Emission Factors for NDC Indicators in the MauNDC Registry

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ICAT Initiative for Climate Action Transparency

Initiative for Climate Action Transparency - ICAT

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Abbreviations

Term	Description
AFOLU	Agriculture, Forestry and Other Land Use
AMS-III	Approved Methodologies for Small-Scale CDM Projects
BEFP	Baseline Emissions Related to Fertilizer Production
BTR	Biennial Transparency Report
CDM	Clean Development Mechanism
CF	Carbon Fraction
CFFG	Carbon Stock from Forest Growth
CNG	Compressed Natural Gas
ECPJ	Electricity Consumed by Project Vehicles
EFBL	Emission Factor for Baseline Vehicle
EFP	Emission Factor for Project
EFPJ	Emission Factor for Project Vehicle
ETF	Enhanced Transparency Framework
FI	Input Factor
FLU	Land Use Factor
FMG	Management Factor
FP	Fertilizer Production
GHG	Greenhouse Gas
ICAT	Initiative for Climate Action Transparency
IPCC	Intergovernmental Panel on Climate Change
IPMVP	International Performance Measurement and Verification Protocol
IPPU	Industrial Processes and Product Use
LPG	Liquefied Petroleum Gas
MCF	Methane Conversion Factor
MOF	Organic Fertilizer
MRV	Monitoring, Reporting and Verification
MS	Manure System
MSF	Synthetic Fertilizer
NBS	Nature-Based Solutions
NCVBL	Net Calorific Value for Baseline Fuel
NCVPJ	Net Calorific Value for Project Fuel
NDC	Nationally Determined Contribution
PEFP	Project Emissions from Fertilizer Production
PV	Photovoltaic
SECPJ	Specific Electricity Consumption by Project Vehicle
SFCPJ	Specific Fossil Fuel Consumption by Project Vehicle

Term	Description
SIDS	Small Island Developing States
SOC	Soil Organic Carbon
SOCREF	Reference Soil Organic Carbon
TJ	Terajoule
UNFCCC	United Nations Framework Convention on Climate Change
UNOPS	United Nations Office for Project Services
VCS	Verified Carbon Standard
VERRA	Voluntary Carbon Market Registry

Executive Summary

Mauritius is taking proactive steps to strengthen climate transparency and accountability under the Paris Agreement, with the MauNDC Registry serving as a central platform for tracking, monitoring, and reporting the outcomes of climate-related policies and measures. Deliverable 5 (D5) focuses on enhancing this registry by developing scientifically robust greenhouse gas (GHG) and non-GHG indicators, supported by appropriate emission factors, methodologies, and data systems. These indicators are crucial for evaluating progress toward Mauritius's Nationally Determined Contributions (NDCs) and fulfilling its international reporting obligations under the Enhanced Transparency Framework (ETF).

D5 builds on the findings of Output 4, which identified key data gaps and highlighted the need for improvements in GHG quantification, standardized methodologies, and institutional coordination. Persistent challenges, such as inconsistent data collection practices, limited availability of sector-specific emission factors, a lack of capacity to estimate GHG impacts from available datasets and other progress indicators, and gaps in evaluating adaptation and cross-cutting interventions, were further reinforced during workshops held in February and July 2025.

The deliverable provides a comprehensive framework for indicator development across all priority sectors, including energy, transport, waste, agriculture, forestry, industry, water, and tourism, as well as cross-cutting areas like nature-based solutions and disaster risk reduction. Indicators are categorized into GHG (e.g., tonnes of CO_2 equivalent reduced) and non-GHG (e.g., hectares restored, number of beneficiaries) metrics, ensuring a holistic assessment of climate action. The report outlines structured methodologies for defining, validating, and integrating indicators into the registry, drawing on international best practices including IPCC guidelines, CDM methodologies, and ICAT Policy Assessment Guides.

A key feature of D5 is its focus on enhancing data quality and institutional coordination. It identifies national data providers, establishes a harmonized template for indicator entry, and ensures standardized reporting fields for intervention names, sector classifications, units of measurement, data sources, and reporting frequency. This structure enhances consistency, comparability, and alignment with ETF and Biennial Transparency Report (BTR) requirements.

The report also offers practical guidance for converting non-GHG indicators into measurable GHG outcomes using emission factors and established methodologies. Worked examples illustrate how activity data, such as electricity saved or waste diverted, can be translated into climate impact metrics. Where quantitative data is limited, D5 recommends the use of proxy indicators and qualitative assessments tailored to the context of Mauritius as a small island developing state.

By integrating refined emission factors, documenting assumptions transparently, and linking socio-environmental indicators to measurable GHG impacts, D5 improves the accuracy, credibility, and replicability of climate reporting. It promotes a dual framework capturing both mitigation outcomes and broader co-benefits, including improved air quality, biodiversity conservation, and community resilience.

Finally, the deliverable provides recommendations for sustaining these improvements through institutional anchoring, ongoing capacity development (including GACMO training), technological integration, and international benchmarking.

Overall, Deliverable 5 represents a significant advancement in Mauritius's transparency system, equipping the MauNDC Registry with the tools, methodologies, and institutional structures necessary to support climate governance through transparent, evidence-based decision-making and to demonstrate tangible progress toward national and global climate goals.

Chapter 1: Introduction

As Mauritius advances its climate commitments under the Paris Agreement, the establishment of transparent, reliable, and comprehensive systems for tracking progress has become a national priority. The Mauritius Nationally Determined Contribution (MauNDC) Registry is at the core of this effort, serving as a structured platform to capture, monitor, and report on the outcomes of policies and measures contributing to the country's Nationally Determined Contributions (NDCs). To ensure that the Registry effectively fulfils its role, it is essential to strengthen the framework for measuring results through well-defined indicators. This chapter introduces the context, linkages, and objectives of Deliverable 5, which focuses on the development of both GHG and non-GHG indicators to enhance the robustness and usability of the Registry.

1.1 Background

The MauNDC Registry has been established as a central platform to facilitate the systematic tracking of policies, measures, and actions that contribute to the country's climate targets under the Paris Agreement. It is an essential tool to operationalize the Enhanced Transparency Framework (ETF), which requires Parties to provide clear and consistent information on progress toward their NDCs. By serving as both a data repository and a monitoring instrument, the MauNDC Registry enables government institutions, technical agencies, and other stakeholders to document interventions, track performance, and assess the overall effectiveness of climate actions.

Within this context, the development of robust greenhouse gas (GHG) and non-GHG indicators becomes central to assess the impacts of the progress of implementation of climate measures and strengthening transparency. Indicators provide measurable parameters that not only capture direct emissions reductions but also reflect broader socio-economic and environmental outcomes. For instance, while GHG indicators quantify changes in carbon dioxide equivalent (tCO_2e) emissions, non-GHG indicators allow the assessment of outcomes such as energy efficiency improvements, biodiversity enhancement, climate resilience, or capacity-building impacts. Together, these indicators serve as a basis for evidence-based reporting, international comparability, and policy decision-making.

The Validation Workshop held on 13 February 2025 and the Hands-on Workshop conducted from 14 to 18 July 2025 under previous project outputs revealed several persistent challenges and gaps. Key issues identified include inconsistencies in data collection practices across sectors, limited availability of sector-specific emission factors, and the absence of standardized methodologies for evaluating certain interventions, particularly those related to adaptation and cross-cutting measures. Additionally, several data custodians reported a lack of clarity regarding reporting requirements, resulting in fragmented or incomplete datasets. Addressing these challenges is crucial to enhancing the credibility, consistency, and usability of the MauNDC Registry, while ensuring its alignment with international transparency and reporting standards.

1.2 Linkages with Deliverable 4

Deliverable 5 builds directly upon the results and recommendations of **Deliverable 4**, which focused on strengthening the accuracy, consistency, and reliability of GHG quantification within the MauNDC Registry. As outlined in Deliverable 4, key post-validation actions were undertaken to refine emission data, address sector-specific data gaps, and enhance emission factors through iterative consultations, registry updates, and hands-on capacity-building exercises. These technical refinements now provide the foundational basis for the development of robust and scientifically credible indicators under Deliverable 5.

The improved data structure and quantification methods emerging from Deliverable 4 directly support indicator development by ensuring that each indicator is grounded in reliable, verifiable, and nationally appropriate data. Enhanced sectoral emission factors and updated activity data enable the creation of indicators that can more accurately track the performance of mitigation and adaptation policies over time.

Deliverable 5 thus leverages the synergies between emission factors, activity data, and performance indicators. While emission factors convert activity data into measurable GHG estimates, indicators interpret these outcomes to provide insights into policy effectiveness and broader climate impacts. By aligning the methodological improvements from Deliverable 4 with the indicator development process in Deliverable 5, the MauNDC Registry will evolve into a more comprehensive and reliable tool for monitoring, reporting, and evaluating climate action, integrating both quantitative emission metrics and qualitative progress dimensions.

1.3 Objective and Scope

The primary objective of Deliverable 5 is to develop standardized GHG and non-GHG indicators that can be systematically applied across priority sectors and interventions in the MauNDC Registry. These indicators will act as benchmarks for evaluating policy and measuring implementation, providing clarity for policymakers, technical agencies, and international reporting under the ETF. Ensuring consistency, transparency, and scientific rigor will strengthen confidence in Mauritius' climate reporting and the credibility of its NDC tracking system.

The indicators cover all priority sectors, including energy, transport, waste, agriculture, forestry, water, tourism, and cross-cutting areas such as nature-based solutions and disaster risk reduction. For each intervention, indicators capture both GHG impacts (e.g., emission reductions, carbon sequestration) and non-GHG co-benefits (e.g., energy efficiency, resilience, biodiversity protection). This dual approach ensures the Registry reflects the full spectrum of climate action rather than focusing solely on emissions. The scope of work under this deliverable includes:

- **Defining indicators**: Identifying suitable GHG and non-GHG indicators for each intervention, building on Output 4 findings and international best practices such as IPCC guidelines and CDM methodologies.
- **Integrating indicators**: Embedding validated indicators within the MauNDC Registry framework to facilitate consistent data entry, monitoring, and reporting.

Through this process, Deliverable 5 aims to provide a comprehensive framework for tracking the impacts of NDC-related policies and measures, thereby strengthening Mauritius' capacity to meet its international commitments and drive effective climate action at the national level.

It is important to note that this document serves as a **guide** and does not present results of the progress of implementation of policies and measures and their impacts. In particular, it provides methodological direction on how non-GHG indicators can be converted into GHG indicators where applicable, ensuring alignment with international methodologies and national circumstances. Further details, including step-by-step guidance and practical applications, will be provided to national stakeholders through a workshop aimed at enhancing capacities to assess the impacts of climate policies and measures.

Chapter 2: Methodological Approach

The development of robust GHG and non-GHG indicators for the MauNDC Registry requires a clear methodological foundation that combines international standards, national data systems, and practical guidance for users. Indicators must be scientifically credible, consistent with global reporting requirements under the Enhanced Transparency Framework (ETF), and adaptable to the specific circumstances of Mauritius as a small island developing state.

This chapter outlines the methodological approach adopted for Deliverable 5, drawing on reference frameworks such as the IPCC Guidelines, CDM and voluntary market methodologies, national statistical systems, and ICAT Policy Assessment Guides. Together, these elements provide a structured basis for defining, validating, and integrating indicators that can track both the GHG impacts and wider co-benefits of NDC interventions.

2.1 Overview of IPCC Guidelines and Emission Factors

The 2006 IPCC Guidelines for National Greenhouse Gas Inventories and the 2019 Refinement form the core methodological framework for developing GHG and non-GHG indicators in Mauritius. These internationally recognized guidelines provide standardized approaches for estimating emissions across all sectors, ensuring transparency, comparability, and alignment with the Enhanced Transparency Framework (ETF).

For Mauritius, they serve as the reference point for structuring emission calculations and indicator development. The framework sets out tiered approaches (Tier 1 default methods, Tier 2 country-specific factors, and Tier 3 detailed models), sectoral classifications (Energy, IPPU, AFOLU, and Waste), and requirements for consistency in time-series reporting.

In cases where national data is lacking, default emission factors (EFs) from the IPCC are applied — for example, methane emissions from landfills. Over time, these defaults can be replaced by nationally derived, sector-specific EFs, developed through field studies and data collection, and supported by current transparency support initiatives such as the Capacity-Building Initiative for Transparency (CBIT) and potential future ICAT support, to improve accuracy and better reflect local conditions. This progressive approach enables Mauritius to begin with globally recognized defaults while building the capacity to generate robust, country-specific indicators.

2.2 Relevance of CDM and Other Intervention-Specific Methodologies

While IPCC guidelines provide a broad framework for national GHG inventories, the design of project- and intervention-level indicators requires more granular methodologies. The Clean Development Mechanism (CDM) has historically provided detailed protocols for quantifying emission reductions across a wide range of interventions. These methodologies remain highly relevant for developing indicators under the MauNDC Registry, as they offer standardized, step-by-step procedures for baseline setting, monitoring, and verification. Additionally, voluntary carbon market standards such as Gold Standard and VERRA (VCS) provide methodologies that extend beyond GHG emissions to include co-benefits, which are essential in the Mauritian context. The table below explains the relevance of such methodologies, sector by sector:

Table 1: Relevant CDM Methodologies for MauNDC Registry Indicators for Mitigation Sectors

Sector	Relevant CDM/Voluntary Methodologies	Baseline	Monitoring	Adaptation for MauNDC Registry	Co-Benefits (Gold Standard / VCS)
Energy / Energy Industries	Grid-connected renewables (solar, wind, hydro, biomass); energy efficiency in power plants; demand-side EE	Fossil fuel-based grid emission factor (tCO_2e/MWh)	Metered renewable generation; efficiency gains	Track avoided fossil fuel emissions, renewable share, and efficiency improvements	Air quality, energy security, green jobs
Transport (Land, Shipping, Aviation)	Modal shift (road→rail), efficient vehicles, biofuels, e-mobility, aviation & shipping fuel efficiency	Fuel use per passenger-km or tonne-km	Fuel consumption reduction, public transport uptake, EV adoption	Quantify reductions from EVs, fleet renewal, biofuels, aviation & shipping programs	Urban air quality, mobility access, reduced fuel imports
Solid Waste Management	Landfill gas capture/flaring, composting, waste-to-energy (incineration, anaerobic digestion)	Methane emissions from uncontrolled landfills	Methane recovery volumes, waste diverted, energy from waste	Indicators for avoided CH_4, diversion rates, waste-to-energy	Public health, extended landfill life, recycling jobs
Wastewater Management	Methane avoidance via advanced treatment, biogas recovery	CH_4 & N_2O from untreated/poorly treated wastewater	Methane captured, wastewater treated, energy from biogas	Track avoided emissions, renewable energy, improved effluent quality	Water reuse, reduced diseases, resource recovery
Industrial Processes & Product Use (IPPU)	Cement, aluminium, chemical processes; energy-efficient industrial tech	Process-specific factors (e.g., clinker ratio in cement)	Reduced fossil inputs, alt. raw materials, tech upgrades	Track reductions in CO_2, N_2O, HFCs/PFCs; adoption of low-carbon practices	Competitiveness, reduced imports, tech transfer
Agriculture (Crops)	fertilizer efficiency, conservation tillage	CH_4 & N_2O from conventional practices	Fertilizer use, irrigation, yields	Indicators for GHG intensity per yield, climate-smart practices, water-use efficiency	Soil health, water savings, farmer income
Agriculture (Livestock)	Improved manure management, biogas digesters, optimized feed	CH_4 from enteric fermentation & unmanaged manure	Animal population, feed quality, methane recovery	Track CH_4 reductions per livestock unit, feed/manure management	Animal health, renewable energy, rural livelihoods
Land use, Land Use Change and Forestry	Afforestation, reforestation, REDD+, forest mgmt.	Historical land use/cover, carbon stocks	Reforested area, avoided deforestation, biomass growth, soil carbon	Track sequestration, avoided deforestation, sustainable mgmt.	Biodiversity, watershed protection, non-timber livelihoods

2.3 Use of National Inventories and Data Sources

The usefulness of climate-relevant indicators, particularly those related to GHG and non-GHG metrics, is contingent upon the availability, reliability, and integration of national data sources. Mauritius has made significant strides in institutionalizing climate data collection and reporting, especially under its commitments to the UNFCCC and the Enhanced Transparency Framework.

2.3.1 Members of the Different Sector-Specific GHG TWGs

Mauritius benefits from a diverse set of institutions that generate sector-specific data relevant to climate mitigation and adaptation:

1. Energy Industries

- Ministry of Energy and Public Utilities (MEPU)
- Central Electricity Board (CEB)
- Mauritius Renewable Energy Agency (MARENA)
- Energy Efficiency Management Office (EEMO)
- Utilities Regulatory Authority (URA)
- Department of Waste Management and Resource Recovery (DWMRR)
- Ministry of National Infrastructure and Community Development (MNICD)
- Ministry of Industrial Development, SMEs and Cooperatives (MIDSMEC)
- State Trading Corporation (STC)
- Business Mauritius (BM)
- Tertiary Education and Scientific Research Division (TESRD)
- Mauritius Research and Innovation Council (MRIC)
- Department of Climate Change (DCC)

2. Transport

- Ministry of Land Transport and Light Rail (MLTLR)
- National Land Transport Authority (NLTA)
- Traffic Management and Road Safety Unit (TMRSU)
- Metro Express Ltd. (MEL)
- Central Electricity Board (CEB)
- Ministry of National Infrastructure and Community Development (MNICD)
- Department of Civil Aviation (DCA)
- Airports of Mauritius Ltd. (AML)
- Air Mauritius Ltd.
- Mauritius Ports Authority (MPA)
- Mauritius Shipping Corporation Ltd. (MSCL)
- Prime Minister's Office – External Communications Division (ECD)
- Ministry of Blue Economy, Marine Resources, Fisheries and Shipping (MBEMRFS)
- State Trading Corporation (STC)
- Tertiary Education and Scientific Research Division (TESRD)
- Mauritius Research and Innovation Council (MRIC)
- Business Mauritius (BM)
- Department of Climate Change (DCC)

3. Solid Waste Management

- Ministry of Environment, Solid Waste Management and Climate Change (MESWMCC)
- Department of Waste Management and Resource Recovery (DWMRR)
- Ministry of Local Government and Disaster Risk Management (MLGDRR)
- Local Authorities (LAs)
- Central Electricity Board (CEB)
- Ministry of Energy and Public Utilities (MEPU)
- Private Operators
- Business Mauritius (BM)
- Tertiary Education and Scientific Research Division (TESRD)
- Mauritius Research and Innovation Council (MRIC)
- Department of Climate Change (DCC)

4. Wastewater Management

- Wastewater Management Authority (WMA)
- Ministry of Energy and Public Utilities (MEPU)
- Central Electricity Board (CEB)
- Utilities Regulatory Authority (URA)
- Tertiary Education and Scientific Research Division (TESRD)
- Mauritius Research and Innovation Council (MRIC)
- Department of Climate Change (DCC)

5. Agriculture

- Ministry of Agro Industry and Food Security (MAIFS)
- Food and Agricultural Research and Extension Institute (FAREI)
- Irrigation Authority (IA)
- Mauritius Cane Industry Authority (MCIA)
- Agricultural Services (AS)
- Mauritius Chamber of Agriculture (MCA)
- Tertiary Education and Scientific Research Division (TESRD)
- Mauritius Research and Innovation Council (MRIC)
- Department of Climate Change (DCC)

6. Land use, Land Use Change and Forestry

- Ministry of Agro Industry and Food Security (MAIFS)
- Forestry Service (FS)
- Mauritius Cane Industry Authority (MCIA)
- Tertiary Education and Scientific Research Division (TESRD)
- Department of Climate Change (DCC)

7. Refrigeration and Air Conditioning (RAC)

- Ministry of Environment, Solid Waste Management and Climate Change (MESWMCC)
- National Ozone Unit
- Department of Climate Change (DCC)

Figure 1: Key Data Providers in Mauritius

Mauritius has made significant strides in establishing a comprehensive framework for climate governance, particularly in the integration of climate-related data across national and international reporting systems. This effort is critical to ensuring transparency, accountability, and evidence-based decision-making in the country's transition toward a low-carbon and climate-resilient future.

2.3.2 Integration with Existing Inventories and Reports

Mauritius has developed a robust and multi-tiered system to align domestic climate data with global reporting obligations under the Paris Agreement and the Enhanced Transparency Framework (ETF):

National GHG Inventory:

- Developed using IPCC 2006 Guidelines and submitted as part of the Biennial Transparency Report (BTR1). Covers emissions from energy, IPPU, waste, agriculture, and LULUCF sectors.

National Inventory Document (NID)

- This annex to BTR1 provides detailed sector-wise emissions data from 2000 to 2022, enabling historical trend analysis and supporting the formulation of mitigation strategies.

