



DEVELOPMENT OF AN MRV FRAMEWORK FOR THE WASTE SECTOR IN CAMBODIA

**Report on NDC tracking indicators and data gaps
for the waste sector**



March 2026



Initiative for Climate Action Transparency - ICAT

DEVELOPMENT OF AN MRV FRAMEWORK FOR THE WASTE SECTOR, INCLUDING
APPLICATION OF THE WASCAD AND GACMO TOOLS, CAMBODIA

Output E - Report on NDC tracking indicators and data gaps for the waste sector

ClimateSI, 2026

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Acknowledgement

The Royal Government of Cambodia (RGC) ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1996, and the Paris Agreement in 2017. The country submitted their Intended Nationally Determined Contribution (INDC) in 2015 and the latest Nationally Determined Contribution (NDC), NDC 3.0, in 2025 to the UNFCCC.

Cambodia has developed Monitoring, Reporting, and Verification (MRV) frameworks for several sectors, including forestry (REDD+), energy efficiency (NAMA in garments), renewable energy, and transport. However, a national MRV framework for the waste sector is still not in place. Existing systems, such as the NDC platform, do not currently enable the estimation of GHG impacts, requiring focal points to depend on external tools. Since tracking progress in the implementation and achievement of NDCs is a key requirement under the Enhanced Transparency Framework (ETF), establishing an MRV system is essential for Cambodia to achieve its targets in a standardized and transparent manner. In this context it is necessary to identify relevant indicators and assess existing data gaps to support the development of an effective and reliable MRV system for the waste sector in Cambodia.

The United Nations Office for Project Services (UNOPS) is providing technical assistance to the RGC under this ICAT project, which aims to design an MRV system for selected mitigation actions in the waste sector of Cambodia. A Team of National Experts, and International Experts of Climate Smart Initiatives (Pvt) Ltd (ClimateSI), were selected to support this project.

Appreciating the invaluable contribution extended from all stakeholders related to the assignment, we would like to extend our sincere thanks and gratitude to H.E. Sum Thy, Director General of General Directorate of Policy and Strategy (GDPS), Ministry of Environment; Mr. Sum Cheat, Deputy Director of the Department of Climate Change; and Mr. Lun Lido, Head of Office, Department of Climate Change, and other relevant key stakeholders for cooperating and assisting with this assignment by granting necessary approvals making relevant officers available for participation for the discussions, and providing necessary information.



Executive summary

This report presents the findings of the NDC tracking assessment for Cambodia’s waste sector under NDC 3.0, undertaken within the framework of ICAT Phase 3 support to strengthen transparency and implementation tracking. The assessment evaluates data availability, institutional arrangements, methodologies, and monitoring systems across solid waste and wastewater sub-sectors, with the objective of determining Cambodia’s readiness to track mitigation progress in line with the Enhanced Transparency Framework (ETF). While Cambodia has articulated clear waste-sector mitigation ambitions under NDC 3.0, the report finds that effective tracking of outcomes remains constrained by data fragmentation, limited operational monitoring, and incomplete MRV institutionalization.

The analysis confirms that Cambodia’s current data systems are sufficient to establish national baselines, characterize waste flows, and support emissions modeling using IPCC Tier 1 and Tier 2 approaches. An estimated 2.09 million tonnes of waste are disposed annually, with approximately 80 percent directed to open dumps and over 90 percent of disposal sites operating without management controls. Municipal solid waste (MSW) is dominated by organic material, with food waste accounting for about 52 percent, followed by plastics and paper. These characteristics underscore methane mitigation as the primary emissions reduction opportunity in the waste sector. However, the absence of country-specific emission factors and limited site-level measurements necessitate continued reliance on IPCC default values, resulting in high uncertainty and constraining robust progress tracking.

For wastewater, the report finds that while industrial activity data and permitting information exist—particularly within the Ministry of Industry, Science, Technology and Innovation—these datasets are not yet systematically linked to the Ministry of Environment’s MRV and inventory systems. Facility-level monitoring of wastewater flows, organic loads, treatment performance, and biogas recovery remains limited, particularly outside large or donor-supported installations. As a result, wastewater mitigation actions



under NDC 3.0 can be modeled at an aggregate level, but cannot yet be verified through consistent, operational data.

A central finding of the assessment is that Cambodia’s waste-sector NDC tracking is implementation-oriented but MRV-constrained. Baseline tracking and projection modeling are feasible using national estimates and IPCC methodologies, but outcome-based tracking of mitigation actions—such as landfill gas capture, organic waste diversion, and wastewater treatment upgrades—remains largely prospective. The absence of operational monitoring systems at landfills and treatment facilities is identified as the dominant gap, particularly for parameters required to quantify methane capture, destruction efficiency, organic fraction reduction, and treatment performance.

The report reviews the institutional arrangements introduced under BTR1 and finds meaningful progress toward a more structured and transparent NDC tracking framework. Roles and responsibilities are increasingly aligned with data-generating institutions at the sectoral level, including the Ministry of Rural Development, National Institute of Statistics, Ministry of Water Resources and Meteorology, Ministry of Industry, Science, Technology and Innovation, and Ministry of Agriculture, Forestry and Fisheries. At the national level, the establishment of a National NDC Tracking Compilation Team, an International NDC Tracking Evaluation Team, and a QA and Verification Team represents a significant improvement in data coordination, methodological oversight, and quality assurance. The Department of Climate Change functions as the national coordinator, ensuring alignment between NDC tracking, national GHG inventory processes, and transparency reporting.

Despite these advances, institutional gaps persist. Standardized reporting templates are not yet consistently applied across institutions and administrative levels, formal data-sharing agreements are largely absent, and QA/QC procedures are unevenly implemented—particularly at sub-national level. In addition, MRV functions remain heavily reliant on project-based technical support, with no long-term staffing plan to ensure continuity, institutional memory, and sustainability of the tracking system.



The consultation process—comprising workshops, technical validation meetings, bilateral discussions with operators, and targeted engagement with development partners—played a critical role in validating assumptions, refining indicators, and grounding the proposed framework in operational realities. Stakeholders confirmed the relevance of the proposed indicators while emphasizing capacity constraints, data availability limitations, and the need for phased implementation of MRV requirements. Inputs from development partners, including data and documentation on plastics, food waste, textile waste, and hazardous waste, further informed the assessment and highlighted opportunities for future system strengthening.

Based on these findings, the report identifies a set of priority interventions required to transition Cambodia’s waste-sector NDC tracking from estimation-based reporting toward credible, implementation-focused MRV. These include the institutionalization of standardized reporting templates, the establishment of formal data-sharing mechanisms between key institutions, the phased introduction of facility-level monitoring at landfills and wastewater treatment plants, and the clarification of methodological alignment between IPCC-based national tracking and project-level monitoring approaches. Strengthening sub-national capacity, integrating private-sector reporting through licensing systems, and embedding MRV functions within permanent government structures are also identified as critical next steps.

Overall, the report concludes that Cambodia has established a solid technical and institutional foundation for waste-sector NDC tracking under NDC 3.0. However, realizing the full transparency and accountability objectives of the Enhanced Transparency Framework will require sustained investment in MRV systems, institutional coordination, and operational monitoring. The recommendations set out in this report provide a practical and phased pathway to close existing gaps and enable credible tracking of waste-sector mitigation outcomes in future BTR and NDC reporting cycles.



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List of Abbreviations

ACM	Approved Consolidated Methodology
AD	Anaerobic Digestion
BOD	Biochemical Oxygen Demand
BTR	Biennial Transparency Report
BTR1	First Biennial Transparency Report
CCCSP	Cambodia Climate Change Strategic Plan
CDM	Clean Development Mechanism
CH ₄	Methane
CO ₂	Carbon Dioxide
CO ₂ e	Carbon Dioxide Equivalent
COD	Chemical Oxygen Demand
COP	Conference of the Parties
DCC	Department of Climate Change
DQM	Department of Water Quality Management
EF	Emission Factor
ETF	Enhanced Transparency Framework
FAO	Food and Agriculture Organization
GACMO	Greenhouse Gas Abatement Cost Model
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GHGIS	Greenhouse Gas Inventory System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GWP	Global Warming Potential
ICAT	Initiative for Climate Action Transparency
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization



IWW	Industrial Wastewater
JICA	Japan International Cooperation Agency
KPI	Key Performance Indicator
LCA	Life Cycle Assessment
LEDS	Long-Term Low Emission Development Strategy
LFG	Landfill Gas
LFGTE	Landfill Gas-to-Energy
LULUCF	Land Use, Land-Use Change and Forestry
MAFF	Ministry of Agriculture, Forestry and Fisheries
MBT	Mechanical–Biological Treatment
MISTI	Ministry of Industry, Science, Technology and Innovation
MLMUPC	Ministry of Land Management, Urban Planning and Construction
MoE	Ministry of Environment
MoH	Ministry of Health
MoP	Ministry of Planning
MoWRAM	Ministry of Water Resources and Meteorology
MPWT	Ministry of Public Works and Transport
MRD	Ministry of Rural Development
MRV	Measurement, Reporting and Verification
MSW	Municipal Solid Waste
NAMA	Nationally Appropriate Mitigation Action
NAP	National Adaptation Plan
NC	National Communication
NC3	Third National Communication
NC4	Fourth National Communication
NDC	Nationally Determined Contribution
NDC 3.0	Third Nationally Determined Contribution
NGGIP	National Greenhouse Gas Inventory Programme
NGO	Non-Governmental Organization



NIS	National Institute of Statistics
ODF	Open Defecation Free
PSC	Project Steering Committee
QA/QC	Quality Assurance / Quality Control
R&D	Research and Development
SBSTA	Subsidiary Body for Scientific and Technological Advice
SDG	Sustainable Development Goal
SME	Small and Medium-sized Enterprise
SWDS	Solid Waste Disposal Site
TNC	Third National Communication
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
WasCAD	Waste Sector Climate Action Database
WASH	Water, Sanitation and Hygiene
WWTP	Wastewater Treatment Plant



I. INTRODUCTION

1.1. Background

The waste sector is one of the fastest-growing contributors to Cambodia's greenhouse gas emissions, accounting for a significant share due to rapid urbanization, increasing waste generation, and gaps in existing waste management systems. Compared to other sectors like energy and agriculture, the waste sector presents unique opportunities for mitigation through integrated waste management strategies, such as composting, landfill gas recovery, and improved wastewater treatment.

Cambodia's Nationally Determined Contribution (NDC) establishes mitigation commitments across key sectors, including waste, to support the country's transition toward a low-emissions and climate-resilient development pathway. The waste sector, encompassing solid waste, wastewater, and open burning, represents a growing share of national greenhouse gas (GHG) emissions, primarily due to rapid urbanization, increasing consumption, and gaps in waste management, treatment, and disposal systems. Strengthening monitoring, reporting, and verification (MRV) arrangements in this sector is therefore essential to track progress toward Cambodia's NDC targets, inform policy adjustments, and enhance transparency under the Enhanced Transparency Framework (ETF) of the Paris Agreement.

Decision 18/CMA.1 provides specific modalities, procedures, and guidelines (MPGs) for reporting information necessary to track progress made in implementing and achieving NDCs. These MPGs require developing country Parties to identify indicators, establish data collection systems, report methodologies, and document progress over time. The Initiative for Climate Action Transparency (ICAT) guidelines provide a complementary, practical framework for designing indicator systems, assessing policy impacts, and strengthening institutional arrangements for transparency. Within this context, this report presents a structured approach to developing NDC tracking indicators and identifying data gaps for Cambodia's waste sector.



1.2. Objective

The purpose of this report is to propose a comprehensive indicator framework for monitoring the implementation and achievement of Cambodia's NDC 3.0 targets in the waste sector. This includes:

- Identifying specific indicators for identified measures.
- Assessing the availability, accessibility, and quality of relevant data required for indicator measurement.
- Mapping institutional arrangements, stakeholder roles, and existing reporting pathways for data collection.
- Documenting critical data gaps, challenges, and capacity needs that must be addressed to operationalize an efficient NDC tracking system.
- Preparing a draft set of indicators for consultation with national and subnational institutions and key stakeholders including developing partners.

This report constitutes **Output E** under Activity 2 of the ICAT-supported assessment and will serve as a key technical input for strengthening the waste sector MRV system of Cambodia.

1.3. Scope

This assessment covers all major waste-sector emission sources, mitigation actions, and enabling systems relevant to Cambodia's NDC 3.0, as classified under the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Volume 5: Waste) and consistent with the scope of the ICAT Phase 3 project on the development of a measurement, reporting and verification (MRV) framework for the waste-sector. The scope encompasses both emission-generating activities and mitigation interventions across the waste management value chain, including upstream waste prevention and reduction, downstream treatment and disposal processes, and cross-cutting institutional arrangement and data management systems required to support MRV, projections, and tracking the NDC implementation. The assessment covers the full municipal and industrial solid waste system, as in the following table.

Table 1: Scope of Solid Waste and Wastewater Sub-Sectors Covered in the Assessment

Sector	Sub-sector / NDC Measure	Scope of Coverage
Solid Waste Management	Solid Waste Disposal Sites (SWDS)	Open dumpsites, unmanaged disposal sites, controlled landfills, and sanitary landfills; landfill gas (LFG) generation, oxidation, recovery, flaring, electricity generation, and potential heat use; dumpsite closure, rehabilitation, and transition to controlled or sanitary disposal
	Waste Reduction and Pollution Control (NDC 1)	Municipal solid waste (MSW) generation trends and per-capita waste reduction; plastic waste reduction measures including single-use plastic (SUP) bans and Extended Producer Responsibility (EPR) schemes; pollution control measures affecting emission pathways (e.g. diversion from open burning and unmanaged disposal)
	Waste Collection and Segregation at Source (NDC 2)	Household, institutional, commercial, and market-level waste collection coverage; source segregation of MSW into organic, recyclable, and residual fractions; reduction of open burning practices associated with uncollected or mixed waste
	Biological Treatment of Solid Waste (NDC 3)	Centralized and decentralized composting systems; anaerobic digestion of organic waste; community-based and household composting initiatives; co-composting practices and management of composting run-off wastewater
	Alternative Solid Waste Processing at Landfills (NDC 4)	Mechanical-Biological Treatment (MBT); Refuse-Derived Fuel (RDF) production; Waste-to-Energy (WtE) facilities; medical waste treatment and incineration capacity expansion



	Textile Waste Management (NDC 6)	Post-industrial textile waste (PITW) collection, sorting, recycling, and traceability; informal and formal textile recycling pathways; avoided landfill disposal of textile waste and associated methane emissions
Wastewater Management	Urban and Domestic Wastewater	Centralized wastewater treatment plants; decentralized systems including septic tanks, lagoons, and small-scale treatment facilities; sludge management and disposal pathways
	Industrial Wastewater (NDC 7)	Food and beverage (F&B), garment, footwear, textile (GFT), and leather sectors; wastewater generation volumes, organic loading (COD/BOD), and treatment coverage; anaerobic and aerobic treatment processes; biogas recovery and utilization from industrial wastewater treatment plants

In addition to physical waste and wastewater systems, the scope explicitly includes:

- Data collection, management, and reporting systems at national and sub-national levels
- Institutional roles and coordination mechanisms among the Ministry of Environment (MoE), line ministries, sub-national authorities, operators, and development partners
- Application of IPCC default parameters versus country-specific emission factors, including identification of data gaps and uncertainties
- Integration with national MRV systems, NDC tracking arrangements, and the Enhanced Transparency Framework (ETF)
- Readiness for transition from modelled estimates to measured performance, particularly for landfill gas recovery and industrial wastewater biogas systems

1.4. Limitations

This assessment is subject to several limitations, including the lack of a unified national MRV framework for the waste sector, fragmented data management systems, and resource



constraints. Additionally, the absence of standardized data collection methodologies and limited institutional and technical capacity pose challenges to implementing the proposed framework. These limitations highlight the need for targeted investments in capacity building, technology, and institutional strengthening.

The scope focuses on emissions occurring within Cambodia’s national boundary and those mitigation actions explicitly included under NDC 3.0 waste-sector measures. Upstream lifecycle emissions (e.g. production of materials) are not included unless explicitly required by approved methodologies. Where site-level monitoring data are unavailable, the assessment relies on IPCC Tier 1 or Tier 2 approaches, proxy indicators, and conservative assumptions, consistent with current MRV readiness.

1.5. Methodology

The assessment adopted a structured five-stage methodological process designed to support the development of a robust, transparent, and implementation-ready MRV framework for Cambodia’s waste sector under NDC 3.0. The methodology was aligned with the Enhanced Transparency Framework (ETF) requirements under Article 13 of the Paris Agreement and applied established international guidance to ensure methodological consistency, traceability, and technical defensibility.

Following figure illustrates the five-stage methodological process used in the assessment.

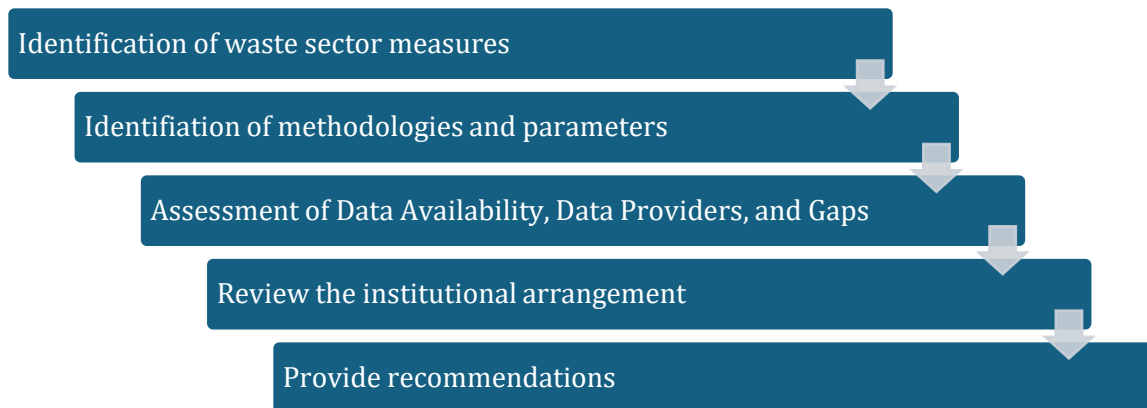




Figure 1: five-stage methodological process

The first stage focused on the systematic identification and consolidation of all mitigation measures included in Cambodia's NDC 3.0 that are relevant to the waste sector. This included all solid waste and wastewater measures across municipal and industrial systems, covering waste reduction, waste treatment, disposal, and recovery activities. Each NDC measure was reviewed in detail to clarify its scope, targeted sub-sector, expected mitigation mechanism, and relevance to greenhouse gas emission sources as defined under the IPCC waste sector categories. This step ensured that the assessment covered the full range of waste-related mitigation actions endorsed at the national level and provided a clear basis for aligning MRV requirements with national policy commitments.

The second stage involved the identification of appropriate quantification methodologies and monitoring parameters required to track implementation progress and estimate greenhouse gas impacts for each NDC measure. Internationally recognized methodologies were used as the primary reference to ensure compatibility with Cambodia's national greenhouse gas inventory system. The 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Volume 5: Waste), were applied to identify emission sources, activity data requirements, and default emission factors, particularly for solid waste disposal sites, wastewater treatment, and open burning of waste. For mitigation activities involving landfill gas recovery, composting, and anaerobic digestion, approved Clean Development Mechanism (CDM) methodologies were reviewed to identify practical monitoring parameters commonly applied at the project level. These methodologies were used not for crediting purposes, but as technical references to define measurable parameters. References include the IPCC National Greenhouse Gas Inventory Programme (NGGIP) Guidelines (<https://www.ipcc-nggip.iges.or.jp>) and the UNFCCC CDM Methodology Booklet (<https://cdm.unfccc.int/methodologies>).

Building on the list of identified parameters, the third stage involved a detailed review of existing data systems and data availability across the entire waste sector. This stage assessed what data are currently available in Cambodia, which institutions generate or hold these



data, how frequently they are collected, and the extent to which quality control and quality assurance procedures are applied. Data sources reviewed included administrative records, sectoral reports, operational data from waste operators, national statistics, and existing MRV-related databases. Particular attention was given to identifying differences between data used for operational purposes and data suitable for national-level MRV and NDC tracking. The assessment also examined whether available data are disaggregated by waste type, treatment method, or geographic level, and whether time series data are sufficiently consistent to support projections and trend analysis. This stage allowed for the identification of data gaps, inconsistencies, and reliance on IPCC default values, which are critical for prioritizing improvements in future MRV system development.

The next stage examined the institutional arrangements that underpin data generation, reporting, verification, and overall MRV functionality for the waste sector. This review assessed the clarity of institutional mandates across the Ministry of Environment, relevant line ministries, sub-national authorities, and private sector operators involved in waste and wastewater management. It evaluated existing data flow pathways, including how information moves from facility or municipal level to national aggregation, and whether formal reporting mechanisms and coordination platforms are in place. The assessment also considered the role of private operators in generating key activity data, the effectiveness of inter-ministerial coordination mechanisms, and institutional capacity to sustain long-term monitoring systems. This stage was essential to understanding not only technical data gaps, but also structural and governance constraints that affect the reliability, continuity, and transparency of waste sector MRV under the ETF.

Together, these five methodological stages ensured that the assessment went beyond a purely technical review of emission factors and activity data. Instead, it provided an integrated evaluation of mitigation measures, quantification approaches, data systems, and institutional readiness, forming a coherent foundation for strengthening Cambodia's waste sector MRV framework and its alignment with NDC 3.0 implementation and future ETF reporting requirements. The final stage translated the assessment findings into practical, prioritized recommendations to address identified gaps, enhance MRV robustness, and support effective implementation and reporting.



II. CAMBODIA'S NDC TARGET & TRACKING NEEDS FOR WASTE SECTOR

2.1. Overview of NDC Targets for the Waste Sector

Cambodia's NDC 3.0 outlines an integrated waste sector strategy aimed at reducing municipal solid waste (MSW) generation, enhancing resource recovery, and improving waste treatment systems to support long-term climate mitigation. The country targets 50% source segregation of MSW, 75% household access to regular waste collection, and a reduction of open burning to 10% by 2035. Organic waste processing capacity is planned to expand to 600,000 tons per year, equivalent to approximately 25% of total MSW, through the establishment of municipal and regional composting facilities, community-based composting, and increased participation of farmers in organic waste utilization.

To extend landfill lifespan and reduce methane generation, the NDC introduces large-scale Refuse-Derived Fuel (RDF) production and waste-to-energy (WtE) development, to decrease landfill MSW disposal by 30% by 2035. Medical waste management will also be strengthened, targeting a capacity of 8 tons per day. Landfill operations will be upgraded through a 50% increase in controlled and sanitary landfills. The Toul Prech regional landfill is expected to integrate landfill gas (LFG) extraction by 2027.

The NDC additionally prioritizes plastic and textile waste reduction, including nationwide recycling programs, public awareness initiatives, centralized textile sorting centres, and factory-level waste minimization supported by incentives. In the wastewater subsector, Cambodia aims to achieve 100% industrial wastewater treatment coverage for Garment, Footwear, and Travel goods (GFT) and leather factories, alongside doubling the number of biogas-producing treatment plants (Cambodia NDC 3.0, 2025).

To operationalize Cambodia's waste-sector NDC targets, the following specific mitigation measures were outlined in NDC 3.0:

- Implement solid waste reduction strategies and pollution control measures;
- Waste collection and segregation at source (at households, schools, markets, restaurants/hotels levels);
- Increase capacities for organic waste processing;
- Introduce alternative SWM processing at existing landfills;



- Landfill management;
- Improve textile waste management capacities; and
- Industrial wastewater (IWW) management.

