Nationally Determined Contributions (NDC3.0): 2025 -2030

MRV Framework

October 2025

Contents

LIST OF ABBREVIATIONS AND ACRONYMS

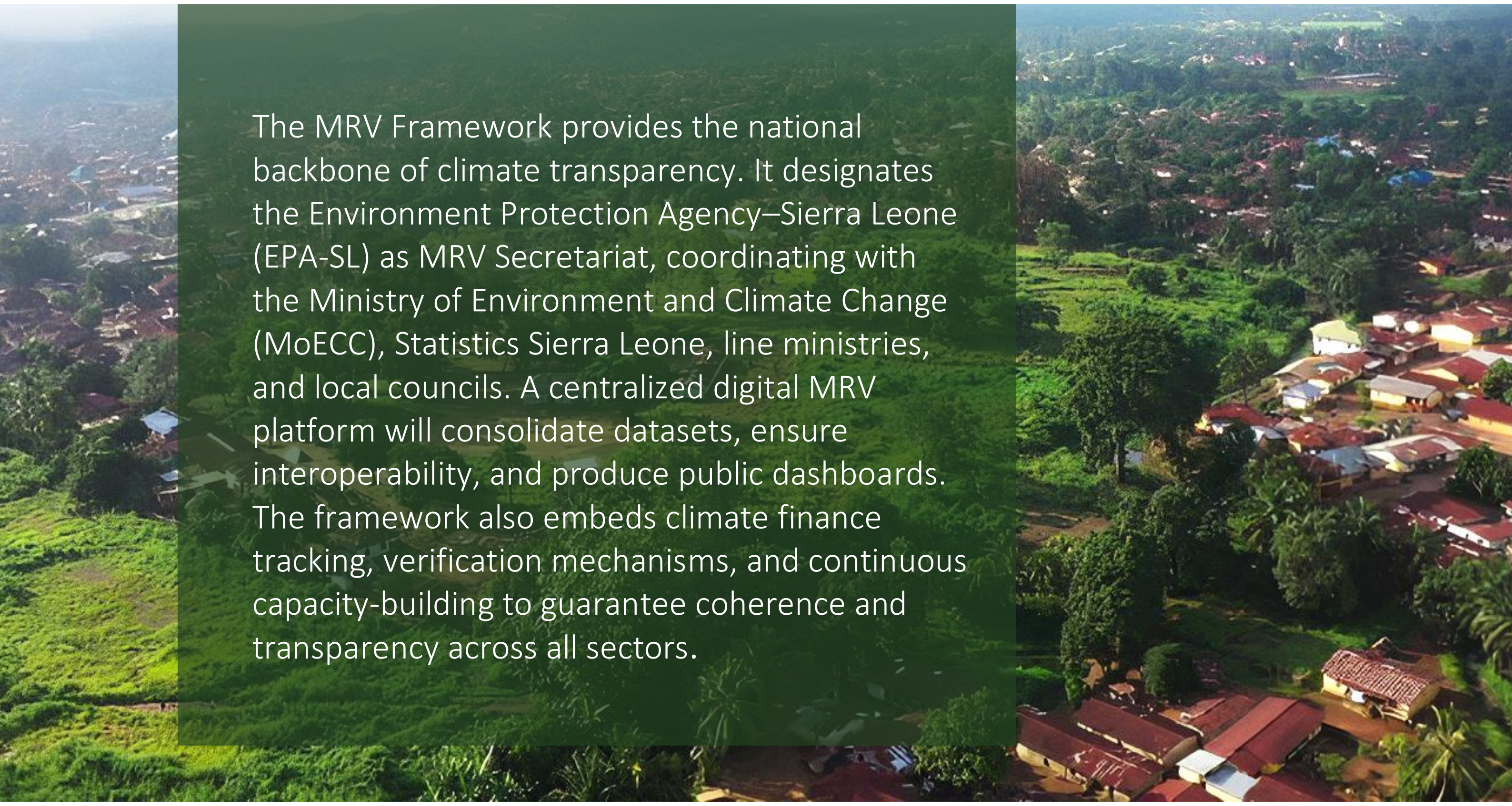
A4P	Agenda for Prosperity
AFOLU	Agriculture, Forestry and Other Land Uses
BUR	Biennial Update Report
CCP	Climate Change Project
CCS	Climate Change Secretariat
CCSAP	Climate Change Strategy and Action Plan
CO2	Carbon Dioxide
CEF	Carbon Emission Factors
CFC	Chloro Fluorocarbon
CH4	Methane
CMB	Coastal Management Board
CO	Carbon Monoxide
COP	Conference of Parties
ECOWAS	Economic Community of West African State
EF	Emission Factor
EI	Energy Industries
EJ	Exajoule
EPA-SL	Environment Protection Agency – Sierra Leone
FAO	Food and Agricultural Organization
FBC	Fourah Bay College
GDP	Gross Domestic Product
GEF	Global Environmental Facility
Gg	Gigagrams
GHG	Greenhouse Gas
HCFC	Hydro-Chlorofluorocarbon
HFO	Heavy Energy Oil
IPCC	Intergovernmental Panel on Climate Change
ICZM	Integrated Coastal Zone Management
IMBO	Institute of Marine Biology and Oceanography
INC	Initial National Communication
IPCC	Inter-governmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
ISIC	International Standard Industrial Classification
MASSADA	A Waste Management Company in Freetown
MAFFS	Ministry of Agriculture, Forestry and Food Security
MBSE	Ministry of Basic and Secondary Education
MCI	Manufacturing and Construction Industries
MoEnv	Ministry of the Environment
MOE	Ministry of Energy
MRU	Mano River Union
MTA	Ministry of Transport and Aviation
MT	Million Tonnes
MTNDP	Medium-Term National Development Plan