Energy Balance and Statistical Yearbooks

- Published by Statistics Mauritius, these documents are used for cross-verification of energy-related emissions and provide a consistent statistical foundation for climate analysis.

Project-Level MRV System

- Under initiatives such as GCF Readiness Support, SIDAR, and the MauNDC Registry, Mauritius has established MRV systems to track emissions reductions, co-benefits, and financial flows at the project level. These systems align with sectoral MRV approaches within national institutions that feed data into the MauNDC Registry.
- Project-level MRV data typically derived from sectoral tracking include Activity Data, Emission Factors, Performance Indicators, Financial and Implementation Data, Co-benefit Metrics, and Data Validation Information, ensuring consistency and transparency in national climate reporting.

Figure 2: National Data References

These systems collectively support Mauritius in meeting its obligations under the UNFCCC and in tracking progress toward its Nationally Determined Contributions (NDCs).

2.4 Reference Registries and International Best Practices

Mauritius is aligning its climate governance and data systems with international best practices to ensure transparency, comparability, and effectiveness in tracking progress toward its Nationally Determined Contributions (NDCs). Among the most relevant global frameworks is the Initiative for Climate Action Transparency (ICAT), which offers a suite of methodologies and tools that go beyond traditional GHG accounting to support comprehensive policy evaluation and reporting.

2.4.1 ICAT's Relevance to Mauritius

The ICAT framework is particularly valuable for Mauritius as it supports the development of integrated MRV systems that reflect not only emissions reductions but also broader policy impacts. This is essential for a small island developing state (SIDS) like Mauritius, where climate actions often yield multiple co-benefits across sectors.

Key ICAT Methodologies that support Mauritius' transparency efforts

A. **Impact Assessment Methodologies**

- These methodologies help quantify the GHG impacts of policies and measures. *The application of the ICAT Renewable Energy Methodology and the ICAT Buildings Efficiency Methodology will part of Deliverable 6 of the ICAT project.*
- For Mauritius, this supports the evaluation of sectoral strategies in the energy sector. This can be expanded and replicated to the other sectors of transport, agriculture, and waste, ensuring that mitigation actions are measurable and attributable. The learnings from the application of ICAT methodologies will contribute to the refinement of the MauNDC Registry.

B. Transformational Change Methodology

- Designed to capture system-wide shifts, such as the transition to renewable energy or electrification of transport.
- Future application of this methodology can support Mauritius to demonstrate long-term structural changes aligned with its low-carbon development goals.

This deliverable aligns indicator development with ICAT's integrated approach, ensuring that the MauNDC Registry not only tracks emissions but also reflects broader policy outcomes.

2.4.2 Alignment with ETF and BTR Reporting

Mauritius is committed to meeting its obligations under the Enhanced Transparency Framework (ETF) of the Paris Agreement. ICAT methodologies support this by:

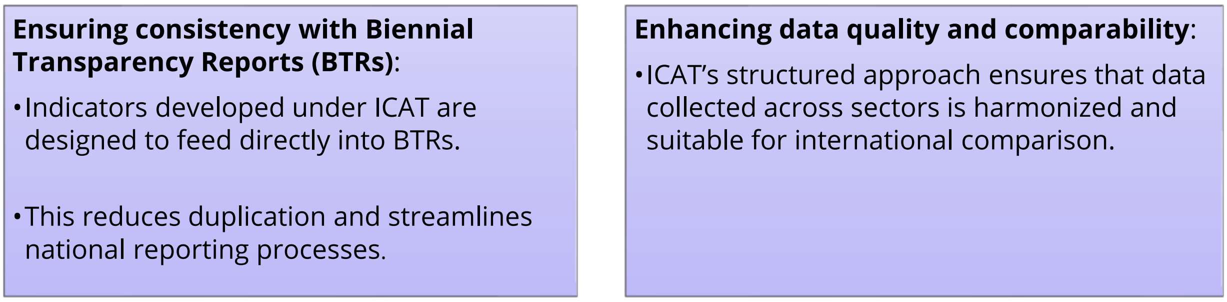

Figure 3: Alignment with ETF and BTR Reporting

2.4.3 Practical Guidance for National Stakeholders

To make ICAT methodologies accessible to a wide range of users, including government officials, technical experts, and project developers, ICAT is supporting Mauritius for developing user-friendly guidance that avoids technical complexity while maintaining analytical rigor. This includes:

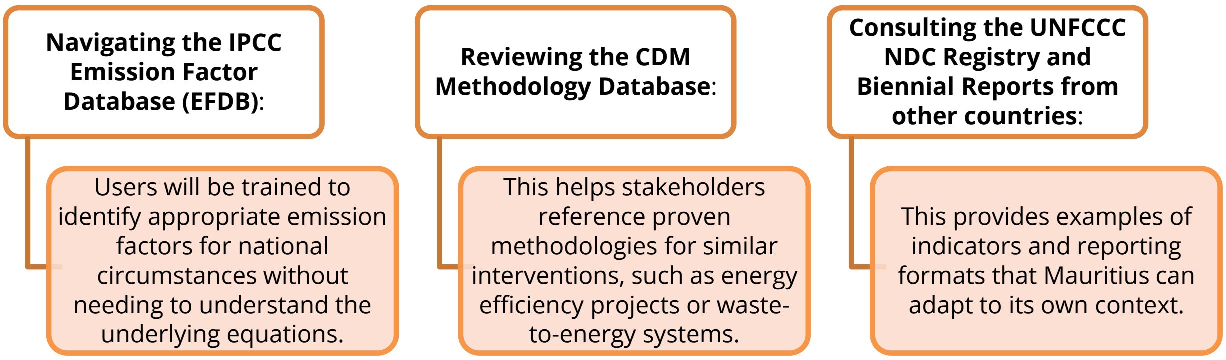

Figure 4: Practical Guidance for National Stakeholders

2.4.4 Adapting to the Mauritian context:

While ICAT provides a robust foundation, Mauritius recognizes the need to tailor approaches to its unique national circumstances:

- **Small-Island Vulnerabilities**: Climate risks such as sea-level rise, coastal erosion, and extreme weather events require localized indicators and adaptation metrics.
- **Limited Data Availability**: ICAT's flexible structure allows Mauritius to use proxy indicators and qualitative assessments where quantitative data is scarce.
- **Priority Sectors**: Water, agriculture, biodiversity, disaster risk reduction, tourism, fisheries, and coastal infrastructure are central to Mauritius' economy and climate resilience.

Chapter 3: From Existing Indicators to Enhanced Quantification

3.1 Review of Proposed Indicators for MauNDC Registry

The MauNDC Registry already contains a set of indicators developed through previous initiatives and national reporting exercises. Many of these indicators have been derived from the Operational Guidelines for Climate Governance, as well as from existing Biennial Update Reports (BURs), National Communications (NCs), and sectoral strategies. These indicators primarily capture outcomes related to policy implementation, institutional arrangements, and progress in mitigation actions.

An initial assessment shows that while these indicators provide a useful starting point, their relevance, measurability, and consistency with NDC tracking needs vary significantly. In some cases, indicators are process-oriented (e.g., number of policies adopted) rather than outcome-oriented (e.g., emissions reduced). In others, data definitions are not standardized, limiting comparability across sectors. This underscores the need to transition toward more quantitative, sector-specific indicators that can reliably demonstrate progress under the Enhanced Transparency Framework (ETF). Refer to Tables 2 and 3 for details. A few process-oriented interventions are not reflected in the Tables but can be captured in the NDC and the MauNDC Registry.

3.2 Classification into GHG and Non-GHG Indicators

A review of the existing indicators within the MauNDC Registry reveals that the majority are currently non-GHG indicators, largely due to limited awareness and technical capacity among data providers and users regarding GHG accounting. These non-GHG indicators typically focus on tracking the implementation of policies, activity data, institutional arrangements, and capacity-building efforts, such as the number of climate-related policies adopted, training sessions conducted, or institutions established. While these indicators are valuable for monitoring progress in governance and enabling conditions, they do not directly reflect the climate outcomes or emission impacts of actions taken.

In contrast, GHG indicators that measure actual emissions reductions or removals are relatively underdeveloped or inconsistently applied across sectors. This gap is particularly evident in adaptation sectors, where methodological challenges and data limitations hinder the development of robust GHG metrics. As Mauritius moves toward enhanced transparency under the Paris Agreement, there is a growing need to balance the indicator framework by integrating more quantitative, outcome-based GHG indicators alongside existing non-GHG metrics. This will not only improve the credibility of NDC tracking but also support evidence-based decision-making and international reporting under the Enhanced Transparency Framework (ETF).

Table 2 and Table 3 present the proposed indicators for each intervention, covering both GHG and non-GHG dimensions. However, within this guidance document, only the most suitable and relevant indicators have been highlighted to facilitate practical tracking of progress toward NDC implementation. Additional indicators may be incorporated over time, as data availability improves and sectoral priorities evolve, to ensure the framework remains comprehensive and responsive to emerging national needs.

Table 2: GHG and Non-GHG Indicators Mitigation for MauNDC Registry

Sector	Outcomes	Interventions	Indicators	Indicator Type	GHG Linkage / Typology
Energy / Energy Industries	Decarbonisation of electricity system	Promote end-use energy efficiency	Emission reductions from energy efficiency (tCO_2e/year)	GHG	Direct GHG indicator – expresses emissions avoided or reduced in CO_2e terms.
	Decarbonisation of electricity system	Promote end-use energy efficiency	Number of Energy Audits Completed	Non-GHG	Indirect proxy – signals potential GHG reductions but is not quantified.
	Decarbonisation of electricity system	Promote end-use energy efficiency	Number of Appliances covered by Minimum Energy Performance Standards (MEPS)	Non-GHG	Enabling indicator – supports conditions that lead to indirect GHG reductions.
	Decarbonisation of electricity system	Enhance renewable energy sources	Share of renewable energy in electricity mix (%)	GHG	Indirect – can be translated into avoided emissions using the grid emission factor.
Transport	Low-carbon land transport system	Improved fuel economy of vehicles	Fuel economy	GHG	Direct GHG indicator – measurable emission intensity.
	Low-carbon land transport system	Improved fuel economy of vehicles	Fuel consumption	GHG	Indirect/convertible – can estimate CO_2e using fuel emission factors.
	Low-carbon land transport system	Improved fuel economy of vehicles	CO_2 emissions per km	GHG	Direct – directly measures emissions intensity.
	Low-carbon land transport system	Reduce peak time congestion	Vehicle speed during peak hours	Non-GHG	Proxy – reflects system efficiency; convertible using modeled fuel use
	Low-carbon land transport system	Adoption of lower-carbon vehicles	Share of EVs	GHG	Indirect/convertible – GHG impact can be derived using the electricity grid factor and fuel displacement.
	Low-carbon land transport system	Electrification of mass transit	% fleet electrified	GHG	Indirect – convertible using the electricity grid emission factor.
	Low-carbon land transport system	Electrification of mass transit	Electricity use	GHG	Indirect – convertible to CO_2e using grid factor.
Solid Waste Management	Circular waste economy	Composting of organic waste	Tons composted	GHG	Indirect – convertible to CH_4 avoided using waste emission factors.
	Circular waste economy	Recycling of municipal solid waste	Recycling rate (%)	GHG	Indirect – convertible using life-cycle emission factors per material type.

	Circular waste economy	Energy recovery from waste	Energy generated from waste-to-energy (MWh/year)	GHG	Indirect – convertible using grid factor and combustion efficiency.
Waste Water Management	Avoided emissions in wastewater management	Low-carbon treatment technologies	Methane avoided	GHG	Direct – quantifies CH_4 emissions avoided.
	Avoided emissions in wastewater management	Low-carbon treatment technologies	Volume of wastewater treated using low-carbon technologies	GHG	Indirect – convertible using CH_4/N_2O emission factors per treatment type.
Industrial Processes & IPPU	Kigali Amendment compliance	Phase-down of HFCs	HFC consumption (tonnes CO_2e)	GHG	Direct – already expressed in CO_2e terms.
	Kigali Amendment compliance	Phase-down of HFCs	% reduction vs baseline	GHG	Indirect – convertible when baseline in CO_2e is known.
	Kigali Amendment compliance	Phase-out of HFC-based appliances	Number of HFC-based appliances imported	Non-GHG	Proxy – convertible using typical HFC charge per unit.
	Kigali Amendment compliance	Disposal of HFC refrigerants	Tonnes of HFCs recovered (tCO_2e)	GHG	Direct – expresses avoided emissions in CO_2e.
Agriculture (Crops)	Emissions reduction from agriculture	Reduce chemical inputs	Fertilizer use per hectare	GHG	Indirect – convertible using N_2O emission factors for fertilizer type.
	Emissions reduction from agriculture	Reduce chemical inputs	N_2O emissions from soils	GHG	Direct – quantifies GHG emissions in N_2O or CO_2e.
	Emissions reduction from agriculture	Smart agriculture and bio-farming	% farmland under smart practices;	Non-GHG	Proxy – convertible using emission reduction potential per hectare depending upon the practices
Agriculture (Livestock)	Food security and mitigation	Improved manure management	% farms with digesters	Non-GHG	Proxy – convertible to CH_4/N_2O avoided using IPCC factors.
	Food security and mitigation	Improved manure management	CH_4/N_2O emissions reduced	GHG	Direct – expresses avoided GHG in CO_2e.
Land use, Land Use Change and Forestry	Increase sink capacity	Urban tree planting	Area afforested (hectares)	GHG	Indirect / Convertible – estimate CO_2e using biomass carbon factor.
	Increase sink capacity	Conservation of native biodiversity	Land under conservation management (Ha)	GHG	Indirect– convertible to avoided CO_2e from deforestation.

This guide primarily focuses on GHG-related indicators; therefore, non-GHG indicators of adaptation are presented separately in Annex C.

Table 3: GHG Indicators Adaptation

Sector	Sr No	Outcomes	Interventions	Proposed Indicators	Indicator Type	GHG Linkage / Typology
Agriculture	A2	Promotion of climate-smart land use and biodiversity	Ensure alignment with water, forestry, and biodiversity adaptation (A2.2)	Area afforested (hectares)	GHG	Direct GHG indicator – increases carbon sequestration; can be converted to CO_2 removals using forest growth and sequestration factors.
Agriculture	A2	Promotion of climate-smart land use and biodiversity	Promote composting and reduce synthetic fertilizer use (A2.4)	% of farms using compost/organic manure as primary soil amendment	GHG	Indirect GHG indicator – reduced synthetic fertilizer use lowers N_2O emissions; requires emission factors for fertilizer substitution.
Fisheries and Blue Economy	F2	Resilient coastal and marine ecosystems and communities (NBS indicator)	Rehabilitate marine habitats: mangroves, seagrass and corals (F2.4)	Area of mangrove replanted (ha/year).	GHG	Direct GHG indicator – mangroves act as high-carbon ecosystems; area replanted can be converted to annual CO_2 removal using blue-carbon sequestration factors.

3.3 Sectoral Mapping and Data Availability

To operationalize the proposed indicators, a comprehensive sectoral mapping exercise was undertaken, aligning each indicator with the key NDC sectors in Mauritius. These sectors include Energy, Transport, Waste, AFOLU (Agriculture, Forestry, and Other Land Use), Industry, Water, and Tourism, along with cross-cutting areas such as disaster risk reduction and nature-based solutions (NBS).

This mapping revealed a diverse mix of GHG and non-GHG indicators, with a notable predominance of non-GHG indicators, especially in adaptation-related sectors. This reflects the current state of awareness and capacity among stakeholders, where outcome-based GHG tracking is still emerging, and process or activity-based indicators are more commonly used.

3.3.1 Responsible Institutions and Reporting Channels

Each sector has designated custodian institutions responsible for data collection and reporting. However, the reporting formats, frequency, and quality vary significantly across sectors:

- Energy and Transport sectors benefit from relatively structured and frequent reporting, with annual data available on electricity generation, fuel consumption, and vehicle registration.
- Waste and AFOLU sectors, while critical for mitigation, face data gaps and inconsistencies, particularly in areas like methane emissions from landfills or fertilizer use in agriculture.
- Forestry and Biodiversity data are often collected through project-based efforts or satellite monitoring but lack integration into national climate reporting systems.
- Water, Fisheries, and Tourism sectors, especially those contributing to nature-based solutions, rely heavily on non-GHG indicators such as area restored, number of coral nurseries, or community-level planning initiatives.

3.3.2 Preliminary Assessment of Data Availability

The assessment highlights several challenges and opportunities:

Data Reliability and Granularity

- Energy and transport sectors show high reliability and granularity, enabling robust GHG quantification. In contrast, sectors like waste, agriculture, and forestry exhibit fragmented data systems, limiting the accuracy of emissions estimates.

Disaggregation

- Most sectors lack disaggregated data by technology, region, or gender which constrains the development of inclusive and targeted non-GHG indicators. For example, while some indicators track the adoption of anaerobic digesters in livestock farming, few distinguish uptake by women farmers.

Indicator Alignment

- Many existing indicators are activity-based (e.g., number of plans developed, hectares restored), which are useful for tracking implementation but insufficient for demonstrating climate impact. There is a need to strengthen GHG quantification methodologies, especially in sectors like agriculture, waste, and forestry.

Figure 5: Assessment Highlights of Data Availability

Chapter 4: Development of GHG and Non-GHG Indicators

4.1 Data Input Requirements by Sector and Agency

Reliable indicators depend on robust, sector-specific activity data. A mapping of data input requirements has been conducted across key NDC sectors, identifying responsible institutions and the types of data needed to support both GHG and non-GHG indicators. The indicators presented below are those populated in the MauNDC Registry, and additional indicators may be incorporated as needed based on emerging requirements or sectoral priorities. **Annex A and B explain how each indicator can be converted or linked to corresponding GHG indicators for emission estimation and tracking.**

Table 4: Data Requirements for Mitigation

Sector	Outcomes	Interventions	MauNDC Registry Indicators	Data Requirements	Responsible Institution
Energy/ Energy Industries	Decarbonisation of the electricity system using renewable energies and demand side energy efficiency	Promote end-use energy efficiency	Emission reductions from energy efficiency (tCO_2e/year)	– Baseline and post-intervention energy consumption data (by sector/facility) - Emission factors for electricity and fuels - Details of implemented EE measures (type, date, coverage) - Methodology used to estimate savings (e.g. IPMVP)	CEB and EEMO
		Enhancing renewable energy sources in the electricity mix, with completed phase out of coal before 2030	Share of renewable energy in electricity mix (%)	- Total electricity generated (MWh) - Electricity from renewable sources (MWh) - Grid emission factor, requiring: - Energy mix breakdown by source Historical and current installed capacity of coal-fired power plants - Fuel-wise generation data (MWh)	CEB
		Rooftop Solar and Solar farm (incl. Agrivoltaic) projects	Farms (incl. Agrivoltaics) • Number of Rooftop Solar and Solar Farm projects	- Installed RE capacity by project and technology (MW) - Annual generation (MWh) where available - Project pipeline and commissioning dates	MARENA