2.2. Prioritization of Targets

Given the scale and diversity of waste-sector interventions under NDC 3.0, targets have been prioritized based on expected greenhouse gas reduction potential, feasibility of implementation, and consistency with national development objectives. In the short term, priority is given to measures that can deliver early mitigation benefits while strengthening system foundations, including the expansion of landfill gas recovery, the rollout of initial municipal solid waste segregation programs, and improvements in waste-sector data collection and reporting systems.

In the medium term, the focus shifts toward scaling infrastructure-based solutions with higher mitigation potential. These include the establishment of large-scale composting facilities, the systematic reduction of open burning practices, and the introduction of refuse-derived fuel production to divert waste from landfills. These measures require greater investment and institutional coordination but are essential for achieving sustained emission reductions.

By 2035, the long-term priority is structural transformation of the waste sector. This includes achieving nationwide targets for source segregation, expanding waste-to-energy projects where appropriate, and ensuring universal industrial wastewater treatment coverage. At this stage, mitigation outcomes are expected to be driven primarily by improved system performance rather than incremental interventions, supported by mature institutions and stable financing mechanisms. The prioritization is as follows:

- Short-Term (2025): Expand landfill gas extraction systems, initiate MSW segregation programs, and improve data collection systems.



- Medium-Term (2030): Establish large-scale composting facilities, reduce open burning to 10%, and implement refuse-derived fuel (RDF) production.
- Long-Term (2035): Achieve 50% source segregation of MSW, expand waste-to-energy (WtE) projects, and ensure 100% industrial wastewater treatment coverage.

To strengthen the wastewater targets, Cambodia will focus on upgrading existing treatment plants, constructing new facilities in underserved areas, and promoting biogas recovery systems. Specific targets include:

- Constructing 10 new centralized wastewater treatment plants by 2030.
- Retrofitting 50% of existing plants with biogas recovery systems.
- Introducing stricter enforcement mechanisms for industrial wastewater discharge standards.

The waste sector's NDC targets align closely with other sectors, such as energy and agriculture. For example, biogas produced from wastewater treatment can be used as a renewable energy source, while compost from organic waste can support sustainable agricultural practices. These synergies will be leveraged to maximize the impact of mitigation measures and promote a circular economy.

2.3. Monitoring Requirements under NDC Implementation

Effective implementation of Cambodia's waste-sector NDC commitments requires a structured monitoring system aligned with the Enhanced Transparency Framework and Decision 18/CMA.1. Monitoring must support tracking of mitigation actions by assessing whether planned interventions—such as composting facilities, landfill upgrades, refuse-derived fuel and waste-to-energy projects, and wastewater treatment improvements—are being implemented as intended and are operating effectively.

Monitoring also plays a critical role in tracking policy and regulatory implementation. This includes assessing the status and enforcement of measures such as source segregation requirements, plastic and textile waste reduction initiatives, landfill management standards,



and industrial wastewater treatment obligations. Understanding policy effectiveness is essential for identifying implementation barriers and adjusting interventions where needed.

Finally, monitoring must enable consistent estimation of greenhouse gas emission reductions and assessment of enabling conditions. This involves applying IPCC- and CDM-aligned methodologies to quantify emission changes, while also tracking inputs such as finance, technology deployment, institutional capacity, and human resources. Together, these monitoring functions form the backbone of an integrated waste-sector MRV system capable of supporting credible NDC tracking and transparent reporting under the Paris Agreement.

Table 2: Monitoring Functions for Tracking Cambodia’s Waste-Sector NDC Commitments

Monitoring dimension	Purpose	Description
Tracking progress of mitigation actions	Implementation and performance tracking	Monitors the implementation status and operational performance of waste-sector mitigation actions, including composting, landfill upgrades, refuse-derived fuel (RDF) and waste-to-energy (WtE) projects, and improvements in wastewater treatment, to assess whether interventions are being executed as planned and delivering expected outputs.
Tracking policy implementation	Policy effectiveness and enforcement	Assesses the status, effectiveness, and enforcement of policies, regulations, and institutional measures supporting NDC commitments, such as source segregation mandates, plastic reduction initiatives, landfill management regulations, and industrial wastewater treatment requirements.



Monitoring dimension	Purpose	Description
Tracking GHG emission reductions	Quantification of mitigation outcomes	Quantifies changes in greenhouse gas emissions resulting from implemented mitigation measures, applying IPCC- and CDM-aligned methodologies to estimate reductions in methane and other emissions from landfills, wastewater systems, waste-to-energy facilities, and avoided open burning.
Tracking inputs (finance, technology, capacity)	Assessment of enabling conditions	Monitors the availability and utilization of financial resources, technologies, institutional capacity, and human resources required to implement NDC measures, ensuring that enabling conditions are in place to support sustained progress and long-term MRV functionality.



III. ASSESSMENT OF DATA AVAILABILITY AND GAPS IN THE WASTE SECTOR FOR NDC TRACKING

3.1. Data Availability Mapping

Data availability mapping identifies the existing datasets, data sources, and institutional responsibilities needed to support Cambodia’s NDC tracking and MRV requirements for the waste sector. This step assesses what information is currently collected (e.g., waste generation, composition, collection coverage, open burning, landfill operations, wastewater treatment), and where it is stored. Given that Cambodia does not yet have a national MRV framework for the waste sector, a centralized digital platform like ICAT’s Waste Climate Action Data Tool (WasCAD) can be introduced to provide a structured platform to compile, manage, and analyse waste-sector data. The tool facilitates the systematic collection, processing, and documentation of activity data and parameters for key waste sector categories. It supports consistent estimation of GHG emissions reduction and facilitates integration of the sector into Cambodia’s NDC tracking and ETF reporting. Data availability mapping is essential to define the baseline for implementing the WasCAD and for integrating the waste sector into the national NDC tracking system and the ETF. The mapping also helps identify data gaps that will affect the application of WasCAD for estimating GHG impacts of waste-sector NDC measures.

Following sections provides a structured overview of existing data, highlights limitations, and establishes the foundation for strengthening data collection, management, and reporting for the waste sector.

3.1.1. NDC 1: Implement solid waste reduction strategies and pollution control measures

This measure focuses on reducing Cambodia’s MSW generation and minimizing pollution through an integrated, policy-driven set of interventions. It operationalizes the national waste management framework by applying the waste hierarchy, strengthening circular economy principles, and enforcing regulatory instruments that target priority waste streams such as plastics and e-waste. These strategies respond to current trends, notably the average



waste generation of 0.78 kg/capita/day in 2020 and the 546,000 tons of plastic waste generated in 2022, which highlight the need for structured mitigation and pollution control.

Implementation aims to achieve the following outcomes:

- Limit MSW generation per capita to 0.84 kg/capita/day by 2030 in contrast to 0.87 kg/capita/day under BAU scenario, and maintain ≤ 0.86 kg/capita/day by 2035 through improved waste segregation, recycling programs, and awareness campaigns;
- Limit national plastic waste generation to 400,000 tons per year by 2035 through SUP restrictions and strengthened EPR frameworks; and
- Promote innovation by supporting research on sustainable, locally sourced alternatives that reduce dependence on conventional plastics.

Baseline and Mitigation scenarios of mitigation actions identified under NDC1 are described in Table 3 below.

Parameters required for tracking the progress of individual actions (action 1.1 and action 1.2) under NDC1 are presented in Tables 4 and 5.



Table 3: Mitigation actions identified under NDC 1

Action	Baseline Scenario	Project Scenario	Methodology & Assumptions
1.1) Reduce MSW generation per capita to 0.84 kg/capita/day by 2030 and maintain below ≤ 0.86 kg/capita/day by 2035 through waste management practices (especially food waste), recycling programs, and public awareness campaigns.	In the absence of the proposed action, municipal solid waste (MSW) generation per capita continues to increase from the 2020 level of 0.78 kg/capita/day to 0.87 kg/capita/day by 2030, driven by population growth, urbanization, and consumption patterns, with only limited recycling practices, improvements in waste prevention and public awareness.	Under the project scenario, MSW generation per capita will reduce to 0.84 kg/capita/day by 2030 and maintain at or below 0.86 kg/capita/day by 2035 through the nationwide implementation of expanded recycling programs	Landfill methodology of Solid Waste Disposal System in volume 5 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
1.2) Limit the plastic waste generation to 400,000 tons per year by 2035 by enforcing a ban on Single Use Plastic (SUP) and strengthening EPR schemes.	In the baseline scenario, plastic waste generation will continue to increase from the 2022 level of 546,000 tons due to limited enforcement of the nationwide single-use plastic ban and weak implementation of EPR schemes.	Under the project scenario, plastic waste generation will limit to 400,000 tons per year by 2035 through the enforcement of a nationwide single-use plastic ban and the strengthening of EPR schemes.	Open burning methodology in volume 5 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories.



<p>1.3) Conduct research on alternatives to replace plastics using locally available materials.</p>	<p>In the absence of the proposed action, plastic use continues largely unchanged due to limited research and development on locally available alternative materials to replace plastics.</p>	<p>Under the project scenario, targeted research and development will be conducted to identify, test, and promote locally available materials as viable alternatives to plastics, supporting a gradual reduction in plastic dependency.</p>	<p>Not Quantifiable</p>
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Action 1.1- Reduce MSW generation per capita to 0.84 kg/capita/day by 2030 and maintain below 0.86 kg/capita/day by 2035 through waste management practices (especially food waste), recycling programs, and public awareness campaigns.

Table 4: Parameters needed to track the progress of Action 1.1 of NDC 1

Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline	Municipal solid waste mass disposed of at SWDS in year y	tonnes/yr	Cambodia NDC 3.0	MoE	0.78 kg/capita/day by 2020	An appropriate monitoring and record-keeping system should be established to track the quantity of waste disposed at landfill sites.
Baseline	Municipal solid waste composition of waste disposed of in SWDS in year y (Food, Garden, Paper, Wood, Textile, inert waste (Glass, plastic, metal), etc.	%	Cambodia BTR1	MoE	Food waste: 51.90%, Paper waste: 9.90%, Wood waste: 2.30%, Textiles: 2.10%, Plastic: 20.90%, Glass: 1.60%, Metal: 1.10%, Ceramic and Stones: 0.50%, Rubber and Leather: 0.20%, Other: 9.50%	Sample-based analysis of the composition of waste disposed at landfill sites should be conducted regularly (monthly or annually)
Project	Municipal solid waste mass disposed of at SWDS in year y	tonnes/yr	Cambodia NDC 3.0	MoE	0.84 kg/capita/day by 2030 0.86 kg/capita/day by 2035	An appropriate monitoring and record-keeping system should be established to track the quantity of waste disposed at landfill sites.



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Project	Municipal solid waste composition of waste disposed of in SWDS in year y (Food, Garden, Paper, Wood, Textile, inert waste (Glass, plastic, metal), etc.	%	Cambodia BTR1	MoE	Food waste: 51.90%, Paper waste: 9.90%, Wood waste: 2.30%, Textiles: 2.10%, Plastic: 20.90%, Glass: 1.60%, Metal: 1.10%, Ceramic and Stones: 0.50%, Rubber and Leather: 0.20%, Other: 9.50%	Sample-based analysis of the composition of waste disposed at landfill sites should be conducted on a regular basis (monthly or annually)
Baseline/ Project	Methane Correction Factor (MCF) – Unmanaged shallow	fraction	Table 3.1, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default value for unmanaged shallow landfill: 0.4 No site-specific methane factor measurements in Cambodia	Need country-specific studies on landfill to derive national-level methane factors
Baseline	Fraction of degradable organic carbon that can decompose (DOC _f)	fraction	Section 3.2.3, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default value for fraction of degradable organic carbon which decomposes: 0.5 No country-specific measurements	Need country-specific studies on waste decomposition to derive fraction of degradable organic carbon which decomposes
Baseline/ Project	Fraction of degradable organic carbon in waste type j (DOC _j) (Food, Garden, Paper, Wood, Textile, inert waste (Glass, plastic, metal), etc.	fraction	Table 2.4, Chapter 2, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default values: Wood - 43% Paper/cardboard- 40% Food waste- 15% Textiles- 24% Garden and Park waste- 20% Nappies- 24%	Need country-specific studies on waste decomposition to derive national-level fractions for DOC in the waste type



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
					Glass, plastic, metal, other inert waste- 0% No country-specific fraction of DOC measurements for waste types	
Baseline/ Project	Methane generation rate for waste type j (kj)	yr-1	Table 3.3, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default values: Wood- 0.035 Paper/cardboard- 0.07 Food waste- 0.4 Textiles- 0.07 Garden and Park waste- 0.17 Nappies- 0.17 Glass, plastic, metal, other inert waste- 0 No country-specific methane generation rate for waste type	Need country-specific studies on waste decomposition to derive national-level fractions for the methane generation rate for the waste type
Baseline/ Project	Fraction of CH ₄ in generated Landfill Gas (F)	Volume fraction	Section 3.2.3, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default value for fraction of CH ₄ in generated landfill gas: 0.5	No country-specific values available



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline/ Project	Amount of CH ₄ recovered from SWDS in year y	tonnes/ yr	NA	MoE	Not yet available. No landfills with operational CH ₄ recovery information within the historical period.	There is a need to identify whether methane recovery is being carried out at landfill sites and to establish a measurement system to accurately record the quantity of recovered methane (CH ₄).
Baseline/ Project	Oxidation factor in year y	fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default values: 0 or 0.1 No site-specific oxidation measurements in Cambodia	Need country-specific studies on waste material and landfill operation to derive national oxidation factors
Baseline/ Project	Global warming potential of CH ₄	tCO _{2e} / tCH ₄	IPCC 6 th Assessment Report	MoE	IPCC 6th Assessment Report	Need explicit confirmation of which GWP series is applied for all waste sector calculations and consistency across sectors and years.

Notes:

SNWM: Phnom Penh Waste Management Authority (PPWMA)

Private sector: Global Action for Environment Awareness PLC. (GAEA), CINTRI, Community Sanitation and Recycling Organization (CSARO), Saeom Trading, Chip Mong Eco cycle, Leap Lim, Battambang Plastic Products (BPP), Wangneng Environment Co.

NGOs: Cambodian Education and Waste Management Organization (COMPED), Sevea

Development partners: GIZ, UNDP, GGGI, the World Bank, ADB



Action 1.1 of Cambodia's NDC 1 focuses on managing municipal solid waste (MSW) by reducing generation per capita to 0.84 kg/day by 2030 and maintaining it at or below 0.86 kg/day by 2035. This initiative employs waste management practices specifically targeting food waste, expanded recycling programs, and large-scale public awareness campaigns to shift consumption and disposal habits. To track this progress, Table 4 above identifies critical monitoring parameters, including the total mass and composition of MSW disposed of at Solid Waste Disposal Sites (SWDS). Baseline data shows a 2020 generation rate of 0.78 kg/capita/day, with food waste making up the largest share (51.90%), followed by plastic (20.90%) and paper (9.90%). The tracking framework relies on a mix of primary data collected by landfill operators and Ministry of Environment (MoE) oversight, alongside default values from the 2006 IPCC Guidelines for technical factors like Methane Correction Factors (MCF), oxidation factors, and degradable organic carbon (DOC) fractions. A significant challenge identified in Table 4 is the current lack of country-specific measurements and standardized national monitoring systems, necessitating the establishment of more robust, sample-based analysis and record-keeping protocols to ensure accurate NDC tracking.

Action 1.2- Limit the plastic waste generation to 400,000 tons per year by 2035 by enforcing a ban on Single Use Plastic (SUP) and strengthening EPR schemes



Table 5: Parameters needed to track the progress of Action 1.2 of NDC 1

Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline/ Project	Total amount of municipal solid waste open-burned (Plastic waste)	Gg/year	MoE/SNAs	MoE	Baseline- 577,535 tons of plastic waste per year by 2026 Project- 607,353 tons of plastic waste per year by 2030 Project- 400,000 tons of plastic waste per year by 2035	Lack of measurement of open burning waste, especially at the rural areas. Limited and inconsistent data based on extrapolation or old studies.
Baseline/ Project	Dry Matter content in the plastic incinerated or open-burned	Fraction	Cambodia BTR1	MoE	1 (IPCC 2006)	Lack of consistency and reporting on waste characteristic data. Default data may lead to high inaccuracy.
Baseline/ Project	Fraction of carbon in the dry matter (plastic)	Fraction	Cambodia BTR1	MoE	0.75	Lack of local carbon content analysis.
Baseline/ Project	Fraction of waste type/material of component j(plastic) in the MSW	Fraction	Country-specific	MoE	0.209	Lack of local carbon content analysis.
Baseline/ Project	Fraction of fossil carbon in the total carbon of plastics	Fraction	Cambodia BTR1	MoE	1	Lack of specific local analyses on fossil carbon fraction for plastics and waste types.



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline/ Project	Oxidation Factor	Fraction	Table 5.2, Chapter 5, Volume 5, 2006 IPCC Guidelines	MoE	0.58	Unavailability of local measurements for this Oxidation Factor
Baseline/ Project	Population	Dimensionless	NIS report, Census data	NIS	17.4million (2024) 16.77million (2022)	Require identifying for specific geographic assessment areas
Baseline/ Project	Fraction of the waste amount that is burned relative to the total amount of waste treated	Fraction	Country-specific	MoE	NA	High uncertainty due to aggregated data collection and incomplete survey data on burning.
Baseline/ Project	Aggregate CH ₄ emission factor	kg CH ₄ /Gg of waste	Section 5.4.2, Chapter 5, Volume 5, 2006 IPCC Guideline	MoE	-Open burning 0.0065Kg CH ₄ /kg	Lack of country specific data and measurements.
Baseline/ Project	N ₂ O emission factor	kg N ₂ O/Gg of waste	Table 5.6, Chapter 5, Volume 5, 2006 IPCC Guideline	MoE	-Open Burning 0.00015Kg N ₂ O/tMSW	Lack of country specific data and measurements.

Note- The waste type categories are denoted as *i* for Municipal Solid Waste and *j* for Plastics.



Table 5 shows the data availability in Cambodia by type of parameters required to monitor Action 1.2 of Cambodia’s NDC 1, which is aiming to limit annual plastic waste generation to 400,000tons by 2035 through regulations to ban single use plastic (SUP) and imposing extended producer responsibility (EPR) schemes. The primary tracking metric is the total amount of municipal solid waste open burned (specifically plastic waste). The baseline is established at 577,535 tons for 2026 while a projected reduction target of 400,000 tons by 2035. Additional technical parameters based on IPCC 2006 Guidelines are dry matter content, fraction of carbon in dry matter and oxidation actors. All of these are required to quantify GHG impacts, although current data is often inconsistent and relies on default values. To address the data gaps in rural areas where open burning measurements are lacking, the table proposes alternative proxy indicators including population data and the fraction of waste burned related to total waste treated. The Ministry of Environment (MoE) and Sub-national administration (SNAs) are identified as the primary responsible entities for collecting this data, which currently faces challenges due to lack of technical support, lack of data management, and unavailable research baseline data.



3.1.2. NDC 2: Waste collection and segregation at source (at households, schools, markets, restaurants/hotels)

This measure focuses on establishing a unified waste collection and segregation system that minimizes the volume of waste that households and communities burn. Key components include:

1. **Strengthening waste collection services in secondary cities**, particularly through the procurement of dedicated organic waste collection vehicles.
2. **Implementing nationwide MSW segregation at source**, supported by a standardized national colour code and sorting guidelines.
3. **Introducing incentive schemes** to encourage household and business participation; and
4. **Conducting large-scale awareness campaigns** to shift social norms away from open burning practices.60%

Reducing open burning is intrinsically linked to improvements in waste collection and segregation. By expanding collection coverage to 75% of the population by 2035, ensuring that 50% of MSW is segregated at source, and enforcing sub-national open-burning restrictions in at least 10 provinces by 2030, Cambodia aims to reduce the proportion of the population engaged in open burning from 54% in 2022 to only 10% by 2035.

Table 6: Action, Baseline Scenario, and methodology for NDC 2

Action	Baseline Scenario	Project Scenario	Methodology & Assumptions
2.1) 25% of MSW collected is segregated at source (at households, schools, markets,	As of 2024, there was no segregation of MSW at the household level. Waste generated from households, schools, markets, and	Source segregation of MSW is introduced and progressively expanded. By 2027, at least 25% of collected MSW is segregated at source in a minimum	It was assumed that waste collected and segregated under Actions 1 and 2 is subsequently managed through appropriate waste treatment and



Action	Baseline Scenario	Project Scenario	Methodology & Assumptions
restaurants/hotels) in at least 5 cities (excluding Phnom Penh) by 2027 and scaling up to at least 50% nationwide by 2035.	commercial establishments is handled as mixed MSW, with collection and disposal systems operating without any form of separation at source.	of five cities outside Phnom Penh, covering households, schools, markets, and commercial establishments. This intervention is scaled up nationwide to achieve at least 50% source segregation by 2035.	disposal pathways, with the associated emission reductions accounted for under other NDC mitigation measures.
2.2) 75% of total population have access to regular household waste collection service by 2035.	Household waste collection coverage is below 50%.	75% of the total population has access to regular household waste collection services by 2035.	
2.3) Reduce the percentage of the total population that engages in open burning	In the baseline, 35% of total municipal solid waste will remain uncollected. This uncollected fraction	Under the project scenario, improved waste collection, segregation, and regulatory enforcement	For the GHG assessment, only this action was quantified. Accordingly, the present assessment quantifies emission



Action	Baseline Scenario	Project Scenario	Methodology & Assumptions
<p>of waste from 54% in 2022 to 10% by 2035.</p>	<p>is assumed to be managed through a combination of open burning (40%) and open dumping (60%). Open burning of waste is widespread, with an estimated 54% of the population engaging in open burning in 2022. No systematic waste segregation is assumed.</p>	<p>significantly reduce open burning and uncontrolled dumping. The share of the population engaging in open burning of waste declines from 54% in 2022 to 10% by 2035, supported by the implementation and enforcement of open-burning restrictions in at least 10 provinces by 2030, with nationwide scale-up by 2035.</p>	<p>reductions from avoided open burning of waste, calculated in accordance with the open burning methodology in volume 5 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories.</p>



Table 7: Parameters needed to track the progress of action 2.3 of NDC 2

Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline/ Project	Total amount of solid waste of type i (wet weight) open-burned	Gg/year	MoE/SNAs	MoE	-Population 16.77 million, -Total waste 2,558.39Gg in 2022 54% open burning -Uncollected waste: 35% (Open dump 60%, Open burn 40%) -Open burning 40% = 358,174.6 t/year	No specific data focus on open burning waste /Lack of measurement of open burning waste, especially in rural areas. Limited and inconsistent data based on extrapolation or old studies.
Baseline/ Project	Dry Matter content in the waste (wet weight) open-burned	Fraction	Cambodia BTR1	MoE	0.78	Lack of consistency and reporting on waste characteristic data. Default data may lead to high inaccuracy.
Baseline/ Project	Fraction of carbon in the dry matter (total carbon content)	Fraction	Cambodia BTR1	MoE	0.34	Lack of local carbon content analysis.
Baseline/ Project	Fraction of fossil carbon in the total carbon	Fraction	Cambodia BTR1	MoE	0.08	Lack of specific local analyses on fossil carbon fraction for plastics and waste type.