MP	Metal Production
NOx	Nitrogen Oxide
N2O	Nitrous Oxide
NC	National Communication
ND	"New Direction" (Sierra Leone National Development Plan 2019/24)
NDC	Nationally Determined Contribution
NGO	Non-Governmental Organization
NMVOC	Non-Methane Volatile Organic Compound
NCCS	National Climate Change Secretariat
NCSP	National Communications Support Programme
NPPA	National Protected Area Authority
PA	Paris Agreement
PRSP	Poverty Reduction Strategy Paper
SLS	Sierra Leone Statistics
SLSB	Sierra Leone Standard Bureau
SNC	Second National Communications
SSL	Statistics Sierra Leone
SO2	Sulphur Dioxide
SF6	Sulphur Hexafluoride
SWDS	Solid Wastes Disposal Sites
TNC	Third National Communications
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNITAR	United Nations Institute for Training and Research
USL	University of Sierra Leone
VMT	Vehicle Miles Traveled
WONES	A women's Empowerment Association

EXECUTIVE SUMMARY

Sierra Leone is committed to strengthening its climate governance by operationalizing a comprehensive national Measurement, Reporting and Verification (MRV) system. This document sets out the MRV framework that underpins the implementation of NDC 3.0, ensures alignment with the Enhanced Transparency Framework (ETF) of the Paris Agreement, and provides the institutional, technical, and financial basis for long-term sustainability.

The MRV is structured around **cross-cutting framework**, **sectoral systems**, and a **ten-year implementation roadmap**. Together, these components establish Sierra Leone's capacity to credibly measure, report, and verify both mitigation outcomes and adaptation progress, while also tracking climate finance flows.



The MRV Framework provides the national backbone of climate transparency. It designates the Environment Protection Agency–Sierra Leone (EPA-SL) as MRV Secretariat, coordinating with the Ministry of Environment and Climate Change (MoECC), Statistics Sierra Leone, line ministries, and local councils. A centralized digital MRV platform will consolidate datasets, ensure interoperability, and produce public dashboards. The framework also embeds climate finance tracking, verification mechanisms, and continuous capacity-building to guarantee coherence and transparency across all sectors.