			• Capacity installed each year (MW) • Same indicators for other RE technologies (wind, hydro, waste-to-energy, etc.)		
Transport (Land Shipping and aviation)	Towards a sustainable low-carbon land transport system in Mauritius	Improved fuel economy of vehicles	Annual fuel consumption by vehicle category (litres)	– Vehicle registration and technical inspection records – Fuel efficiency test results – National fuel consumption statistics – Emission factors per fuel type	Traffic Management and Road Safety Unit (TMRSU) and National Land Transport Authority (NLTA)
		Decreasing peak time congestion to improve traffic fluidity	Total vehicle hours lost due to congestion per year	Traffic flow and GPS speed monitoring data – Road network performance studies – Surveys or telematics on trip-level fuel consumption	Traffic Management and Road Safety Unit (TMRSU) and National Land Transport Authority (NLTA)
		Reducing consumption of fossil fuels through increased adoption of lower-carbon vehicles	Annual sales of electric/hybrid vehicles (units)	Vehicle fleet composition and registration database – National fuel import and sales statistics – Methodology for estimating avoided emissions (baseline vs actual)	Traffic Management and Road Safety Unit (TMRSU) and National Land Transport Authority (NLTA)
		Electrification of mass transit mode of passenger transport	Electricity consumption by electric public transport (MWh/year)	– Public transport authority fleet inventory – Energy consumption data (electricity bills, diesel purchase records) – Emission factors for diesel vs electricity grid mix – Calculation of avoided emissions	Traffic Management and Road Safety Unit (TMRSU) and National Land Transport Authority (NLTA)
Solid Waste Management	Avoided emissions at landfills from a circular waste economy	Composting of the putrescible fraction of solid waste	Tons of organic waste composted annually	– Annual data on municipal organic waste generated – Quantity of waste diverted to composting facilities – Emissions associated with composting– Emission factors for landfill methane generation	Solid Waste Management Division
		Recycling of municipal solid waste	Recycling rate (% of total MSW)	– Municipal solid waste generation statistics – Recycling facility throughput data by material type – Recycling rate calculation methodologies	Solid Waste Management Division
		Energy recovery from municipal solid waste	Energy generated from waste-to-energy (MWh/year)	– Waste-to-energy facility operating data (MWh/year generated) – Quantity of waste processed in energy recovery – National electricity grid emission factors	Solid Waste Management Division
Waste Water Management	Avoided emissions in	Reduced methane emissions from the	Methane avoided in wastewater treatment	– Average wastewater generated by household	Wastewater Management Authority

	wastewater management	adoption of low-carbon water treatment technologies	through more Population connected to the centralised wastewater system (co2e/year)	– Emissions associated with baseline technology (I assume septic tanks) by household – Emission associated per volume unit of treated wastewater.	
Industrial Processes and Product Use	Reducing the import of HFCs according to the Kigali Amendment to the Montreal Protocol	Phase-Down of hydrofluorocarbons (HFCs) refrigerants in Mauritius	Annual HFC refrigerants consumption (tonnes CO_2e)	– Annual imports of HFCs (by type and GWP) - Baseline year consumption data (HFC tonnes, converted to CO_2e) - Customs data on refrigerant imports - HFC use data from the servicing sector and HFC refrigerants retailers - Calculation methodology for % reduction	Ozone Unit
		Phase out of HFC based domestic refrigerators and small commercial refrigeration equipment	Number of HFC based domestic refrigerators and small commercial refrigeration equipment imported	– Annual number of imports of refrigerators and cooling appliances, disaggregated by refrigerant type (eg HFC, HCFCs, natural refrigerants) - Market share of non-HFC alternatives (e.g., natural refrigerants like R-600a, CO_2) - Registration/certification records for appliances - Customs and trade statistics	Ozone Unit
		Environmentally sound disposal of HFC refrigerants	Tonnes of HFCs recovered (tCO_2e)	– Quantity of HFCs collected and recovered from decommissioned equipment - Records from recovery/recycling units and licensed waste operators - Number of certified technicians trained in HFC recovery and safe disposal - Documentation of disposal in compliance with Montreal Protocol guidelines	Ozone Unit
Agriculture (Crops)	Reducing emissions from good agricultural practices	Reducing chemical inputs in crop production	Fertilizer use per hectare (kg/ha) in agricultural land	– Total fertilizer consumed (by type: nitrogen, phosphate, potash, etc.) - Total agricultural land area under cultivation (ha) Or - Type and quantity of fertilizer applied - Crop type and area (hectares) - Soil characteristics (N content, organic matter)	MAIFSBEF/FAREI/MCA/ MCIA/MISRI/MOESWMCC
		Implementation of smart agriculture, bio-farming and other sustainable agricultural practices	% farmland under smart agriculture, bio-farming, and sustainable practices.	– Total farmland area (ha) -Baseline emissions from conventional agricultural practices (tCO_2e/ha) -Number or area of farms implementing low-emission technologies (e.g., precision irrigation, conservation tillage, organic inputs)	MAIFSBEF/FAREI/MCA/MCIA/MSIRI/ MOESWMCC

				-Soil organic carbon increase or carbon sequestration rate (tCO_2e/ha/year)	
Agriculture (Livestock)	Improved food security with application of mitigation technologies for livestock waste management	Improved food security through the adoption of environmentally sound animal excrement management technologies	CH_4/N_2O emissions reduced from manure management (tCO_2e/year)	– Number of livestock farms by type and size - Volume of manure treated by type of treatment system (m^3/year or tonnes/year) - Number and percentage of livestock farms applying anaerobic digestion or other low-emission manure management systems - Average manure volume biodigested per farm (m^3/farm/year) - Baseline and project emission factors for CH_4 and N_2O from different manure management methods (kg CH_4 or N_2O per tonne of manure) – Estimated GHG emission reductions from improved manure management (tCO_2e/year)	FAREI
Land use, Land Use Change and Forestry	Increasing the sink capacity of Mauritius	Planting trees in urban areas	Area afforested (hectares)	– Municipal/urban greening project records – Tree species, age, and survival rates – Growth rates and biomass accumulation factors – Carbon sequestration coefficients by species/region	MoESWMCC/ Forestry Service
		Afforestation of abandoned agricultural land	CO_2 removal from biomass growth (tCO_2e/year)	– Land-use data on abandoned agricultural land – Area covered under afforestation projects – Tree species mix and planting density – Biomass growth rates and carbon sequestration coefficients – Monitoring data on survival and growth rates	MoESWMCC/ Forestry Service
		Conservation of Native Biodiversity	Land under conservation management and restoration (Cumulative Ha)	– Total area (hectares) under legally designated conservation management (national parks, nature reserves, restored forest areas, wetlands, etc.) - Area newly brought under conservation/restoration each year (ha/year) - Types of conservation/restoration measures undertaken (e.g., reforestation, invasive species removal, watershed restoration) - Monitoring of the survival rate of restored vegetation and biodiversity indicators	National Parks and Conservation Service/ Forestry Service

Table 5: Data Requirements for Adaptation

Sector	Sr No	Outcomes	Interventions	Proposed Indicators	Indicative Data Requirements	Responsible Institution
Agriculture	**A2**	**Promotion of climate-smart land use and biodiversity**	Ensure alignment with water, forestry, and biodiversity adaptation (e.g., water conservation, forest cover increase) (A2.2)	Area afforested (hectares)	– Area under micro-irrigation (ha) – Annual Forest cover statistics (remote sensing/GIS) – List & size of floodplain easements implemented	
			Promote composting and reduce synthetic fertilizer use (A2.4)	% of farms using compost/ organic manure as primary soil amendment	– Total number of farms in the region - Number of farms primarily using compost/organic manure instead of synthetic fertilizers - Volume of compost produced and applied annually (tons) - Reduction in synthetic fertilizer sales/consumption (tons/year)	FAREI, MCIA/MSIRI, MCA
Fisheries and Blue Economy	**F2**	**Resilient coastal and marine ecosystems and communities**	Rehabilitate marine habitats: mangroves, seagrass and corals (F2.4)	Area of mangrove replanted (ha/year)	– Area of mangroves replanted (ha/year) with GPS mapping - Area of seagrass restored (ha/year) - Number and size of coral nurseries/farming sites established - Monitoring reports on ecosystem survival rates	Ministry of Agro Industry, Food Security, Blue Economy and Fisheries (Fisheries Division)

4.2 Identification and Integration of Emission Factors

Emission factors are a cornerstone of any GHG monitoring and reporting system. They serve as the quantitative bridge between raw activity data (e.g., amount of electricity consumed, litres of fuel used, tonnes of waste generated) and actual emissions expressed in carbon dioxide equivalent (tCO_2e). An emission factor essentially describes the average emission rate of a given GHG relative to a unit of activity, product, or process.

For Mauritius, selecting and applying emission factors requires careful consideration of both national circumstances (such as availability of data on, e.g. energy mix, waste management practices, or agricultural systems) and internationally recognized standards (such as IPCC guidelines). The use of inappropriate or outdated emission factors can result in inaccurate emissions estimates and undermine the transparency and credibility of the national climate reporting framework. On the other hand, in the absence of precise data or applicability of internationally recognized methodologies, alternative approaches can be used to estimate impacts based on available data to have approximate indications of policy and measures' progress and impacts. Careful consideration should be given to the trade-off between accuracy and the provision of potential impact information.

Sector-Specific Emission Factors

Emission factors are essential for converting activity data into quantifiable greenhouse gas (GHG) emissions. They vary across sectors depending on technologies, practices, and local conditions. For Mauritius, applying country-specific factors where available and IPCC defaults where not will strengthen the accuracy of the national GHG inventory and MauNDC Registry. The detailed methodologies for calculating sector-specific emission factors are explained in Chapter 5.

Table 6: Methodology for Identification of Sector-Specific Emission Factors

Sector	Emission Factors	Details / Considerations	Data Sources / Notes
Energy / Energy Industries	Grid emission factors (kg CO_2/kWh)	Estimate emissions from electricity generation and consumption; reflect evolving energy mix (renewables, fossil fuels).	Country-specific grid studies; IPCC defaults as interim values, Grid emission Factor, Mauritius.
Transport (Land, Shipping, Aviation)	Fuel combustion factors (kg CO_2/litre, per km, per tonne-km)	Differ by mode, vehicle type, fuel efficiency, and technology.	National fuel consumption/import data; IPCC defaults.
Solid Waste Management	CH_4 factors for landfilling; CO_2/CH_4 for incineration; CH_4 for anaerobic digestion, Composting	Depends on the waste composition and treatment/disposal method.	Regional averages or IPCC defaults adjusted for tropical conditions.
Wastewater Management	CH_4 and N_2O factors	Vary by treatment technology (aerobic, anaerobic, lagoon) and influent composition.	IPCC guidelines; regional data.
Industrial Processes & Product Use (IPPU)	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	From cement, lime, and chemical production, use of refrigerants, and solvents.	Industry-specific data; IPCC emission factors.
Agriculture (Crops)	N_2O factors from fertilizer use;	Vary by crop type, fertilizer efficiency, and local practices.	National agricultural statistics; IPCC guidelines.
Agriculture (Livestock)	CH_4 from enteric fermentation; CH_4 & N_2O from manure; biodigesters	Differ by livestock type, breed, and feeding practices.	Livestock population data; IPCC defaults adjusted for local breeds.
Land use, Land Use Change and Forestry	CO_2 sequestration/removal and emissions from deforestation, degradation, biomass burning	Sensitive to land cover change, soil type, and management practices.	National forestry inventories; satellite data; IPCC defaults.

Buildings	CO_2 factors from electricity use and fuel combustion	Linked to energy efficiency and appliance standards.	Grid factors: appliance/fuel use data.
Tourism	Composite emission factors integrating energy consumption (electricity, fuels), transport energy use	Supports assessment of low-carbon tourism and NBS-based resilience.	National energy statistics, tourism data (arrivals, occupancy), hotel energy audits, IPCC default
Fisheries and Blue Economy	CO_2 factors from marine fuel combustion and processing	Depend on vessel type, gear, and efficiency.	Fisheries data; IPCC defaults for marine fuels.

Fallback to International Sources

Where national emission factors are either unavailable, outdated, or inconsistent, Mauritius should systematically adopt default or peer-reviewed values from international sources, such as:

- **IPCC 2006 Guidelines** for National GHG Inventories.
- **IPCC 2019 Refinement**, which provides updated default factors and methodologies.
- **CDM methodologies**, particularly where activity-level indicators need precision (e.g., renewable energy projects, methane capture from landfills).
- **ICAT sectoral guides**, which provide frameworks for linking policy impacts with quantifiable GHG reductions.

The consistent use of such internationally recognized emission factors ensures comparability with other countries, alignment with the Enhanced Transparency Framework (ETF), and compliance with reporting under the Paris Agreement.

4.3 Assumptions and Referencing (IPCC, CDM, National Sources)

Emission estimates and indicators do not rely solely on activity data and emission factors; they also require carefully defined assumptions that guide the application of methodologies. These assumptions describe the boundary conditions, data gaps, and calculation logic applied in the estimation process. Documenting and publishing them is critical to ensuring transparency, reproducibility, and credibility in Mauritius's GHG reporting framework.

Examples of Key Assumptions

- **Grid Emission Factor Stability**: Assumes that the emission factor remains constant or changes gradually over time unless new statistics on the electricity mix are available. This assumption avoids sudden inconsistencies in reporting.
- **Per Capita Waste Generation**: Uses average waste generated per person as a proxy when detailed waste audits are unavailable. This assumption directly influences national municipal solid waste estimates.
- **Fertilizer Efficiency via Crop Yield**: Links fertilizer input to crop output, assuming a relationship between nutrient application and crop productivity. Variations in this assumption can significantly alter emission intensity calculations for agriculture.
- **Lifespan of Renewable Energy Installations**: Assumes a standard operational lifetime (e.g., 20–25 years for solar PV, 15–20 years for wind turbines) to calculate cumulative avoided emissions.

Referencing Sources

National Sources	International Sources
GHG Inventory Reports – Provide official baseline	**IPCC Guidelines (2006, 2019 Updates)** – Global reference for

emissions, sectoral breakdowns, and time-series data.	emission factors, calculation methods, and sectoral approaches.
Biennial Transparency Reports (BTRs) – Document applied methodologies, mitigation measures, and sectoral progress.	**ICAT Methodologies** – Frameworks for linking policy interventions with measurable GHG impacts.
National Communications (NCs) – Contain historical emissions, projections, and national circumstances.	**CDM, Gold Standard, VERRA** – Project-level validated methodologies applicable for mitigation interventions.
Statistics Mauritius – Official authority for economic, demographic, and sectoral activity data.	

4.4 Validation with National and International Practices

Validation ensures that the selected indicators, emission factors, and assumptions are credible, scientifically robust, and practically implementable. It involves both internal validation (national checks) and external benchmarking (comparison with international best practices).

Internal Validation Measures

1. **Cross-Checks with GHG Inventory**: Indicators must align with official national inventory figures to maintain consistency and avoid double-counting.
2. **Sectoral Database Alignment**: Activity data (e.g., energy use, fuel imports, crop yields) should be verified against Statistics Mauritius and sectoral ministry datasets.
3. **Registry Integration**: Indicators must be compatible with the MauNDC Registry's technical structure, data entry protocols, and reporting templates.

External Benchmarking

Peer Comparison: Benchmark indicators against other Small Island Developing States (SIDS) and African countries, ensuring relevance to regional contexts with similar vulnerabilities and economic structures.

As Mauritius is currently at the initial stage of developing and operationalizing the MauNDC Registry, the validation of indicators against national and international practices will be undertaken in greater detail at later phases of implementation. At this stage, the focus remains on establishing a robust methodological foundation and integrating priority emission factors and assumptions. As the system matures, Mauritius will progressively strengthen validation through comprehensive cross-checks with the national GHG inventory, benchmarking against peer countries, alignment with ETF reporting requirements, and structured stakeholder consultations.

Chapter 5: Technical Guide for Indicator Conversion

5.1 How to Use IPCC and CDM Resources

Non-GHG indicators such as the number of households gaining access to solar lighting, hectares of forest restored, or tonnes of waste diverted are extremely useful for measuring resilience outcomes. They help governments and stakeholders track the progress of interventions in a tangible way that is easy to communicate. However, when it comes to reporting under the ETF and compliance with NDC reporting requirements, such indicators need to be expressed in terms of measurable GHG reductions or removals, quantified in tonnes of carbon dioxide equivalent (tCO_2e).

To bridge this gap, practitioners rely on authoritative international resources such as the IPCC Guidelines, the CDM methodologies, and more recent ICAT guidance tools. These resources provide emission factors, default values, and step-by-step approaches to convert activity data (e.g., energy saved, waste recycled, fuel consumption, etc.) into GHG outcomes.

The goal of this guide is to simplify the conversion process. Instead of requiring practitioners to navigate complex equations and advanced modelling, it provides a practical, hands-on tool for straightforwardly applying existing methodologies. Users are guided through a sequence of steps: identifying the activity, locating relevant data, applying emission factors, and documenting assumptions. This ensures that activity-level information can be transparently transformed into climate impact metrics, which are consistent with international standards.

5.2 Searching for Similar Projects and Methodologies

The conversion of non-GHG indicators into GHG outcomes follows a structured process. Practitioners can adopt the following stepwise approach:

1. Identify the intervention

- Define the nature of the activity or intervention.
- *Example*: Solar PV installation, distribution of energy-efficient appliances, recycling of municipal waste, or reforestation.

2. Note the non-GHG indicator being tracked

- Identify the activity-level data being collected.
- *Example*: MWh of electricity saved, hectares of forest restored, or tonnes of waste diverted.

3. Locate the relevant activity data

- Use official and verifiable sources such as national agency reports, project documentation, household or enterprise surveys, or statistical datasets.

4. Consult reference methodologies

- Use international sources to find emission factors and calculation methods:
  - **IPCC Guidelines (2006, 2019 Refinement)** for national or sectoral emission factors.
  - **CDM methodologies** for detailed project- or intervention-specific quantification protocols.

- ICAT Guidance for linking policy impact and aspects.

5. Match activity data with emission factors

- Align the specific activity with the appropriate emission factor.
- *Example*: Electricity saved (MWh) × grid emission factor (tCO_2/MWh) = avoided emissions.

6. Derive the GHG outcome

- Express the results in **tCO_2e**, a standard metric that enables aggregation across sectors.

7. Document assumptions and data sources

- Record how the calculation was performed, which emission factors were used, and the source of activity data.
- Ensure transparency so results can be independently verified or updated.

5.3 Interpreting Emission Factors and Activity Data

Emission factors are the critical link between activity data (such as electricity saved, waste diverted, or hectares reforested) and their resulting GHG outcomes. Interpreting and applying them correctly is essential to ensure that results are accurate, transparent, and consistent with international reporting requirements. While the IPCC Guidelines provide broad, globally recognized default factors and methodological tiers, the CDM methodologies offer detailed, intervention-specific calculation approaches. Together, they allow practitioners to move from raw activity data to robust estimates of emission reductions or removals.

To guide users, the following steps explain how to apply IPCC emission factors and CDM methodologies in a practical, easy-to-follow manner.

5.3.1 Usage of IPCC Emission Factors

Step 1: Define the Sector and Activity

Begin by clearly identifying the sector (e.g., Energy, Transport, Agriculture) and the specific activity that generates emissions. For example:

- Electricity generation from fossil fuels (Energy)
- Fuel combustion in vehicles (Transport)
- Methane emissions from livestock (Agriculture)

This step ensures that the emission factor selected corresponds precisely to the activity being measured.

Step 2: Choose the Appropriate IPCC Tier Method

The IPCC provides three tiers of methodological complexity:

- **Tier 1**: Uses default emission factors provided by IPCC. Suitable for countries with limited data.
- **Tier 2**: Uses country-specific emission factors and activity data.
- **Tier 3**: Involves detailed modelling and facility-level data.

For Mauritius, Tier 1 and Tier 2 methods are most commonly used, depending on data availability.

Step 3: Refer to IPCC Guidelines and Databases

Use the following IPCC resources to identify emission factors:

- **IPCC 2006 Guidelines for National GHG Inventories**: The foundational document for most sectors.
- **2019 Refinement to the 2006 Guidelines**: Updates and improves methodologies and emission factors.
- **IPCC Emission Factor Database (EFDB)**: An online searchable database of peer-reviewed emission factors.

Guidelines cans be accessed here:

- **IPCC 2006 Guidelines for National GHG Inventories**: https://www.ipcc-nggip.iges.or.jp/public/2006gl/
- **IPCC 2019 Refinement**: https://www.ipcc-nggip.iges.or.jp/public/2019rf/

Each sector has a dedicated volume in the guidelines:

- **Volume 2**: Energy
- **Volume 3**: Industrial Processes and Product Use
- **Volume 4**: Agriculture, Forestry and Other Land Use (AFOLU)
- **Volume 5**: Waste

Step 4: Select the Relevant Emission Factor

Within the guidelines or EFDB, locate the emission factor that matches:

- The fuel type (e.g., diesel, coal, natural gas)
- The process type (e.g., combustion, fermentation, decomposition)
- The pollutant (e.g., CO_2, CH_4, N_2O)

For example:

- **Energy**: CO_2 emission factor for diesel = ~74.1 tCO_2/TJ (IPCC 2006, Vol. 2)
- **Agriculture**: N_2O emission factor for synthetic fertilizer = ~0.01–0.03 kg N_2O-N/kg N applied (IPCC 2006, Vol. 4)

Emission Factors cans be accessed here:

- **IPCC Emission Factor Database (EFDB)**: https://www.ipcc-nggip.iges.or.jp/EFDB/main.php

Step 5: Document Assumptions and Sources

Each emission factor must be accompanied by:

- **Source reference** (e.g., IPCC 2006 Table 2.2)
- **Assumptions** (e.g., combustion efficiency, technology type)
- **Applicability** (e.g., national vs. default values)

This ensures transparency and reproducibility in indicator development.

Step 6: Validate and Update Periodically

Emission factors should be reviewed and updated as:

- New national data becomes available
- IPCC releases refinements or new guidelines
- Sectoral technologies and practices evolve

5.3.2 CDM Methodologies

The Clean Development Mechanism (CDM) under the UNFCCC provides one of the most comprehensive sets of methodologies for quantifying GHG emission reductions at the project and program level. Although CDM credits are no longer being issued for many new projects, the methodologies remain highly relevant for NDC reporting, MRV systems, and policy assessment, because they provide detailed, intervention-specific calculation approaches.