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline/ Project	Oxidation Factor	Fraction	Table 5.2, Chapter 5, Volume 5, 2006 IPCC Guidelines	MoE	0.58	Local measurements unavailable for this Oxidation Factor
If MSW data are available based on waste types/materials (such as paper, wood, plastics) in the waste open burning						
Baseline/ Project	Total amount of municipal solid waste as wet weight, open-burned	Gg/year	MoE, SNWMs, SNAs report	MoE	-Population 16.77 million, -Total waste 2,558.39Gg in 2022 , 54% open burning -Uncollected waste: 35% (Open dump 60%, Open burn 40%) -Open burning 40%=358,174.6 t/year	No waste data specified on open burning annually Data based on estimation or infrequent surveys. Uncertainty for rural areas.
If the above total amount of MSW open-burned data is unavailable, the following alternative parameters can be used						
Baseline/ Project	Population	Dimensionless	NIS report, Census data	NIS	17.4million (2024) 16.77million (2022) 19.7million (2035)	Requires to identify with specific geographic assessment areas
Baseline/ Project	Fraction of population burning waste	Fraction	MoE / SNA/ Development partners/ University field survey, report.	MoE	-54% of 16.77million people -54% People burning waste: 9,055,800 people -40% Waste total burned: 358,174.6t/y -Waste burned per person: 0.03955t/y (39.55Kg per person)(BTR1)	Lack of systematic and frequent recording, Data is available only in some areas. Data available for self-report, pilot survey sites



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline/ Project	Per capita waste generation	kg waste/capita/day	Waste characteristic studies, field survey, report.	MoE	0.74 kg waste/capita/day (BTR1)	Lack of recording and studying waste generation across the nation (limited in rural areas)
Baseline/ Project	Fraction of the waste amount that is burned relative to the total amount of waste treated	Fraction	Country-specific	MoE	Total waste 2,558.39Gg in 2022 -Population 16.77 million, 54% of population practice open burning -Uncollected waste: 35% (Open dump 60%, Open burn 40%) -Open burning 40%=358,174.6 t/year	High uncertainty due to aggregated data collection and incomplete survey data on burning.
Baseline/ Project	Fraction of waste type/material of component j in the MSW (as wet weight incinerated or open-burned)	Fraction	Country-specific	MoE	-Food 54.86% -Garden 0% -Paper 10.47% -Wood 2.43% -Textile 2.43% -Nappies 0% -Plastic and other inert 29.81%	Lack of standardized national assumption for waste characterization between urban and rural area.



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline/ Project	Dry matter content in the component j of the MSW incinerated or open-burned	Fraction	In the presence of the fraction of waste types, this can be calculated using IPCC default values	MoE	0.78	Lack of country specific data and measurement.
Baseline/ Project	Fraction of carbon in the dry matter (i.e., carbon content) of component j	Fraction	Cambodia BTR1	MoE	0.34	Lack of country specific data and measurement.
Baseline/ Project	Fraction of fossil carbon in the total carbon of component j	Fraction	Cambodia BTR1	MoE	0.08	Lack of country specific data and measurement.
Baseline/ Project	Oxidation factor	Fraction	Table 5.2, Chapter 5, Volume 5, 2006 IPCC Guidelines	MoE	0.58	Lack of country specific data and measurement.
Baseline/ Project	Amount of solid waste of type i open-burned	Gg/ year	Calculation based on activity data	MoE	Total waste 2,558.39Gg in 2022 -Population 16.77 million, 54% open burning -Uncollected waste: 35% (Open dump 60%, Open burn 40%) -Open burning 40%=358,174.6 t/year	Data estimation assumption, uncertainty



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline/ Project	Aggregate CH ₄ emission factor	kg CH ₄ /Gg of waste	Section 5.4.2, Chapter 5, Volume 5, 2006 IPCC Guideline	MoE	Composting 0.004kg CH ₄ /kg Waste treat -Anaerobic digestion 0.0008kg CH ₄ /kg Waste treat -Open burning 0.0065Kg CH ₄ /kg	Lack of country specific data and measurement.
Baseline/ Project	N ₂ O emission factor	kg N ₂ O/Gg of waste	Table 5.6, Chapter 5, Volume 5, 2006 IPCC Guideline	MoE	-Composting 0.0003kg N ₂ O/tMSW -Open Burning 0.00015kg N ₂ O/tMSW -Incineration 0.00005kg N ₂ O/tMSW -Landfill Considered with CH ₄ -Human Sewage 0.01kg N ₂ O N/kg	Lack of country specific data and measurement.



Table 7 provides specific parameters required to track the progress of Action 2.3 under NDC 2, which focuses on establishing unified waste collection and segregation systems at the source including households, schools, markets, and hotels to minimize open burning. The tracking framework is primarily built around the Open Burning Methodology from Volume 5 of the 2006 IPCC Guidelines. Key monitoring parameters identified in the table include the fraction of MSW open-burned, with a baseline objective to reduce such practices significantly by 2035. Technical parameters required for GHG quantification include the fraction of carbon in dry matter, oxidation factors, and dry matter content, which currently rely on IPCC default values due to the lack of country-specific measurements in Cambodia. The table indicates the Ministry of Environment (MoE) and Sub-National Administrations (SNAs) as the lead responsible entities for data collection, while highlighting critical gaps such as the absence of a unified national monitoring system and the need for standardized reporting templates for local waste operators. Waste type categories denoted as *i* and *j* in Table 8 and Table 9 correspond to the classifications presented in Table 7. During data collection, data collectors must ensure that waste information is recorded according to these specific categories to maintain consistency and accuracy in NDC tracking.

Table 8: Waste Type (i) Categories for NDC 2

Waste type (i)
MSW: Municipal solid waste
ISW: Industrial solid waste
SS: Sewage sludge
HW: Hazardous Waste
CW: Clinical waste
Others (that must be specified)



Table 9: MSW Component (j) Categories for NDC 2

Component of the MSW open-burned (j)	
Paper/cardboard	Disposable nappies
Plastics	Metal
Glass	Textiles
Food waste	Wood
Garden (yard) and park waste	Rubber and leather
Inert waste	

3.1.3. NDC 3: Increase capacities for organic waste processing

This NDC measure targets the diversion and treatment of approximately 600,000 tons of organic waste per year by 2035, equivalent to around 25 percent of the total organic waste fraction. The intervention combines centralized solutions, such as municipal and regional composting and anaerobic digestion facilities, with decentralized approaches including community-based and household composting, particularly in rural and peri-urban areas. Integrating organic waste treatment into landfill design and retrofitting existing landfill sites further strengthens the mitigation impact by reducing the quantity of biodegradable waste disposed of and improving overall landfill management. Together, these actions are intended to reduce methane generation, lower transport-related emissions, and improve the resilience and sustainability of waste management systems.

From an MRV and NDC tracking perspective, organic waste processing presents both opportunities and challenges. While international methodologies for estimating avoided methane emissions from composting and biological treatment are well established, Cambodia currently lacks comprehensive, site-specific data on organic waste quantities, treatment performance, and associated emissions. As a result, tracking progress under NDC 3 requires a structured approach that combines internationally recognized methodologies with progressively improved national data systems. Table 9 and Table 10 define the baseline and project scenarios, methodologies, assumptions, and parameters required to quantify



mitigation outcomes and monitor implementation progress. These parameters were identified through consultations with relevant institutions and are largely based on IPCC 2006 Guidelines, the 2019 Refinement, and applicable CDM methodologies. Current data gaps and institutional responsibilities for data provision are explicitly documented to support future MRV system strengthening. The measure aims to reduce the volume of organic waste sent to landfills by:

- Redirecting organic fractions from municipal solid waste (MSW) and agro-processing industries, particularly cassava, rubber, and mango sectors to suitable treatment facilities that use aerobic or anaerobic digestion.
- Integrating composting facilities into the design of new landfills and retrofitting existing landfill sites wherever technically feasible.
- Promoting decentralized solutions, including community-based and household composting, especially in urban and peri-urban areas, to reduce transport distances, fuel consumption, and associated air pollution.

Table 10: Action, Baseline Scenario, Methodology and Assumption for NDC 3

Action	Baseline Scenario	Project Scenario	Methodology and Assumption
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<p>1) 600,000 tons per year of organic waste (or 25% or total organic waste fraction) are processed through dedicated facilities. This includes composting, anaerobic digestion, and other biological treatment techniques.</p> <p>Breakdown:</p> <ul style="list-style-type: none"> - 550,000 tons per year of organic waste to be processed in dedicated municipal and regional facilities. - 50,000 tons per year of organic waste diverted through community-based composting programs in rural areas, focusing on farmers' participation. 	<p>Under the baseline scenario, only a limited portion of organic waste (73,000 tons per year) will be treated through composting facilities, with most organic waste being disposed of in landfills or unmanaged sites due to insufficient composting, anaerobic digestion, and community-based treatment systems.</p>	<p>Under the project scenario, approximately 600,000 tons per year of organic waste (about 25% of the total organic waste fraction) will be treated through composting, including 550,000 tons per year in municipal and regional facilities and 50,000 tons per year through community-based composting programs in rural areas with active farmer participation.</p>	<p>Methodology: AMS-III.F.: Avoidance of methane emissions through composting --- Version 12.0</p> <p>Assumption: Not Applicable</p>
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Action 3.1- 600,000 tons per year of organic waste (or 25% of total organic waste fraction) are processed through dedicated facilities. This includes composting, anaerobic digestion, and other biological treatment techniques.

Table 11: Parameters needed to track the progress of NDC 3

Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year y	weight fraction	Section 3.2.3, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	0.5	No country estimate available for DOC
Baseline	Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x	tonne	Cambodia NDC 3.0	MoE	2,094,320 (2020)	Municipal solid waste disposal at landfills
Baseline	Model correction factor to account for model uncertainties for year y	fraction	CDM tool 04	MoE	0.85	No country estimate available for this model correction factor
Baseline	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y	weight fraction	Section 3.2.3, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	0.0	No country estimate available for this methane fraction
Baseline	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)	-	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	0.1	No country estimate available for this fraction



Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection														
Baseline	Fraction of methane in the SWDS gas	volume fraction	Section 3.2.3, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	0.5	No country estimate available for this methane fraction														
Baseline	Methane correction factor for year y	Fraction	Table 3.1, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	- Managed: 1.0 - Managed semi aerobic: 0.5 - Unmanaged deep: 0.8 - Unmanaged shallow: 0.4 - Uncategorized: 0.6	No country estimate available for this model correction factor														
Baseline	Fraction of degradable organic carbon in the waste type j	weight fraction	Table 2.4, Chapter 2, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default values: <table border="1" data-bbox="1423 857 1665 1333"> <tbody> <tr> <td>Wood</td> <td>43%</td> </tr> <tr> <td>Paper/card board</td> <td>40%</td> </tr> <tr> <td>Food waste</td> <td>15%</td> </tr> <tr> <td>Textiles</td> <td>24%</td> </tr> <tr> <td>Garden and Park waste</td> <td>20%</td> </tr> <tr> <td>Nappies</td> <td>24%</td> </tr> <tr> <td>Glass, plastic, metal,</td> <td>0%</td> </tr> </tbody> </table>	Wood	43%	Paper/card board	40%	Food waste	15%	Textiles	24%	Garden and Park waste	20%	Nappies	24%	Glass, plastic, metal,	0%	No country estimate available for this DOC fraction
Wood	43%																			
Paper/card board	40%																			
Food waste	15%																			
Textiles	24%																			
Garden and Park waste	20%																			
Nappies	24%																			
Glass, plastic, metal,	0%																			



Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection																
					<table border="1"> <tr> <td>other inert waste</td> <td></td> </tr> </table>	other inert waste																
other inert waste																						
Baseline	Decay rate for the waste type j	1/y	Table 3.3, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	<table border="1"> <tr> <td colspan="2">IPCC default values:</td> </tr> <tr> <td>Wood</td> <td>0.035</td> </tr> <tr> <td>Paper/car dboard</td> <td>0.07</td> </tr> <tr> <td>Food waste</td> <td>0.4</td> </tr> <tr> <td>Textiles</td> <td>0.07</td> </tr> <tr> <td>Garden and Park waste</td> <td>0.17</td> </tr> <tr> <td>Nappies</td> <td>0.17</td> </tr> <tr> <td>Glass, plastic, metal, other inert waste</td> <td>0</td> </tr> </table>	IPCC default values:		Wood	0.035	Paper/car dboard	0.07	Food waste	0.4	Textiles	0.07	Garden and Park waste	0.17	Nappies	0.17	Glass, plastic, metal, other inert waste	0	No country estimate available for this decay rate
IPCC default values:																						
Wood	0.035																					
Paper/car dboard	0.07																					
Food waste	0.4																					
Textiles	0.07																					
Garden and Park waste	0.17																					
Nappies	0.17																					
Glass, plastic, metal, other inert waste	0																					
Baseline	Amount of methane that would have to be captured and combusted in the year y to comply with the prevailing regulations	tonne	Cambodia BTR1	MoE	Assume zero capture efficiency (OX=0 or R=0).	No data available due to the lack of landfill gas recovery systems at sites like Phnom																



Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
						Penh's Dangkor or Steung Mean Chey.
Baseline	Global Warming Potential for CH ₄ applicable for the year	tCO ₂ e/tC H ₄	IPCC 6 th Assessment Report	MoE	27	NA
Project	Quantity of waste composted in year y	tonne/yr	Cambodia BTR1	MoE	79,000	Insufficient infrastructure for composted waste collection
Project	Default value for the specific quantity of electricity consumed per tonne of waste composted	kWh/t	Scenario analysis of the benefit of municipal organic-waste composting over landfill, Cambodia	MME	20-30	No country specific estimation for this default value
Project	Emission factor for electricity generation for source in year Y	kgCO ₂ e/kWh	Cambodia NDC 3.0	MME	0.62	Rely on international standard
Project	Average technical transmission and distribution losses for providing electricity to source in year y	%	World Bank portal data ¹	MoE	12-13%	Rely on international standard
Project	Project emissions from fossil fuel consumption associated with composting in year y	kgCO ₂ /tonne	Scenario analysis of the benefit of municipal organic-waste composting over landfill, Cambodia	MoE	195 kg CO ₂ -eq per ton	No country-specific breakdown

¹ <https://data.worldbank.org/indicator/EG.ELC.LOSS.ZS?locations=KH>



Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
						isolates fossil fuel combustion
Project	Default emission factor for fossil fuels consumed by the composting activity per tonne of waste	kgCO ₂ /litre of diesel	CDM tools 13	MoE	0.0207	Rely on international standard. No country specific factor defined
Project	Emission factor of methane per tonne of waste composted valid for year y	kgCH ₄ /tonne	Table 4.1, Chapter 4, Volume 5, 2006 IPCC Guidelines	MoE	4 kg/tonne	No country specific emission factor
Project	Global Warming Potential for CH ₄ applicable for the year	tCO ₂ e/tCH ₄	IPCC 6 th Assessment Report	MoE	27	NA
Project	Emission factor of nitrous oxide per tonne of waste composted valid for year y	kgN ₂ O/t	Table 4.1, Chapter 4, Volume 5, 2006 IPCC Guidelines	MoE	0.24 kg/tonne	No country specific emission factor
Project	Global Warming Potential for N ₂ O applicable for the year	tCO ₂ e/tN ₂ O	IPCC 6 th Assessment Report	MoE	273	NA
Project	Quantity of COD of the run-off wastewater from the co-composting installation in year y	tCOD/yr	NA	MoE	NA	No country recorded data
Project	The default methane-producing capacity of the run-off wastewater	kgCH ₄ /tCOD	Table 6.2, Chapter 6, Volume 5, 2006 IPCC Guidelines	MoE	0.25 kg CH ₄ per kg COD removed	Rely on international standard. No country specific factor defined



Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Project	Default methane correction factor for the wastewater treatment system where the run-off wastewater is treated	Fraction	Table 6.3, Chapter 6, Volume 5, 2006 IPCC Guidelines	MoE	<ul style="list-style-type: none"> - Aerobic treatment: 0 - Anaerobic ponds/lagoons: 0.5-1 - Septic tanks or primary treatment: 0.3-0.5 	Rely on international standard. No country specific factor defined
Project	Default model correction factor to account for model uncertainties of methane emissions from run-off wastewater	Fraction	AMS-III.H.	MoE	0.89	No country specific factor defined

Table 11 describes the parameters and data needed to track the progress of NDC 3 on increasing capacities for organic waste processing, under baseline and project scenarios. Both baseline and project parameters and data were identified based on the consultation with relevant institutions and government bodies in related fields. As a result, it was revealed that they mostly rely on international standards such as the IPCC 2006 guideline for both baseline and project parameters, while all the data related to organic waste was undercharged by the Ministry of Environment and its authorized bodies.



3.1.4. NDC 4: Introduce alternative SWM processing at existing landfills

This measure aims to prolong the lifetime of existing landfill sites by implementing alternatives for the treatment of mixed MSW and hazardous waste. Other key aspects of this measure are,

- By 2030, to establish RDF processing facilities to convert at least 200,000 tons per year of fresh or old MSW into RDF for industrial use.
- By 2035, to construct and operationalize at least one large-scale WtE facility capable of processing 300,000 tons per year of MSW to generate electricity and reduce landfill dependency.
- By 2035, to achieve a 30% reduction in MSW disposed of in landfills through RDF, WtE, and other waste treatment initiatives.
- By 2035, to increase the capacity of Medical Waste Management Unit (MWMU) to at least 8 tons/day, to face the growing amount of medical waste.

Table 12: Actions, Baseline Scenarios, Methodologies and Assumptions

Action	Baseline Scenario	Project Scenario	Methodology and Assumptions
1) By 2030, to establish RDF processing facilities to convert at least 200,000 tons per year of fresh or old MSW into RDF for industrial use.	In the absence of RDF processing facilities, fresh and old MSW continues to be disposed of primarily in landfills or dumpsites, missing opportunities for waste diversion and alternative fuel production.	By 2030, RDF processing facilities will be established to convert at least 200,000 tons per year of fresh or old MSW into RDF for industrial use, reducing landfill disposal and supporting fuel	Methodology: Integrated IPCC and CDM methodologies for SWDS, incineration and heat generation Assumptions: Not applicable



Action	Baseline Scenario	Project Scenario	Methodology and Assumptions
		substitution in industry.	
2) By 2035, to construct and operationalize at least one large-scale WtE facility capable of processing 300,000 tons per year of MSW to generate electricity and reduce landfill dependency.	In the absence of large-scale waste-to-energy infrastructure, most municipal solid waste continues to be disposed of in landfills, increasing landfill dependency and associated environmental impacts.	By 2035, at least one large-scale waste-to-energy facility will be constructed and operational, processing 300,000 tons per year of municipal solid waste to generate electricity and significantly reduce reliance on landfilling.	Methodology: Integrated IPCC and CDM methodologies for SWDS, incineration and electricity generation Assumptions: Not applicable
3) By 2035, to achieve a 30% reduction in MSW disposed of in landfills through RDF, WtE, and	Without waste treatment initiatives, most of the municipal solid waste continues to be disposed of in landfills, with limited diversion to alternative treatment options.	By 2035, the implementation of RDF, waste-to-energy, and other waste treatment initiatives will achieve a 30% reduction in municipal solid	Methodology: Not applicable (GHG ER is not estimated) Assumptions: The effects of Project 03 will be covered under Project 1 and Project 2, eliminating



Action	Baseline Scenario	Project Scenario	Methodology and Assumptions
other waste treatment initiatives.		waste disposed of in landfills.	the need for separate implementation and avoiding duplication of efforts.
4) By 2035, to increase the capacity of the Medical Waste Management Unit (MWMU) to at least 8 tons/day, to face the growing amount of medical waste.	Without capacity expansion, the Medical Waste Management Unit operates below the level required to manage increasing volumes of medical waste, leading to treatment bottlenecks and potential environmental and health risks (In 2021, the capacity of the Medical Waste Management Unit (MWMU) was 2 tons/day. Meanwhile the total amount of medical waste was estimated at 4 tons/day in 2021).	By 2035, the capacity of the Medical Waste Management Unit will be increased to at least 8 tons per day, enabling safe and effective management of the growing quantities of medical waste.	Methodology: Integrated IPCC and CDM methodologies for SWDS, incineration and heat generation Assumptions: Not applicable



Action 4.1- By 2030, to establish RDF processing facilities to convert at least 200,000 tons per year of fresh or old MSW into RDF for industrial use.

Table 13: Parameters needed to track the progress of NDC 4.1

Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline emission: GHG emission from MSW disposal						
Baseline	Methane Correction Factor (MCF) – Unmanaged shallow	fraction	Table 3.1, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default value for unmanaged shallow landfill: 0.4 No site-specific methane factor measurements in Cambodia	Need country-specific studies on landfill to derive national-level methane factors
Baseline	Fraction of degradable organic carbon that can decompose (DOCf)	fraction	Table 3.5, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default value for fraction of degradable organic carbon which decomposes: 0.5 No country-specific measurements	Rely on international standard
Baseline	Fraction of degradable organic carbon in waste type j (DOCj) (Food, Garden, Paper, Wood, Textile, inert waste (Glass, plastic, metal), etc.	fraction	Table 2.4, Chapter 2, Volume 5, 2006 IPCC Guidelines	MoE	IPCC 2006 guideline - Food waste: 0.4 - Garden: 0.2 - Paper: 0.4 Wood and straw: 0.43 - Textiles: 0.24 Disposable nappies: 0.24 - Sewage sludge: 0.05 - Industrial waste: 0.15	No country-specific fraction of DOC measurements for waste types



Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline	Oxidation factor in year y	fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default values: 0 or 0.1	No site-specific oxidation measurements in Cambodia
Baseline	Global warming potential of CH ₄	tCO ₂ e/ tCH ₄	IPCC 6 th Assessment Report	MoE	IPCC Assessment Report (AR), AR6: 27	NA
Baseline	Model correction factor to account for model uncertainties	fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC guideline: 0.85	NA
Baseline	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere	fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC 2006 guideline (BTR1): 0.0 for unmanaged	NA
Baseline	Fraction of methane in the SWDS gas (volume fraction)	volume fraction	Table 3.2 of 2006 IPCC guidelines ¹	MoE	IPCC 2006 guideline (BTR1): 0.5	NA
Baseline	Decay rate for the waste type	1/y	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC 2006 guideline (BTR1): 0.1	NA
Baseline	Waste composition of waste type (MSW)	%	Cambodia BTR1	MoE (leading)	Available (See the waste composition table below)	Since waste composition may change annually, the reliability of emission reduction calculations will be increased by using annual composition data rather than average values.



Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline	MSW disposal quantity	t/year	Department of Solid Waste Management	MoE (leading)	NA	Inadequate infrastructure and poor enforcement
Baseline Emission: GHG emission related with, Heat generation from the project						
Baseline	Efficiency of the boiler or air heater used for heat generation in the baseline	%	NA	MoE	NA	NA
Baseline	Quantity of heat supplied by the project activity displacing baseline heat generation by the fossil fuel boiler or air heater in year	TJ	NA	MoE	NA	NA
Baseline	CO ₂ emission factor of the fossil fuel type used for heat generation by the boiler or air heater in the baseline	tCO ₂ /TJ	NA	MoE	NA	NA
Project emissions: GHG Emission from combustion within the project boundary						
Project	Combustion efficiency of combustor c in year y	NA	NA	MoE (leading)	NA	NA
Project	Quantity of fresh waste or RDF/SB fed into combustor c in year y	t/year	NA	MoE (leading)	NA	NA
Project	Emission factor for N ₂ O associated with waste treatment option	t N ₂ O/t	Table 5.6, Chapter 5, Volume 5, 2006 IPCC Guidelines	MoE (leading)	Depending on the technology used.	NA



Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Project	Emission factor for CH ₄ associated with treatment option	t CH ₄ /t	Table 5.3, Chapter 5, Volume 5, 2006 IPCC Guidelines	MoE (leading)	Depending on the technology used.	NA
Project	Global Warming Potential of nitrous oxide	NA	IPCC 6 th Assessment Report	MoE (leading)	273	NA
Project	Global Warming Potential of methane valid for the commitment period	NA	IPCC 6 th Assessment Report	MoE (leading)	29.8	NA
Project	Quantity of fuel type (diesel) combusted in process during the year y	t/year	NA	MoE (leading)	NA	NA
Project	Weighted average net calorific value of diesel in year y	GJ/t	Table 1.2, Chapter 1, Volume 2, 2006 IPCC Guidelines	MoE (leading)	43	NA
Project	Weighted average CO ₂ emission factor of diesel in year y	tCO ₂ /GJ	Table 1.4, Chapter 1, Volume 2, 2006 IPCC Guidelines	MoE (leading)	0.0741	Rely on international standards



Table 13 describes the parameters and data for both baseline and projection that needed to be used to track the progress of NDC 4 on introducing alternative SWM processing at existing landfills. Both baseline and projection parameters and data were identified based on consultations with relevant institutions and government bodies in related fields. For the sub-table on the GHG emissions from SWM disposal, good baseline data is available from the Ministry of Environment and its authorized body. However, improvement in infrastructure, law enforcement, and public participation are still needed.

The sub-table on Baseline Emission: GHG emission related to heat generation from the project, all the data and information are not available nor recorded so far. Further discussion and improvement need to be taken into consideration. Last but not least, the sub-table on Project emissions: GHG emissions from combustion within the project boundary indicates the parameters that will be used to quantify the GHG emissions within the combustion-related waste project boundary.

Action 4.1 Cont.- By 2030, to establish RDF processing facilities to convert at least 200,000 tons per year of fresh or old MSW into RDF for industrial use.

Table 14: Waste composition data for each waste type

Waste type (j)	Waste composition of waste type j
Food/Organic waste	51.90%
Plastics	20.90%
Paper	9.90%
Wood	2.30%
Textiles	2.10%
Glass	1.60%
Metal	1.10%
Ceramics and Stones	0.50%
Rubber and Leather	0.20%
Others	9.50%



Action 4.2- By 2035, to construct and operationalize at least one large-scale WtE facility capable of processing 300,000 tons per year of MSW to generate electricity and reduce landfill dependency.

Table 15 : Parameters needed to track the progress of NDC 4.2

Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline emission: GHG emission from MSW disposal						
Baseline	Methane Correction Factor (MCF) – Unmanaged shallow	fraction	Table 3.1, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default value for unmanaged shallow landfill: 0.4	Need country-specific studies on landfill to derive national-level methane factors No site-specific methane factor measurements in Cambodia
Baseline	Fraction of degradable organic carbon that can decompose (DOCf)	fraction	Table 3.5, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default value for fraction of degradable organic carbon which decomposes: 0.5	Rely on international standard No country-specific measurements
Baseline	Fraction of degradable organic carbon in waste type j (DOCj) (Food, Garden, Paper, Wood, Textile, inert waste (Glass, plastic, metal), etc.	fraction	Table 2.4, Chapter 2, Volume 5, 2006 IPCC Guidelines	MoE	IPCC 2006 guideline - Food waste: 0.4 - Garden: 0.2 - Paper: 0,4 Wood and straw: 0.43 - Textiles: 0.24 Disposable nappies: 0.24 - Sewage sludge: 0.05 - Industrial waste: 0.15	No country-specific fraction of DOC measurements for waste types



Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline	Oxidation factor in year y	fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default values: 0 or 0.1	No site-specific oxidation measurements in Cambodia
Baseline	Global warming potential of CH ₄	tCO ₂ e/ tCH ₄	IPCC 6 th Assessment Report	MoE	IPCC Assessment Report (AR), AR6: 27	NA
Baseline	Model correction factor to account for model uncertainties	fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC guideline: 0.85	No country-specific model correction factor in Cambodia to estimate these uncertainties
Baseline	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere	fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC 2006 guideline (BTR1): 0.0 for unmanaged	No country-specific measurement to estimate the fraction of methane captured at the SWDS
Baseline	Fraction of methane in the SWDS gas (volume fraction)	volume fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC 2006 guideline (BTR1): 0.5	No country-specific measurement to estimate the fraction of methane in the SWDS gas
Baseline	Decay rate for the waste type	1/y	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC 2006 guideline (BTR1): 0.1	No country-specific method to define the decay rate for the waste type
Baseline	Waste composition of waste type (MSW)	%	Cambodia BTR1	MoE (leading)	Available (See the waste composition table below)	Since waste composition may change annually, the reliability of emission reduction calculations will be increased by



Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
						using annual composition data rather than average values.
Baseline	MSW disposal quantity	t/year	Department of Solid Waste Management	MoE (leading)	NA	Inadequate infrastructure and poor enforcement
Baseline Emission: GHG emission related with, electricity consumption from grid (Here, it is assumed that electricity generated by the project activity displaces grid electricity usage)						
Baseline	Quantity of electricity that would be consumed by the baseline electricity consumption source k in year y	MWh/yr	NA	MoE (leading)	NA	Lack of recording data system for this particular purpose
Baseline	Emission factor for electricity generation for source.	tCO ₂ /MWh	Input from expert	MoE (leading)	0.62	Rely on international standards
Baseline	Average technical transmission and distribution losses for providing electricity to source k in year y	%	Worldbank portal data	MoE (leading)	12-13	NA
Project emissions: GHG Emission from combustion within the project boundary						
Project	Combustion efficiency of combustor c in year y	NA	NA	MoE (leading)	NA	NA
Project	Quantity of fresh waste or RDF/SB fed into combustor c in year y	t/year	NA	MoE (leading)	NA	NA



Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Project	Emission factor for N ₂ O associated with waste treatment option	t N ₂ O/t	Table 5.6, Chapter 5, Volume 5, 2006 IPCC Guidelines	MoE (leading)	Depending on the technology used.	NA
Project	Emission factor for CH ₄ associated with treatment option	t CH ₄ /t	Table 5.3, Chapter 5, Volume 5, 2006 IPCC Guidelines	MoE (leading)	Depending on the technology used.	Rely on international standards
Project	Global Warming Potential of nitrous oxide	NA	IPCC 6 th Assessment Report	MoE (leading)	273	NA
Project	Global Warming Potential of methane valid for the commitment period	NA	IPCC 6 th Assessment Report	MoE (leading)	29.8	NA
Project	Quantity of fuel type(Diesel) combusted in process during the year y	t/year	NA	MoE (leading)	NA	Lack of country data recording system for this purpose
Project	Weighted average net calorific value of diesel in year y	GJ/t	Table 1.2, Chapter 1, Volume 2, 2006 IPCC Guidelines	MoE (leading)	43	Rely on international standards
Project	Weighted average CO ₂ emission factor of diesel in year y	tCO ₂ /GJ	Table 1.4, Chapter 1, Volume 2, 2006 IPCC Guidelines	MoE (leading)	0.0741	Rely on international standards



Action 4.2 Cont.- By 2035, to construct and operationalize at least one large-scale WtE facility capable of processing 300,000 tons per year of MSW to generate electricity and reduce landfill dependency.

Action 4.4 Cont.- By 2035, to increase the capacity of the Medical Waste Management Unit (MWMU) to at least 8 tons/day, to face the growing amount of medical waste.

Table 16 : Parameters needed to track the progress of NDC 4.4

Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline emission: GHG emission from MSW disposal						
Baseline	Methane Correction Factor (MCF) – Unmanaged shallow	fraction	Table 3.1, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default value for unmanaged shallow landfill: 0.4	No site-specific methane factor measurements in Cambodia Need country-specific studies on landfill to derive national-level methane factors
Baseline	Fraction of degradable organic carbon that can decompose (DOCf)	fraction	Table 3.5, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default value for fraction of degradable organic carbon which decomposes: 0.5	Rely on international standards
Baseline	Fraction of degradable organic carbon in waste type j (DOCj) (Food, Garden, Paper, Wood,	fraction	Table 2.4, Chapter 2, Volume 5, 2006 IPCC Guidelines	MoE	IPCC 2006 guideline - Food waste: 0.4 - Garden: 0.2 - Paper: 0,4	No country-specific fraction of DOC measurements for waste types



Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
	Textile, inert waste (Glass, plastic, metal), etc.				Wood and straw: 0.43 - Textiles: 0.24 Disposable nappies: 0.24 - Sewage sludge: 0.05 - Industrial waste: 0.15	
Baseline	Oxidation factor in year y	fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default values: 0 or 0.1	No site-specific oxidation measurements in Cambodia
Baseline	Global warming potential of CH ₄	tCO ₂ e/ tCH ₄	IPCC 6 th Assessment Report	MoE	IPCC Assessment Report (AR), AR6: 27	NA
Baseline	Model correction factor to account for model uncertainties	fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC guideline: 0.85	Rely on international standards
Baseline	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere	fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC 2006 guideline (BTR1): 0.0 for unmanaged	Rely on international standard
Baseline	Fraction of methane in the SWDS gas (volume fraction)	volume fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC 2006 guideline (BTR1): 0.5	Rely on international standard
Baseline	Decay rate for the waste type	1/y	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC 2006 guideline (BTR1): 0.1	Rely on international standard



Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline	Waste composition of waste type (Medical Waste)	%	NA	MoE (leading)	NA	NA
Baseline	Medical waste disposal quantity	t/year	Department of Solid Waste Management	MoE (leading)	NA	Inadequate infrastructure and poor enforcement
Baseline Emission: GHG emission related with, Heat generation from the project						
Baseline	Efficiency of the boiler or air heater used for heat generation in the baseline	%	NA	MoE	NA	NA
Baseline	Quantity of heat supplied by the project activity displacing baseline heat generation by the fossil fuel boiler or air heater in year	TJ	NA	MoE	NA	NA
Baseline	CO ₂ emission factor of the fossil fuel type used for heat generation by the boiler or air heater in the baseline	tCO ₂ /TJ	NA	MoE	NA	NA
Project emissions: GHG Emission from combustion within the project boundary						
Project	Combustion efficiency of combustor c in year y	NA	NA	MoE (leading)	NA	NA
Project	Quantity of fresh waste or RDF/SB fed into combustor c in year y	t/year	NA	MoE (leading)	NA	NA



Type	Data Required	Unit	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Project	Emission factor for N ₂ O associated with waste treatment option	t N ₂ O/t	Table 5.6, Chapter 5, Volume 5, 2006 IPCC Guidelines	MoE (leading)	Depending on the technology used.	NA
Project	Emission factor for CH ₄ associated with treatment option	t CH ₄ /t	Table 5.3, Chapter 5, Volume 5, 2006 IPCC Guidelines	MoE (leading)	Depending on the technology used.	NA
Project	Global Warming Potential of nitrous oxide	NA	IPCC 6 th Assessment Report	MoE (leading)	273	NA
Project	Global Warming Potential of methane valid for the commitment period	NA	IPCC 6 th Assessment Report	MoE (leading)	29.8	NA
Project	Quantity of fuel type(Diesel) combusted in process during the year y	t/year	NA	MoE (leading)	NA	NA
Project	Weighted average net calorific value of diesel in year y	GJ/t	Table 1.2, Chapter 1, Volume 2, 2006 IPCC Guidelines	MoE (leading)	43	Rely on international standard
Project	Weighted average CO ₂ emission factor of diesel in year y	tCO ₂ /GJ	Table 1.4, Chapter 1, Volume 2, 2006 IPCC Guidelines	MoE (leading)	0.0741	Rely on international standard



3.1.5. NDC 5: Landfill management

This measure will contribute to strengthening the operations of controlled and sanitary landfills. It also supports the MoE's interim strategy of establishing necessary dumpsite locations where appropriate, with a long-term goal of transitioning from open dumpsites to sanitary waste disposal systems. The targets of this measure include:

- Increase the share of waste disposed at controlled and sanitary landfills to 50% of total collected municipal solid waste (MSW) by 2035. In parallel, support the MoE's interim strategy to establish necessary dumpsite locations in underserved areas to address immediate waste management needs.
- Launch a National Plan for Dumpsite Closure and Transition, aiming to rehabilitate or upgrade at least 2 dumpsites per year. This plan should prioritize sites where controlled and/or sanitary landfills or improved alternatives become available.
- Ensure LFG extraction technology is installed and operational at the new Phnom Penh regional sanitary landfill by 2027 (considering that this landfill is expected to start operating in Q2 2025).
- Assess the feasibility of Mechanical-Biological Treatment (MBT) technologies for pre-treatment of waste prior to disposal, to reduce organic content, lower GHG emissions, and optimize landfill space. Target reducing the organic content of landfilled waste to below 20% by 2035.

Data required to track progress under NDC 5 include: *(i) activity data on waste disposed and waste composition, (ii) system parameters used in IPCC solid waste disposal models (e.g., MCF, DOC, DOCf, k, oxidation), and (iii) project-level monitoring data required for landfill gas (LFG) capture and destruction/utilization (e.g., CH₄ flow, gas composition, flare operating hours, electricity generation).* At present, Cambodia has partial availability for national-level activity data and IPCC default parameters, while **project-level monitoring data are largely unavailable** because metered LFG systems have not been operational in the baseline period and monitoring protocols are not yet institutionalized across sites.



For **Action 5.1 (increase disposal at controlled/sanitary landfills)** and the LFG-related components, the largest data gap concerns direct monitoring of methane recovered/destroyed and the supporting operational parameters (flow, CH₄ concentration, moisture, temperature, pressure) needed under crediting-style approaches (e.g., ACM0001) and for robust NDC tracking. Therefore, while baseline estimation can proceed using conservative defaults and national proxies, credible progress tracking after new sanitary landfill systems start operating will require installation of metering and adoption of standardized data reporting obligations for operators.

For **Action 5.2 (dumpsite closure/transition)** and **Action 5.3 (MBT feasibility and organic content reduction)**, the most readily available information is: (a) national estimates of total waste disposed and the distribution of disposal types (open dumps vs. controlled landfills), and (b) national waste composition percentages from existing communications. These allow baseline modelling using IPCC Tier 1/Tier 2 approaches but remain insufficient to track implementation performance (e.g., closures completed, upgraded sites meeting standards, reductions in organic fraction at disposal) without routine site reporting and verification systems.

Parameters needed to track the progress of action 1 of NDC 5 are shown in the following table.

Table 17 : Parameters needed to track the progress of action 1 of NDC 5

Action	Baseline Scenario	Project Scenario	Methodology and Assumption
1) Increase the share of waste disposed at controlled and sanitary landfills to 50% of total collected municipal solid waste (MSW) by 2035. In parallel, support the MoE's interim strategy to establish necessary dumpsite locations in underserved areas to address immediate waste management needs.	Under the baseline scenario, the share of municipal solid waste disposed of at controlled and sanitary landfills remains at or near the 2024 level , with most waste continuing to be disposed of in open dumps or poorly managed sites.	Under the project scenario, the action will increase the share of total collected MSW disposed of at controlled and sanitary landfills to 50% by 2035.	Methodology: ACM0001: Flaring or use of landfill gas --- Version 19.0 Assumption: Not Applicable
2) Launch a National Plan for Dumpsite Closure and Transition, aiming to rehabilitate or upgrade at least 2 dumpsites per year. This plan should prioritize sites where controlled and/or sanitary landfills or improved alternatives become available.	Without intervention, existing dumpsites continue to operate with minimal upgrades , leading to ongoing environmental and health risks, and no systematic closure or rehabilitation program is implemented.	The National Plan for Dumpsite Closure and Transition will be launched, rehabilitating or upgrading at least two prioritized dumpsites per year , focusing on sites where controlled or sanitary landfills, or improved alternatives, are available.	Methodology: IPCC 4.A. Solid Waste Disposal Assumption: Not applicable



Action	Baseline Scenario	Project Scenario	Methodology and Assumption
<p>3) Ensure LFG extraction technology is installed and operational at the new Phnom Penh regional sanitary landfill by 2027 (considering that this landfill is expected to start operating in Q2 2025).</p>	<p>Without intervention, the new Phnom Penh regional sanitary landfill operates without landfill gas (LFG) extraction technology, resulting in uncontrolled greenhouse gas emissions and lost energy recovery opportunities.</p>	<p>By 2027, LFG extraction technology will be installed and fully operational at the new Phnom Penh regional sanitary landfill, enabling controlled gas management and potential energy recovery.</p>	<p>Assumption: This action also discusses the installation of LFG extraction technology, like the sanitary landfill approach considered under Action 5.1, where landfill gas is captured and flared or utilised. Therefore, it is assumed that Action 5.3 is already covered under Action 5.1.</p>
<p>4) Assess the feasibility of Mechanical-Biological Treatment (MBT) technologies for pre-treatment of waste prior to disposal, to reduce organic content, lower GHG emissions, and optimize landfill space. Target reducing the organic content of landfilled waste to below 20% by 2035.</p>	<p>Without assessing MBT technologies, waste continues to be landfilled with high organic content (As of 2024, the average organic content of landfill waste is 55%), leading to increased GHG emissions and inefficient use of landfill space.</p>	<p>A feasibility assessment of MBT technologies is conducted, aiming to implement pre-treatment that reduces the organic content of landfilled waste to below 20% by 2035, thereby lowering GHG emissions and optimizing landfill capacity.</p>	<p>Methodology: IPCC 4.A. Solid Waste Disposal</p> <p>Assumption: Not applicable</p>



Table 18: Parameters needed to track the progress of action 1 of NDC 5

Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline emissions of methane from the SWDS (BECH₄,y)						
Baseline	Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline	Dimension-less	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE (inventory and MRV team);	Available only as IPCC default values; no site specific oxidation measurements in Cambodia. IPCC default values: 0 or 0.1	Need country specific studies on cover material and landfill operation to derive national oxidation factors; establish guidance for operators to document cover design and maintenance. ipcc-nggip.iges
Baseline	Global warming potential of CH ₄	tCO ₂ e/tCH ₄	IPCC 6 th Assessment Report	MoE (national inventory team)	Available from inventory documentation and IPCC reports; used consistently for national reporting. unosd.un 27	Need explicit decision and documentation on which GWP series is used for NDC tracking and MRV in the waste sector; ensure consistency across sectors and years. unosd.un
Baseline	Amount of methane in the LFG that would be flared in the baseline in year y	tCH ₄ /yr	Article 6 methodology for flaring or use of landfill gas (ACM0001, A6.4AMM001) – monitoring section.	MoE (data compilation)	Not yet available; no sanitary landfills with operational, metered LFG flaring in the historical period.	Need installation of calibrated flow meters and gas analysers on flare lines at new sanitary landfills; establish data templates and reporting obligations for



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
						operators to submit annual LFG flared volumes to MoE. unfccc
Baseline	Amount of methane in the LFG which is destroyed by flaring in year y	tCH ₄ /yr	ACM0001 / A6.4AMM001 (flare destruction efficiency and mass flow calculation).	MoE (data compilation)	Not available; flare destruction efficiency not yet monitored at Cambodian sites.	Need adoption of default flare destruction efficiency (e.g. 90–99%) or stack test procedures; establish QA/QC on flare operation hours, downtime and maintenance logs. unfccc
Baseline	Amount of methane in the LFG which is used for electricity generation in year y	tCH ₄ /yr	ACM0001 / A6.4AMM001 (LFG-to-power option).	MoE;	Not available; LFG-to-power facilities at Phnom Penh regional sanitary landfill are planned but not yet operating in the baseline period.	Need technical specifications for gas and electricity metering; include reporting of LFG quantities and electricity sent to grid in PPAs and environmental permits; establish annual data transfer from operators to MoE/MME. unfccc
Baseline	Amount of methane in the LFG which is used for heat generation in year y	tCH ₄ /yr	ACM0001 / A6.4AMM001 (heat use option).	MoE	Not available; no identified LFG heat use applications in Cambodia over the assessment period.	Need assessment of potential industrial offtakes and design of contracts requiring monitoring and reporting of LFG volumes and useful heat output.



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline	Amount of methane in the LFG which is sent to the natural gas distribution network and/or dedicated pipeline and/or to the trucks in year y	tCH ₄ /yr	ACM0001 / A6.4-AMM-001 (pipeline/truck supply options)	MoE	Not applicable for current period; there is no LFG upgrading, pipeline injection or LFG trucking in Cambodia at present.	Future biomethane projects would need metering at injection/dispatch points and a regulatory framework defining reporting of CH ₄ volumes and leakage; such framework is not yet in place. unfccc
Baseline emissions associated with electricity generation (BEEC,y)						
Baseline	Quantity of electricity that would be consumed by the baseline electricity consumer k in year y	MWh/yr	Historical electricity bills and meters for landfill facilities; ACM0001 baseline electricity consumption definition.	MoE	Partially available for existing landfill operations through operator records and EDC billing data, but not systematically compiled for MRV.	Need standardized template for landfill operators to record electricity use by process (pre-project vs with LFG project) and formal data sharing arrangement between EDC/MME and MoE.
Baseline	Emission factor for electricity generation for source k in year y – Grid emissions factor	tCO _{2e} /MWh	Cambodia grid emission factor from national GHG inventory / power statistics	MME (energy statistics, grid EF)	Available annually from national GHG inventories and energy statistics, though not yet routinely linked to waste sector MRV.	Need clear decision on which grid EF series to apply for NDC tracking and procedures to update values regularly and communicate them to MoE and project developers. unodc.un



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline	Average technical transmission and distribution losses for providing electricity to source k in year y	Fraction or %	National power system statistics; EDC annual reports	MME	Available in power sector reports as national T&D loss percentages but not disaggregated by sector or systematically incorporated into landfill calculations.	Need annual transfer of T&D loss data from MME/EDC to MoE and integration of these values into NDC tracking guidance for landfill projects.
Baseline emissions associated with heat generation (BEHG,y)						
Baseline	Net calorific value of methane at reference conditions	TJ/tCH ₄	Table 1.2, Chapter 1, Volume 2, IPCC 2006 Guidelines	MoE (technical team)	Available as internationally accepted default constant; no country specific NCV required. unosd.un	Need to fix a single NCV value for methane in national MRV guidance to avoid inconsistencies between projects.
Baseline	Efficiency of the heat generation equipment type j used in the baseline	%	Manufacturer specifications and performance tests of existing boilers/burners; CDM fossil fuel combustion tool.	MoE	Partially available from plant documentation where industrial heat plants exist; not systematically reported to MoE.	Need inventory of relevant heat generation equipment and a mandate to report design and measured efficiencies to MoE/MME; QA/QC on test methods.
Baseline	Efficiency of the heat generation equipment type j used in the project activity in year y	%	Measured operating efficiency of LFG fired heat equipment; ACM0001 and fuel combustion tool.	MoE	Not available; no LFG heat use equipment operational during assessment period.	Need monitoring procedures for LFG fired boilers including fuel input and useful heat output; mandate to report annually to MoE.