To ensure the MRV Framework is operational and routine, clear SOPs assign responsibilities to agencies on a weekly, monthly, quarterly, and annual basis. These cover EPA-SL, MoECC, Statistics Sierra Leone, Ministry of Finance, line ministries, local councils, and independent verifiers. SOPs ensure that climate data collection, validation, consolidation, and reporting are consistent, transparent, and embedded into regular government operations.

On top of this, sector-specific frameworks are provided for Energy, Transport, AFOLU/Forestry, Waste, Industrial Processes and Product Use (IPPU), and Coastal and Urban Systems. For each sector, the framework sets out mitigation and adaptation indicators, baselines, methodologies, institutional mandates, and outputs.

The **Energy sector** covers renewables, mini-grids, solar home systems, and clean cooking for mitigation, alongside resilience indicators for climate-proofed assets.	The **Transport sector** focuses on electric mobility, fuel efficiency standards, and resilient road infrastructure.	The **AFOLU/Forestry sector** integrates reforestation, avoided deforestation, climate-smart agriculture, and mangrove restoration.
The **Waste sector** prioritizes methane capture, composting, and waste-to-energy.	The **IPPU sector** monitors industrial processes including cement and refrigerant use.	**Coastal and Urban systems** track resilience measures against flooding, erosion, and extreme weather impacts.

Sierra Leone's MRV system requires an estimated USD 50 to 60 million for the period 2025–2035. The document details the justification of cost components and identifies potential financing sources, including international climate funds, multilateral development banks, bilateral donors, domestic resources, and emerging market instruments such as Article 6 transactions.

The roadmap sets out three sequential phases:

- **Phase I (2025–2027). Foundations & Pilots**: institutional arrangements, digital platform development, and sectoral pilots.
- **Phase II (2028–2030). Scaling & International Reporting**: expansion of MRV across all sectors, production of Biennial Transparency Reports (BTRs), and consolidation of finance tracking.
- **Phase III (2031–2035). Integration, Markets & Sustainability**: embedding MRV in national systems, ensuring financial sustainability, and preparing for full Article 6 market participation.

The framework incorporates a Quality Assurance & Quality Control (QA/QC) system, a RACI matrix clarifying roles and responsibilities across institutions, and a risk register with mitigation measures. These features ensure accountability, minimize duplication, and prepare institutions to address challenges such as data gaps, financing uncertainties, and staff turnover.

In conclusion, this MRV system provides Sierra Leone with a credible, transparent, and nationally owned system for tracking climate action. By integrating institutional mandates, sectoral indicators, financial mechanisms, and a phased roadmap, it enables the country to deliver robust evidence of progress toward its climate commitments. The system not only supports international reporting under the Paris Agreement but also enhances domestic planning, unlocks climate finance opportunities, and strengthens resilience for communities and ecosystems across Sierra Leone.

1 Introduction

This document presents Sierra Leone's comprehensive Measurement, Reporting and Verification (MRV) system developed to operationalize the commitments outlined in the country's Updated Nationally Determined Contribution (NDC 3.0) and to align with the Enhanced Transparency Framework (ETF) of the Paris Agreement. The MRV is designed to be both sector-specific and cross-cutting, providing the institutional, technical, and financial foundations required to deliver credible, transparent, and sustainable climate reporting.

The report begins with the **MRV Framework**, which establishes the institutional backbone of Sierra Leone's transparency system. This section details the governance structure led by the Environment Protection Agency–Sierra Leone (EPA-SL) as MRV Secretariat, supported by the Ministry of Environment and Climate Change (MoECC), Statistics Sierra Leone, line ministries, local councils, and independent verifiers. It also outlines the digital MRV platform, finance-tracking mechanisms, verification procedures, and capacity-building programs that ensure coherence and harmonization across all sectors.