Step 1: Define the intervention

- Clearly describe the project or policy intervention that needs to be quantified.
- *Examples*:
    - Efficient lighting appliances → reduced electricity use.
    - Composting organic waste → avoided methane from landfill.
    - Renewable energy project → displaced fossil-fuel-based generation.
- At this stage, identify the non-GHG indicator (e.g., MWh saved, tonnes of waste composted).

Step 2: Access the CDM Methodology Database

- Visit the UNFCCC CDM Methodology Database: https://cdm.unfccc.int/methodologies
- The database includes large-scale, small-scale, and afforestation/reforestation (A/R) methodologies.
- You can search by:
    - **Sectoral scope** (e.g., Energy industries, Waste handling, Transport).
    - **Keyword** (e.g., “biogas,” “transport,” “composting”).
    - **Type of methodology** (large-scale vs. small-scale AMS).

Step 3: Select a relevant methodology

- Begin by reviewing the executive summary to quickly understand:
    - Scope of the methodology.
    - Eligible project activities.
    - Key emission sources covered.
- Examples of commonly used small-scale methodologies:
    - **AMS-II.C**: Demand-side energy efficiency activities for specific technologies (e.g., efficient appliances).
    - **AMS-I.D**: Grid-connected renewable electricity generation.

Step 4: Review applicability conditions

- Each methodology specifies **applicability criteria** that must be met.
- For example:
  - AMS-II.C requires that the efficient technology directly reduces electricity consumption.
  - AMS-III.F applies only if the waste would otherwise be landfilled under a baseline scenario.
- Check that the national or project context matches the methodology scope.

Step 5: Collect activity data as per methodology requirements

- CDM methodologies define **parameters** that must be measured or estimated.
- Examples:
  - For AMS-II.C (efficient appliances): baseline electricity use, post-intervention use, number of appliances distributed.
  - For AMS-III.F (composting): tonnes of waste diverted, methane correction factors, landfill management type.
- Collect this data from national institutions, surveys, project monitoring, or statistical reports.

Step 6: Apply baseline and monitoring procedures

- **Baseline setting:**
  - CDM methodologies define how to estimate emissions in the "without-project" case.
  - Example: For renewable energy, baseline=electricity from fossil-fuel grid generation.
- **Monitoring requirements:**
  - CDM methodologies include monitoring plans (e.g., annual metering of generation, household surveys, sampling approaches).
  - These procedures ensure results are verifiable and repeatable.

Step 7: Apply the calculation formulas

- CDM methodologies provide detailed equations.
- Example (AMS-II.C):

  Emission Reductions = Electricity Saved (MWh)×Grid Emission Factor (tCO_2/MWh)
- Example (AMS-III.F):

  Emission Reductions = Waste Diverted (tonnes)×Methane Factor (tCH_4/tonne)×GWP of CH_4

Step 8: Document assumptions, parameters, and methodology references

  - Record: CDM methodology code (e.g., AMS-II.C, AMS-III.F).
  - Activity data sources (e.g., national statistics, project reports).
  - Assumptions made (e.g., grid factor constant, no rebound effect).
- Ensure traceability by citing the methodology document.
- Example methodology document for AMS-II.C: https://cdm.unfccc.int/methodologies/DB/0RHKD9X5Y8UR0NFFZWWTXQ4XYV9A3W

5.4 Guidance for Estimating GHG Impacts from Non-GHG Indicators

Non-GHG indicators serve as the entry point for translating sectoral actions and interventions into quantifiable climate outcomes. In most cases, these indicators are associated with mitigation efforts—such as renewable energy generation, energy savings, waste diversion, or efficiency improvements—because they can be more directly converted into tCO_2e reductions using emission factors and established methodologies.

In contrast, adaptation interventions (e.g., improving climate resilience in agriculture or water management) focus on enhancing adaptive capacity, reducing vulnerability, or improving livelihoods. These outcomes are not directly measurable in terms of emission reductions. Only a limited set of adaptation-related actions (e.g., afforestation, soil carbon enhancement) yield quantifiable GHG impacts. Most adaptation indicators are instead tracked qualitatively or through resilience metrics, rather than through emission factors.

Mitigation Indicators

Mitigation-related indicators are generally easier to quantify because of the direct link between activity data and GHG emissions. Examples include:

- Renewable energy generation (MWh)
- Energy efficiency savings (kWh)
- Vehicle fuel consumption (litres)
- Methane avoided from waste management (tonnes)

Such indicators can be systematically expressed in tCO_2e/year and reported under the Enhanced Transparency Framework (ETF).

Adaptation Indicators

Adaptation interventions aim at building resilience and reducing vulnerability rather than directly cutting emissions. Their results are usually measured through qualitative and resilience-based metrics, such as:

- Community land use plans developed and % of land under such plans
- Improvements in water security
- % of farms using compost/organic manure
- Protection of coastal and marine ecosystems

While a few adaptation interventions (e.g., afforestation, soil carbon enhancement) provide measurable GHG benefits, the majority are monitored through non-GHG indicators, often aligned with Nature-Based Solutions (NBS).

Reference to Annexure

To ensure consistency, transparency, and comparability across sectors, the Annex provides for each indicator a stepwise explanation of the conversion or tracking process, including:

1. Indicator definition and scope
2. Data requirements (activity data, baselines, units, frequency)
3. Applicable emission factors and reference methodologies
4. Step-by-step calculation procedures

5. Guidance for adaptation indicators where GHG impacts are not directly quantifiable
6. Reporting format for integration into the MauNDC Registry

This structured approach ensures that:

- Mitigation indicators are consistently translated into measurable GHG impacts.
- Adaptation indicators are systematically tracked through resilience metrics.

Together, they provide a comprehensive picture of climate action and its outcomes.

Chapter 6: Integration into the MauNDC Registry

6.1 Template Structure and Key Elements

To enable standardized, comparable, and transparent reporting of climate actions, the MauNDC Registry requires a structured template for all indicator entries. A harmonized format ensures that data collected across sectors can be aggregated and analysed consistently, thereby supporting national reporting obligations under the ETF of the Paris Agreement. The template design also ensures compatibility with existing data systems and facilitates stakeholder use by providing clarity on definitions, data requirements, and reporting responsibilities.

To ensure standardized and comparable entries, all indicators in the MauNDC Registry should follow a structured template. This not only strengthens transparency and consistency but also facilitates aggregation and reporting under the ETF. The proposed template includes the following key elements:

Intervention Name: Clear identification of the intervention, directly linked to an NDC target, policy, or measure.

↓

Sector & Sub-Sector: Classification (e.g., Energy → Power Generation; Waste → Solid Waste Management).

↓

Type of Indicator: GHG (e.g., tCO_2e reduced) or non-GHG (e.g., number of beneficiaries, hectares restored).

↓

Activity Data Required: Parameters and units (e.g., MWh generated, tonnes of waste composted).

↓

Data Source & Responsible Agency: Institution mandated for data collection and reporting (e.g., CEB, Statistics Mauritius, MoE).

↓

Emission Factor or Reference Method Applied: Specification of whether a national factor, IPCC default, or international methodology is used.

↓

Frequency of Reporting: Annual, biannual, or project-based depending on intervention.

↓

Validation/Verification Status: Status of internal review, cross-checks, and/or third-party validation.

↓

Metadata: Notes on assumptions, proxy data, or caveats to enhance transparency.

Figure 6: Elements of the Proposed template

This structure ensures compatibility with existing modules in the MauNDC Registry while meeting ETF requirements for clarity, comparability, and completeness.

6.2 Worked Examples of Selected NDC Interventions

To ensure consistency, transparency, and comparability, all interventions recorded in the MauNDC Registry must demonstrate how indicators are converted into measurable outcomes either in the form of GHG emission reductions or non-GHG adaptation and resilience benefits. The worked examples below illustrate how the registry template can be applied across different sectors. They show the stepwise process of moving from intervention-specific indicators to measurable results, and how both activity data and outcomes are systematically captured in the Registry. This allows interventions to be classified, monitored, and reported in a structured manner under the Enhanced Transparency Framework (ETF).
Detailed Guidance on each indicator is explained in the Annexures

6.2.1 Energy Sector (GHG)

- **Intervention:** Promote end-use energy efficiency as part of the decarbonisation of the electricity system.
- **Indicator:** Emission reductions from energy efficiency (tCO_2e/year).
- **Conversion:**
    1. **Project boundary:** Identify households, industries, or buildings included define monitoring period; specify energy sources (electricity, fossil fuels).
    2. **Baseline scenario:** Estimate baseline energy consumption using National Grid Emission Factor. Apply emission from national grid data.
    3. **Project scenario:** Record post-intervention energy consumption through metering or billing.
    4. **Emission reductions:** Subtract project emissions from baseline emissions → apply national grid emission factors → result expressed in tCO_2e avoided.
- **Registry Entry:** Captures both activity data (baseline and post-intervention energy consumption in MWh or TJ) and outcome (tCO_2e reduced). Provides transparent linkage between technical efficiency gains and national climate targets.

Example: Promoting Energy Efficiency in a Commercial Building
Project Scope:
- 1 commercial building in Mauritius
- Energy source: Electricity from the national grid
- Monitoring period: 1 year

Step 1: Baseline Scenario
- Baseline electricity consumption (before energy efficiency measures): 500 MWh/year
- National grid emission factor: $0.7521\ tCO_2e/MWh$ (March 2025 from CEB)

Baseline emissions:

$$500\ MWh \times 0.7521\ tCO_2e/MWh = 376\ tCO_2e/year$$

Step 2: Project Scenario
- After implementing LED lighting, efficient HVAC, and smart meters, post-intervention consumption: 400 MWh/year

Project emissions:

$$400\ MWh \times 0.7521\ tCO_2e/MWh = 301\ tCO_2e/year$$

Step 3: Emission Reductions

$$Emission\ reductions = Baseline\ emissions - Project\ emissions = 376 - 301 = 75\ tCO_2e/year$$

Step 4: Registry Entry

6.2.2 Land use, Land Use Change and Forestry (Non-GHG)

- **Intervention:** Mangrove restoration to enhance climate resilience and protect coastal ecosystems.
- **Indicator:** Hectares of mangroves restored.
- **Conversion:**
  1. **Activity data:** Area of mangroves restored (hectares), type of species replanted, and location.
  2. **Co-benefits:** Recorded as non-GHG indicators such as improved biodiversity, reduced coastal erosion, and strengthened community resilience.
  3. **Optional GHG linkages:** In cases where biomass growth and soil carbon are measured, carbon sequestration benefits can be estimated.
- **Registry Entry:** Records hectares restored, qualitative co-benefits (ecosystem resilience, biodiversity), and optional quantitative GHG benefits if measured. Classified as a **non-GHG adaptation indicator** aligned with Nature-Based Solutions (NBS).

Example: Mangrove Restoration Project

Project Scope:

- Location: Coastal area in Mauritius
- Restoration area: 50 hectares
- Species: *Rhizophora mucronata and Avicennia marina*
- Monitoring period: 1 year

Step 1: Baseline Scenario

- Area restored: 50 hectares
- Species planted: Rhizophora mucronata, Avicennia marina
- Location: Specific coastal coordinates or site name

Step 2: Co-Benefits (Non-GHG Indicators)

Indicator	Measurement / Description
Biodiversity improvement	Presence of 10+ fish species and migratory birds observed
Coastal protection	Estimated reduction in shoreline erosion by 5 meters along restored site
Community resilience	20 local fishers engaged in restoration and maintenance activities

Step 3: Optional GHG Linkages

- Biomass growth: 5 tC/ha/year (tons of carbon per hectare per year)
- Total carbon sequestered:

$$50\ ha \times 5\ tC/ha/year = 250\ tC/year \approx 917 tCO2e/year$$

(using 1 tC = 3.67 tCO_2e)

This step is optional; if biomass and soil carbon are not monitored, the intervention remains purely non-GHG.

Step 4: Registry Entry

These examples show how the MauNDC Registry captures both GHG and non-GHG indicators, linking measurable activity data to climate impacts. Energy efficiency interventions report emissions reductions, while mangrove restoration tracks hectares restored and ecosystem co-benefits, with optional carbon estimates. This ensures transparent, consistent, and effective tracking of NDC implementation.

6.3 Data Entry and Quality Control Procedures

To ensure that NDC interventions are accurately captured and reported in line with the Biennial Transparency Report (BTR), clear procedures for data entry, review, and quality assurance are essential.

Data Entry Process

1. **Select Intervention** – Identify the intervention and choose the corresponding MauNDC Registry fields.
2. **Input Activity Data** – Enter quantitative data in standardized units (e.g., MWh, tCO_2e, hectares) to maintain consistency across the registry.
3. **Assign Responsibility** – Record the institution or agency responsible for the data and verify the source for reliability.
4. **Apply Methodologies and Emission Factors** – Use national emission factors or approved methodologies first; fall back on international references (IPCC, UNFCCC) only if national data are unavailable.
5. **Include Metadata** – Document assumptions, proxies, data gaps, and limitations to provide context for reviewers and future audits.
6. **Submit for Review** – Save the entry and flag it for internal verification to ensure accuracy before finalizing.

Handling Common Data Challenges

Proactively addressing common issues such as missing data, inconsistent units, and proxy use is essential to ensure accurate and reliable entries in the MauNDC Registry.

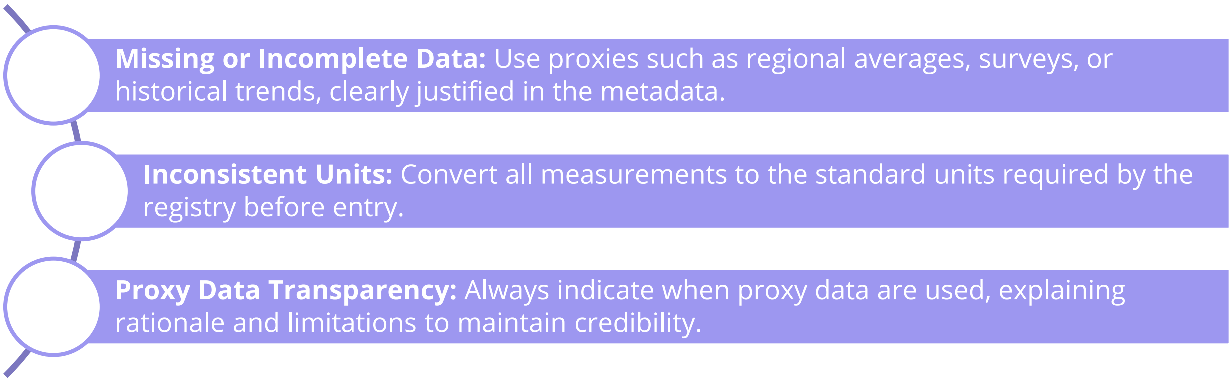

Figure 7: Common Data Challenges

Metadata and Quality Assurance

Proactively addressing common issues such as missing data, inconsistent units, and proxy use is essential to ensure accurate and reliable entries in the MauNDC Registry**.**

- **Transparency:** Metadata captures the assumptions, methods, and limitations behind each entry.
- **Consistency:** Ensures uniformity across reporting cycles and facilitates comparison over time.
- **BTR Alignment:** Structured data entry and detailed metadata allow direct integration with BTR submissions, supporting both national and international reporting obligations.

Chapter 7: Results and Improvements Achieved

7.1 Enhanced Data Consistency and Availability

The implementation of this deliverable has significantly strengthened the collection, organization, and accessibility of climate-related indicators within the MauNDC Registry. By systematically covering all priority sectors under Mauritius's NDC including Energy, Transport, Waste, Agriculture, Forestry and Other Land Use (AFOLU), Industry, Water, And Tourism the registry now provides a comprehensive representation of the country's climate mitigation and adaptation activities.

A standardized template for indicator entry has been developed, which defines clear fields for intervention names, sectoral classifications, units of measurement, baseline and target values, data sources, and reporting frequency. This structured approach has markedly reduced variations in reporting formats and ensured that all indicators are consistently captured, facilitating comparability across interventions and sectors.

Moreover, this initiative has fostered better integration of inputs from multiple institutions and line ministries. By reducing data fragmentation and promoting harmonization across government departments, the registry is progressing towards a coordinated national system rather than a collection of isolated datasets. This institutional integration not only improves internal data management but also strengthens Mauritius's alignment with the ETF under the Paris Agreement. It ensures that national data flows are robust, harmonized, and capable of supporting transparent and credible international reporting.

Key outcomes of this improved data consistency include:

- Comprehensive coverage of all NDC priority sectors.
- Standardized metadata capturing assumptions, methodologies, and limitations.
- Reduced discrepancies in indicator reporting between ministries.
- Stronger institutional coordination fostering harmonized data inputs.

7.2 Improved Accuracy in Estimating GHG and Non-GHG Outcomes

The integration of refined emission factors has enhanced the accuracy of GHG quantification in the registry. Nationally derived emission factors have been prioritized where available, while IPCC default values have been applied systematically in the absence of local data. This approach ensures that reported GHG reductions are both realistic and scientifically robust.

In parallel, non-GHG indicators such as jobs created, hectares of land restored, energy access rates, or improved water efficiency have been systematically linked to measurable GHG outcomes. By connecting socio-economic and environmental indicators to emission reductions, the MauNDC Registry can now be enhanced to provide a dual perspective that captures both climate mitigation and adaptation impacts.

A critical improvement has been the enhanced documentation of assumptions, data sources, and methodologies for each indicator. Detailed metadata ensures transparency, facilitates replicability of calculations, and supports peer verification. This rigorous documentation strengthens the credibility of reported outcomes and enables meaningful comparisons of intervention performance across sectors and over time.

7.3 Lessons Learned and Recommendations

The experience of developing, testing, and operationalizing indicators for the MauNDC Registry has provided valuable insights into both technical and institutional aspects of national climate data management. This process has highlighted the critical importance of coordination among sectoral institutions, rigorous methodology application, and systematic capacity-building to ensure reliable and consistent data. The lessons learned not only reflect practical challenges encountered during implementation but also inform strategies for strengthening long-term sustainability, transparency, and effectiveness of the registry as a central tool for monitoring Mauritius's NDC commitments.

Early and Continuous Coordination

- Engaging sectoral institutions early in the process ensures timely data sharing, reduces duplication of efforts, and minimizes gaps in indicator coverage.

Capacity Building is Critical

- Continuous training for data entry technicians and institutional focal points is essential for maintaining data quality and ensuring consistent application of methodologies across sectors.

Dual Indicator Integration

- Embedding both GHG and non-GHG indicators enriches the registry, allowing it to capture climate mitigation and adaptation outcomes in a holistic manner.

Iterative Testing and Refinement

- Piloting indicators before full integration helps identify challenges in data collection, computation, and usability, allowing methods to be refined before final implementation.

Institutional Ownership

- Assigning clear responsibilities to ministries and agencies fosters accountability and ensures long-term sustainability of indicator management processes.

Figure 8: Lessons Learned and Recommendations

7.4 Recommendations for Future Updates and Sustainability

Building on the progress achieved in strengthening data consistency, accuracy, and institutional coordination, it is essential to implement forward-looking measures to maintain and enhance the MauNDC Registry over time. Sustaining these improvements requires a combination of institutional anchoring, continuous capacity development, technological integration, and alignment with international best practices.

The following recommendations provide a roadmap to ensure that the registry remains a robust, reliable, and evolving tool capable of supporting transparent reporting, informed policymaking, and Mauritius's long-term climate objectives.

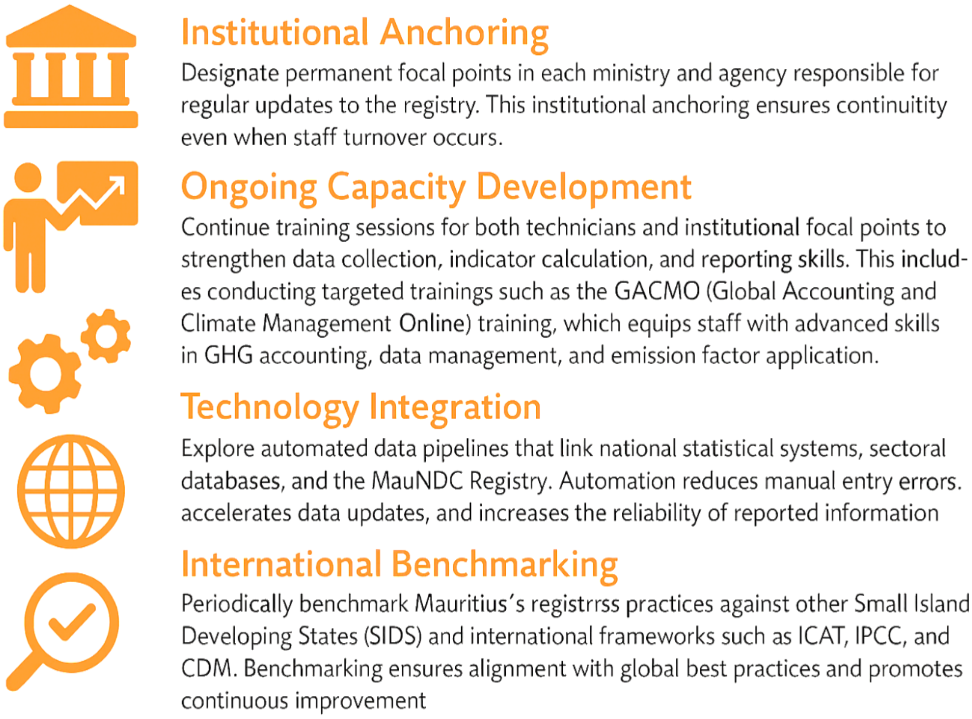

Figure 9: Recommendations for Future Updates and Sustainability

By adopting these recommendations, the MauNDC Registry can remain a dynamic and credible tool for national reporting, ETF compliance, and international climate transparency. The registry will continue to provide reliable insights for policymaking, enable tracking of progress toward NDC targets, and support Mauritius's long-term climate goals.