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline	Default value for the fraction of methane destroyed when used for heat generation equipment type j	Fraction	ACM0001 / A6.4-AMM-001 default methane destruction fractions for combustion devices.	MoE (MRV guidance)	Available as methodology defaults but not yet adopted formally in Cambodian MRV guidance.	Need to select and document default destruction fractions and conditions under which site-specific tests are required. unfccc
Baseline	Amount of methane in the LFG which is used for heat generation equipment type j in year y	tCH ₄ /yr	Flow metering and gas composition at heat use facility; ACM0001 mass flow equations.	MoE	Not available; no LFG heat use projects in operation.	Future projects must install meters and submit annual CH ₄ consumption data. Institutional arrangements not yet in place.
Baseline	CO ₂ emission factor of the fossil fuel type used for heat generation by equipment type j in the baseline	tCO ₂ /TJ	Table 2.2, Chapter 2, Volume 2, IPCC 2006 Guidelines	MME	Available as IPCC defaults and/or national factors from the energy inventory.	Need to document chosen EF values in waste sector MRV guidance and ensure updates when national energy inventory is revised. unosd.un
Baseline	Number of different heat generation equipment used	dimensionless	Project design documents and equipment inventory; ACM0001.	MoE	Not applicable yet; no LFG heat use systems in current projects.	Need to mandate project developers to provide a complete inventory of heat equipment types and



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
	in the project activity					capacities when LFG heat use projects are implemented.
Baseline emissions associated with natural gas use (BENG,y)						
Baseline	Average CO ₂ emission factor of natural gas in the natural gas network or dedicated pipeline or in the trucks in year y	tCO ₂ /TJ	Table 2.2, Chapter 2, Volume 2, IPCC 2006 Guidelines	MME	Available as IPCC default; no national natural gas network currently in operation.	Need to confirm EF to be used for any future biomethane/LFG injection or trucking schemes and include it in MRV guidance.
Baseline	Amount of methane in the LFG which is sent to the natural gas distribution network or dedicated pipeline or to the trucks in year y	tCH ₄ /yr	Flow meters and gas analysers at upgrading, injection and loading points; ACM0001. unfccc	MoE	Not applicable in the historical period; no LFG upgrading and distribution projects.	Need regulatory framework and mandatory data reporting for any future biomethane projects; institutional roles between MoE and MME to be defined.
Emissions from consumption of electricity due to the project activity in year y						
Project	Quantity of electricity consumed by the project electricity	MWh/yr	Electricity meters and bills for all project electricity uses (LFG extraction, treatment, compression, etc.); CDM	MoE	Not available yet for LFG systems, as projects are not fully operational; partial data may exist for	Need mandate for separate metering of project electricity uses and standardized reporting of



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
	consumption source j in year y		tools for project electricity emissions. cdm.unfccc		general landfill operation.	annual consumption to MoE/MME.
Project	Emission factor for electricity generation for source j in year y	tCO _{2e} /MWh	Same grid emission factor as baseline, from national inventory / power statistics.	MME	Available annually but needs to be formally adopted for project calculations.	Need MRV guidance specifying which grid EF to use and how often to update; ensure consistent use across all NDC 5 calculations. unosd.un
Project	Average technical transmission and distribution losses for providing electricity to source j in year y	Fraction or %	National power system statistics; EDC reports.	MME	Available as national averages, not tailored to specific projects.	Need inclusion of T&D loss assumptions in MRV protocols and annual communication of updated values to MoE and project developers.
Emissions from consumption of fossil fuels due to the project activity, for purposes other than electricity generation, in year y						
Project	Quantity of fuel type i combusted in process j during the year y	mass or volume unit/yr	Fuel purchase records, stock logs and meters at project facilities; CDM fossil fuel combustion tool. cdm.unfccc	MoE	Partially available where diesel or other fuels are used for existing landfill machinery but not structured for MRV.	Need detailed fuel consumption records by process (pumps, compressors, vehicles) and standardized annual reporting template to MoE.
Project	Weighted average net calorific value	GJ/mass or volume unit	Table 1.2, Chapter 1, Volume 2, IPCC 2006 Guidelines	MME	Available as IPCC defaults; country specific	Need decision on whether to use IPCC defaults or commission local NCV



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
	of the fuel type i in year y				NCVs not yet developed for all fuels.	studies; document chosen values in MRV guidance. unosd.un
Project	Weighted average CO ₂ emission factor of fuel type i in year y	tCO ₂ /GJ	Table 2.2, Chapter 2, Volume 2, IPCC 2006 Guidelines	MME	Available as IPCC defaults and/or national factors.	Need alignment of project EF values with national inventory assumptions and periodic updates when inventory is revised.
Emissions from the distribution of compressed/liquefied LFG using trucks, in year y						
Project	Quantity of fuel type i combusted in process j during the year y	mass or volume unit/yr	Fuel consumption records for LFG distribution trucks; CDM transport/fossilfuel tools. cdm.unfccc	MoE	Not applicable yet; no LFG trucking activity implemented.	Need contractual requirement for future LFG trucking operators to monitor and report annual fuel use and mileage for MRV purposes.
Project	Weighted average net calorific value of the fuel type i in year y	GJ/mass or volume unit	Table 1.2, Chapter 1, Volume 2, IPCC 2006 Guidelines	MME	Available as IPCC defaults.	Need documentation of selected NCVs in MRV guidance and consistency across all transport related calculations.
Project	Weighted average CO ₂ emission factor of fuel type i in year y	tCO ₂ /GJ	Table 2.2, Chapter 2, Volume 2, IPCC 2006 Guidelines	MME	Available; used in national inventory.	Need to ensure same emission factors are used in waste and transport MRV to maintain consistency with inventory.



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Project	Global warming potential of CH ₄	tCO ₂ e/tCH ₄	IPCC 6 th Assessment Report	MoE	Available from national documentation. 27	Need consistency of GWP values between baseline and project calculations and across waste sub-sectors.
Project	Amount of methane in the LFG which is sent to trucks in year y	tCH ₄ /yr	Flow meters and gas analysers at truck filling station; ACM0001 / A6.4AMM001. unfccc	MoE	Not applicable during assessment period; no LFG trucking implemented.	Need metering, data logging and reporting requirements for any future LFG trucking operations as part of licence conditions.
Project	Amount of methane in the LFG which is delivered to consumers using trucks in year y	tCH ₄ /yr	Delivery logs, onboard meters and customer receipts; ACM0001. unfccc	MoE	Not applicable during assessment period.	Need contractual obligations for future consumers and logistics operators to provide delivery data for MRV.
Emissions from the supply of LFG to consumers through a dedicated pipeline, in year y						
Project	Default emission factor for the supply of LFG to consumers due to physical leakage through the dedicated pipeline	tCO ₂ e/TJ	ACM0001 / A6.4AMM001 default leakage factors; IPCC 2006 & 2019 Refinement fugitive emissions guidance. unfccc+1	MoE	Available as methodology and IPCC defaults; no dedicated LFG pipelines currently in operation.	Need to adopt appropriate default leakage factors in MRV guidance and define when project specific leakage measurements are required.



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Project	Amount of methane in the LFG which is sent to the consumer through a dedicated pipeline in year y	tCH ₄ /yr	Gas flow and composition meters at pipeline outlet and customer connection points; ACM0001. unfccc	MoE	Not applicable during assessment period; no LFG pipelines installed.	Need technical and institutional framework for monitoring and reporting LFG pipeline flows if such projects are developed in future.



During the baseline period for NDC 5 (Landfill Management), **direct measurement of landfill gas (LFG) methane flows is not available in Cambodia**, as sanitary landfills with fully operational and metered LFG systems have not yet been commissioned. Consequently, key parameters required to quantify methane sent to flaring, electricity generation, heat use, or off-site delivery cannot be derived from primary monitoring data. Table 19, therefore, presents a set of **alternative parameters and proxy indicators**, drawn from internationally recognized methodologies (e.g. IPCC Guidelines, CDM and Article 6 landfill gas methodologies), which define the technical requirements needed to estimate methane mass flows when direct measurements are absent or only partially available.

The table 18 demonstrates that, while certain constants (such as molecular mass of methane and global warming potential values) are readily available, **most operational parameters necessary for outcome-based methane accounting, such as gas flow rate, methane concentration, moisture content, temperature, and pressure are currently not monitored at landfill sites**. As a result, near-term NDC tracking under Action 5 must rely on modelled emissions and output-based indicators rather than measured methane reductions. At the same time, the identification of these alternative parameters provides a clear roadmap for MRV system development, enabling a future transition from modelled estimates to **measured, verifiable landfill methane mitigation** once monitoring infrastructure, standardized procedures, and institutional reporting arrangements are established.



Table 19: Alternative parameters and proxy indicators for estimating landfill gas (LFG) methane flows in the absence of direct baseline measurements

Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline	Amount of methane in the LFG which is sent to the flare in year y	tCH ₄ /yr	Direct measurements from LFG flow meter and CH ₄ analyser on flare line; CDM/Article 6 landfill gas methodologies (e.g. ACM0001, A6.4AMM001) – massflow equations. unfccc+1	MoE (aggregation and QA/QC)	Not yet available; no operating sanitary landfill with metered LFG flaring in the baseline period in Cambodia. gmsarnjournal	Installation of calibrated flow meters and gas analysers on flare lines; development of standard operating procedures and reporting templates for annual LFG to flare data submitted to MoE. unfccc
Baseline	Project emissions from flaring of the residual gas stream in year y	tCO _{2e} /yr	Calculated using monitored CH ₄ mass flow and default/designed flare destruction efficiency in landfill gas methodologies (ACM0001, A6.4AMM001). unfccc	MoE	Not available; no LFG flaring projects with documented destruction efficiency during assessment period. gmsarnjournal	Need adoption of default flare destruction efficiency (or stack tests), procedures for recording flare uptime/downtime, and calculation tools within MoE's MRV guidance. unfccc
Baseline	Global warming potential of CH ₄	tCO _{2e} /t CH ₄	IPCC 6 th Assessment Report	MoE (national inventory/MRV team)	Available from national inventory documentation and IPCC reports. unfccc+1 27	Need explicit confirmation of which GWP series is applied for all waste sector calculations and consistency across sectors and years. unosd.un
Baseline	Moisture content	mg H ₂ O/m ³ dry gas	Online gas analyser readings or periodic lab analysis of LFG; guidance from landfill gas methodologies on moisture correction for mass flow options. unfccc	MoE	Not available; no LFG moisture monitoring currently in Cambodian landfills.	Specification and procurement of gas analysers capable of measuring moisture; calibration, maintenance, and datalogging protocols, with regular reporting to MoE. unfccc
Baseline	Saturation absolute humidity	kg H ₂ O/kg dry gas	Calculated from gas temperature and pressure using standard psychrometric relationships; equations provided in LFG monitoring guidance and engineering handbooks. unfccc+1	MoE (technical MRV team)	Not calculated at present; depends on future installation of temperature, pressure, and moisture sensors on LFG lines.	Need calculation tools (spreadsheets or software) and staff training to derive absolute humidity from measured variables for use in the mass flow equation. unfccc
Baseline	Pressure of the gaseous stream in time interval t	Pa	Pressure transmitters installed in LFG collection and flare lines; monitoring requirements under	MoE	Not available; existing dumpsites and landfills do not use continuous	Need installation of pressure sensors and data loggers integrated into SCADA/manual



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
			ACM0001/A6.4AMM001 mass flow options. unfccc		pressure monitoring. gmsarnjournal	logging systems and standardised hourly/daily data reporting to MoE. unfccc
Baseline	Temperature of the gaseous stream in time interval t	K	Temperature sensors on LFG lines; monitored as per landfill gas methodologies for accurate mass flow determination. unfccc	MoE	Not available; no systematic gas temperature monitoring at current landfills.	Need specification of temperature sensor locations, calibration and QA/QC procedures, and regular transfer of recorded data to MoE for unfccc
Baseline	Density of greenhouse gas i in the gaseous stream	kg gas i/m ³ gas i	Derived from gas composition, temperature, and pressure using the ideal gas law or more detailed equations of state; parameters from IPCC and engineering data. ipcc-nggip.iges+1	MoE (review)	Not currently determined; gas composition and operating conditions are not yet measured at Cambodian landfills. gmsarnjournal	Need routine sampling/analysis of LFG composition and development of calculation procedures (or software) for density, embedded in MoE's MRV tools and guidance. ipcc-nggip.iges
Baseline	Molecular mass of greenhouse gas i	kg/kmol	Physical constants for CH ₄ , CO ₂ , N ₂ O and other gases from IPCC Guidelines and standard chemistry references. ipcc-nggip.iges+1	MoE (technical team)	Available as universal constants; no measurement required. ipcc-nggip.iges	Need to fix and document the molecular masses used in Cambodia's MRV guidance to ensure all projects apply identical values in mass flow calculations. ipcc-nggip.iges



Table 20 presents the alternative calculation options for estimating the mass flow of a greenhouse gas (GHG) in a gaseous stream, as defined in internationally recognized landfill gas methodologies. The table clarifies that methane mass flow can be derived using different combinations of measured parameters, depending on whether gas flow is monitored on a volumetric or mass basis, and whether measurements are taken under dry or wet gas conditions. In all cases, the calculation relies on two fundamental inputs: the flow rate of the gas stream and the volumetric fraction of the GHG. The selection of an option therefore depends on the type of instrumentation installed and the basis on which gas composition is measured.

The implications for NDC 3.0 tracking are that there is flexibility in how methane flows can be quantified, provided that the chosen calculation option is applied consistently and supported by appropriate monitoring and correction parameters (e.g. moisture, temperature, and pressure where relevant). For Cambodia, where baseline landfill gas monitoring systems are not yet in place, Table 20 serves as a forward-looking framework that defines acceptable calculation pathways once monitoring equipment is installed. It also underscores the importance of clearly specifying the selected option in MRV protocols, as different options entail different data requirements and QA/QC considerations, but all can produce methodologically equivalent methane mass flow estimates when correctly implemented.

However, the specific parameters required vary depending on the selected option for calculating the mass flow of greenhouse gas (GHG) in a gaseous stream. The mass flow calculation is based on measurements of (a) the flow rate of the gaseous stream and (b) the volumetric fraction of the GHG. Accordingly, the alternative parameters differ depending on the chosen calculation option.



Table 20: Alternative calculation options for determining methane mass flow in landfill gas systems

Options	Flow	Units	Fraction	Units
OPTION A	Volume flow - dry basis	(m ³ dry gas/h):	measured on dry basis (vi,t,db)	(m ³ gas i/m ³ dry gas):
OPTION B	Volume flow - wet basis	(m ³ wet gas/h):	measured on dry basis (vi,t,db)	(m ³ gas i/m ³ dry gas):
OPTION C	Volume flow - wet basis	(m ³ wet gas/h):	measured on wet basis (vi,t,wb)	(m ³ gas i/m ³ wet gas):
OPTION D	Mass flow - dry basis	(kg/h):	measured on dry basis (vi,t,db)	(m ³ gas i/m ³ dry gas):
OPTION E	Mass flow - wet basis	(kg/h):	measured on dry basis (vi,t,db)	(m ³ gas i/m ³ dry gas):
OPTION F	Mass flow - wet basis	(kg/h):	measured on wet basis (vi,t,wb)	(m ³ gas i/m ³ wet gas):

Table 21 clarifies the additional parameters required to support each methane mass flow calculation option, depending on whether landfill gas measurements are taken on a dry or wet basis and whether gas moisture is directly measured or conservatively assumed. The table shows that different calculation options (A–F) place different demands on monitoring systems, particularly with respect to moisture correction, pressure, temperature, and gas composition parameters. Options that assume dry gas conditions or rely on conservative assumptions require fewer supporting measurements, while options based on wet gas or mass flow measurements require a broader set of physical parameters to accurately convert measured values into methane mass flow.

The key implication for NDC 3.0 tracking is that the choice of calculation option directly determines the complexity and data intensity of the MRV system. For early implementation stages, conservative options with fewer measurement requirements may be appropriate, but they limit precision and transparency. As monitoring capacity improves, more data-intensive options can be adopted to enhance accuracy and credibility of methane accounting. Table 21 therefore provides a practical decision framework for aligning MRV system design with available instrumentation, while ensuring methodological consistency and enabling a gradual transition toward more robust, measurement-based landfill methane mitigation reporting.



Table 21: Parameter requirements for methane mass flow calculation options under different landfill gas measurement conditions

Option	Confirm gas is dry	Moisture content, $CH_2O_{t,db,n}$ (mg H_2O/m^3 dry gas)	Conservative situation	Pressure, Pt (Pa)	Temperature (K)	Saturation absolute humidity:	Density of the gaseous stream on a dry basis	H_2O saturation pressure, $P_{H_2O,t,db,sat}$ (Pa)	Molecular mass of gaseous stream on dry basis
Option A	Temperature or Moisture content of gas	If moisture content of gas is selected	Not required	Required	Required	Not required	Not required	Not required	Not required
Option B	Not required	Option 1	If Option 2 Selected - gas saturated or gas dry	Option 2	Not required	Option 1	If option 1 selected	Option 2 (assumed that gas saturated)	Required
Option C	Not required	Not required	Not required	Required	Required	Not required	Not required	Not required	Not required
Option D	Temperature or Moisture content of gas	If moisture content of gas is selected	Not required	Required	Required	Not required	Not required	Not required	Required
Option E	Not required	Option 1	If Option 2 Selected - gas saturated or gas dry	Option 2	Not required	Option 1	If option 1 selected	Option 2 (assumed that gas saturated)	Required
Option F	Not required	Not required	Not required	Not required	Not required	Not required	Required	Not required	Not required



This table identifies the minimum set of alternative parameters required to estimate project emissions from flaring of the residual landfill gas (LFG) stream when direct annual emissions data are not available. The calculation of flaring emissions relies on three core elements: the global warming potential (GWP) applied to methane, the mass flow of methane entering the flare, and the instantaneous flare destruction efficiency. While GWP values are readily available from IPCC Assessment Reports and can be applied consistently at national level, the table highlights that methane mass flow and flare efficiency cannot currently be measured in Cambodia due to the absence of operational LFG capture and flaring systems in the baseline period.

The implications for NDC 3.0 tracking are that project emissions from flaring cannot yet be quantified using measured data, and any near-term assessment must rely on methodological defaults and conservative assumptions once flaring systems are installed. The table also provides a clear roadmap for MRV system development, showing that credible flaring emissions accounting will require inline methane flow meters, continuous flare operation monitoring, and minute-level data logging. Establishing these monitoring requirements in advance ensures that, when landfill gas flaring becomes operational, Cambodia can transition directly to transparent, verifiable, and methodologically consistent estimation of flaring emissions under NDC 5.

The parameters listed below serve as alternative indicators for determining “Project emissions from flaring of the residual gas stream in year y (tCO_{2e}/yr)”



Table 22: Alternative parameters for estimating project emissions from flaring of landfill gas residual streams

Type	Data required	Units	Source	Primary responsible Entity	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline	Global warming potential of CH ₄	tCO ₂ e/tCH ₄	IPCC 6 th Assessment Report	MoE	27	Need explicit confirmation of which GWP series is applied for all waste sector calculations and consistency across sectors and years.
Baseline	Mass flow of methane in the residual gas in the minute <i>m</i>	kg	NA	MoE	Data not available, as there is no landfill gas (LFG) capture system in the country to measure the mass flow rate of methane in the residual gas on a per-minute basis.	Install inline methane flow meters with CH ₄ analysers and data logging at 1-minute intervals.
Baseline	Flare efficiency in the minute <i>m</i>	%	CDM tool 06	MoE	From CDM tool: Open flares: Flare efficiency is 50% in minute <i>m</i> if a flame is detected; otherwise, efficiency is 0% ; Enclosed flares: A default flare efficiency of 90% applies in minute <i>m</i> if both the flare temperature and residual gas flow rate are within the manufacturer's specifications and a flame is detected; otherwise, efficiency is 0% .	A flame detector or flame sensor providing continuous measurement, with signals aggregated and recorded at 1-minute intervals.



Action 5.2- Launch a National Plan for Dumpsite Closure and Transition, aiming to rehabilitate or upgrade at least 2 dumpsites per year. This plan should prioritize sites where controlled and/or sanitary landfills or improved alternatives become available.

Table 23: Parameters needed to track the progress of action 2 of NDC 5

Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline	Municipal solid waste mass disposed of at SWDS in year y	tonnes/ yr	Summary of Key Assumptions, Baseline, Methodology, and Results for Cambodia NDC3.0 Waste Sector Modelling	MoE	The total waste ended up in landfill is 2,094,320 ton/year. 80% Open Dumps. 180 operational open landfills (91% of sites). 15% Controlled Landfills	An appropriate monitoring and record-keeping system should be established to track the quantity of waste disposed at landfill sites.
Baseline	Municipal solid waste composition of waste disposed of in SWDS in year y (Food, Garden, Paper, Wood, Textile, inert waste (Glass, plastic, metal), etc.	%	Cambodia BTR1	MoE	Food waste: 51.90%, Paper waste: 9.90%, Wood waste: 2.30%, Textiles: 2.10%, Plastic: 20.90%, Glass: 1.60%, Metal: 1.10%, Ceramic and Stones: 0.50%, Rubber and Leather: 0.20%, Other: 9.50%	Sample-based analysis of the composition of waste disposed at landfill sites should be conducted regularly (monthly or annually)
Project	Municipal solid waste mass	tonnes/ yr	Cambodia NDC 3.0	MoE	No dumpsites have been properly closed as of 2024. Launch a	An appropriate monitoring and



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
	disposed of at SWDS in year y				National Plan for Dumpsite Closure and Transition, to rehabilitate/upgrade at least 2 dumpsites/y.	record-keeping system should be established to track the quantity of waste disposed at landfill sites.
Project	Municipal solid waste composition of waste disposed of in SWDS in year y (Food, Garden, Paper, Wood, Textile, inert waste (Glass, plastic, metal), etc.	%	Cambodia BTR1	MoE	Food waste: 51.90%, Paper waste: 9.90%, Wood waste: 2.30%, Textiles: 2.10%, Plastic: 20.90%, Glass: 1.60%, Metal: 1.10%, Ceramic and Stones: 0.50%, Rubber and Leather: 0.20%, Other: 9.50%	Sample-based analysis of the composition of waste disposed at landfill sites should be conducted on a regular basis (monthly or annually)
Baseline/ Project	Methane Correction Factor (MCF) – Unmanaged shallow	fraction	Table 3.1, Chapter 3,, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default value for unmanaged shallow landfill: 0.4 No site-specific methane factor measurements in Cambodia	Need country-specific studies on landfill to derive national-level methane factors
Baseline	Fraction of degradable organic carbon that can decompose (DOCf)	fraction	Section 3.2.3, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default value for fraction of degradable organic carbon which decomposes: 0.5 No country-specific measurements	Need country-specific studies on waste decomposition to derive fraction of degradable organic



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection														
						carbon which decomposes														
Baseline/ Project	Fraction of degradable organic carbon in waste type j (DOCj) (Food, Garden, Paper, Wood, Textile, inert waste (Glass, plastic, metal), etc.	fraction	Table 2.4, Chapter 2, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default values: <table border="1" style="margin-left: 20px;"> <tr><td>Wood</td><td>43%</td></tr> <tr><td>Paper/cardboard</td><td>40%</td></tr> <tr><td>Food waste</td><td>15%</td></tr> <tr><td>Textiles</td><td>24%</td></tr> <tr><td>Garden and Park waste</td><td>20%</td></tr> <tr><td>Nappies</td><td>24%</td></tr> <tr><td>Glass, plastic, metal, other inert waste</td><td>0%</td></tr> </table> No country-specific fraction of DOC measurements for waste types	Wood	43%	Paper/cardboard	40%	Food waste	15%	Textiles	24%	Garden and Park waste	20%	Nappies	24%	Glass, plastic, metal, other inert waste	0%	Need country-specific studies on waste decomposition to derive national-level fractions for DOC in the waste type
Wood	43%																			
Paper/cardboard	40%																			
Food waste	15%																			
Textiles	24%																			
Garden and Park waste	20%																			
Nappies	24%																			
Glass, plastic, metal, other inert waste	0%																			
Baseline/ Project	Methane generation rate for waste type j (kj)	yr-1	Table 3.3, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default values: <table border="1" style="margin-left: 20px;"> <tr><td>Wood</td><td>0.035</td></tr> <tr><td>Paper/cardboard</td><td>0.07</td></tr> <tr><td>Food waste</td><td>0.4</td></tr> <tr><td>Textiles</td><td>0.07</td></tr> <tr><td>Garden and Park waste</td><td>0.17</td></tr> <tr><td>Nappies</td><td>0.17</td></tr> </table>	Wood	0.035	Paper/cardboard	0.07	Food waste	0.4	Textiles	0.07	Garden and Park waste	0.17	Nappies	0.17	Need country-specific studies on waste decomposition to derive national-level fractions for the methane generation rate for the waste type		
Wood	0.035																			
Paper/cardboard	0.07																			
Food waste	0.4																			
Textiles	0.07																			
Garden and Park waste	0.17																			
Nappies	0.17																			



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection		
					<table border="1"> <tr> <td>Glass, plastic, metal, other inert waste</td> <td>0</td> </tr> </table> <p>No country-specific methane generation rate for waste type</p>	Glass, plastic, metal, other inert waste	0	
Glass, plastic, metal, other inert waste	0							
Baseline/ Project	Fraction of CH ₄ in generated Landfill Gas (F)	Volume fraction	Section 3.2.3, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default value for fraction of CH ₄ in generated landfill gas: 0.5	No country-specific values available		
Baseline/ Project	Amount of CH ₄ recovered from SWDS in year y	tonnes/ yr	NA	MoE	Not yet available. No landfills with operational CH ₄ recovery information within the historical period.	There is a need to identify whether methane recovery is being carried out at landfill sites and to establish a measurement system to accurately record the quantity of recovered methane (CH ₄).		
Baseline/ Project	Oxidation factor in year y	fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default values: 0 or 0.1 No site-specific oxidation measurements in Cambodia	Need country-specific studies on waste material and landfill operation to derive		



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
						national oxidation factors
Baseline/ Project	Global warming potential of CH ₄	tCO ₂ e/tCH ₄	IPCC 6 th Assessment Report	MoE	27	Need explicit confirmation of which GWP series is applied for all waste sector calculations and consistency across sectors and years.

