solutions to control emissions. At the global level, the Biennial Transparency Reports (BTR), are submitted by Parties to the Paris Agreement every two years to track progress towards the goals of the Agreement. It includes information on national GHG emissions inventories, progress toward the NDCs, climate policies and measures related to mitigation, adaptation and support, including the waste sector. Some MRV methods include:

- Developing and implementing robust emissions MRV systems to track methane emissions, detect leaks and validate waste sector mitigation efforts.
- Adopting the Global Methane Initiative's (GMI) Policy Maker's Handbook for MRV to standardize emissions tracking for organic waste diversion projects (U.S. EPA, 2022).
- Deploying satellite monitoring (e.g., methane sensors) to detect super-emitter sites and prioritize interventions in high-leakage areas.

- Submitting Biennial Transparency Reports (BTRs) under the Paris Agreement to report waste-sector emissions and mitigation efforts.
- Partnering with academia and NGOs to build local capacity in GHG inventory development and MRV methodologies.

Capacity-building and awareness generation

There is also an urgent need to build institutional capacities within urban local bodies and raise awareness and generate knowledge among the public regarding effective waste management practices in order to move from linear disposal to circular systems. Public awareness and staff training that focuses on source separation of waste and their connections to public and environmental health also supports cities in improving healthy living conditions by:

- Developing a comprehensive capacity-building strategy that targets all staff involved in various waste management activities within urban local bodies. Training and capacity-building should enhance the effectiveness of the waste management system and the operational efficiency of waste management staff by prioritizing circular approaches and appropriate MRV systems.
- Launching public campaigns to promote waste segregation at source, emphasizing connections between waste management and public and environmental health.
- Formalizing the informal waste sector by integrating waste pickers into recycling value chains and providing green job opportunities.
- Engaging communities in decentralized solutions (e.g., composting hubs, biogas digesters) to foster ownership and long-term sustainability.

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