Conclusion

Deliverable 5 marks a significant milestone in operationalizing the MauNDC Registry as a robust, transparent, and scientifically credible tool for climate governance in Mauritius. Through standardized GHG and non-GHG indicators, supported by sector-specific emission factors and international methodologies, the registry now provides a comprehensive framework for tracking NDC implementation while capturing both mitigation and adaptation outcomes.

Key achievements include enhanced data consistency via standardized templates and metadata, improved accuracy through refined emission factors, strengthened institutional integration across ministries, and the ability to track dual impacts linking climate action with social and environmental benefits.

To sustain these improvements, it is recommended to anchor responsibilities institutionally, continue capacity development including GACMO training, integrate technology to streamline data flows, benchmark against international frameworks like ICAT and IPCC, and embed indicator management within the broader climate governance framework. These measures will ensure that the MauNDC Registry remains a dynamic, credible, and future-ready platform supporting transparent reporting and effective climate action in Mauritius.

Annexures

Annex-A: Mitigation Indicators Methodologies

A. Energy/Energy Industries

Emission reductions from energy

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Decarbonisation of the electricity system using renewable energies and demand side energy efficiency	Promote end-use energy efficiency	Emission reductions from energy efficiency (tCO_2e/year)	https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf

Step 1: Define the Project Boundary

- Identify all facilities, households, or sectors included in the intervention (e.g., industrial motors, commercial buildings, residential appliances).
- Define the time period of monitoring.
- Establish energy sources included (electricity, fossil fuels, etc.).

Step 2: Establish the Baseline Scenario

- Use **TOOL02**: *Combined Tool to Identify the Baseline Scenario and Demonstrate Additionality*[1].
- Use IPMVP (International Performance Measurement and Verification Protocol).
- Baseline emissions are calculated using:

$$Emission_{Baseline} = \sum_{j} (E_{Baseline,j} \times EF_j)$$

  - $E_{Baseline,j}$ = baseline energy consumption (MWh or TJ) by source *j*.
  - EF_j = emission factor (tCO_2/MWh for electricity, tCO_2/TJ for fuels).
  - Sources for emission factors: IPCC (default), or country-specific grid factors.

Step 3: Determine the Project Scenario

- Measure actual post-intervention energy consumption (e.g., metering, billing data, or monitored equipment performance).
- Calculate project emissions:

$$Emission_{Project} = \sum_{j} (E_{Project.j} \times EF_j)$$

- $E_{Project,j}$ = actual energy consumption after intervention (MWh or TJ).
- EF_j = emission factor (same source as baseline).

Step 4: Calculate Energy Savings

[1] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v2.2.pdf/history_view

- Subtract post-intervention energy use from baseline energy use:

$$Emission\ Reductions\ (tCO^2e) = Emission_{Baseline} - Emission_{Project}$$

Step 5: Apply Emission Factors

- Use **National Grid emission factor**[2].
- For electricity:
    - Use IPCC default emission factors or national grid emission factors (e.g., kg CO_2/kWh).

Share of renewable energy in electricity mix (%)

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Decarbonisation of the electricity system using renewable energies and demand side energy efficiency	Enhancing renewable energy sources in the electricity mix, with completed phase out of coal before 2030	Share of renewable energy in electricity mix (%)	https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html

Step 1: Define the Project Boundary

- Electricity generation sector, including all grid-connected power plants.
- Define time period of monitoring (annual basis).
- Identify renewable sources (solar, wind, hydro, biomass, geothermal) and fossil-based generation (coal, oil, gas)[3].

Step 2: Establish the Baseline Scenario

- Determine historical electricity mix (share of coal, oil, gas, renewables).
- Collect baseline activity data: total electricity generation by source (MWh/year).
- Calculate baseline share of renewable energy:

$$RE_{Baseline}(\%) = \frac{Generation_{RE,Baseline}}{Generation_{Total,Baseline}} \times 100$$

  - RE = Renewable Energy share in the mix (%)
  - $Generation_{RE,Baseline}$ = amount of electricity generated from renewable sources in the baseline year (MWh).
  - $Generation_{Total,Baseline}$ = total electricity generated from **all sources** (renewables + fossil fuels) in the baseline year (MWh).
- Methodological reference: **IPCC (2006, Volume 2 – Energy, Chapter 1: Introduction)**.

Step 3: Determine the Project Scenario

- Measure actual electricity generation from all renewable sources after intervention.
- Calculate project renewable energy share:

$$RE_{Baseline}(\%) = \frac{Generation_{RE,Project}}{Generation_{Total,Project}} \times 100$$

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[2] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v1.1.pdf/history_view
[3] https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html

- $Generation_{RE,Project}$ = renewable electricity generated in the project/monitoring year (MWh).
- $Generation_{Total,Project}$ = total electricity generated in the project/monitoring year (MWh).

Step 4: Calculate Change in Renewable Energy Share

- Compare project scenario with baseline:

$$\Delta RE(\%) = RE_{Project} - RE_{Baseline}$$

- This indicator provides a non-GHG measure of progress towards electricity system decarbonisation, consistent with reporting under the ETF (UNFCCC).

Step 5: Estimate Associated Emission Reductions (Optional)

- Multiply fossil generation displaced by grid emission factor.
- Formula:

$$Emission\ Reductions\ (tCO2e) = RE_{project} \times EF_{Grid}$$

  - $\mathbf{RE_{project}}$ = Renewable Electricity Generated by NDC-related RE projects in the year (MWh).
  - EF_{Grid} = grid emission factor (tCO_2/MWh).

- Apply **TOOL07: Tool to Calculate the Emission Factor for an Electricity System (UNFCCC, 2015)**.
- Use either **IPCC default emission factors (2006, 2019 Refinement)** or country-specific grid emission factors.

B. Transport (Land Shipping and Aviation)

Annual fuel consumption by vehicle category (litres)

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Towards a sustainable low-carbon land transport system in Mauritius	Improved fuel economy of vehicles	Annual fuel consumption by vehicle category (litres)	https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf

Step 1: Define the Project Boundary

- Identify all vehicles included in the intervention (e.g., cars, buses, trucks).
- Identify all fuel types used by vehicles (e.g., diesel, petrol, LPG).

Step 2: Establish the Baseline Scenario

- Use **TOOL02**: *Combined Tool to Identify the Baseline Scenario and Demonstrate Additionality*.
- Determine what the fuel consumption would have been without the intervention using:[4]

$$Emissions = \sum_j (Fuel_j \times EF_j)$$

  - Emissions = Emissions (kg)
  - $Fuel_j$ = fuel consumed (TJ)
  - EF_j = emission factor (kg/TJ)
  - j = fuel type

[4] https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf

- Use historical fuel consumption data or model projections.

Step 3: Determine the Project Scenario

- Measure actual fuel consumption (vehicle wise) after implementing the improved fuel measures (e.g., replacing diesel buses with CNG buses) using:[5]

$$Emissions = \sum_j (Fuel_j \times EF_j)$$

  - Emissions = Emissions (kg)
  - $Fuel_j$ = fuel consumed (TJ)
  - EF_j = emission factor (kg/TJ)
  - j = fuel type
- Ensure monitoring is consistent with CDM guidelines

Step 4: Calculate Emission Savings

- Subtract project emissions from baseline emissions

Total vehicle hours lost due to congestion per year

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Towards a sustainable low-carbon land transport system in Mauritius	Decreasing peak time congestion to improve traffic fluidity	Total vehicle hours lost due to congestion per year	https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf?utm https://www.researchgate.net/publication/321486249_Estimation_of_fuel_loss_due_to_idling_of_vehicles_at_a_signalized_intersection_in_Chennai_India

Step 1: Define the Project Boundary

- Identify vehicle type included in the intervention (e.g., cars, buses, trucks).
- Identify fuel types included in the intervention (e.g., diesel, petrol, LPG).
- Define the area of project intervention (major corridors, city-wide).

Step 2: Establish the Baseline Scenario

- Use **TOOL02**: *Combined Tool to Identify the Baseline Scenario and Demonstrate Additionality*.
- Convert vehicle-hours lost into fuel consumption using: [6]

$$Total\ fuel\ consumption\ in\ litres\ for\ a\ particular\ vehicle\ type = \left[Fuel\ consumption\ rate\ for\ one\ vehicle\ \left(\frac{ml}{hr}\right) \times\ Total\ red\ time \times No.of\ idling\ vehicles\right] \div 1000$$

- Determine what the fuel consumption would have been without the intervention using:[7]

[5] https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf

[6] https://www.researchgate.net/publication/321486249_Estimation_of_fuel_loss_due_to_idling_of_vehicles_at_a_signalized_intersection_in_Chennai_India

[7] https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf?utm

$$Emissions = \sum_j (Fuel_j \times EF_j)$$

- Emissions = Emissions (kg)
- $Fuel_j$ = fuel consumed (TJ)
- EF_j = emission factor (kg/TJ)
- j = fuel type

- Use historical fuel consumption data or model projections.

Step 3: Determine the Project Scenario

- Measure total vehicle-hours lost after the intervention (e.g., after traffic optimization, signal improvements, or low-congestion measures).
- Convert the vehicle-hours saved into fuel saved using the same formula.[8]

$$Total\ fuel\ consumption\ in\ litres\ for\ a\ particular\ vehicle\ type = \left[Fuel\ consumption\ rate\ for\ one\ vehicle\ \left(\frac{ml}{hr}\right) \times Total\ red\ time\ (post\ project\ implementation) \times No.of\ idling\ vehicles\right] \div 1000$$

- Calculate project emissions:[9]

$$Emissions = \sum_j (Fuel_j \times EF_j)$$

- Emissions = Emissions (kg)
- $Fuel_j$ = fuel consumed (TJ)
- EF_j = emission factor (kg/TJ)
- j = fuel type

- Ensure monitoring is consistent with CDM guidelines

Step 4: Calculate Emission Savings

- Subtract project emissions from baseline emissions

Annual sales of electric/hybrid vehicles (units)

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Towards a sustainable low-carbon land transport system in Mauritius	Reducing consumption of fossil fuels through increased adoption of lower-carbon vehicles	Annual sales of electric/hybrid vehicles (units)	AMS-III.C: Emission reductions by electric and hybrid vehicles

Step 1: Define the Project Boundary

- Identify vehicle type included in the intervention (e.g., cars, buses, trucks).
- Identify baseline fuel types included in the intervention (e.g., diesel, petrol, LPG).
- Identify the geographic boundaries where the project activity vehicles are operated.
- Identify the charging service providers for the project vehicles, including the charging

[8] https://www.researchgate.net/publication/321486249_Estimation_of_fuel_loss_due_to_idling_of_vehicles_at_a_signalized_intersection_in_Chennai_India
[9] https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf?utm

equipment, stations, electricity sources (grid or renewable), and any supporting facilities.

Step 2: Establish the Baseline Scenario[10]

- Use **TOOL02**: *Combined Tool to Identify the Baseline Scenario and Demonstrate Additionality* and **CDM Methodology AMS-III.C**: *Emission reductions by electric and hybrid vehicles*
- Establish the number of the project vehicles in operation ($N_{i,y}$) through annual sales records or official data on registered project vehicles cross-checked against the results from a representative sample survey vehicles to determine the percentage of vehicles in use.
- Calculate emission factor for baseline vehicle category ($EF_{BL,km,i}$).[11]

$$EF_{BL,km,i} = SFC_i \times NCV_{BL,i} \times EF_{BL,i} \times IR^t$$

  - SFC_i = Specific fuel consumption of baseline vehicle category i (g/km)
  - $NCV_{BL,i}$ = Net calorific value of fossil fuel consumed by baseline vehicle category I (J/g)
  - $EF_{BL,i}$ = Emission factor of fossil fuel consumed by baseline vehicle category i (g CO2/J) t
  - IR^t = Technology improvement factor for baseline vehicle in year t (default value of the technology improvement factor for all baseline vehicle categories is 0.99)
  - T = Year counter for the annual improvement (dependent on age of data per vehicle category)

- Calculate baseline emissions by using distance travelled by project vehicles via the following equation:[12]

$$BE_y = \sum_i EF_{BL,km,i} \times DD_{i,y} \times N_{i,y} \times 10^{-6}$$

  - BE_y = Total baseline emissions in year y (t CO2)
  - $EF_{BL,km,i}$ = Emission factor for baseline vehicle category i (g CO2/km)
  - $DD_{i,y}$ = Annual average distance travelled by project vehicle category i in the year y (km)
  - $N_{i,y}$ = Number of operational project vehicles in category i in year y

- Use historical fuel consumption data or model projections.

Step 3: Determine the Project Scenario

- Establish the number of the project vehicles in operation ($N_{i,y}$) through annual sales records or official data on registered project vehicles cross-checked against the results from a representative sample survey vehicles to determine the percentage of vehicles in use.
- Calculate emission factor for project vehicle category ($EF_{PJ,km,i,y}$).[13]

$$EF_{PJ,km,i,y} = \sum_i SEC_{PJ,km,i,y} \times \frac{EF_{elect,y}}{(1-TDLy)} \times 10^{-3} + \sum_i SEC_{PJ,km,i,y} \times NCV_{PJ,i} \times EF_{PJ,i} \times 10^{-6}$$

  - $SEC_{PJ,km,i,y}$ = Specific electricity consumption by project vehicle category i per km in year y in urban conditions (kWh/km)

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10 The baseline scenario assumes that, in the absence of the project, the newly adopted electric vehicles would have otherwise been conventional fossil fuel vehicles.

11 AMS-III.C: Emission reductions by electric and hybrid vehicles

12 AMS-III.C: Emission reductions by electric and hybrid vehicles

13 AMS-III.C: Emission reductions by electric and hybrid vehicles

- $EF_{elect,y}$ = CO2 emission factor of electricity consumed by project vehicle category i in year y (kg CO2/kWh)
- $SFC_{PJ,km,i,y}$ = Specific fossil fuel consumption by project vehicle category i per km in year y in urban conditions (g/km). For electric vehicle the value is 0.
- $EF_{PJ,i}$ = CO2 emission factor of fossil fuel consumed by project vehicle category i in year y (g CO2/J)
- $NCV_{PJ,i}$ = Net calorific value of the fossil fuel consumed by project vehicle category i in year y (J/g)
- TDL_y = Average technical transmission and distribution losses for providing electricity in the year y)

- Calculate the project emissions for the project (electric/hybrid) vehicles via the following equation:[14]

$$PE_y = \sum_i EF_{PJ,km,i,y} \times DD_{i,y} \times N_{i,y}$$

- PE_y = Total baseline emissions in year y (t CO2)
- $EF_{PJ,km,i,y}$ = Emission factor per kilometer travelled by the project vehicle type i
- (t CO2/km)
- $DD_{i,y}$ = Annual average distance travelled by project vehicle category i in the year y (km)
- $N_{i,y}$ = Number of operational project vehicles in category i in year y

- Ensure monitoring is consistent with CDM guidelines

Step 4: Calculate Emission Savings

- Subtract project emissions from baseline emissions

Electricity consumption by electric public transport (MWh/year)

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Towards a sustainable low-carbon land transport system in Mauritius	Electrification of mass transit mode of passenger transport	Electricity consumption by electric public transport (MWh/year)	https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf?utm https://www.researchgate.net/publication/321486249_Estimation_of_fuel_loss_due_to_idling_of_vehicles_at_a_signalized_intersection_in_Chennai_India

Step 1: Define the Project Boundary

- Identify vehicle type included in the intervention (e.g., cars, buses, trucks).
- Identify baseline fuel types included in the intervention (e.g., diesel, petrol, LPG).
- Identify the geographic boundaries where the project activity vehicles are operated.
- Identify the charging service providers for the project vehicles, including the charging equipment, stations, electricity sources (grid or renewable), and any supporting facilities.

[14] AMS-III.C: Emission reductions by electric and hybrid vehicles

Step 2: Establish the Baseline Scenario[15]

- Use **TOOL02**: *Combined Tool to Identify the Baseline Scenario and Demonstrate Additionality* and **CDM Methodology AMS-III.C**: *Emission reductions by electric and hybrid vehicles*
- Calculate emission factor for baseline vehicle category ($EF_{BL,km,i}$).[16]

$$EF_{BL,km,i} = SFC_i \times NCV_{BL,i} \times EF_{BL,i} \times IR^t$$

  - ➢ SFC_i = Specific fuel consumption of baseline vehicle category i (g/km)
  - ➢ $NCV_{BL,i}$ = Net calorific value of fossil fuel consumed by baseline vehicle category I (J/g)
  - ➢ $EF_{BL,i}$ = Emission factor of fossil fuel consumed by baseline vehicle category i (g CO2/J) t
  - ➢ IR^t = Technology improvement factor for baseline vehicle in year t (default value of the technology improvement factor for all baseline vehicle categories is 0.99
  - ➢ T = Year counter for the annual improvement (dependent on age of data per vehicle category)

- Calculate baseline emissions by using distance travelled by project vehicles via the following equation:[17]

$$BE_y = \sum_i EF_{BL,km,i} \times DD_{i,y} \times N_{i,y} \times 10^{-6}$$

  - ➢ BE_y = Total baseline emissions in year y (t CO2)
  - ➢ $EF_{BL,km,i}$ = Emission factor for baseline vehicle category i (g CO2/km)
  - ➢ $DD_{i,y}$ = Annual average distance travelled by project vehicle category i in the year y (km)
  - ➢ $N_{i,y}$ = Number of operational project vehicles in category i in year y

- Use historical fuel consumption data or model projections.

Step 3: Determine the Project Scenario

- Establish the number of the project vehicles in operation ($N_{i,y}$) through annual sales records or official data on registered project vehicles cross-checked against the results from a representative sample survey vehicles to determine the percentage of vehicles in use.
- Calculate emission factor for project vehicle category ($EF_{PJ,km,i,y}$).[18]

$$EF_{PJ,km,i,y} = \sum_i SEC_{PJ,km,i,y} \times \frac{EF_{elect,y}}{(1 - TDLy)} \times 10^{-3} + \sum_i SEC_{PJ,km,i,y} \times NCV_{PJ,i} \times EF_{PJ,i} \times 10^{-6}$$

  - ➢ $SEC_{PJ,km,i,y}$ = Specific electricity consumption by project vehicle category i per km in year y in urban conditions (kWh/km)
  - ➢ $EF_{elect,y}$ = CO2 emission factor of electricity consumed by project vehicle category i in year y (kg CO2/kWh)
  - ➢ $SFC_{PJ,km,i,y}$ = Specific fossil fuel consumption by project vehicle category i per km in year y in urban conditions (g/km). For electric vehicle the value is 0.

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15 The baseline scenario assumes that, in the absence of the project, the newly adopted electric vehicles would have otherwise been conventional fossil fuel vehicles.
16 AMS-III.C: Emission reductions by electric and hybrid vehicles
17 AMS-III.C: Emission reductions by electric and hybrid vehicles
18 AMS-III.C: Emission reductions by electric and hybrid vehicles

- $EF_{PJ,i}$ = CO2 emission factor of fossil fuel consumed by project vehicle category i in year y (g CO2/J)
- $NCV_{PJ,i}$ = Net calorific value of the fossil fuel consumed by project vehicle category i in year y (J/g)
- TDL_y = Average technical transmission and distribution losses for providing electricity in the year y)

- Calculate the project emissions using the electricity used to charge the vehicles via the following equation:[19]

$$PE_y = \sum_i EF_{PJ,km,i,y} \times EC_{PJ,i,y} \div SEC_{PJ,km,i,y}$$

  - $EC_{PJ,i,y}$ = Electricity consumed by the project vehicles of type i in year y (kWh)
  - $SEC_{PJ,km,I,y}$ = Electricity consumed by the project vehicles of type i in year y (kWh)
  - i = Vehicle types of project activities
- Ensure monitoring is consistent with CDM guidelines

Step 4: Calculate Emission Savings

- Subtract project emissions from baseline emissions

C. Solid Waste Management

Composting of Organic Waste

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Avoided emissions at landfills from a circular waste economy	Composting of the putrescible fraction of solid waste	Tons of organic waste composted annually	https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/5_Volume5/19R_V5_3_Ch03_SWDS.pdf https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_4_Ch4_Bio_Treat.pdf

Step 1: Define the Project Boundary

- Solid waste management system (municipal solid waste stream).
- Include only composting facilities diverting organic waste from landfills.
- Monitoring period: Annual.