Action 5.3- Assess the feasibility of Mechanical-Biological Treatment (MBT) technologies for pre-treatment of waste prior to disposal, to reduce organic content, lower GHG emissions, and optimize landfill space. Target reducing the organic content of landfilled waste to below 20% by 2035.

Table 24: Parameters needed to track the progress of action 4 of NDC 5

Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline	Municipal solid waste mass disposed of at SWDS in year y	tonnes/ yr	Cambodia NDC 3.0	MoE	As of 2024, the average organic content of landfill waste is 55%.	An appropriate monitoring and record-keeping system should be established to track the quantity of waste disposed at landfill sites.
Baseline	Municipal solid waste composition of waste	%	Cambodia BTR1	MoE	Food waste: 51.90%, Paper waste: 9.90%, Wood waste:	Sample-based analysis of the composition of waste disposed at



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
	disposed of in SWDS in year y (Focusing only on organic portion of the waste: Food, Garden, Paper, Wood, etc.)				2.30%, Textiles: 2.10%, Plastic: 20.90%, Glass: 1.60%, Metal: 1.10%, Ceramic and Stones: 0.50%, Rubber and Leather: 0.20%, Other: 9.50%	landfill sites should be conducted on a regular basis (monthly or annually)
Project	Municipal solid waste mass disposed of at SWDS in year y	tonnes/yr	Cambodia NDC 3.0	MoE	Target reducing the organic content of landfilled waste to below 20% by 2035.	An appropriate monitoring and record-keeping system should be established to track the quantity of waste disposed at landfill sites.
Project	Municipal solid waste composition of waste disposed of in SWDS in year y (Focusing only on organic portion of the waste: Food, Garden, Paper, Wood, etc.)	%	Cambodia BTR1	MoE	Food waste: 51.90%, Paper waste: 9.90%, Wood waste: 2.30%, Textiles: 2.10%, Plastic: 20.90%, Glass: 1.60%, Metal: 1.10%, Ceramic and Stones: 0.50%, Rubber and Leather: 0.20%, Other: 9.50%	Sample-based analysis of the composition of waste disposed at landfill sites should be conducted on a regular basis (monthly or annually)
Baseline/ Project	Methane Correction Factor (MCF) – Unmanaged shallow	fraction	Table 3.1, Chapter 3,, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default value for unmanaged shallow landfill: 0.4 No site-specific methane factor measurements in Cambodia	Need country-specific studies on landfill to derive national-level methane factors
Baseline/ Project	Fraction of degradable organic carbon that can decompose (DOCf)	fraction	Section 3.2.3, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default value for fraction of degradable organic carbon which decomposes: 0.5	Need country-specific studies on waste decomposition to derive fraction of degradable organic carbon which decomposes



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection										
					No country-specific measurements											
Baseline/ Project	Fraction of degradable organic carbon in waste type j (DOC _j) (Focusing only on organic portion of the waste: Food, Garden, Paper, Wood, etc.)	fraction	Table 2.4, Chapter 2, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default values: <table border="1" style="margin-left: 20px;"> <tr> <td>Wood</td> <td>43%</td> </tr> <tr> <td>Paper/cardboard</td> <td>40%</td> </tr> <tr> <td>Food waste</td> <td>15%</td> </tr> <tr> <td>Textiles</td> <td>24%</td> </tr> <tr> <td>Garden and Park waste</td> <td>20%</td> </tr> </table> No country-specific fraction of DOC measurements for waste types	Wood	43%	Paper/cardboard	40%	Food waste	15%	Textiles	24%	Garden and Park waste	20%	Need country-specific studies on waste decomposition to derive national-level fractions for DOC in the waste type
Wood	43%															
Paper/cardboard	40%															
Food waste	15%															
Textiles	24%															
Garden and Park waste	20%															
Baseline/ Project	Decay rate constant for waste type j (k _j)	yr ⁻¹	Table 3.3, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default values: <table border="1" style="margin-left: 20px;"> <tr> <td>Wood</td> <td>0.035</td> </tr> <tr> <td>Paper/cardboard</td> <td>0.07</td> </tr> <tr> <td>Food waste</td> <td>0.4</td> </tr> <tr> <td>Textiles</td> <td>0.07</td> </tr> <tr> <td>Garden and Park waste</td> <td>0.17</td> </tr> </table> No country-specific methane generation rate for waste type	Wood	0.035	Paper/cardboard	0.07	Food waste	0.4	Textiles	0.07	Garden and Park waste	0.17	Need country-specific studies on waste decomposition to derive national-level fractions for the methane generation rate for the waste type
Wood	0.035															
Paper/cardboard	0.07															
Food waste	0.4															
Textiles	0.07															
Garden and Park waste	0.17															



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline/ Project	Fraction of CH ₄ in generated Landfill Gas (F)	Volume fraction	Section 3.2.3, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default value for fraction of CH ₄ in generated landfill gas: 0.5	No country-specific values available
Baseline/ Project	Amount of CH ₄ recovered from SWDS in year y	tonnes/ yr	Cambodia NDC 3.0	MoE	Not yet available. No landfills with operational CH ₄ recovery information within the historical period.	There is a need to identify whether methane recovery is being carried out at landfill sites and to establish a measurement system to accurately record the quantity of recovered methane (CH ₄).
Baseline/ Project	Oxidation factor in year y	fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	IPCC default values: 0 or 0.1 No site-specific oxidation measurements in Cambodia	Need country-specific studies on waste material and landfill operation to derive national oxidation factors
Baseline/ Project	Global warming potential of CH ₄	tCO ₂ e/ tCH ₄	IPCC 6 th Assessment Report	MoE	27	Need explicit confirmation of which GWP series is applied for all waste sector calculations and consistency across sectors and years.



3.1.6. NDC 6: Improve textile waste management capacities

The measure aims to establish centralized textile waste collection and sorting centres in Cambodia to increase the recycling rate of post-industrial textile waste (PITW). This includes creating a registration system for textile waste operators (e.g., companies managing the collection and sorting centres), implementing a standardized textile waste data-reporting process to the Ministry of Environment (MoE), and considering an auction mechanism to facilitate transparent textile waste transactions.

Table 25: Action, Baseline Scenario, Methodology & assumptions of NDC 6

Action	Baseline Scenario	Project Scenario	Methodology & assumptions
1) 80% of PITW is traceable, recorded, and sent to recyclers, directly or through registered waste collectors/aggregators.	A significant portion of post-industrial textile waste (PITW) will be untracked and informally managed, leading to low recycling rates and environmental leakage (In 2024, less than 20% of PITW is traceable and recycled).	At least 80% of PITW will be traceable, properly recorded, and directed to recyclers, either directly or via registered waste collectors and aggregators, improving recycling efficiency and accountability	Only this measure was included in the mitigation assessment, as it directly results in measurable and attributable GHG emission reductions. The baseline scenario assumes that PITW would be disposed of in a landfill in the absence of the project. In the project scenario, the quantity of PITW that would otherwise be landfilled is diverted to recycling.



Action	Baseline Scenario	Project Scenario	Methodology & assumptions
			<p>Accordingly, baseline emissions were estimated in accordance with the CDM methodology AMS-III.AJ, while project emissions from recycling of waste were calculated based on CDM methodology in Tool 5.</p>
<p>2) 40% of garment factories have received at least one external training on textile waste management.</p>	<p>Most garment factories will operate without external guidance on textile waste management, resulting in limited awareness and low adoption of sustainable practices (As of 2024, 21 factories and 13 waste handlers were trained about sustainable textile waste management).</p>	<p>At least 40% of garment factories will receive at least one external training on textile waste management, enhancing knowledge and promoting improved waste handling practices.</p>	<p>This action, which focuses on capacity building and training, was excluded from the quantitative assessment because its impacts on GHG emissions are indirect and cannot be robustly quantified.</p>



Table 26: Parameters needed to track the progress of action 1 of NDC 6

Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Institutional and Data gaps
Baseline	Fraction of DOC that decomposes under the specific conditions occurring in the SWDS for year y	weight fraction	Table 2.4, Chapter 2, Volume 5, 2006 IPCC Guidelines for	MoE	2006 IPCC guideline: 0.5	Rely on international standard
Baseline	Amount of solid waste type j (Textile materials) disposed in the SWDS in the year x	tonne	Input from experts	MoE	NA	NA
Baseline	Model correction factor to account for model uncertainties for year y	Fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	2006 IPCC guideline: 0.85	NA
Baseline	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y	Fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	2006 IPCC guideline: 0.0 for unmanaged	NA
Baseline	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)	Fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	2006 IPCC guideline: 0.1	NA
Baseline	Fraction of methane in the SWDS gas	volume fraction	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	2006 IPCC guideline: 0.5	NA
Baseline	Methane correction factor for year y	Fraction	Table 3.1, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	2006 IPCC guideline -Managed: 1.0 -Managed semi aerobic: 0.5 -Unmanaged deep: 0.8 -Unmanaged shallow: 0.4 -Uncategorized: 0.6	NA
Baseline	Fraction of degradable organic carbon in the waste type j (Textile materials)	weight fraction	Table 3.5, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	2006 IPCC guideline - Food waste: 0.4 - Garden: 0.2 - Paper: 0.4 -Wood and straw: 0.43 - Textiles: 0.24 -Disposable nappies: 0.24	NA



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Institutional and Data gaps
					- Sewage sludge: 0.05 - Industrial waste: 0.15	
Baseline	Decay rate for the waste type j (Textile materials)	1/y	Table 3.2, Chapter 3, Volume 5, 2006 IPCC Guidelines	MoE	2006 IPCC guideline: 0.1	NA
Baseline	Global Warming Potential for CH ₄ applicable for the year	NA	IPCC 6 th Assessment Report	MoE	27	NA
Project	Material-specific electricity intensities for recycling	MWh/tonne	Input from expert	MME	NA	NA
Project	Quantity of textile material recycled	tonne	Input from expert	MISTI	NA	NA
Project	Grid emissions factor	tCO _{2e} /MWh	Input from expert	MME	0.53	NA
Project	Average technical transmission and distribution losses for providing electricity to source k in year y	%	World bank portal data	MoE	12-13	NA



3.1.7. NDC 7: Industrial Wastewater (IWW) management

This measure will improve the management of industrial wastewater in the food & beverage (F&B), GFT and leather sectors. It aims to address the second biggest GHG emitter under the waste sector, namely wastewater management. By properly treating wastewater, it allows the reduction of uncontrolled anaerobic digestion and contributes to reducing GHG emissions. It also presents the opportunity to produce biogas and reduce environmental pollution. Under this measure, there are two targets that have been identified for 2035.

- 100% of GFT and leather factories are connected to a centralized wastewater treatment plant (or equipped with their own plant in specific cases).
- Increase by 100% the number of industrial wastewater treatment plants producing biogas.

Table 27: Action, Baseline Scenario, Methodology and Assumption

Action	Baseline Scenario	Project Scenario	Methodology and Assumption
100% of GFT and leather factories are connected to a centralized wastewater treatment plant (or equipped with their own plant in specific cases).	Baseline treatment is assumed as 5% for F&B and 9% for non-F&B sectors.	This project will increase the wastewater treatment by 100% for GFT, textile, and leather industries. This will be carried out by connecting 100% of GFT and leather factories to a centralized wastewater treatment	Methodology for Industrial Wastewater Treatment and Discharge, in volume 5 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories. (CDM tool 3 to calculate project emission from



Action	Baseline Scenario	Project Scenario	Methodology and Assumption
		plant (or equipped with their own plant in specific cases).	fossil fuel combustion and tool 5 to calculate project emissions from electricity consumption)
Increase by 100% the number of industrial wastewater treatment plants producing biogas	There are 12 large beer & soft drink factories in Cambodia in 2024 and in the baseline scenario, at least 3 of them are producing biogas	In the project scenario, the number of industrial wastewater treatment plants producing biogas will increase up to 100%.	Methodology for Industrial Wastewater Treatment and Discharge, in volume 5 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories. (CDM tool 3 to calculate project emission from fossil fuel combustion and tool 5 to calculate project emissions from electricity consumption)

Action 7.1 - 100% of GFT and leather factories are connected to a centralized wastewater treatment plant (or equipped with their own plant in specific cases)



Table 28: Parameters needed to track the progress of action 1 of NDC 7 – For non-food & beverage sector



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline/Project	Total volume of wastewater generated for the respective industry sector	m ³ /yr	Input from industry experts	MOE and MISTI	NA	NA
Baseline/Project	Percentage of wastewater treated in the respective year from the project activity	%	Project flow meters; estimates	MISTI	NA	Limited flow meters; estimated data
Baseline	Chemical Oxygen Demand (untreated)	kg COD/m ³	Laboratory analysis; design assumptions	MISTI	12	Infrequent sampling; limited lab capacity
Baseline/Project	Sludge removed in the respective industry (only if applicable)	kg COD/yr	Operator records; estimates	MISTI	NA	Incomplete sludge tracking
Baseline	Maximum CH ₄ producing capacity (untreated)	kg CH ₄ /kg COD	Section 6.2.3.2, Chapter 6, Volume 5, 2006 IPCC Guidelines	MISTI	0.25	Default assumption
Baseline	Methane correction factor (Untreated)	Fraction	Table 6.8, Chapter 6, Volume 5, 2006 IPCC Guidelines	MISTI	0.8	No site-specific validation
Baseline/Project	Methane recovered (only if applicable)	kg CH ₄	Operator logs; meter readings	MISTI	NA	Manual data recording
Baseline/Project	Global Warming Potential for CH ₄ applicable for the year	CO ₂ e	IPCC 6 th Assessment Report	MOE	28	NA
Project	Chemical Oxygen Demand (treated)	kg COD/m ³	Lab tests; assumptions	MISTI	1.5	Sparse effluent sampling



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Project	Maximum CH ₄ producing capacity (treated)	kg CH ₄ /kg COD	Section 6.2.3.2, Chapter 6, Volume 5, 2006 IPCC Guidelines	MISTI	0.25	Default assumption
Project	Methane correction factor (treated)	Fraction	Table 6.8, Chapter 6, Volume 5, 2006 IPCC Guidelines	MISTI	0.1	NA
Project	Quantity of electricity consumed by the project electricity consumption	MWh/yr	Project monitoring records	EDC	NA	Partial metering coverage
Project	Emission factor for electricity	t CO ₂ /MWh	MoE Grid Emission Factor	EDC	0.53	Time lag in annual updates
Project	Average T & D loss	%	Worldbank portal data	MoE	12-13	National average only; no site-specific losses
Project	Quantity of fuel type i combusted in process	kg	Project fuel records	MME	NA	Inconsistent log-books
Project	Weighted average net calorific value of the fuel type i in year y	GJ/kg	Table 1.2, Chapter 1, Volume 2, 2006 IPCC Guidelines	MME	0.043	No Cambodia-specific fuel testing -Default values only
Project	Weighted average CO ₂ emission factor of fuel type i	tCO ₂ /GJ	Table 2.3, Chapter 2, Volume 2, 2006 IPCC Guidelines	MME	0.0741	Reliance on default factors



Action 7.2 – Increase by 100% the number of industrial wastewater treatment plants producing biogas

Table 29: Parameters needed to track the progress of action 2 of NDC 7(For food & beverage sector)

Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
Baseline/Project	Total volume of wastewater generated for the respective industry sector	m ³ /yr	Input from industry experts	MISTI	NA	NA
Baseline/Project	Percentage of wastewater treated by the plants that producing biogas for the respective year due to the project activity	%	Input from industry experts	MISTI	NA	NA
Baseline/Project	Chemical Oxygen Demand (treated)	kg COD/m ³	Limited lab tests; assumptions	MISTI	1.5	Sparse effluent sampling
Baseline/Project	Sludge removed in respective industrial sector (only if applicable)	kg COD/yr	Operator records; estimates	MISTI	NA	Incomplete sludge tracking
Baseline/Project	Maximum CH ₄ producing capacity (treated)	kg CH ₄ /kg COD	Section 6.2.3.2, Chapter 6, Volume 5, 2006 IPCC Guidelines	MISTI	0.25	Default assumption
Baseline/Project	Methane correction factor (treated)	Fraction	Table 6.8, Chapter 6,	MISTI	0.1	NA



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
			Volume 5, 2006 IPCC Guidelines			
Baseline/Project	Global Warming Potential for CH ₄ applicable for the year	CO ₂ e	IPCC 6 th Assessment Report	MOE	28	NA
Baseline	Biogas recovered (only if applicable)	kg CH ₄	Operator logs; meter readings	MISTI	NA	Manual data recording
Project	Biogas recovered in respective industrial sector in respective year, due to the project activity	kg CH ₄	Operator logs; meter readings	MISTI	NA	Manual data recording
Baseline/Project	Quantity of electricity consumed by the project electricity consumption	MWh/yr	Project monitoring records	EDC	NA	Partial metering coverage
Baseline/Project	Emission factor for electricity generation	t CO ₂ /MWh	MoE Grid Emission Factor	EDC	0.53	Time lag in annual updates
Baseline/Project	Average T & D loss	%	Worldbank portal data	MoE	12-13	National average only; no site-specific losses
Baseline/Project	Quantity of fuel type i combusted in process	kg	Project fuel records	MME	NA	Inconsistent logbooks
Baseline/Project	Weighted average net calorific value of the fuel type i in year y	GJ/kg	Table 1.2, Chapter 1,	MME	0.043	No Cambodia-specific fuel testing -Default values only



Type	Data required	Units	Source	Primary data provider	Data availability for the assessment period	Data and institutional gaps for data collection
			Volume 2, 2006 IPCC Guidelines			
Baseline/Project	Weighted average CO ₂ emission factor of fuel type i	tCO ₂ /GJ	Table 2.3, Chapter 2, Volume 2, 2006 IPCC Guidelines	MME	0.0741	Reliance on default factors



3.2. Data Quality

To improve data quality, standardized QA/QC procedures will be implemented. These include regular audits of data collection processes, validation of reported data by independent third parties, and the use of automated tools to minimize human error. A dedicated QA/QC team will be established based on the roles and responsibilities of the governmental institutions to oversee these processes. For example, the ministry of environment will act as QA/QC team for the solid waste and waste water while the ministry of mines and energy will be a QA/QC team for waste to energy or electricity consumption, etc.

Data quality in the waste sector—particularly for wastewater—remains uneven across institutions and sub-sectors. While basic activity data such as the number of wastewater treatment plants, industrial permits, and compliance reports are available, these data are often incomplete, inconsistently reported, and not collected using standardized methodologies aligned with MRV or ETF requirements. For wastewater, key parameters required for GHG estimation such as influent flow rates, COD/BOD loads, treatment technologies, sludge management practices, and biogas production, are only partially available and are largely self-reported by operators without systematic QA/QC procedures. In the solid waste sub-sector, data quality challenges are similarly linked to infrequent surveys, reliance on default emission factors, and limited waste characterization studies. Strengthening data quality will require standardized templates, regular data verification, improved digitization, and clearer institutional responsibility for QA/QC at the national level. Data quality considerations were assessed across five dimensions: *accuracy, completeness, consistency, timeliness, and verifiability*.

1. **Accuracy: IPCC default parameters** (e.g., oxidation factor, DOC_f, DOC fractions, decay rates, F=0.5) provide technically defensible starting points, but they are not Cambodia-specific. This limits the accuracy of national estimates, especially where disposal conditions diverge from default assumptions (cover practices, waste moisture, management level). **Waste quantity and disposal shares** are available as national estimates; however, measurement error is likely where weighbridge



coverage is incomplete, where waste is not routinely weighed at sites, or where reporting is not harmonized across municipalities and operators.

2. **Completeness:** For the baseline period, datasets are incomplete for *site-level disposal quantities, site typology* (open dump vs. controlled vs. sanitary) with consistent definitions, and **methane recovery** (almost entirely missing). For project tracking, completeness is currently low because **LFG metering and operational logs** (flare uptime, maintenance, destruction efficiency) are not yet established as standard requirements.
3. **Consistency:** Consistency issues arise when different entities use different GWPs (AR4/AR5/AR6) or different grid emission factor series. This can cause inconsistent reporting across years and sectors. A single official decision (and documentation) on GWPs and grid EF updates is needed for the waste MRV system to maintain consistency.
4. **Timeliness:** Most currently available values originate from periodic national reporting and studies; they are not collected annually at the site level. For MRV purposes, timeliness must shift toward **annual (or more frequent) reporting** for key operational variables and waste tonnages.
5. **Verifiability and QA/QC:** Verifiability is limited where data are derived from assumptions or aggregated estimates without traceable source records. Establishing QA/QC will require calibrated instruments (weighbridges, flow meters, gas analysers), documented SOPs, audit trails, and a clear chain of custody for data submission from operators → sub-national authorities → MoE.

3.3. Key Findings

3.3.1. Analytical basis and rationale

The key findings presented below are derived from a combined assessment of (i) available quantitative data used for NDC 3.0 waste sector modelling and MRV design, and (ii)



structured consultations with national institutions, sub-national authorities, operators, and development partners conducted under each NDC waste measure. The analysis focused on identifying what can currently be tracked with available data, what relies on assumptions or proxies, and where institutional and data constraints limit outcome-based reporting.

Across all waste sub-sectors, a consistent pattern emerges: policy frameworks and implementation activities are progressing, but data systems and MRV arrangements are lagging implementation. As a result, most NDC 3.0 waste actions can currently be tracked through activity-based and output indicators (e.g. coverage, capacity, infrastructure status), while measured mitigation outcomes (e.g. tCO₂e reduced) remain limited to modelled estimates using IPCC defaults.