Building on this foundation, the document introduces **Mitigation and Adaptation MRV Design Features**, which specify the methodological standards, data pipelines, indicator catalogues, and verification mechanisms that ensure emission reductions and resilience outcomes are tracked consistently. These design features also integrate Sierra Leone's MRV system with global agendas such as the Paris Agreement, the Sustainable Development Goals (SDGs), and the Sendai Framework on Disaster Risk Reduction.

The framework then provides **Agency-Specific Standard Operating Procedures (SOPs)**, assigning weekly, monthly, quarterly, and annual responsibilities to key institutions. This ensures that MRV is not an abstract policy framework, but a set of operational tasks embedded in the daily routines of EPA-SL, line ministries, the Ministry of Finance, Statistics Sierra Leone, and community-level actors.

The core of the report is the **Sectoral MRV Frameworks**, covering Energy, Transport, AFOLU/Forestry, Waste, Industrial Processes and Product Use (IPPU), and Coastal and Urban Systems. For each sector, the framework presents both mitigation and adaptation MRV systems, specifying indicators, baselines, data sources, methodologies, frequency of data collection, institutional mandates, and expected outputs. This provides a clear, sector-by-sector roadmap for how Sierra Leone will monitor its transition toward low-carbon development and climate resilience.

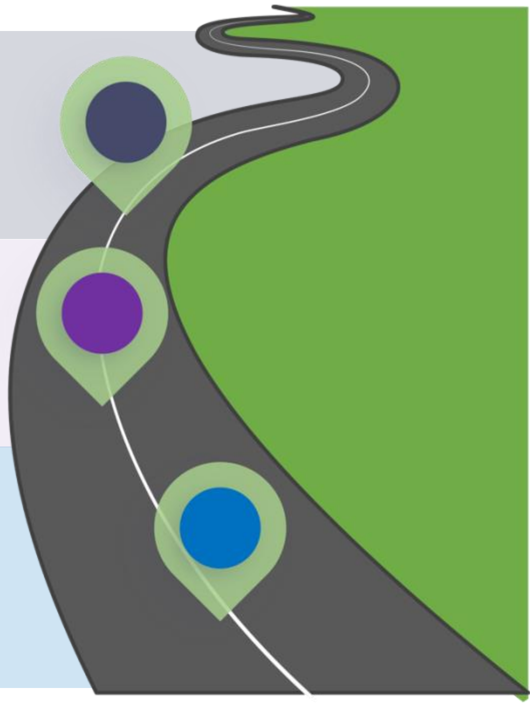
Recognizing that effective MRV requires sustainable financing, the document dedicates a full section to **Costing and Financing Instruments** for the period 2025–2035. This section justifies the estimated costs of MRV implementation and identifies financing sources, including international climate finance, development banks, bilateral partners, market-based instruments, and domestic contributions.

To ensure that the MRV system evolves strategically over time, the report includes an **Integrated Roadmap (2025–2035)** divided into three phases:

01 **Phase I (2025–2027). Foundations & Pilots**: establishing institutional arrangements, piloting the digital MRV platform, and launching sectoral pilots.

02 **Phase II (2028–2030). Scaling & International Reporting**: expanding coverage across all sectors, producing Biennial Transparency Reports (BTRs), and scaling verification systems.

03 **Phase III (2031–2035). Integration, Markets & Sustainability**: embedding MRV into national systems, ensuring readiness for Article 6 carbon markets, and achieving financial and institutional sustainability.



Complementing the roadmap, the document also sets out a **Quality Assurance & Quality Control (QA/QC) Framework**, a high-level **RACI matrix (Roles and Responsibilities)**, and a register of **Top Risks and Mitigation Measures**. These elements ensure accountability, clarity of institutional roles, and preparedness to address challenges such as data gaps, institutional turnover, or financing constraints.

Finally, the report provides a **References section**, consolidating the national policies, international guidelines, and technical sources that underpin the design of the MRV system.