Step 2: Establish the Baseline Scenario

- Baseline assumes putrescible waste is disposed of in landfills, generating methane emissions.
- Baseline CH_4 emissions from landfills are estimated using **IPCC 2006 Waste Model (First Order Decay method, Volume 5, Chapter 3)**

$$CH_{4,Baseline} = MSWT \times MSWF \times MCF \times DOC \times DOC_f \times F \times \frac{12}{16} \times (1 - R) \times (1 - OX)$$

  - **MSWT** = total municipal solid waste generated (tons/year).

[19] AMS-III.C: Emission reductions by electric and hybrid vehicles

- **MSWF** = fraction of waste disposed to landfill.
- **MCF** = methane correction factor (0.4–1.0).
- **DOC** = degradable organic carbon fraction.
- **DOC_f** = fraction of DOC that decomposes.
- **F** = fraction of methane in landfill gas (0.5 default).
- **R** = methane recovery (if any).
- **OX** = oxidation factor (0–0.1).

Step 3: Determine the Project Scenario

- In the project, organic waste is composted rather than landfilled.
- Composting produces negligible methane compared to landfilling.
- Project emissions mainly include small amounts of CO_2 and N_2O (can be included if data available, per **IPCC 2006, Vol. 5, Ch. 4**).

Step 4: Calculate Emission Reductions

- Avoided methane is the difference between baseline landfill emissions and project composting emissions:

$$ER = (CH_{4,Baseline} - CH_{4,Project}) \times GWP_{CH4}$$

- $CH_{4,Project}$ = methane from composting (usually negligible or estimated at ~0.005 tons CH_4/ton waste).
- GWP_{CH4} = global warming potential of methane (per IPCC AR6: 27.2 over 100 years).

Step 5: Apply Emission Factors

- Default factors provided in **IPCC 2006, Vol. 5, Ch. 4** for composting[20].
- National or facility-specific data can replace defaults if available.

Recycling of Municipal Solid Waste

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Avoided emissions at landfills from a circular waste economy	Recycling of municipal solid waste	Recycling rate (% of total MSW)	https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

Step 1: Define the Project Boundary

- Municipal solid waste (MSW) management system.
- Includes all recyclable streams (paper, plastics, metals, glass, etc.).
- Monitoring period: annual.

Step 2: Establish the Baseline Scenario

- Baseline assumes recyclable waste is landfilled or incinerated without energy recovery.
- No significant recycling activities considered.

Step 3: Determine the Project Scenario

- Record the amount of MSW collected and the portion sent for recycling.

[20] https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_4_Ch4_Bio_Treat.pdf

- Data sources: municipal records, waste management facilities, or national statistics.

Step 4: Calculate the Indicator

$$Recycling\ Rate(\%) = \frac{MSW_{Recycled}}{MSW_{Total}} \times 100$$

- ➢ $MSW_{Recycled}$ = Quantity of municipal solid waste recycled (tons/year).
- ➢ MSW_{Total} = Total municipal solid waste generated (tons/year).

Step 5: Calculate Avoided Emissions

$$ER_{Recycling} = \sum_i (Qi \times EFi)$$

- ➢ $ER_{Recycling}$ = Emission reductions from recycling (tCO_2e/year)
- ➢ Q_i = Quantity of material *i* recycled (tons/year)
- ➢ EF_i = Emission factor for recycling material *i* (tCO_2e/ton)

Step 5: Apply Global Warming Potentials (GWPs)

- For methane avoided: use IPCC AR6 GWP for CH_4 = 27.2 (100-year)[21].
- For upstream displacement: apply material-specific lifecycle emission factors (e.g., aluminium ≈ 9.1 tCO_2e/ton recycled vs virgin).

Link to Climate Benefits

- Higher recycling rates reduce demand for virgin materials, lowering upstream energy use and emissions.
- Also avoids methane emissions from landfill disposal of recyclable fractions (refer to IPCC Vol. 5, Ch. 3 for landfill methane calculation)[22].

Energy Recovery from Municipal Solid Waste

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Avoided emissions at landfills from a circular waste economy	Energy recovery from municipal solid waste	Energy generated from waste-to-energy (MWh/year)	https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html

Step 1: Define the Project Boundary

- MSW-to-energy plants converting municipal solid waste into electricity and/or heat.
- Include all waste streams processed, and energy recovered (MWh/year).
- Monitoring period: annual.

Step 2: Establish the Baseline Scenario

- Baseline assumes all waste would be landfilled, generating methane emissions (CH_4).
- Optional: baseline electricity generation from the national grid mix (fossil fuel-based) to determine displaced emissions.

Step 3: Determine the Project Scenario

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[21] https://www.ipcc-nggip.iges.or.jp/2019-refinement/
[22] https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/5_Volume5/19R_V5_3_Ch03_SWDS.pdf

- Measure actual energy generated from waste-to-energy (MWh/year).
- Identify plant efficiency and emissions from combustion if any.

Step 4: Calculate Avoided Emissions

$$ER_{WTE} = E_{generated} \times EF_{grid} + CH_{4,avoided} \times GWP_{CH4}$$

- ➢ ER_{WTE} = Emission reductions from waste-to-energy (tCO_2e/year)
- ➢ $E_{generated}$ = Net electricity or heat generated (MWh/year)
- ➢ EF_{grid} = Emission factor of displaced grid electricity (tCO_2e/MWh)
- ➢ $CH_{4,avoided}$ = Methane emissions avoided by diverting organic waste from landfill (tCH_4/year)
- ➢ GWP_{CH4} = Global Warming Potential for methane (IPCC AR6: 27.2, 100-year)

Step 5: Apply Emission Factors

- Use **TOOL07** for electricity emission factor or national grid factor[23].
- Use IPCC 2006 defaults for methane generated per ton of landfilled waste (FOD method, Vol. 5, Ch. 3[24])

D. Wastewater Management

Wastewater Management

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Avoided emissions in wastewater management	Reduced methane emissions from the adoption of low-carbon water treatment technologies	Methane avoided in wastewater treatment through more Population connected to the centralised wastewater system (co2e/year)	https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_6_Ch6_Wastewater.pdf

Step 1: Define the Project Boundary

- Centralized wastewater treatment facilities serving residential and commercial populations.
- Include all households or connections added due to intervention.
- Monitoring period: annual.

Step 2: Establish the Baseline Scenario

- Baseline assumes wastewater is untreated or treated with conventional high-emission methods (e.g., septic tanks, anaerobic lagoons).
- CH_4 emissions calculated using **IPCC Tier 2 methodology**:

$$CH_4^{Baseline} = P \times BOD \times EF_{CH4} \times (1 - S)$$

- ➢ $CH_4^{Baseline}$ = Methane emissions without intervention (tCH_4/year)
- ➢ P = Population connected (persons)
- ➢ BOD = Biochemical Oxygen Demand per capita (kg BOD/person/year)

[23] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf
[24] https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html

- EF_{CH4} = Emission factor for untreated wastewater (kg CH_4/kg BOD)
- S = Fraction of methane recovered or destroyed (if any)

Step 3: Determine the Project Scenario

- Calculate methane emissions under the intervention scenario (low-carbon wastewater treatment):

$$CH_4^{Project} = P \times BOD \times EF_{CH4}^{Project} \times (1 - S)$$

- $CH_4^{Project}$ = Emission factor for methane under low-carbon treatment technology (kg CH_4/kg BOD)

Step 4: Calculate Emission Reductions

$$ER_{WW} = (CH_4^{Baseline} - CH_4^{Project}) \times GWP_{CH4}$$

- ER_{WW} = Avoided emissions (tCO_2e/year)
- GWP_{CH4} = Global Warming Potential of methane (IPCC AR6: 27.2, 100-year)

Step 5: Reporting

- **Record activity data:** number of people connected to the treatment system.
- **Record outcome:** avoided methane emissions in tCO_2e/year.
- Include methodology references for transparency and replication.

E. Industrial Processes and Product Use

Phase-down of HFC refrigerants — Annual HFC refrigerants consumption (tCO_2e)

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Reducing the import of HFCs according to the Kigali Amendment to the Montreal Protocol	Phase-Down of hydrofluorocarbons (HFCs) refrigerants in Mauritius	Annual HFC refrigerants consumption (tonnes CO_2e)	https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/reporting-requirements https://ozone.unep.org/treaties/montreal-protocol

Step 1: Define the project boundary and scope

- Geographical: national (Mauritius).
- Source scope: HFCs placed on the market for refrigeration, air-conditioning, foam blowing, aerosols, fire-suppression, etc.
- Time step: annual.
- Data sources: customs/import records, production (if any), exports, destruction records, and stock change estimates.

Step 2: Baseline & project scenarios

- **Baseline consumption (mass)**: annual mass of HFCs placed on the market in the baseline year(s) (tonnes of refrigerant, by compound/species).
- **Project consumption (mass)**: annual mass after phase-down measures (tonnes, by compound).

- Track species (e.g., HFC-134a, HFC-410A, HFC-32, etc.) separately because each has a different GWP[25].

Step 3: Convert mass to GHG emissions (tCO_2e) — core equations

1. **Mass → CO_2e (accounting for emissions fraction / stock change):**

$$E_{i,t} = M_{i,t} \times f_{e,i} \times GWP_i$$

- ➢ $E_{i,t}$ = Emissions (tCO_2e) from HFC species iii in year t
- ➢ $M_{i,t}$ = Mass of HFC species iii placed on the market in year t (tonnes)
- ➢ $f_{e,i}$ = Emission fraction for species iii (dimensionless; fraction of mass that is ultimately emitted in the accounting period). Default approach often uses $f_{e,i}$=1 for consumption-based accounting unless stock changes or destruction are explicitly quantified.
- ➢ GWP_i = Global Warming Potential of species I (tCO_2e per t refrigerant) — use IPCC GWPs (e.g., AR6 or the 2019 refinement as selected by the country).

2. **Total annual HFC consumption in CO_2e (sum across species):**

$$E_t = \sum_i E_{i,t} = \sum_i (M_{i,t} \times f_{e,i} \times GWP_i)$$

3. **Emission reductions (tCO_2e) due to phase-down (baseline vs project):**

$$\boldsymbol{ER_t = E_t^{Baseline} - E_t^{Project}}$$

- ➢ ER_t = avoided emissions in year t (tCO_2e).

Step 4: Assumptions & defaults

- GWP values: adopt from IPCC AR6 unless Mauritius specifies another (e.g., IPCC 2019 Refinement).
- Emission fraction $f_{e,i}$: if no stock/destruction data, use $f_{e,i}$=1. If robust data exist, apply the inventory identity[26]:

$$\boldsymbol{E_{i,t} = Imports_{i,t} + Production_{i,t} - Exports_{i,t} - Destruction_{i,t} - \Delta Stock_{i,t}}$$

Policy context: HFC reductions are aligned with the Kigali Amendment to the Montreal Protocol[27].

Step 5: Registry entry (for MauNDC)

Phase-out of HFC-based Domestic and Small Commercial Refrigeration Equipment

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Reducing the import of HFCs according to the Kigali Amendment to the Montreal Protocol	Phase out of HFC based domestic refrigerators and small commercial refrigeration equipment	Number of HFC based domestic refrigerators and small commercial refrigeration equipment imported	IPCC 2006 Guidelines — Vol. 3: Industrial Processes and Product Use (IPPU), Ch. 7: Emissions from the Production, Handling, and Use of Fluorinated GHGs.

[25] https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/3_Volume3/19R_V3_Ch07_ODS_Substitutes.pdf
[26] https://unfccc.int/ghg-inventories-annex-i-parties/2023
[27] https://ozone.unep.org/treaties/montreal-protocol/amendments/kigali-amendment-2016-amendment-montreal-protocol-agreed

Step 1: Project boundary & scope

- **System boundary:** Domestic refrigeration and small commercial refrigeration equipment imported into the country, focusing on refrigerant types and their global warming potential (GWP).
- **Scope:** HFC refrigerants (e.g., HFC-134a, R-410A, R-404A, etc.) used in newly imported units.
- **Time step:** Annual (calendar year).
- **Activity data required:**
    - Number of refrigeration units imported by type and refrigerant (units/year).
    - Refrigerant charge per unit (kg/unit).
    - Type and composition of refrigerant gas (by HFC species).
- **Data sources:** Customs import records, National Ozone Unit (NOU) or environmental authority data, Manufacturer or distributor declarations, Kigali Implementation Plan reports.
- **Methodology reference:** IPCC 2006 Guidelines — *Vol. 3: Industrial Processes and Product Use (IPPU), Ch. 7: Emissions from the Production, Handling, and Use of Fluorinated GHGs*.

Step 2: Baseline scenario

- **Description:** Without phase-out interventions, the import of HFC-based refrigerators would continue at baseline trends.
- **Baseline activity data:**
    - Average annual imports of HFC-based refrigeration equipment over a reference period (e.g., 3–5 years before intervention).
    - Average refrigerant charge and leakage rates for these systems.
- **Baseline emissions:**

$$E_{Baseline} = \sum_{i}(N_{i,baseline} \times C_i \times L_{lifetime} \times GWP_i)$$

Where:

- $N_{i,baseline}$ = Number of units imported (baseline year)
- C_i = Average refrigerant charge per unit (kg/unit)
- $L_{lifetime}$ = Lifetime leakage rate (fraction of refrigerant emitted over equipment lifetime)
- GWP_i = Global Warming Potential of refrigerant *i* (from IPCC AR6)

- **Reference:** IPCC 2006 Vol. 3, Ch. 7; UNFCCC Refrigeration & Air Conditioning Methodologies (e.g., AMS-III.X, ACM0006).

Step 3: Project scenario (measurements)

- **Intervention:** Import and use of low-GWP alternatives (e.g., R-600a, R-290, CO_2, or HFO blends).
- **Project emissions**

$$E_{Baseline} = \sum_{i}(N_{i,baseline} \times C_i \times L_{lifetime} \times GWP_i)$$

- **Measured data:**
    - $N_{i,project}$: Number of units imported using low-GWP refrigerants.
    - C_i: Refrigerant charge per unit (kg).
    - GWP_i: GWP of alternative refrigerants.
    - $L_{lifetime}$: Estimated leakage rate over lifetime.

Step 4: Calculate avoided emissions

$$ER_{HFC} = E_{baseline} - E_{project}$$

- ER_{HFC} = Avoided HFC emissions due to phase-out program (tCO_2e/year).

A **positive** ER_{HFC} indicates emission reduction from shifting to low-GWP refrigerants.

Step 5: Apply emission factors and GWPs (references)

- **GWPs:** Use values from *IPCC AR6 WG1 Annex VII, Table 7.SM.7*.
    - Example: HFC-134a = 1,530; HFC-410A = 2,570; HFC-404A = 4,720; R-600a = 3; R-290 = 0.02.
- **Leakage rates:** As per *IPCC 2006 Vol.3, Ch.7* — typically 5–15% of charge annually for domestic/commercial refrigeration.
- **Charge sizes:** From manufacturer specifications or national inventory reports.
- **Alternative methodologies:**
    - UNFCCC AMS-III.X — "Demand-side energy efficiency activities for specific technologies."
    - GEF/UNEP ODS Phase-out Guidelines.

Step 6: Registry entry

- **Indicator name:** *Annual reduction in HFC refrigerant emissions from imported domestic and small commercial refrigeration equipment.*
- **Unit:** *tCO_2e avoided per year.*
- **Reporting frequency:** Annual (calendar year).
- **Verification:** Cross-check customs import data, refrigerant specifications, and stakeholder declarations.
- **Registry field references:**
    - *Activity data type*: Quantitative (imports, refrigerant composition).
    - *Emission factor source*: IPCC AR6, Vol.3 Ch.7.

Linkage: Kigali Amendment tracking under National Cooling Action Plan or ODS/HFC inventory.

Environmentally Sound Disposal of HFC Refrigerants

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Reducing the import of HFCs according to the Kigali Amendment to the Montreal Protocol	Environmentally sound disposal of HFC refrigerants	Tonnes of HFCs recovered (tCO_2e)	https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol3.html

Step 1: Project boundary & scope

- **Scope:** All HFC refrigerants recovered from equipment (e.g., air-conditioners, refrigerators, industrial chillers, foams, fire suppression systems).
- **Boundary:** Recovery, collection, and destruction/disposal facilities in Mauritius.
- **Time step:** Annual.
- **Data sources:** Records from servicing companies, recovery/recycling operators, destruction plants, or import/export logs for recovered refrigerants[28].

Step 2: Baseline scenario

- **Baseline assumption:** Without intervention, HFCs contained in end-of-life equipment would be vented to atmosphere.
- Thus, baseline emissions = 100% of recoverable HFC mass × GWP.

Step 3: Project scenario

- HFCs are recovered and sent for destruction (or reclamation, if emissions are prevented).
- Emissions are reduced relative to baseline.

Step 4: Calculation methodology

Equation 1 — HFC emissions avoided (per species):

$$ER_{i,t} = M_{i,t} \times DE \times GWP_i$$

- $ER_{i,t}$ = Emission reductions from recovery of HFC species iii in year t (tCO_2e)
- $M_{i,t}$ = Mass of HFC species i recovered (tonnes/year)
- DE = Destruction efficiency of facility (fraction, typically 0.98–1.00 depending on technology; defaults in IPCC 2006 Vol.3, Ch.7)
- GWP_i = Global Warming Potential of HFC species i (IPCC AR6 WG1 Annex VII).

Equation 2 — Total emissions avoided (all species):

$$ER_t = \sum_i (M_{i,t} \times DE \times GWP_i)$$

Step 5: Assumptions & parameters

- **Recovery efficiency:** If not all refrigerant in end-of-life equipment is recovered, apply a recovery efficiency factor (RE).
- **Destruction technology:** Common technologies (e.g., rotary kiln incineration, plasma arc, cement kilns) have DE ≥ 99%.
- **GWPs:** Use consistent set (e.g., IPCC AR6 values unless Mauritius specifies otherwise).
- **Policy context:** Aligned with the Kigali Amendment to the Montreal Protocol.

Step 6: Registry entry (MauNDC)

F. Agriculture (Crops)

Fertilizer use per hectare (kg/ha) in agricultural land

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies

[28] https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol3.html

Reducing emissions from good agricultural practices	Reducing chemical inputs in crop production	Fertilizer use per hectare (kg/ha) in agricultural land	https://cdm.unfccc.int/Panels/meth/meeting/07/MP27_repan10_Tool_cultivation_of_biomass

Step 1: Define the Project Boundary

- Identify the area (in hectares) considered.
- Record the total amount of nitrogen (N) applied through fertilizers (both synthetic and organic).

Step 2: Establish the Baseline Scenario

- Use **TOOL02**: *Combined Tool to Identify the Baseline Scenario and Demonstrate Additionality.*
- Calculate emissions from the production/use of synthetic fertilizer:[29]

$$BE_{FP,y} = \sum_{q} EF_{CO2e,FP,q} \times M_{SF,q,y}$$

  - $BE_{FP,y}$ = Baseline emissions related to the production/use of synthetic fertilizer that is used at the dedicated plantation in year y (tCO2e/yr)
  - $EF_{CO2e,FP,f}$ = Emission factor for GHG emissions associated with the production of fertilizer type f (tCO2e/t fertilizer)
  - $M_{SF,q,y}$ = Amount of synthetic fertilizer q applied at the plantation in year y (t synthetic fertilizer/yr)
  - q = Synthetic fertilizer types applied at the plantation in year y

- Use historical data or model projections.

Step 3: Determine the Project Scenario

- Calculate emissions from the production/use of organic fertilizer:[30]

$$PE_{FP,y} = \sum_{q} EF_{CO2e,FP,q} \times M_{OF,q,y}$$

  - $PE_{FP,y}$ = Project emissions related to the production/use of organic fertilizer that is used at the dedicated plantation in year y (tCO2e/yr)
  - $EF_{CO2e,FP,f}$ = Emission factor for GHG emissions associated with the production of fertilizer type f (tCO2e/t fertilizer)
  - $M_{OF,q,y}$ = Amount of organic fertilizer q applied at the plantation in year y (t organic fertilizer/yr)
  - q = Organic fertilizer types applied at the plantation in year y

- Ensure monitoring is consistent with CDM guidelines

Step 4: Calculate Emission Savings

- Subtract project emissions from baseline emissions

% farmland under smart agriculture, bio-farming, and sustainable practices.