Stakeholder consultations confirmed that this gap is not primarily methodological—internationally accepted methodologies are available for all waste sub-sectors—but rather institutional and operational, particularly the absence of routine reporting requirements, standardized templates, and plant- or site-level monitoring systems. This has direct implications for the credibility and transparency of NDC tracking as Cambodia moves from planning and early implementation toward full-scale delivery.

3.3.2. Implications for interpreting the findings

The findings should therefore be interpreted as a diagnostic of MRV readiness and implementation maturity, rather than a judgment on policy ambition. Sub-sectors with stronger infrastructure planning (e.g. landfill management) show clearer pathways toward measurable mitigation, while upstream measures (e.g. waste reduction, segregation) remain essential enablers but are inherently more difficult to quantify without dedicated behavioural and material flow monitoring systems. The table below summarizes the evidence-based findings by waste sub-sector, combining real data references with consultation insights to clearly show current status, limitations, and readiness for NDC tracking.



Table 30: Summary of key findings by waste sub-sector under NDC 3.0 (based on data assessment and consultations)

NDC measure / sub-sector	Evidence from available data	Evidence from consultations	Key analytical finding for NDC tracking
<p>NDC 1 – Solid waste reduction & pollution control</p>	<p>National datasets report total MSW generation and disposal but do not quantify waste avoided or reduced. Pollution control actions (e.g. site management, leachate control) are not linked to emissions metrics in MRV datasets.</p>	<p>Stakeholders reported waste reduction is implemented mainly through pilot initiatives and regulations, with no shared definition or measurement approach across institutions.</p>	<p>Waste reduction is strategically critical but weakly quantifiable; current tracking can only reflect policy adoption and project outputs, not measurable reductions in waste generation or emissions.</p>
<p>NDC 2 – Collection & segregation at source</p>	<p>Collection coverage data exist, but segregation rates at households, schools, markets, and commercial entities are not routinely measured. Waste composition studies are infrequent and</p>	<p>Municipalities emphasized that segregation remains largely voluntary, uneven, and weakly enforced, despite its importance for downstream treatment.</p>	<p>Segregation is a foundational enabling action, but the absence of routine indicators prevents assessment of its contribution to organic diversion and mitigation outcomes.</p>

NDC measure / sub-sector	Evidence from available data	Evidence from consultations	Key analytical finding for NDC tracking
	not designed for annual tracking.		
NDC 3 – Organic waste processing	Waste composition data confirm organic waste dominance (>50% of MSW). Data on quantities treated through composting or anaerobic digestion are incomplete and project based.	Operators and authorities reported feedstock contamination and inconsistent supply, largely due to weak upstream segregation.	Organic waste processing has high mitigation potential but limited operational data and upstream constraints prevent robust emissions reduction quantification.
NDC 4 – Alternative SWM processing at landfills	Information on RDF, MBT, or pre-treatment exists mainly in feasibility studies; throughput and diversion rates are not reported nationally.	Stakeholders indicated most initiatives remain at pilot or concept stage, with uncertainty over long-term operation and integration.	Alternative processing is conceptually recognized but operationally immature , and its mitigation impact remains modelled rather than measured.
NDC 5 – Landfill management	National data support IPCC-based baseline emissions modelling. Site-level data on landfill gas	Stakeholders confirmed infrastructure development is advancing faster than	Landfill management is the most technically mature sub-sector , but mitigation tracking

NDC measure / sub-sector	Evidence from available data	Evidence from consultations	Key analytical finding for NDC tracking
	recovery, flaring efficiency, and energy generation are largely unavailable.	MRV system deployment; reporting is not yet mandatory.	currently relies on modelled estimates rather than measured outcomes.
NDC 6 – Textile waste management	Textile waste quantities are aggregated under mixed waste categories; no dedicated activity data or emission factors are applied.	Consultations highlighted growing textile waste flows and significant informal reuse/recycling not captured in official statistics.	Textile waste remains a data-poor and institutionally diffuse sub-sector , limiting assessment of mitigation potential and progress.
NDC 7 – Industrial wastewater management	Data on industrial wastewater volumes, treatment technologies, and organic loading are fragmented and facility specific.	Operators cited confidentiality and lack of reporting mandates; authorities acknowledged MRV systems are underdeveloped.	Industrial wastewater is the least MRV-ready sub-sector , requiring plant-level data frameworks before meaningful NDC tracking is possible.

3.3.3. Overall synthesis

Taken together, the assessment confirms that Cambodia’s waste sector under NDC 3.0 is implementation-oriented but MRV-constrained. Existing data systems are adequate to



establish national baselines, characterize waste flows, and define mitigation priorities across solid waste and wastewater sub-sectors. However, emissions reductions remain largely prospective rather than measurable, as outcome-based tracking depends on the timely establishment of standardized MRV protocols, operational monitoring, and formalized data flows across institutions. At present, baseline tracking is feasible using national estimates and IPCC Tier 1 and Tier 2 methodologies, but it does not yet meet the requirements of “MRV-grade” implementation tracking for NDC reporting cycles.

The waste sector is characterized by a high structural emissions risk driven by unmanaged disposal practices and organic waste dominance. An estimated 2.09 million tonnes of waste are disposed annually, with approximately 80% sent to open dumps and 91% of disposal sites operating without management controls. Food waste constitutes the largest fraction of MSW (about 52%), followed by plastics (21%) and paper (10%), reinforcing methane mitigation as the primary emissions lever. While Cambodia has articulated clear mitigation ambitions—including landfill gas recovery, waste segregation, organic waste diversion, industrial wastewater treatment expansion, and reduction of open burning—the ability to quantify progress is limited by fragmented sub-national data, minimal facility-level wastewater reporting, and continued reliance on IPCC default emission factors due to the absence of country-specific parameters.

The dominant constraint is the absence of operational monitoring systems at disposal and treatment facilities. Critical parameters required for direct mitigation accounting—such as methane captured and destroyed, flare efficiency, gas composition, organic fraction reduction, and wastewater treatment performance—are not yet available because sanitary landfill and LFG systems have only recently been initiated and lack metered monitoring. As a result, NDC actions such as landfill gas capture (Action 5.1) and organic fraction reduction (Action 5.3) cannot be verified through direct emissions measurement and must rely on proxy indicators until systems become operational. Methodologically, this reinforces the need to clearly distinguish between IPCC-based approaches used for national inventory and baseline tracking, and project-level methodologies (e.g., ACM-type monitoring) applied for



implementation-level mitigation accounting. Strengthening institutional coordination, standardizing reporting templates, and embedding routine measurement at facilities therefore emerge as prerequisites for credible, outcome-based NDC tracking in subsequent reporting cycles.

Table 31: Summary of Key Insights and Implications

Dimension	Key Insight	Implication for NDC Tracking
Disposal practices	80% of waste disposed in open dumps; 91% unmanaged sites	High baseline methane emissions; urgent need for operational controls
Waste composition	Organic fraction ~52% of MSW	Methane mitigation is the dominant reduction pathway
Data availability	Reliance on IPCC defaults; no country-specific EFs	Baselines possible, but high uncertainty remains
Monitoring systems	No metered LFG or routine landfill monitoring	Direct mitigation outcomes cannot yet be quantified
Wastewater data	Industrial data not linked to MoE MRV systems	Limits facility-level emissions tracking
Methodology	Mixed use of IPCC and project-level approaches	Requires explicit clarification to avoid inconsistency

3.4. Implications for NDC Tracking

Identified data and institutional gaps pose several risks to effective NDC tracking. First, incomplete and inconsistent data may undermine transparency and completeness of reporting under the Enhanced Transparency Framework (ETF). Second, difficulties in accessing reliable wastewater and solid waste activity data limit Cambodia's ability to quantify against NDC targets, particularly for GHG mitigation outcomes. Third, the continued reliance on default emission factors and assumptions increases uncertainty in emission estimates, reducing the robustness of reported mitigation impacts. Without improvement in



data quality and coordination, tracking progress on key measures such as industrial wastewater management and biogas recovery will remain challenging.

In addition, the absence of standardized data collection methods could hinder the ability to assess the status and effectiveness of waste sector policies, such as sources segregation mandates and plastic reduction initiative. The absence of standardized data collection methodologies limits the consistency and comparability of waste sector data, thereby constraining the assessment of policy effectiveness, including source segregation requirements and plastic reduction measures. In addition, the lack of formal inter-institutional data-sharing agreements and the absence of dedicated, long-term MRV focal points undermine institutional continuity and reduce the capacity to maintain a robust and sustainable monitoring system for tracking progress toward national targets.

These implications highlight a priority need for targeting investment in capacity building, technology for centralized digital platform such as WasCAD tools and online NDC tracking system, etc. The development or upgrading to a higher tier to quantify the GHG inventory in waste sector requires to update the data collection system, improve methodologies, advance technology, and improve country specific emission factors.

1. **Shift from “model-based estimation” to “measured performance” is essential by 2027–2030.**: In early years, NDC 5 progress will be tracked mainly through proxy indicators (e.g., share of waste disposed in controlled/sanitary sites, number of dumpsites upgraded/closed, installation milestones). Once the Phnom Penh regional sanitary landfill LFG system is operational, NDC tracking should transition toward **measured methane recovery and destruction**, supported by verified monitoring systems.
2. **Progress indicators must be tiered (outcome + output).** Given the data gaps, the MRV framework should adopt two layers:



1. **Output indicators:** number of sites upgraded/closed, operational status of LFG system, existence of MBT feasibility study and investment decision, weighbridge and metering coverage.
2. **Outcome indicators:** tonnes of MSW disposed at each site type, organic fraction at landfill entry, tCH₄ recovered/destroyed, electricity generated/used, estimated tCO₂e reduced.
3. **Consistency decisions (GWP and grid EF series) are “system-critical.”** If Cambodia’s waste MRV uses changing GWPs or inconsistent grid emission factors, the resulting time series will be difficult to interpret and compare. The implication is that MoE should formally adopt and publish MRV constants/series (with update rules) to ensure stable tracking.
4. **Institutionalizing operator reporting becomes mandatory for credibility.** Without binding reporting requirements (permits, contracts, SOPs), LFG and disposal data will remain unavailable or non-standard. NDC tracking for landfill management therefore depends as much on institutional arrangements as on technical methods.



IV. INSTITUTIONAL ARRANGEMENTS FOR DATA COLLECTION

4.1. Current Institutional Setup

The current institutional arrangement for NDC tracking in the waste sector is primarily anchored in the sector lead agency, the Ministry of Environment, with technical and implementation support from the Ministry of Industry, Science, Technology and Innovation and the Phnom Penh Municipality. While this institutional arrangement was identified in the First Biennial Transparency Report (BTR1) as the basis for tracking NDC implementation in the waste sector, recent developments associated with the preparation of NDC 3.0 indicate that the arrangement requires updating. Accordingly, revisions to the institutional setup are reflected in Section 4.4 to ensure alignment with the current national context and enhanced NDC tracking requirements.

Nationally Determined Contribution (NDC) reporting in Waste Sector in Cambodia is structured by multiple stakeholders, consisting of national ministries, subnational authorities and private operators. The national management of waste sector was designed to facilitate data collection, validation, and reporting to meet international transparency requirements under the Paris Agreement's Enhanced Transparency Framework (ETF).

4.2. National and Sub-national Coordination

At the national level, the Ministry of Environment (MoE) serves as the lead entity responsible for data compilation, national greenhouse gas (GHG) inventory documentation, and overall monitoring, reporting and verification (MRV) activities. Within the MoE, specific teams handle inventory and MRV tasks, often collaborating with the Department of Climate Change (DCC), which is the national coordinator for climate related reporting. The Ministry of Mines and Energy (MME) also plays a critical role in providing energy statistics and grid emission factors required for waste-to-energy plants.

The operational implementation and primary data gathering often occur at the sub-national level. Sub National Administrations (SNAs) and Provincial Departments of Environment (PDoEs) are the key actors in monitoring local waste management activities. Specifically, the



Phnom Penh Waste Management Authority (PPWMA), is a significant institutional body managing waste in the capital city.

The workflow illustrates Cambodia's institutional architecture for Nationally Determined Contribution (NDC) tracking, structured to ensure compliance with the Enhanced Transparency Framework under the UNFCCC. At the apex, the national climate change lead agency is the Ministry of Environment, operating through the General Directorate of Policy and Strategy (GDPS), which provides overall policy oversight, strategic direction, and formal reporting linkage to the UNFCCC. Within this structure, the Department of Climate Change (DCC) serves as the national NDC Tracking Coordinator, translating policy mandates into operational tracking guidance, consolidating sectoral inputs, and ensuring alignment between national inventory systems, mitigation actions, and reporting requirements. An independent QA and Verification Team operates alongside this core structure to safeguard transparency, consistency, and credibility across the tracking process.

Below the coordination level, the workflow distinguishes between evaluation, compilation, and sectoral implementation functions. An International NDC Tracking Evaluation Team provides technical backstopping, methodological review, and alignment with international good practice, particularly for MRV design and indicator robustness. In parallel, the National NDC Tracking Compilation Team—comprising of sectoral national experts—aggregates data, applies agreed methodologies, manages assumptions, and prepares sector-level tracking outputs. For the waste sector specifically, this compilation function translates national mitigation targets into measurable indicators, tracks progress against baselines, and documents uncertainties. This layered evaluation–compilation structure ensures that NDC tracking is not only nationally owned but also technically defensible and externally credible.

At the sectoral and data generation level, the waste sector is led jointly by the Ministry of Environment, the Ministry of Industry, Science, Technology and Innovation, and Phnom Penh Municipality, reflecting the cross-cutting nature of waste management across policy, regulation, and service delivery. Under the sector lead, specialized teams are assigned clear



technical roles: category leads coordinate sub-sector data (solid waste, wastewater, treatment technologies), the archiving team ensures data traceability and documentation, the uncertainty management team assesses data limitations and methodological uncertainty, and the QC team conducts internal consistency checks before submission. Primary data providers include line ministries and institutions such as the National Institute of Statistics, the Ministry of Agriculture, Forestry and Fisheries, the Ministry of Rural Development, the Ministry of Water Resources and Meteorology, and MISTI, which supply activity data, operational statistics, and administrative records. Data flows upward from these providers through sectoral structures to the national coordination level, where they are validated, compiled, and ultimately reported as part of Cambodia's NDC tracking and transparency obligations.

Following figure illustrates the proposed institutional arrangements of the Waste sector for NDC progress tracking.

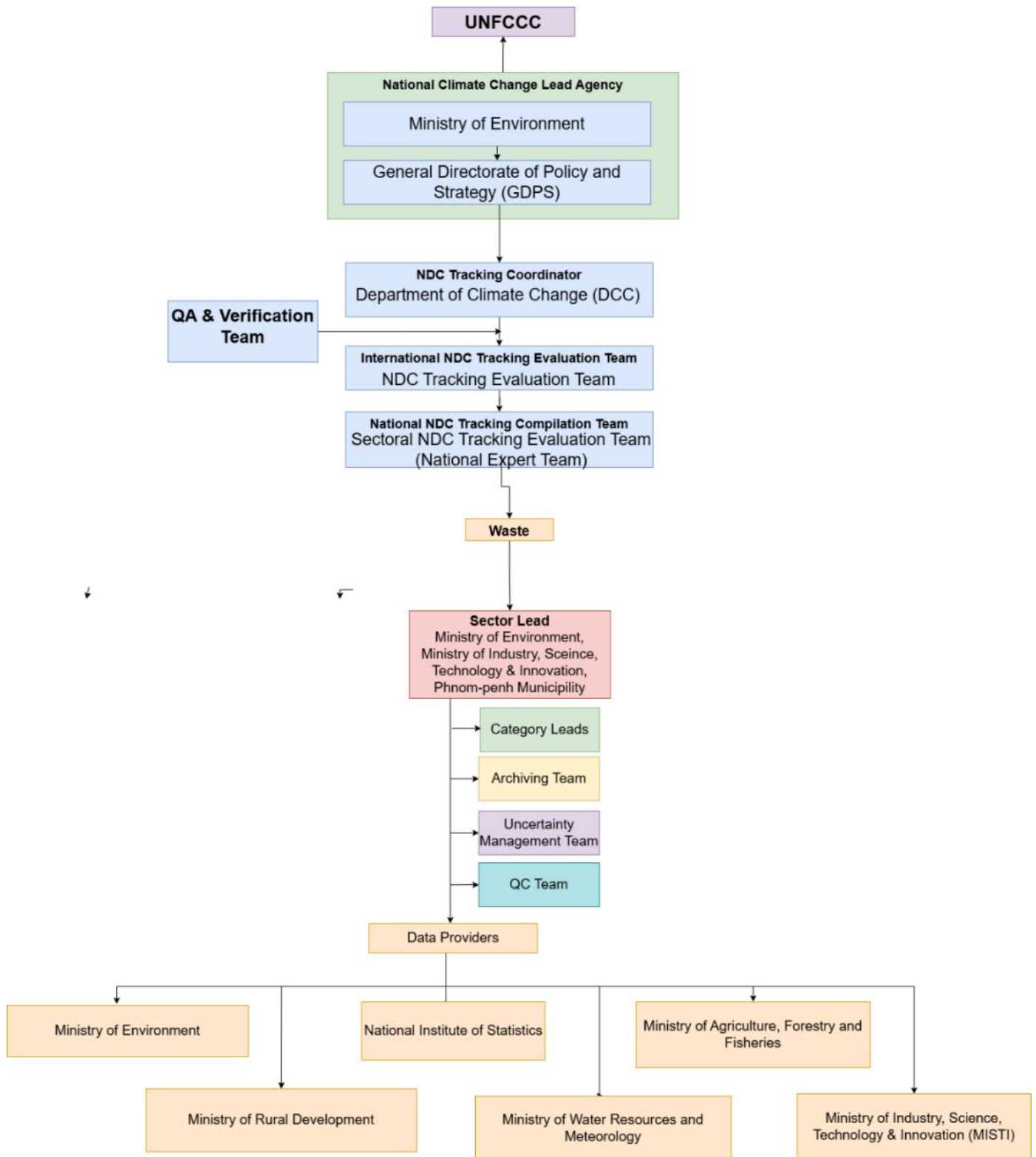


Figure 2: The proposed institutional arrangements of the Waste sector for NDC progress tracking, as outlined in BTR 1



4.3. Private Operators and Partners

Private waste management companies are integral to the current implementation of data collection on the waste sector. They are responsible for primary data collection at the waste disposal sites for recycling mechanisms. CINTRI, GAEA, Mizuda Sanitation Cambodia Co. Ltd, CSARO, and Chip Mong Eco-cycle, are required to report data on waste collection, generation, treatment and disposal as part of their licensing agreements. Their information is intended to be integrated into a centralized platform to provide a comprehensive view of the waste management and further action plan.

Furthermore, several international development partners including GIZ, UNDP, GGGI, the World Bank and ADB are support the institutional framework by providing technical assistance, funding and capacity building to improve data collection systems and align with international standards.

4.4. Gaps in Institutional Arrangements

These gaps reinforce the need for an agreed coordination mechanism and role clarity among MoE departments, sub-national administrations, operators, and line ministries—an objective already emphasized through the inception-phase stakeholder platform.

1. **Unclear routine data submission chain for landfill operators:** Although MoE leads national inventory/MRV, routine site-level reporting obligations for landfill operators are not consistently defined or enforced (e.g., annual waste tonnage, site operation parameters, flare logs).
2. **Fragmentation between national and sub-national roles:** Municipalities/provinces and service operators hold key operational data, but these are not systematically transferred to MoE through a standardized template and schedule. This creates discontinuities between service delivery records and national MRV needs.
3. **No standardized MRV protocol for LFG systems:** For LFG capture, the absence of national protocols for instrument calibration, minimum data fields (flow, CH₄%,



uptime), and QA/QC procedures will delay credible methane accounting even after infrastructure is installed.

4. **Limited coordination mechanism across line ministries for cross-cutting parameters:** Waste MRV requires parameters such as grid emission factors and T&D losses (energy institutions), industrial energy/heat use (MME/industry), and statistics (NIS). Coordination mechanisms and data-sharing arrangements are not yet formalized for routine annual updates.

4.5. Roles and Responsibilities

The proposed institutional arrangement outlined in Cambodia's BTR1 represents a deliberate shift toward a more structured, role-based system for managing sectoral data and strengthening transparency in NDC tracking. At the sectoral level, responsibilities are explicitly assigned to institutions that generate or manage primary activity data relevant to the waste sector. These include the Ministry of Rural Development, the National Institute of Statistics, the Ministry of Water Resources and Meteorology, the Ministry of Industry, Science, Technology and Innovation, and the Ministry of Agriculture, Forestry and Fisheries. Each institution contributes data within its legal mandate, including rural sanitation and waste service coverage, population and household statistics, hydrological and discharge context, industrial wastewater volumes and permitting information, and agricultural or agro-processing organic waste streams. Together, these datasets form the empirical foundation for tracking waste-sector mitigation actions under NDC 3.0. The proposed institutional arrangement outlined in Cambodia's BTR1, introduce a more structured and comprehensive approach to managing sectoral data and improving transparency in the NDC tracking process. At the sectoral level, each sector category now includes designated teams for (BTR1, 2025).

At the national level, BTR1 introduces a clearer separation of coordination, compilation, and evaluation functions to enhance data integrity and methodological consistency. A National NDC Tracking Compilation Team has been established to systematically collect activity data from sectoral institutions, support emissions and mitigation calculations, and apply quality



assurance checks in line with the national QA/QC plan. This team operates under the coordination of the Department of Climate Change, which serves as the national focal point for NDC tracking and ensures consistency with national GHG inventory systems, national communications, biennial transparency reporting, and NDC 3.0 tracking requirements. To reinforce technical credibility and alignment with international good practice, an International NDC Tracking Evaluation Team independently reviews compiled datasets, methodologies, assumptions, and uncertainty treatment.

To further strengthen accuracy, transparency, and completeness, a dedicated QA and Verification Team is embedded within the institutional arrangement to validate compiled data prior to submission to the Department of Climate Change. In parallel, private waste management operators are required to report operational data on waste collection, treatment, recycling, and disposal as part of their environmental licensing and permitting obligations. This reporting requirement enables integration of private-sector operations into the centralized NDC tracking framework, reduces reliance on project-based or ad hoc data sources, and improves coverage of waste-sector activities. Collectively, these roles and responsibilities establish a coherent institutional chain from data generation and validation to national compilation and reporting, consistent with BTR1, NDC 3.0, and Cambodia’s broader transparency obligations under the Enhanced Transparency Framework.