Taken together, the document provides Sierra Leone with a comprehensive, government-ready blueprint for climate transparency. It links institutional mandates, sectoral data systems, financing strategies, and long-term roadmaps into a unified national MRV framework. This ensures that Sierra Leone can credibly measure, report, and verify progress on both mitigation and adaptation, thereby strengthening national planning, enabling access to climate finance, and fulfilling its obligations under the Paris Agreement

In sum, this MRV is not only a reporting tool but a governance instrument. It creates the structures, procedures, and incentives needed to ensure that climate action in Sierra Leone is measurable, transparent, and trusted both nationally and internationally. By linking institutions, sectors, finance, and long-term planning into one integrated system, Sierra Leone positions itself to deliver on its NDC 3.0 commitments, unlock new climate finance, and build resilience for its people and ecosystems.

2 MRV Framework

While sectoral MRV frameworks are designed to track emissions reductions and resilience outcomes within specific domains such as energy, transport, AFOLU, waste, and IPPU, the effectiveness of Sierra Leone's overall MRV system depends on a set of mechanisms. The **MRV Framework** provides the institutional, technical, and procedural backbone required to ensure coherence, consistency, and transparency across all sectors.

This framework addresses several critical dimensions:

- **Institutional Governance:** It establishes the Environment Protection Agency–Sierra Leone (EPA-SL) as the national MRV Secretariat, coordinating with line ministries, Statistics Sierra Leone, and local councils. MoECC will provide high-level policy oversight to ensure coherence with NDC 3.0, LT-LEDS, and international reporting obligations. Line ministries will function as data custodians within their respective sectors. Statistics Sierra Leone will validate datasets, ensure quality and methodological rigor, and address uncertainties. Local councils and communities will contribute to data collection and validation, particularly for adaptation and community-level projects.This ensures clarity of roles, minimizes duplication, and strengthens accountability through a whole-of-government approach.

- **Legal and Policy Alignment:** It integrates MRV activities within Sierra Leone's broader climate governance architecture, linking directly with the National Adaptation Plan (NAP), the updated Nationally Determined Contribution (NDC 3.0), and the forthcoming Climate Change Act.

- **Data and Digital Systems:** A centralized digital MRV platform forms the core of data collection, consolidation, and reporting. This platform enables interoperability across ministries, integrates community-based monitoring. This platform will feature dashboards for energy, transport, AFOLU, waste, IPPU, and coastal/urban systems. It will enable near real-time data integration, facilitate public access to information, and ensure interoperability with UNFCCC reporting systems. The platform will also integrate geospatial tools, mobile data collection applications, and climate finance tracking modules.

- **Verification and Quality Assurance**: Verification will be conducted through a tiered approach: (i) internal QA/QC within line ministries; (ii) statistical harmonization by Statistics Sierra Leone; and (iii) independent third-party verification for large-scale projects, including renewable energy, REDD+, and landfill methane capture. Community-based participatory verification will be applied to adaptation measures such as CSA adoption, mangrove restoration, and resilient infrastructure.

- **Finance Tracking:** The framework embeds climate budget tagging and finance MRV to ensure that financial flows supporting mitigation and adaptation are transparently tracked. The mechanism will be managed by the Ministry of Finance, using budget tagging and donor reporting. This will allow Sierra Leone to transparently report support received and needed, and to align domestic climate budget allocations with international commitments. The finance tracking system will also be linked to Article 6 readiness, enabling Sierra Leone to participate effectively in international carbon markets.

- **Capacity Building:** Training programs, institutional strengthening, and partnerships with academic and regional institutions are central to ensuring that the system is resilient to staff turnover and capable of sustaining long-term MRV operations. Technology transfer, especially in digital MRV platforms, mobile-based monitoring, and GIS-based data management, will be pursued through international cooperation.

- **Community and Inclusivity:** The framework emphasizes the role of local councils, civil society, and community-based organizations in data collection and validation, ensuring that MRV is inclusive, participatory, and reflective of local realities.