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies

[29] https://cdm.unfccc.int/Panels/meth/meeting/07/MP27_repan10_Tool_cultivation_of_biomass
[30] https://cdm.unfccc.int/Panels/meth/meeting/07/MP27_repan10_Tool_cultivation_of_biomass

Reducing emissions from good agricultural practices	Implementation of smart agriculture, bio-farming and other sustainable agricultural practices	% farmland under smart agriculture, bio-farming, and sustainable practices.	https://cdm.unfccc.int/Panels/ssc_wg/meetings/030/ssc_030_an02.pdf

Step 1: Define the Project Boundary

- Identify the area of the project boundary (e.g., farmland area).
- Specify all GHG emission sources and sinks within this boundary.

Step 2: Establish the Baseline Scenario

Note: The term "sustainable practices" is generic and can include a wide range of activities in agriculture. For the purpose of this calculation, "sustainable practices" are defined as changes in crop cultivation practices/methods and water management regimes. The baseline and project emission calculations are applied based on this definition.

- Use **TOOL02**: *Combined Tool to Identify the Baseline Scenario and Demonstrate Additionality.*
- Calculate baseline emissions considering continuation of the current practice:[31]

$$BE_y = \sum_s BE_s$$

$$BE_s = \sum_{g=1}^{G} EF_{BL,s,g} \times A_{s,g} \times 10^{-3} \times GWP_{CH4}$$

  - BE_y = Baseline emissions in year y [tCO2e]
  - BE_s = Baseline emissions from project fields in season s [tCO2e]
  - $EF_{BL,s,g}$ = Baseline emission factor of group g in season s [kgCH_4/ha per season] [32]
  - $A_{s,g}$ = Area of project fields of group g in season s [ha]
  - GWP_{CH4} = Global warming potential of CH_4 [tCO2e/tCH_4]
  - g = Group g, covers all project fields with the same cultivation (pattern as determined with the help of table 1 in indicative simplified baseline and monitoring methodologies)

- Use historical data or model projections.

Step 3: Determine the Project Scenario

- Calculate project emissions (CH4 emissions, which will still be emitted under the changed cultivation practice):[33]

$$PE_y = \sum_s PE_s$$

[31] https://cdm.unfccc.int/Panels/meth/meeting/07/MP27_repan10_Tool_cultivation_of_biomass
[32] Baseline reference fields shall represent baseline conditions, with at least three fields per cultivation pattern measured using the closed chamber method, and $EF_{BL,s,g}$ calculated as their average.
[33] https://cdm.unfccc.int/Panels/meth/meeting/07/MP27_repan10_Tool_cultivation_of_biomass

$$PE_s = \sum_{g=1}^{G} EF_{P,s,g} \times A_{s,g} \times 10^{-3} \times GWP_{CH4}$$

- PE_y = Project emissions in year y [tCO2e]
- PE_s = Project emissions from project fields in season s [tCO2e]
- $EF_{P,s,g}$ = Project emission factor of group g in season s [kgCH4/ha per season][34]

- Ensure monitoring is consistent with CDM guidelines

Step 4: Calculate Emission Savings

- Subtract project emissions from baseline emissions

Given, the above approach is broad-based, other possible GHG impacts from interventions or practices, such as composting and manure management, could also be covered under the indicator of '% farmland under smart agriculture, bio-farming, and sustainable practices.' Methodologies for these practices are further outlined below.

Methodology for manure management: Agriculture (Livestock)

Methodology for composting: Solid Waste Management

G. Agriculture (Livestock)

CH_4/N_2O emissions reduced from manure management (tCO_2e/year)

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Improved food security with application of mitigation technologies for livestock waste management	Improved food security through the adoption of environmentally sound animal excrement management technologies	CH_4/N_2O emissions reduced from manure management (tCO_2e/year)	https://www.ipcc-nggip.iges.or.jp/public/gp/bgp/4_3_CH4_Animal_Manure.pdf

Step 1: Define the Project Boundary

- Identify the livestock facilities or farms included in the intervention (e.g., dairy farms, pig farms).
- Specify all manure management systems covered (e.g., anaerobic digester, covered storage, composting).
- Include the geographic area and clearly define which emission sources are included (CH_4 from manure) and excluded.

Step 2: Establish the Baseline Scenario[35]

- Use **TOOL02**: *Combined Tool to Identify the Baseline Scenario and Demonstrate Additionality*.

[34] Project emission factor to be determined using measurements on at least 3 project reference fields meeting same conditions as baseline reference fields, except that they are managed according to the defined project cultivation practice.
[35] Considering CH_4 as the main gas

- Calculate baseline total annual methane emissions for animal type i in a particular climate region is the sum of annual emissions over all applicable manure systems j:[36]

$$CH_4^i = \sum_j B_o^i \times VS_i \times MS\%_{ij} \times MCF_j$$

$$VS_i = N_i \times vs_i$$

  - CH_4 = Methane emissions (m3 /yr)
  - B_o = Biodegradability of manure (m3 CH4/kg VS)
  - MCF = Methane conversion factor (%)
  - MS% = Manure management system usage (%)
  - VS = Total volatile solids produced annually (kg/yr)
  - N = Animal number (heads)
  - vs = Average annual volatile solids production per head (kg/head/yr)

- Use historical energy consumption data or model projections.

Step 3: Determine the Project Scenario

- Adjust MS% to reflect manure now managed in digesters
- Calculate project total annual methane emissions for animal type i in a particular climate region is the sum of annual emissions over all applicable manure systems j:[37]

$$CH_4^i = \sum_j B_o^i \times VS_i \times MS\%_{ij} \times MCF_j$$

$$VS_i = N_i \times vs_i$$

  - CH_4 = Methane emissions (m3 /yr)
  - B_o = Biodegradability of manure (m3 CH4/kg VS)
  - MCF = Methane conversion factor (%)
  - MS% = Manure management system usage (%)
  - VS = Total volatile solids produced annually (kg/yr)
  - N = Animal number (heads)
  - vs = Average annual volatile solids production per head (kg/head/yr)

- Ensure monitoring is consistent with CDM guidelines

Step 4: Calculate Emission Savings

- Subtract project emissions from baseline emissions

H. Land use, Land Use Change and Forestry

Area afforested (hectares)

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Increasing the sink capacity of Mauritius	Planting trees in urban areas	Area afforested (hectares)	https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_04_Ch4_Forest_Land.pdf

Step 1: Define the Project Boundary

[36] https://www.ipcc-nggip.iges.or.jp/public/gp/bgp/4_3_CH4_Animal_Manure.pdf
[37] https://www.ipcc-nggip.iges.or.jp/public/gp/bgp/4_3_CH4_Animal_Manure.pdf

- Identify the area or plots where trees are planted (ha) or record the number of trees per plot.
- Specify tree species, planting density, and land-use type prior to planting (e.g., abandoned cropland, degraded land).
- Define the monitoring period.

Step 2: Establish the Baseline Scenario[38]

- Use **TOOL02**: *Combined Tool to Identify the Baseline Scenario and Demonstrate Additionality*.
- Calculate the baseline carbon stocks:[39]

$$\Delta C_{Mineral} = [(SOC_0 - SOC_{(0-T)})] \div D^{40}$$

$$SOC = \sum_{c,s,i} (SOC_{REF\ csi} \times F_{LUc,s,i} \times F_{MG\ c,s,i} \times F_{I\ c,s,i} \times A_{c,s,i})$$

  - $\Delta C_{Mineral}$ = Annual change in carbon stocks in mineral soils, tonnes C yr-1
  - SOC_0 = Soil organic carbon stock in the last year of an inventory time period, tonnes C
  - $SOC_{(0-T)}$ = Soil organic carbon stock at the beginning of the inventory time period, tonnes
  - T = Number of years over a single inventory time period, yr
  - D = Time dependence of stock change factors which is the default time period for transition between equilibrium SOC values, yr.
  - c = represents the climate zones, s the soil types, and i the set of management systems that are present in a country.
  - SOC_{REF} = the reference carbon stock, tonnes C ha-1 (https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_02_Ch2_Generic.pdf)
  - F_{LU}, F_{MG}, F_I = Default stock change factors
  - A = Land area of the stratum being estimated, ha.
- Use historical energy consumption data or model projections.

Step 3: Determine the Project Scenario

- Adjust SOC to reflect increased number of (planted) trees
- Calculate project carbon stocks:[41]

$$\Delta C_{Mineral} = [(SOC_0 - SOC_{(0-T)})] \div D^{42}$$

$$SOC = \sum_{c,s,i} (SOC_{REF\ csi} \times F_{LUc,s,i} \times F_{MG\ c,s,i} \times F_{I\ c,s,i} \times A_{c,s,i})$$

  - $\Delta C_{Mineral}$ = Annual change in carbon stocks in mineral soils, tonnes C yr-1
  - SOC_0 = Soil organic carbon stock in the last year of an inventory time period, tonnes C
  - $SOC_{(0-T)}$ = Soil organic carbon stock at the beginning of the inventory time period, tonnes
  - T = Number of years over a single inventory time period, yr

[38] Considering CH_4 as the main gas
[39] https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_04_Ch4_Forest_Land.pdf
[40] T is used in place of D in this equation if T is ≥ 20 years
[41] https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_04_Ch4_Forest_Land.pdf
[42] T is used in place of D in this equation if T is ≥ 20 years

- D = Time dependence of stock change factors which is the default time period for transition between equilibrium SOC values, yr.
- c = represents the climate zones, s the soil types, and i the set of management systems that are present in a country.
- SOC_{REF} = the reference carbon stock, tonnes C ha-1 (https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_02_Ch2_Generic.pdf)
- F_{LU}, F_{MG}, F_{I} = Default stock change factors
- A = Land area of the stratum being estimated, ha.

- Ensure monitoring is consistent with CDM guidelines

Step 4: Calculate Emission Savings

- Subtract project emissions from baseline emissions

CO_2 removal from biomass growth (tCO_2e/year)

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Increasing the sink capacity of Mauritius	Afforestation of abandoned agricultural land	CO_2 removal from biomass growth (tCO_2e/year)	https://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/Chp3/Chp3_2_Forest_Land.pdf

Step 1: Define the Project Boundary

- Identify the area and the land category: e.g. urban forest / plantation / afforested area (ha).
- Define the monitoring period (usually 1 year).

Step 2: Establish the Baseline Scenario[43]

- Use **TOOL02**: *Combined Tool to Identify the Baseline Scenario and Demonstrate Additionality*.
- Calculate baseline emissions using:[44]

$$\Delta C_{FFG} = \sum_{ij} (A_{ij} \times G_{totalij}) \times CF$$

- ΔC_{FFG} = Annual increase in carbon stocks due to biomass increment in forest land remaining forest land by forest type and climatic zone, tonnes C yr-1
- A_{ij} = area of forest land remaining forest land, by forest type (i = 1 to n) and climatic zone (j = 1 to m), ha
- $G_{TOTALij}$ = Average annual increment rate in total biomass in units of dry matter, by forest type (i = 1 to n) and climatic zone (j = 1 to m), tonnes d.m. ha-1 yr-1
- CF = Carbon fraction of dry matter (default = 0.5), tonnes C (tonne d.m.)-1

- Use historical energy consumption data or model projections.

Step 3: Determine the Project Scenario

- Adjust $G_{TOTALij}$ to reflect increased biomass growth
- Calculate project emissions using:[45]

[43] Considering CH_4 as the main gas
[44] https://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/Chp3/Chp3_2_Forest_Land.pdf
[45] https://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/Chp3/Chp3_2_Forest_Land.pdf

$$\Delta C_{FFG} = \sum_{ij}(A_{ij} \times G_{totalij}) \times CF$$

- ΔC_{FFG} = Annual increase in carbon stocks due to biomass increment in forest land remaining forest land by forest type and climatic zone, tonnes C yr-1
- A_{ij} = area of forest land remaining forest land, by forest type (i = 1 to n) and climatic zone (j = 1 to m), ha
- $G_{TOTALij}$ = Average annual increment rate in total biomass in units of dry matter, by forest type (i = 1 to n) and climatic zone (j = 1 to m), tonnes d.m. ha-1 yr-1
- CF = Carbon fraction of dry matter (default = 0.5), tonnes C (tonne d.m.)-1

- Ensure monitoring is consistent with CDM guidelines

Step 4: Calculate Emission Savings

- Subtract project emissions from baseline emissions

Annex-B: Adaptation Indicators Methodology

A. Agriculture

Area afforested (hectares)

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Promotion of climate-smart land use and biodiversity	Ensure alignment with water, forestry, and biodiversity adaptation (e.g., water conservation, forest cover increase) (A2.2)	Area afforested (hectares)	https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_04_Ch4_Forest_Land.pdf

Please refer to the methodology for the indicator*:* **Agriculture (Crops)***Land use, Land Use* **Change and Forestry**

% of farms using compost/ organic manure as primary soil amendment

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Promotion of climate-smart land use and biodiversity	Promote composting and reduce synthetic fertilizer use (A2.4)	% of farms using compost/ organic manure as primary soil amendment	https://cdm.unfccc.int/Panels/meth/meeting/07/MP27_repan10_Tool_cultivation_of_biomass

Please refer to methodology for the indictor: *Agriculture (Crops)*

B. Fisheries

Area of mangrove replanted (ha/year)

Outcomes	Interventions	Indicators	Reference/Link to relevant methodologies
Resilient coastal and marine ecosystems and communities (NBS indicator)	Rehabilitate marine habitats: mangroves, seagrass and corals (F2.4)	Area of mangrove replanted (ha/year)	https://www.ipcc-nggip.iges.or.jp/public/wetlands/pdf/Wetlands_separate_files/WS_Chp4_Coastal_Wetlands.pdf

Step 1: Define the Project Boundary

- Identify project area (ha) and strata.
- Define temporal boundary (monitoring/ reporting period, e.g. 1 year).

Step 2: Establish the Baseline Scenario[46]

- Use **TOOL02**: *Combined Tool to Identify the Baseline Scenario and Demonstrate Additionality*.
- Calculate baseline CH_4 emissions without considering the land-use prior to rewetting:[47]

$$CH_{4-SO-REWET} = \sum_{v} (A_{REWET} - EF_{REWET})_v$$

  - $CH_{4\text{-SO-REWET}}$ = CH4 emissions associated with rewetted and created coastal wetlands by vegetation; type kg CH4 yr^{-1}
  - A_{REWET} = Area of soil that has been rewetted (including tidal marsh or mangrove wetland creation), by vegetation type; ha
  - EF_{REWET} = CH_4 emissions from mineral and organic soils that have been rewetted by vegetation type; kg CH4 ha^{-1} yr^{-1}

- Use historical energy consumption data or model projections.

Step 3: Determine the Project Scenario

- Adjust A_{REWET} to reflect project area of soil that has been rewetted (including tidal marsh or mangrove wetland creation), by vegetation type; ha
- Calculate baseline CH_4 emissions without considering the land-use prior to rewetting:[48]

$$CH_{4-SO-REWET} = \sum_{v} (A_{REWET} - EF_{REWET})_v$$

  - $CH_{4\text{-SO-REWET}}$ = CH4 emissions associated with rewetted and created coastal wetlands by vegetation; type kg CH4 yr^{-1}
  - A_{REWET} = Area of soil that has been rewetted (including tidal marsh or mangrove wetland creation), by vegetation type; ha
  - EF_{REWET} = CH_4 emissions from mineral and organic soils that have been rewetted by vegetation type; kg CH4 ha^{-1} yr^{-1}

- Ensure monitoring is consistent with CDM guidelines

Step 4: Calculate Emission Savings

- Subtract project emissions from baseline emissions[49]

[46] Considering CH_4 as the main gas
[47] https://www.ipcc-nggip.iges.or.jp/public/wetlands/pdf/Wetlands_separate_files/WS_Chp4_Coastal_Wetlands.pdf
[48] https://www.ipcc-nggip.iges.or.jp/public/wetlands/pdf/Wetlands_separate_files/WS_Chp4_Coastal_Wetlands.pdf
[49] For conversion to CO_2eq, after estimating CH_4 emissions, convert them to CO_2-equivalent emissions by applying the relevant global warming potential (GWP)

Annex-C: Adaptation: Outcomes, Interventions and Indicators (GHG and non-GHG)

Sector	Sr No	Outcomes	Interventions	Proposed Indicators	Responsible Institution	Indicative Data Requirements
Water	W1	**Enhanced governance and adaptation planning capacity in the Water Sector**	Develop hydrological models and socioeconomic risk assessments (W1.1)	% of watershed areas with climate-risk models	MEPU, WRU	- List of watershed areas - Presence/coverage of hydrological & risk models
			Conduct technical studies and research on climate change and water sector-related activities (W1.2)	# of water-sector policies updated # of prioritized adaptation activities identified	MEPU, WRU	-Inventory of existing & updated water-sector policies - List of adaptation activities from studies/research
			Support research on long-range sea-level rise and application in planning (W1.3)	% of national/local plans integrating long-range sea-level rise research # of long-range sea-level rise studies conducted/updated # of planning documents applying findings from sea-level rise research	MEPU, WRU	- Existence of long-range sea-level rise research - Application of findings in national/local plans
	W2	**Improve water use efficiency**	Develop funding mechanisms for wastewater treatment and reuse (W2.1)	% of reuse projects financed through new mechanisms	Waste Water Management Authority (WMA)	-Total number of reuse projects - Number financed through new mechanisms
			Increase awareness and capacity-building on reuse of treated water (W2.2)	Number of stakeholders trained or sensitized on safe reuse of treated water	MEPU, WRU, WMA	-Total number of reuse projects - Number financed through new mechanisms
			Invest in irrigation infrastructure and access to water for agriculture (W2.3)	Area of land under irrigation Increase in irrigated area Water use efficiency	Irrigation Authority	Total irrigated land area (baseline & current) - Water use efficiency values
			Install rainwater harvesting systems and improve legal/regulatory frameworks (W2.4)	# of systems installed # of water policies or regulations updated	MEPU	Number & type of rainwater harvesting systems installed - Policy/regulation documents updated
			Construct desalination plants (W2.5)	Desalination capacity (m³/day) Volume of desalinated water produced	MEPU	Installed capacity of desalination plants - Annual water output data
			Promote water-saving technology in crop production	(1) Area under water saving technology (ha) Or (2) Number of water-saving technologies developed and promoted.	FAREI	Total cultivated land area (ha) - Area equipped with water-saving technologies (e.g., drip irrigation, sprinkler irrigation, laser land levelling, soil moisture sensors) - Type of water-saving technology adopted Or - List of water-saving technologies

						researched/developed - Number of technologies actively disseminated and promoted via extension services, farmer training programs, or government schemes
	W3	**Practice and promote Integrated water management and ecosystem-based adaptation**	Develop cross-sectoral ecosystem-based adaptation strategy (W3.1)	Area of floodplains reconnected # of wetlands mapped # of institutions trained on NbS		GIS mapping of floodplains & wetlands - Area (ha) reconnected - List of wetlands mapped - Training reports, attendance records
			Identify and protect land for wetland adaptation to sea-level rise (W3.2)	Area (ha) designated for tidal wetland adaptation		Official records of designated wetland areas - GIS maps showing boundaries - Land use/zoning documents
			Mainstream adaptation into National IWRM Plan (W3.3)	Inclusion of adaptation measures in IWRM Plan # of adaptation measures integrated		Updated IWRM Plan - List of adaptation measures included - Stakeholder validation reports
			Promote multi-level and intersectoral water governance (W3.4)	# of coordination platforms or committees established # of policies/strategies jointly developed		Records of coordination bodies - List of intersectoral policies or strategies developed
	W4	**Improved data, monitoring and evaluation for water adaptation**	Develop oceanic and atmospheric observation systems (W4.1)	# of oceanic/atmospheric observation stations established		List of observation stations - Technical specifications and location data - Operational status reports
			Develop M&E framework for water adaptation (W4.2)	Existence of M&E framework for water adaptation # of adaptation indicators tracked	MEPU	Official M&E framework document - List of indicators developed and monitored - Progress reports on adaptation measures
Agriculture	**A1**	**Enhanced knowledge base on climate risks and ecosystem services in Agriculture Sector**	Conduct climate change risk and adaptation assessments to identify vulnerable areas (A1.1)	# of climate risk and adaptation studies completed # of vulnerable ecosystems and communities identified		List of studies completed (titles, year, scope) – Geographic areas covered – Vulnerability mapping outputs – Profiles of communities identified as vulnerable
			Develop research programs and technical studies to integrate climate change into agriculture sector policies (A1.2)	# of agriculture policies/strategies with integrated climate actions # of prioritized activities identified with climate benefits		Official agriculture policies and strategies (with climate sections highlighted) – Research/technical study reports – List of identified priority activities with climate co-benefits – Status of implementation
			Conduct evaluation of ecosystem services and their economic value (A1.3)	# of ecosystem services evaluated Economic value (USD) of key ecosystem services		List of ecosystem services considered (e.g., pollination, soil fertility, water retention) – Economic valuation methodology used – Valuation results (USD)