Table 32: Summary of Roles and Responsibilities for Waste Sector NDC Tracking

Institution / Team	Primary Role in NDC Tracking	Key Data Provided	Data Use in NDC Tracking	Main Source References
Ministry of Rural Development (MRD)	Generation and reporting of rural sanitation and decentralized	Rural waste collection coverage, on-site sanitation systems, sludge	Activity data for rural solid waste and domestic wastewater components;	Cambodia NDC 3.0; National Sanitation Policy; NC3/NC4 Waste



Institution / Team	Primary Role in NDC Tracking	Key Data Provided	Data Use in NDC Tracking	Main Source References
	waste service data	management practices	scaling of national estimates	Chapter; BTR1 (2025)
National Institute of Statistics (NIS)	National statistical authority and cross-sector data harmonization	Population statistics, household surveys, waste generation proxies, urban-rural splits	Baseline scaling, consistency checks, extrapolation of waste quantities	Cambodia Statistical Yearbook; Population Census; NDC 3.0 assumptions; NC reports; BTR1 (2025)
Ministry of Water Resources and Meteorology (MoWRAM)	Provision of hydrological and water resource context	River flows, water availability, discharge points, climatic data	Validation and contextualization of wastewater generation and discharge estimates	National Water Resources Strategy; NC3/NC4; Sectoral water reports; BTR1 (2025)
Ministry of Industry, Science, Technology and Innovation (MISTI)	Regulation and oversight of industrial facilities and industrial wastewater	Industrial wastewater volumes, permits, treatment status, industrial activity data	Tracking of industrial wastewater (IWW) mitigation actions and treatment coverage	Cambodia NDC 3.0; Industrial Policy; NC reports; Environmental permitting records; BTR1 (2025)



Institution / Team	Primary Role in NDC Tracking	Key Data Provided	Data Use in NDC Tracking	Main Source References
Ministry of Agriculture, Forestry and Fisheries (MAFF)	Management of agricultural and agro-processing waste streams	Organic waste from agro-processing, crop residues, livestock-related waste	Estimation of organic waste diversion and biological treatment potential	Cambodia NDC 3.0; Agriculture Sector Strategy; NC3/NC4; MAFF statistical reports
National NDC Tracking Compilation Team	Aggregation, calculation, and consolidation of sectoral data	Compiled activity data, mitigation indicators, assumptions	Estimation of emissions and mitigation outcomes; preparation of sector tracking outputs	BTR1 (2025); NDC 3.0 tracking framework; National QA/QC Plan
International NDC Tracking Evaluation Team	Independent technical and methodological review	Reviewed datasets, methodologies, assumptions	Validation of methodological alignment with IPCC and ETF requirements	BTR1 (2025); ICAT guidance; IPCC 2006 & 2019 Refinement
QA and Verification Team	Quality assurance, consistency checks, and verification	Verified datasets, QA/QC logs, review findings	Ensuring transparency, completeness, and readiness for submission	National QA/QC Plan; BTR1 (2025); NC reporting procedures
Private waste management operators	Operational data generation	Waste collection volumes,	Improving completeness and accuracy of	Environmental licensing regulations;



Institution / Team	Primary Role in NDC Tracking	Key Data Provided	Data Use in NDC Tracking	Main Source References
	under licensing and contracts	treatment capacity, disposal methods, recycling data	waste-sector activity data	MoE/Municipal reports; NDC 3.0; BTR1 (2025)

Private waste management operators will be required to report data on waste collection, treatment, and disposal as part of their licensing agreements. This data will be integrated into the centralized platform to provide a complete picture of waste-sector activities.

4.6. Gaps in Institutional Arrangements

Despite the strengthened institutional framework introduced under BTR1, significant gaps remain that constrain effective MRV implementation for the waste sector. Institutional mandates related to waste and wastewater data remain fragmented across multiple ministries and agencies, with overlapping responsibilities and limited clarity on data ownership for NDC tracking purposes. While the Ministry of Environment is responsible for national MRV coordination and GHG inventory compilation, key datasets—particularly for industrial wastewater and treatment performance—are generated and held by other institutions, including MISTI, the Department of Water Quality Management, industrial zone authorities, and private operators. In the absence of formalized data-sharing mechanisms, data transfer remains irregular and largely dependent on project-based arrangements.

A critical operational gap is the lack of standardized reporting templates and harmonized data definitions across institutions and administrative levels. Data are often reported in inconsistent formats, timeframes, and units, limiting their usability for national aggregation and trend analysis. QA/QC procedures, while defined at the national level, are not yet



systematically applied across sectoral and sub-national data providers, resulting in uneven data quality. At the sub-national level, limited technical capacity and resources further weaken consistency, particularly for solid waste management data and wastewater monitoring, where routine measurement systems are still underdeveloped.

To address these gaps, several steps have been initiated, including the identification of core data providers under BTR1 and the conceptual design of a centralized data platform. However, additional actions are required to institutionalize these improvements. These include the development and mandatory use of standardized reporting templates, the establishment of formal memoranda of understanding or legal instruments to govern data sharing, and the expansion of QA/QC procedures to facility and sub-national levels. Furthermore, the absence of a long-term MRV staffing plan poses a structural risk to continuity and institutional memory, underscoring the need to embed MRV functions within permanent government structures rather than relying on short-term project support.

Table 33: Summary of Institutional Gaps and Required Actions

Gap Area	Current Situation	Impact on NDC Tracking	Steps Taken	Actions Required
Reporting templates	No unified templates across institutions	Inconsistent and non-comparable data	Gap identified in BTR1	Develop and mandate standardized templates
Data-sharing mechanisms	No formal MoUs or legal instruments	Irregular data transfer	Informal coordination	Establish formal data-sharing agreements
QA/QC implementation	Defined but unevenly applied	Variable data quality	National QA/QC plan exists	Extend QA/QC to sub-national and facilities



Institutional coordination	Overlapping mandates	Duplication and data gaps	Roles clarified conceptually	Clarify roles through formal mandates
Sub-national capacity	Limited technical expertise	Weak data consistency	Ad hoc training	Systematic capacity-building programs
MRV staffing	Project-based reliance	Risk to continuity	Short-term consultants	Establish permanent MRV units

No long-term MRV staffing plan

Institutional arrangements for waste sector MRV are characterized by overlapping mandates and unclear data-sharing mechanisms. While MoE is responsible for national MRV and GHG inventory compilation, key wastewater data are generated and managed by other institutions, notably MISTI, the Department of Water Quality Management, industrial zone authorities, and private operators. There is no formalized mechanism or legal instrument to ensure routine data transfer, validation, and aggregation for NDC tracking purposes. At the sub-national level, capacity constraints and limited technical expertise further weaken data consistency, particularly for solid waste management and wastewater monitoring. These gaps highlight the need for clearer role definitions, formal MoUs, and strengthened coordination platforms.

4.7. Proposed institutional arrangements

Section 4.2 presents the proposed institutional arrangements for waste sector NDC progress tracking under Cambodia’s NDC 3.0, structured explicitly around the roles and data flows of identified data providers. As illustrated in Figure 3, the institutional architecture is anchored at the national level by the Ministry of Environment, acting as the National Climate Change Lead Agency through the General Directorate of Policy and Strategy. This level holds overall



policy authority, ensures alignment with national climate commitments, and serves as the formal interface with the UNFCCC. The Department of Climate Change functions as the NDC tracking coordinator, responsible for operationalizing NDC targets into trackable indicators, coordinating sectoral inputs, and ensuring coherence between mitigation implementation, national GHG inventory processes, and transparency reporting requirements. A QA and Verification Team is positioned alongside this coordination function to independently review data consistency, methodological application, and documentation quality before results are finalized.

The proposed arrangement distinguishes clearly between evaluation, compilation, and sectoral data generation to reflect the realities of Cambodia’s waste data landscape. An International NDC Tracking Evaluation Team provides methodological oversight, alignment with international MRV good practice, and independent technical review of assumptions and uncertainty treatment. In parallel, the National NDC Tracking Compilation Team—comprising of national sector experts—aggregates data received from sectoral and institutional sources, applies agreed methodologies, and consolidates progress across all waste-related NDC measures. This separation ensures that national ownership of data and results is maintained, while technical robustness and credibility are reinforced through structured review. For the waste sector, this compilation role is critical to translating diverse data inputs into coherent tracking outputs across solid waste management, organic waste processing, landfill management, textile waste, and industrial wastewater actions.

Figure 3 reflects a data-provider-driven model at the operational level in which sector leadership and technical functions are closely linked to institutions responsible for implementation and data generation. The waste sector is led jointly by the Ministry of Environment, the Ministry of Industry, Science, Technology and Innovation, and Phnom Penh Municipality, recognizing the cross-cutting governance of waste across policy, regulation, and service delivery. Under the sector lead, category leads coordinate specific NDC actions, while dedicated teams manage archiving, uncertainty assessment, and quality control. Primary data providers—including line ministries, the National Institute of



Statistics, sub-national authorities, private sector operators, universities, and development partners—supply activity data, operational statistics, and project-level information relevant to each NDC action. Data flow upward through this structured pathway to the national coordination level, enabling systematic compilation, review, and reporting of waste sector NDC progress. This proposed arrangement is designed to strengthen institutional clarity, improve data traceability, and progressively transition Cambodia’s waste sector NDC tracking from estimation-based reporting toward a more robust, implementation-focused MRV system.

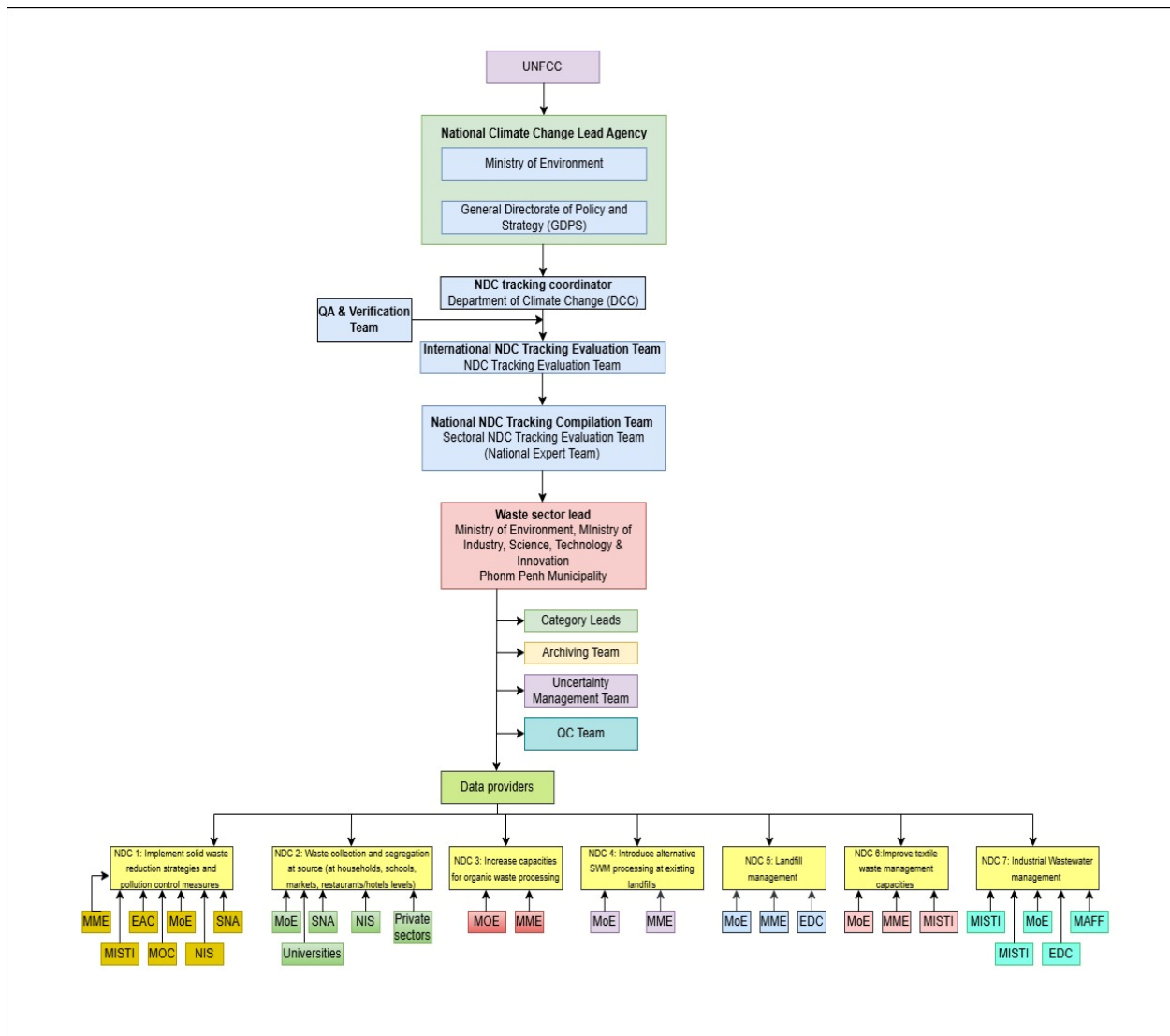


Figure 3: The proposed institutional arrangements of the Waste sector NDC progress tracking in NDC 3.0



V. STAKEHOLDER CONSULTATION AND VALIDATION

Stakeholder consultation and validation were integrated into the inception phase to ensure that the MRV framework is practical, institutionally owned, and aligned with NDC implementation realities. The inception workshop structure provided a platform to (i) disseminate preliminary stocktaking and scoping findings, (ii) validate key assumptions on data sources and institutional responsibilities, and (iii) identify coordination mechanisms needed for sustained MRV operations.

The consultation approach engaged a broad group of stakeholders, including: (a) MoE departments responsible for climate change, solid waste management, water quality management, and hazardous substances management; (b) the entity responsible for managing transfer stations and landfills for solid waste; (c) key line ministries involved in NDC implementation; (d) selected sub-national administrations (e.g., Phnom Penh and provincial authorities); (e) development partners; and (f) private sector operators. This diversity is critical for landfill management MRV because the required data reside across multiple institutions—particularly operators and sub-national authorities—while MoE is responsible for national compilation and reporting. Validation priorities for NDC 5 focused on:

- confirming baseline waste quantities, disposal pathways, and site typology definitions;
- verifying feasibility of proposed monitoring requirements (weighbridges, LFG metering, composition sampling);
- agreeing on reporting responsibilities and frequency; and
- identifying immediate steps to operationalize data templates and QA/QC procedures.

Stakeholder consultation plays a critical role in validating proposed indicators, identifying practical data constraints, and ensuring institutional buy-in for MRV implementation. Consultations with MoE, MISTI, water management authorities, sub-national administrations, and selected private operators help confirm data availability, report feasibility, and alignment with existing regulatory processes. For the wastewater sector,



engagement with technical staff is particularly important to validate assumptions related to treatment technologies, operational performance, and biogas recovery potential. Feedback from stakeholders should be systematically incorporated to refine indicators, improve data templates, and enhance the practicality of the MRV framework.

5.1. Consultation Process

The consultation process combined workshops, technical validation meetings, bilateral discussions, trainings, and targeted partner consultations to ensure that the proposed waste and wastewater NDC tracking framework was both policy-relevant and operationally feasible. Stakeholders confirmed the relevance of the proposed indicators and methodologies, while highlighting key constraints related to facility-level monitoring, sub-national capacity, data consistency, and alignment with existing regulatory and policy frameworks, including NDC 3.0 and sectoral strategies. Development partners, including GIZ, GGGI, supplemented the process by providing datasets and documentation on waste streams such as plastics, food waste, textiles, and hazardous waste, reinforcing the need for a phased and pragmatic MRV implementation approach grounded in available data.

Table 34: Consultation process and key feedback from stakeholders

Consultation process	Stakeholders involved	Key feedback from stakeholders
Workshops	Ministry of Environment (MoE), MISTI, Department of Water Quality Management, sub-national authorities, development partners	Confirmed relevance of proposed waste and wastewater indicators for NDC tracking; highlighted the need for alignment with existing regulatory reporting systems and national policies (CCCSP, NDC 3.0); emphasized capacity constraints at sub-national level.

Consultation process	Stakeholders involved	Key feedback from stakeholders
Technical validation meetings	MoE technical teams, MISTI technical staff, wastewater engineers, industrial zone authorities	Validated technical assumptions related to wastewater treatment technologies, monitoring parameters (flow, COD), sludge management, and biogas recovery; identified limitations in facility-level monitoring and data consistency; recommended simplified indicators aligned with available data.
Bilateral discussions	Selected industrial facility operators, WWTP operators, local authorities	Provided practical insights on data availability, reporting frequency, operational constraints, and feasibility of data collection; confirmed challenges in measuring biogas production and energy use; suggested phased implementation of MRV requirements.
Consultation meeting	GIZ	Providing data availability and some documents related to waste management in Cambodia, Recycling plastic waste, GGI4CE project, Food waste in urban and rural area, Fabric waste and hazardous waste information.

VI. RECOMMENDATIONS AND NEXT STEPS

To strengthen waste-sector MRV for NDC tracking, it is recommended to standardize data collection using ICAT-aligned templates covering both wastewater and solid waste, and to digitize data flows through an integrated national platform linked to WasCAD. Regular capacity-building and technical training should be provided to line ministries, sub-national authorities, and facility operators, with a particular focus on wastewater monitoring parameters relevant to GHG estimation. Institutional arrangements should be reinforced



through formal data-sharing agreements, clearer mandates for QA/QC, and the establishment of a regular annual reporting cycle for NDC indicators. As a next step, pilot implementation of the MRV framework in selected wastewater and solid waste facilities can help test data collection procedures, refine methodologies, and progressively scale up national coverage.

6.1. Recommendations for Improving Data Collection

To improve data collection for waste-sector MRV and NDC tracking, it is recommended to develop and adopt standardized, ICAT-aligned data collection templates covering both wastewater and solid waste sub-sectors. These templates should prioritize key parameters required for GHG estimation and NDC indicators, including wastewater flows, treatment technologies, COD monitoring, sludge management, biogas recovery, waste generation, and treatment coverage. Data collection processes should be digitized through an integrated national platform, linked with existing systems such as WasCAD, to enable consistent data submission, storage, and retrieval across institutions. Establishing a regular annual reporting cycle for NDC indicators will support timely aggregation, validation, and reporting, while reducing ad-hoc data requests and improving transparency under the Enhanced Transparency Framework (ETF). Annual indicator reporting cycle. Recommendations to Strengthen Institutional Arrangements

Strengthening institutional arrangements is essential to ensure effective and sustainable MRV implementation. It is recommended to establish formal Memorandums of Understanding (MoUs) or data-sharing agreements between the Ministry of Environment (MoE), MISTI, Department of Solid Waste Management, Department of Water Quality Management, sub-national authorities, and other relevant agencies to clarify roles, responsibilities, and reporting timelines. Regular capacity-building and technical training programs should be provided to technical staff and facility operators, with a focus on wastewater monitoring, data management, and MRV requirements. In addition, a strengthened QA/QC framework should be implemented, including clear procedures for data validation, consistency checks, and verification, overseen by MoE as the lead MRV institution. These measures will enhance coordination, data reliability, and institutional ownership of



the MRV system. The MRV system should be provides the standardized reporting tools to all stakeholders, local authorities to be more confidentially responsible for their own data management and data reporting for the national government. This creates a unified flow of information that ensures local waste management activities are contributing directly to country's overarching green growth and sustainable development objectives.

6.2. Policy alignment

Measurement, Reporting and Verification (MRV) system for waste sector is necessity to dive the international climate commitments and domestic development goals. It should be set as a standardized tools that align the national policy to transforms waste management sector from a burden environment into measurable asset for climate diplomacy that allows the government prove it progress, secure international funding and refine local waste collection services based on real time data. Waste-sector MRV implementation should be fully aligned with Cambodia's existing policy and strategic frameworks to ensure coherence and sustainability. This includes alignment with Long-term Strategy for Carbon Neutrality (LTS4CN), Circular Strategy on Environment (2023-2028), the Urban Solid Waste Management Policy 2020–2030, Circular Economy Strategy and Action Plan (2021-2035), the Industrial Development Policy, and relevant environmental regulations governing wastewater and industrial pollution control. MRV systems and indicators should also be consistent with national climate frameworks, including the Cambodia Climate Change Strategic Plan (CCCSP) 2024–2033 and the Third Nationally Determined Contribution (NDC 3.0), which emphasize cross-sectoral mitigation actions and strengthened transparency. Alignment with national MRV protocols, WasCAD, and reporting under the Enhanced Transparency Framework (ETF) will support harmonized data flows, reduce reporting duplication, and ensure that waste-sector mitigation impacts are accurately reflected in national and international climate reporting.



Table 35: Summary of key recommendations

Waste sub-sector	Recommendation area	Key actions (what must be done)	Lead entity	Supporting entities	Implementation timeframe	Key outputs
MSW / SWDS (cross-cutting)	National landfill reporting	Adopt a minimum national annual landfill reporting template covering waste received (t/yr), disposal method/site type, operational status, site characteristics, and LFG system status (if applicable). Embed reporting obligation in permits, contracts, or MoE guidance.	MoE (CCDM / Waste / MRV)	PDoE, SNAs, landfill operators	Immediate - within 12 months	(i) Approved reporting template (ii) MoE guidance note (iii) first annual dataset submitted
SWDS – controlled & sanitary landfills	Regulatory compliance	Make annual reporting mandatory through environmental permits or operating contracts; define minimum data quality requirements and deadlines.	MoE	SNAs, PDoE	Immediate - within 12 months	(i) Permit clauses / guidance issued (ii) compliance tracking list



Waste sub-sector	Recommendation area	Key actions (what must be done)	Lead entity	Supporting entities	Implementation timeframe	Key outputs
SWDS – landfill gas (LFG)	MRV system readiness	Develop a national MRV protocol for LFG before and during commissioning of sanitary landfills: minimum instrumentation, calibration rules, logging frequency, flare uptime/downtime, default destruction efficiencies, and calculation methods.	MoE (MRV technical team)	Landfill operators, PDoE, DPs	Short term (1-2 years)	(i) National LFG MRV protocol (ii) SOPs and calculation tools
SWDS – landfill gas (LFG)	QA/QC & verification	Establish QA/QC procedures: instrument calibration certificates, raw data retention, cross-checks, and spot-verification by MoE/PDoE.	MoE	PDoE, operators	Short term (1-2 years)	(i) QA/QC checklist (ii) verification plan
SWDS / waste MRV (cross-cutting)	Methodological consistency	Formally decide and publish: (a) GWP values for waste MRV, (b) grid emission factor series and update rule, (c) national default parameters (oxidation, DOCf, F),	MoE (Inventory & MRV)	MME, EDC, NIS	Immediate – within 12 months	(i) Official MRV parameter List (ii) version-controlled parameter registry



Waste sub-sector	Recommendation area	Key actions (what must be done)	Lead entity	Supporting entities	Implementation timeframe	Key outputs
		and (d) conditions for moving to country-specific values.				
SWDS – dumpsite closure & transition	Progress indicators	Define clear indicators for Action 5.2 beyond site counts: waste diverted, area rehabilitated, closure compliance status, and post-closure monitoring.	MoE (Waste Dept.)	SNAs, PDoE	Immediate – within 12 months	(i) Indicator framework (ii) reporting format
MSW – MBT / organic diversion	Organic fraction monitoring	Establish routine monitoring of organic content of landfilled waste (or MBT outputs): sampling protocol, frequency (annual minimum), QA/QC, and reporting.	MoE	Operators, SNAs, labs/universities	Short to medium term (1–3 years)	(i) Sampling SOP (ii) annual organic fraction dataset
MSW – waste composition (national)	Improve baseline robustness	Implement periodic national waste composition studies to refine DOC, DOCf, and decay parameters over time.	MoE	NIS, universities, DPs	Medium term (2–4 years)	(i) Updated waste composition datasets
All waste sub-sectors	Institutional coordination	Establish a formal data-sharing and coordination mechanism : named focal points, reporting	MoE	SNAs, PDoE, MME,	Immediate – within 12 months	(i) Coordination SOP (ii) focal-point list



Waste sub-sector	Recommendation area	Key actions (what must be done)	Lead entity	Supporting entities	Implementation timeframe	Key outputs
		calendar aligned with inventory/NDC cycles, and data transfer protocols.		EDC, operators		
All waste sub-sectors	Phased NDC indicators	Apply phased indicators: near-term - focus on output indicators; later phase - integrate outcome indicators (tCH ₄ recovered, electricity generated, organic fraction reduced).	MoE	All stakeholders	Immediate → 2035	(i) Indicator roadmap (ii) annual NDC tracking tables



VII. REFERENCES

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