By embedding these elements, Sierra Leone's MRV system will move beyond sectoral silos to operate as an integrated, nationally owned, and internationally credible framework. The MRV Framework ensures that all sectoral data feeds into a unified system, producing outputs such as **Biennial Transparency Reports (BTRs), national climate dashboards, and consolidated MRV summaries** that align with the Enhanced Transparency Framework of the Paris Agreement.

In summary, the MRV Framework provides the backbone of Sierra Leone's national climate transparency system, ensuring that sectoral efforts are harmonized and that the country can reliably measure, report, and verify progress towards its climate commitments.

Mitigation MRV Design Features

This section deepens the system-wide design features that make Sierra Leone's mitigation MRV robust, interoperable, and credible across all sectors (energy, transport, AFOLU/forestry, waste, and IPPU). It specifies how data are generated, governed, processed, verified, and reported so that emission-reduction results are defensible for national decision-making, Biennial Transparency Reports (BTRs), and potential Article 6 transactions.

System architecture and data model

The national MRV Platform (hosted by EPA-SL as MRV Secretariat) implements a hub-and-spoke architecture:

- **Unique IDs & metadata.** Every facility, project, asset, device, and dataset carries a persistent identifier, timestamp, geolocation, sector tag, version, and provenance (source, method, owner).
- **Layered data model.** Raw activity data (meters, logs, surveys) → validated datasets (QA/QC passed) → **calculated indicators** (tCO_2e, intensities) → **reporting outputs** (sector reports, BTR annexes).
- **APIs & interoperability.** Secure APIs connect line-ministry databases (MoE/NPA, MoTA/SLRA, MAFFS/REDD+ MRV, MLGRD/municipal councils, MoTI/industry) and allow bulk uploads from developers and operators.

Data acquisition pipelines

- **Energy:** SCADA and revenue-grade meters for generation; mini-grid logs; SHS distributor sales & after-sales; Stove Use Monitors (SUMs) and LPG/biogas sales ledgers.
- **Transport:** Vehicle registry, telematics/GPS for e-buses and e-kekeh, fuel import and sales statistics, inspection data for fuel-efficiency programs.
- **AFOLU/Forestry:** Permanent sample plots, biomass/allometric surveys, Landsat/Sentinel imagery, activity records for re/afforestation and ANR, mangrove restoration logs, CSA adoption surveys.
- **Waste:** Weighbridges, landfill gas flow meters and flare/generator logs, composting and sorting facility records, municipal collection routes.

- **IPPU:** Plant production logs (clinker, cement), material balance sheets, QC systems, refrigerant inventories. All pipelines support **offline mobile forms**, minimum sampling sizes, and **data dictionaries** to standardize field entries.

Indicator catalogue and calculation methods

A national **Indicator Catalogue** maintains formulas, units, boundaries, and references for each mitigation indicator, including:

- **Activity indicators:** MWh generated by renewables, Nm^3 CH_4 captured, km travelled by electric fleets, ha restored, tons of clinker produced.

- **Result indicators:** tCO_2e avoided/reduced, emission intensities (e.g., gCO_2/kWh, tCO_2e/ton cement), leakage factors where applicable.

  For quantification, the platform applies the **2006 IPCC Guidelines (with 2019 Refinement where relevant)** and recognized mechanisms (e.g., AMS-I.L for mini-grids, AMS-II.G for clean cooking, AMS-III.C/III.S for low-emission vehicles, ACM0001/AMS-III.E for waste, ACM0005 for cement blending). Each indicator entry stores: method name, equations, parameters, default vs country-specific factors, uncertainty class, and QA/QC checks.

Emission-factor and parameter governance

- **Master Emission Factor (EF) Register.** Central repository for grid EF, fuel NCVs and EFs, methane correction factors, default biomass fractions, clinker emission factors, etc.
- **Update cycle.** Annual review chaired by EPA-SL and Stats SL; grid EF recomputed from the national generation mix; sector-specific EFs updated when new measurements justify a change.
- **Versioning & traceability.** Every calculation cites EF version; recalculations are logged and documented for inventory consistency.