	A2	**Promotion of climate-smart land use and biodiversity**	Encourage participatory land use planning for sustainable agriculture (A2.1)	# of community land use plans developed % of targeted land area under such plans		Number of land use plans prepared and approved – Maps of targeted vs. covered areas – Community participation records
			Ensure alignment with water, forestry, and biodiversity adaptation (e.g., water conservation, forest cover increase) (A2.2)	% of land area under micro-irrigation Area of forest cover increased (ha/year) # of floodplain easements implemented (New)		Area under micro-irrigation (ha) – Annual forest cover statistics (remote sensing/GIS) – List & size of floodplain easements implemented
			Promote ecosystem-based adaptation including bee pastures and agroforestry (A2.3)	Area under agroforestry practices (ha) # of bee pasture conservation projects supported		Agroforestry area mapped (ha, by region) – Records of supported bee pasture projects – Number of farmers adopting practices
			Promote composting and reduce synthetic fertilizer use (A2.4)	% of farms using compost/ organic manure as primary soil amendment	FAREI, MCIA/MSIRI, MCA	Total number of farms in the region - Number of farms primarily using compost/organic manure instead of synthetic fertilizers - Volume of compost produced and applied annually (tons) - Reduction in synthetic fertilizer sales/consumption (tons/year)
			Promote climate-resilient technologies and new crop varieties (A2.5)	# of climate-resilient crop varieties introduced Or Annual food crop production per unit area	FAREI, MCIA/MSIRI	Number and type of climate-resilient crop varieties developed/released officially - Adoption rate of these varieties (hectares cultivated) Or - Area cultivated under food crops (ha) - Total production of key food crops (tons) - Yield per hectare (tons/ha) - Disaggregated data by crop type and region for better accuracy
	A3	**Strengthened institutional capacity and financial support for climate adaptation in agriculture**	Build institutional and community capacity (A3.1)(NBS indicator)	# of training sessions held # of participants trained (gender-disaggregated)		Training program records – Attendance sheets with gender-disaggregated data – Evaluation/feedback reports
			Develop financial planning for transition to climate-smart agriculture (A3.2)	Financial resources allocated for CSA transition (USD/year)	Ministry of Finance	National budget allocations for CSA – Donor/IFI contributions & grants – Private sector investments/loans – List of CSA projects funded – Disbursement vs allocation data

			Develop M&E framework for all adaptation strategies (A3.3)	M&E framework developed # of strategies with tracked indicators		Copy of M&E framework – List of strategies with included indicators – Reports on monitoring progress
			Strengthen communication tools and early warning systems (EWS) (A3.4)	# of communication tools upgraded or developed # of farmers reached through advisories		List of tools/platforms developed (apps, SMS, radio, etc.) – Coverage statistics (# of farmers reached, disaggregated) – Feedback surveys from users
Fisheries and Blue Economy	**F1**	**Sustainable utilisation of fisheries resources**	Promote collaboration with regional and international bodies for stock assessments (F1.1)	# of regional/international collaboration initiatives on fisheries	Ministry of Agro Industry, Food Security, Blue Economy and Fisheries (Fisheries Division)	Records of MoUs/agreements signed with regional or international fisheries bodies -Number and type of joint initiatives (e.g., stock assessments, surveys, joint projects) -Reports and proceedings of collaboration meetings/workshops
			Establish integrated Blue Economy-based sector management framework (F1.2)	Existence of integrated management framework # of sector policies/strategies aligned with Blue Economy principles	Ministry of Agro Industry, Food Security, Blue Economy and Fisheries (Fisheries Division)	Existence of sector management framework (policy/legal documents, cabinet approvals) - Number of fisheries/aquaculture sector strategies aligned with Blue Economy principles - Records of stakeholder consultations for policy integration
			Strengthen linkages between fisheries, value addition, and infrastructure (F1.3)	# of new value chain linkages developed # of infrastructure projects supporting fisheries value addition	Ministry of Agro Industry, Food Security, Blue Economy and Fisheries (Fisheries Division)	Records of new or upgraded infrastructure projects supporting fisheries (landing sites, processing facilities, storage, logistics) - Investment/ incentives provided to fishermen
			Upgrade the Vessel Monitoring System (VMS) (F1.4)	Functionality level of VMS (e.g., % of vessel coverage) # of enforcement cases supported by VMS data	Ministry of Agro Industry, Food Security, Blue Economy and Fisheries (Fisheries Division)	% of registered vessels with active VMS units installed - VMS operational reports (uptime, functionality) - Enforcement cases supported by VMS data (illegal fishing, area violations, unreported catches)
	F2	**Resilient marine ecosystems and communities (NBS indicator)**	Promote good fishing practices and integrated catchment-coast climate responses (F2.1)	# of sustainable fishing training programs conducted	Ministry of Agro Industry, Food Security, Blue Economy and	Training program records (dates, participants, modules) - Number of fishermen trained in sustainable fishing practices

					Fisheries (Fisheries Division)	
			Expand and strengthen Marine Protected Areas (F2.3)	# of MPAs established or expanded Total area (km²) under MPAs	Ministry of Agro Industry, Food Security, Blue Economy and Fisheries (Fisheries Division)	Number of MPAs established or expanded (gazetted area notifications) - Total area (km²) under legal protection - Monitoring reports on compliance and effectiveness
			Rehabilitate marine habitats: mangroves, seagrass and corals (F2.4)	Area of mangrove replanted (ha/year) # of coral nurseries/farming sites established area of seagrass planted (ha/year)	Ministry of Agro Industry, Food Security, Blue Economy and Fisheries (Fisheries Division)	Area of mangroves replanted (ha/year) with GPS mapping - Area of seagrass restored (ha/year) - Number and size of coral nurseries/farming sites established - Monitoring reports on ecosystem survival rates
			Upskill or re-skill under-employed fishermen (F2.5)	# of fishermen trained	Ministry of Agro Industry, Food Security, Blue Economy and Fisheries (Fisheries Division)	-Training program records (curriculum, trainers, modules) - Number of fishermen trained, disaggregated by gender and age group
			Carry out Risk Assessment and Ridge to Reef Feasibility Studies before restoration Programme (2.6)	# of feasibility and risk assessment reports		-Ridge to Reef data (land–sea interaction zones) - Methodology for risk classification and feasibility analysis - Stakeholder engagement records - Prioritization criteria used in selecting restoration sites
	F3	**Climate-resilient aquaculture development**	Promote ocean ranching form of aquaculture (F3.1)	# of ocean ranching projects implemented Volume of aquaculture production from ranching systems	Ministry of Agro Industry, Food Security, Blue Economy, and Fisheries (Fisheries Division)	- Number of projects implemented (location, type of species) - Annual aquaculture production from ranching systems (tons/year) - Financial/investment records of projects
			Evaluate role of currents and ecosystems in aquaculture planning (F3.3)	# of studies on currents and ecosystem effects on aquaculture	Ministry of Agro Industry, Food Security, Blue	-Research studies on currents, temperature, nutrient flows, and ecosystem effects - Mapping outputs of aquaculture suitability

					Economy and Fisheries (Fisheries Division)	zones - Reports on implications for site selection
	F4	**Strengthened data systems and stakeholder capacity for Fisheries**	Build stakeholder capacity for ecosystem identification and fishery plans (F4.2)	# of stakeholders trained	Ministry of Agro Industry, Food Security, Blue Economy and Fisheries (Fisheries Division)	Number of training programs conducted (records, modules, attendees) - Fishery-specific management plans developed (policy or technical documents)
			Facilitate interdisciplinary knowledge exchange on fish phenology (F4.3)	# of interdisciplinary meetings/workshops # of research outputs shared with managers	Ministry of Agro Industry, Food Security, Blue Economy and Fisheries (Fisheries Division)	Records of workshops/meetings conducted (attendance, agendas, outcomes) - Research reports/outputs shared with fisheries managers - Collaborative publications or knowledge briefs
			Develop fisheries knowledge and data-sharing system (F4.5)	Data platform operational # of users accessing platform # of data points uploaded and updated annually	Ministry of Agro Industry, Food Security, Blue Economy and Fisheries (Fisheries Division)	-Operational status of the fisheries data platform - Number of registered users accessing the platform
			Economic valuation of marine and coastal ecosystems (F4.4)	Estimated value (USD) of coastal/marine ecosystem services	Ministry of Finance	-Baseline valuation studies of marine and coastal ecosystems - Data on fisheries production, aquaculture yield, and market prices - Tourism revenue linked to marine and coastal areas - Coastal protection and storm surge buffering value (avoided damage costs) - Carbon sequestration value from mangroves, seagrasses, and reefs - Biodiversity valuation and ecosystem service assessment reports - National accounts / environmental-economic accounts

Tourism and Coastal Management	**T1**	**Improved protection of critical ecosystems and climate-resilient tourism infrastructure**	Develop an implementation plan for Strategic Tourism Plan incl. financing (T1.1)	Implementation plan developed Budget allocated for climate-resilient tourism activities (USD/year)	Ministry of Finance	Drafts/final Strategic Tourism Plan - National and sectoral budget allocations - Climate-resilient project pipeline in tourism
			Promote restoration: native vegetation, marshes, mangroves, seagrass, dunes, coral habitat (T1.2)	Number of restoration projects implemented Number of coral nurseries established Length of coastline affected Length of coastline rehabilitated	ICZM Division – Department of Environment	Project implementation reports - GIS/remote sensing data - Monitoring reports on survival rates - Biodiversity baseline data
			Use pilot studies with developers for governance innovation (T1.3)	# of pilot studies completed # of governance innovations adopted by tourism operators	Tourism Authority	Pilot study reports - Records of governance innovations adopted - MoUs/agreements with developers - Stakeholder feedback
			Develop multi-stakeholder decision-making processes for land-use planning (T1.4)	Stakeholder consultation framework adopted # of stakeholders participating in planning processes	Ministry of Housing and Lands	Consultation records and minutes - Stakeholder lists (by sector) - Policy/land-use planning documents - Workshop/training attendance sheets
			Develop integrated tourism planning aligned with agri-biodiversity-coastal strategies (T1.5)	Integrated tourism-ecosystem plan developed # of cross-sectoral projects initiated	Ministry of Environment, Solid Waste Management and Climate Change (Integrated Coastal Zone Management Division)	- Draft/final integrated plans - Records of cross-sectoral initiatives - Policy alignment documents - Sectoral budget allocations
	T2	**Active engagement of the tourism sector in adaptation and sustainability**	Launch ecotourism linked to carbon sequestration (T2.1)	# of ecotourism projects launched Carbon sequestered through associated conservation projects (tons CO_2e/year)		-Project pipeline of ecotourism initiatives - Carbon sequestration monitoring reports - GIS data on conservation areas - Carbon accounting methodologies
			Build capacity for sustainable tourism & valorisation of local resources (T2.2)	# of stakeholders trained in sustainable tourism # of awareness campaigns conducted # of resource-efficient innovations adopted in tourism	Tourism Authority	-Training reports & participant lists - Awareness campaign records - Innovation/technology adoption surveys - Case studies from tourism operators
			Implement incentives: PES, eco-taxes, biodiversity offsets (T2.3)	# of operators benefitting from PES or eco-tax schemes Total funds mobilized through tourism-based incentive schemes (USD/year)	Ministry of Finance, Economic Planning and Development	- Records of PES/eco-tax scheme beneficiaries - Tax collection data - Biodiversity offset agreements - Conservation fund allocation report

	T3	**Strengthened monitoring and accountability of tourism development impacts**	Develop ecotourism strategy, EMS, audits, and M&E framework (T3.1)	Ecotourism strategy adopted # of hotels/IRS auditedM&E framework developed and used	Ministry of Agro-Industry, Food Security, Blue Economy and Fisheries (Blue Economy Division) Tourism Authority	-Draft/final ecotourism strategy - EMS certification records - Hotel/resort audit reports - M&E framework guidelines
			Promote eco-friendly practices and eco-labelling in tourism operations (T3.2)	# of certified eco-labelled hotels/resorts % of tourism operators implementing verified eco-practices	Tourism Authority and Ministry of Tourism	-Eco-label certification records - Compliance audit reports - Monitoring reports from tourism associations - Independent verification assessments
Health	H1	**Climate-resilient health policy and institutional frameworks developed**	Develop knowledge base on climate-related health risks and adaptation actions (H1.1)	# of climate-health studies conducted # of risk and vulnerability maps developed	Ministry of Health	-Research reports & publications - GIS/spatial data on health risks - National health statistics (climate-related diseases) - Vulnerability mapping datasets
			Develop community-based health and climate approaches (H1.2)	# of community programs initiated # of communities covered by adaptation outreach	Ministry of Health	-Community outreach program reports - List of participating communities - NGO/CSO reports on health adaptation - Beneficiary/coverage data
			Develop cross-sectoral institutional framework for health adaptation (H1.3)	Institutional framework developed # of public health plans integrating climate risks	Ministry of Health	-Draft/final framework documents - National and regional health plans - Policy integration evidence (climate-health references)
			Prepare Health National Adaptation Plan (HNAP) with roadmap and M&E (H1.4)	HNAP developed (Yes/Nonb) M&E framework established # of health adaptation actions budgeted/funded	Ministry of Health	-Draft/final HNAP - Government budget allocations for health adaptation - Donor-funded health projects - M&E guidelines and implementation reports
	H2	**Strengthened health infrastructure**	Upgrade health facilities for surge capacity and climate-sensitive disease response (H2.1)	# of risk assesment of the health institution yearly	Ministry of Health	-Infrastructure upgrade reports - Facility audit reports - Ministry of Health (MoH) infrastructure databases - Disaster preparedness plans
			Establish observatory and a unit for climate-	Observatory established # of new surveillance units operational	Ministry of Health	-Institutional set-up documents - National Disease Surveillance reports

			sensitive/vector-borne diseases (H2.3)			- MoH registry of health observatories - Staffing and operational budgets
			Expand Early Warning Systems (EWS) for disease/environmental hazard surveillance (H2.4)	# of diseases and hazards under EWS Frequency of updates/alerts issued Coverage (national/regional) of EWS	Ministry of Health	-EWS technical specifications - Health surveillance data - Alert/notification logs - GIS maps of coverage - Collaboration records with meteorological/hazard monitoring agencies
		Strengthened systems to address climate-sensitive health risks	Expand medical insurance coverage for climate-related health issues (H2.2)	# of insurance products covering climate-sensitive diseases # of people covered under climate-inclusive insurance	Ministry of Health	-Insurance product details - Insurance coverage data - Health insurance reports
			Introduce new mosquito/vector control techniques (H2.5)	# of new vector control technologies deployed Change in vector population or disease incidence (before/after intervention)	Ministry of Health	-Vector control program data - Disease incidence data - Research/impact assessments
	H3	**Improved public awareness and preventive health behavior**	Develop IEC plans to change public perception and behavior (H3.1)	# of IEC materials produced # of awareness campaigns conducted Reach (% of population)	Ministry of Health	-IEC materials - Campaign records - Survey data
			Promote healthy lifestyles, nutrition, and vector control (H3.2)	% increase in population practicing healthy behaviors (survey-based) # of community-led initiatives on nutrition/vector control	Ministry of Health	-Survey reports - Community initiative records
	H4	**Skilled health workforce for climate-related disease burden**	Develop curricula for life-long learning on climate-health (H4.1)	# of curricula/modules developed for academic puporses (for schools) # of institutions integrating modules	Ministry of Health	-Curricula documents - Records from educational institutions
			Train health professionals on climate change adaptation (H4.2)	# of health workers trained # of planning units with trained personnel	Ministry of Health	-Training records - Health ministry HR data
	H5	**Availability and preparedness for essential medicines and vaccines**	Maintain stockpile of emergency medical supplies (H5.1)	Volume and type of emergency supplies stocked # of stockpile replenishment cycles annually	Ministry of Health	-Stockpile inventory records - Procurement reports - Replenishment schedules
			Expand vaccine availability (H5.2)	# of vaccines added to national immunization program % coverage of at-risk populations	Ministry of Health	-Immunization program data - Vaccination coverage reports
Infrastructure and disaster risk	**I1**	**Improved knowledge on climate risks to**	Conduct climate risk and vulnerability assessments (I1.1)	# of risk and vulnerability assessments conducted # of vulnerable hotspots identified	Ministry of Environment, SWMCC	-Reports of completed assessments – GIS/maps of vulnerable zones – List of identified hotspots with classification

reduction (NBS indicator)		**coastal infrastructure and communities**	Develop information systems and promote climate data in infrastructure planning (I1.2)	Climate-infrastructure data platform operational # of infrastructure projects using topographic, hydrologic, and climate data		-Existence of operational data platform – Number of infrastructure projects using integrated data – Access logs/records of platform usage
	I2	**Climate risks mainstreamed in sectoral infrastructure policies and coastal development planning**	Develop technical guidelines for adaptation using nature-based solutions (I2.1)	Guidelines published and in use # of projects implementing NbS (nature-based solutions)	Ministry of Health	-Published adaptation guidelines – List and status of projects applying NbS
			Build awareness and capacity among developers and engineers (I2.2)	# of professionals trained# of awareness sessions held		-Training records – Participant lists and feedback – Agenda/summary of awareness sessions
			Establish coordination and consultation mechanisms for integrated landscape planning (I2.3)	Inter-agency coordination mechanism established # of joint planning sessions conducted	Ministry of Health	-Existence of coordination mechanism – Records/minutes of planning sessions – List of participating agencies
			Optimize land use for priority infrastructure adaptation (I2.4)	% of strategic land areas designated for priority climate-resilient infrastructure # of land-use plans updated to reflect climate risks		-Land-use maps and zoning documents – Records of updated plans – Percentage of strategic areas designated
	I3	**Strengthened disaster preparedness and risk reduction systems for infrastructure**	Operationalize real-time warning systems for infrastructure failure (I3.1)	Warning system operational # of alerts issued annually		-Existence and functionality of warning system – Records/logs of alerts issued
			Develop M&E framework including use of Doppler radar data (I3.2)	M&E framework developed # of infrastructure adaptation activities tracked using indicators		-Approved M&E framework – Database of tracked adaptation activities – Reports using Doppler radar data
	I4	**Climate-resilient road infrastructure systems in place and operational**	Identify roads at high risk for damage during climate events (I4.1)	# of roads mapped as climate-vulnerable Risk classification system developed	RDA	-GIS-based vulnerability mapping - Road inventory (length, type, location) - Hazard exposure data (flood, landslide, cyclone zones) - Classification methodology & criteria
			Define mechanisms for rapid damage assessment and funding (I4.2)	Emergency response funding plan developed Average response time post-disaster (hours/days)		-Existence and approval of emergency funding framework - Historical records of response times - Contingency budget allocation and disbursement mechanism
			Establish intervention mechanisms for road recovery (I4.3)	Road intervention protocol implemented # of emergency intervention teams activated		-Formalized road recovery SOPs - Number and readiness of emergency response teams - Activation records post-disaster

			Revise road design guidelines for climate resilience (I4.4)	Guidelines revised # of new projects using updated guidelines		-Official publication of revised road design standards - Project approval data referencing new guidelines - Compliance monitoring reports
			Introduce resilient materials for road construction (I4.5)	# of projects using climate-resilient materials Performance rating of materials post-disaster		-Project records (type of materials used) - Lab/field test results on material durability - Post-disaster performance assessments
			Ensure timely restoration of damaged roads (I4.6)	% of damaged roads restored within set timeframe Average restoration time post-event		-Records of road damages vs restoration timelines - Defined “set timeframe” benchmarks - Post-disaster progress monitoring reports
			Amend procurement processes to be climate-responsive (I4.7)	New procurement procedures adopted Procurement lead time during emergencies	Procurement Policy Office	-Official revised procurement policies - Procurement records during emergency events - Time between disaster and contract award
			Use simulation models for climate stress testing of road infrastructure (I4.8)	# of models developed # of road segments tested with simulation tools	RDA & UoM	-Existence of models (flood, cyclone, heat stress tests) - Road segments tested and results documented - GIS/engineering model outputs
			Integrate responses to new infrastructure failure types (e.g., bridge collapses) (I4.9)	Response protocols developed for new failure types # of contingency plans covering emerging risks	RDA	-Official protocols for new failure modes - Inventory of contingency plans - Lessons learned from past failures