Calculation engines and reproducibility

- **Embedded calculators.** The platform hosts vetted calculation modules for each method; inputs/outputs are machine-readable and exportable.
- **Reproducible runs.** Each reporting cycle locks inputs, EF versions, and computation settings to generate auditable “calculation packets” with hashes and run IDs.
- **Boundary & baseline management.** Project/system boundaries, baseline types (historic average, modeled, standardized baseline), and leakage/permanence flags are stored with justification.

QA/QC and automated data validation

A standardized validation pipeline runs at ingest and at consolidation:

- **Completeness & range checks** (mandatory fields, plausible ranges, unit checks).
- **Temporal consistency** (trend breaks, missing periods, duplicated records).
- **Cross-source reconciliation** (e.g., fuel imports vs sales vs activity; mass balance at plants; landfill gas vs electricity generated).
- **Outlier diagnostics** using interquartile ranges or z-scores, with analyst review workflows.

- **Device calibration & maintenance logs** required for meters, SUMs, flow meters, weighbridges; calibration overdue alerts.
  All QA/QC actions create an **audit trail** (who, what, when), enabling trace-back for verifiers.

Verification design (ISO 14064-3-aligned)

- **Risk-based sampling.** Higher-materiality projects, first-time reporters, or outlier datasets receive deeper verification coverage.
- **Document and site checks.** Chain-of-custody, meter certificates, raw data extracts; selective field visits for high-impact sources (e.g., LFG plants, mini-grids, forestry plots).
- **Verification opinions & findings.** Third-party statements are uploaded to the MRV Platform, cross-referenced to datasets; corrective actions are tracked to closure.

Integration with the national GHG inventory and BTRs

- **Mapping tables** link MRV indicators to inventory categories (1996/2006 IPCC sectors and sub-categories).
- **Cut-off dates & locks** ensure the same data freeze across sectors for each BTR/Inventory submission.
- **Variance monitoring.** Differences between MRV-based estimates and inventory aggregates are analyzed and documented (activity vs EF driver analysis).

Article 6 readiness features (mitigation only)

- **Authorization & registry hooks.** Flags for authorized mitigation activities, serializable Mitigation Outcomes (MOs), and registry-ready metadata (vintage, sector, method, monitoring period).
- **Corresponding adjustments.** Data structures to track first-transfer quantities and adjustments to national accounts.
- **Safeguards & benefit sharing.** Linkages to social/environmental safeguards records, grievance logs, and benefit-sharing statements; leakage/permanence monitoring for land-based activities.

Linkage to finance MRV and results-based instruments

- **Cost & results linkage.** Optional unit-cost fields (USD/tCO_2e, USD per device/ha/MWh) connect mitigation outputs to finance disbursements.
- **Results-based finance (RBF).** Milestone tracking aligned to verified tCO_2e; payment triggers tied to verification statements.
- **Budget tagging.** Climate budget tagging codes attached to MRV records for consolidated finance transparency.

Data governance, security, and confidentiality

- **Role-based access control (RBAC)** distinguishes data providers, compilers, verifiers, and public viewers.
- **Confidentiality regimes** (e.g., IPPU plant data) protected through MoUs and controlled views; public dashboards show aggregated, non-sensitive indicators.
- **Backups & continuity.** Daily encrypted backups, disaster-recovery procedures, and mirrored storage for critical datasets.

Transparency, disclosure, and public dashboards

- **Release calendar.** Quarterly sector briefs; annual mitigation MRV report; BTR annexes by submission year.
- **Dashboards.** Public, near-real-time displays of key indicators (renewable capacity, CH_4 captured, e-mobility kilometres, hectares restored, clinker ratio trends) with glossary and methodology notes.

SOPs, capacity-building, and change management

- **SOP library.** Standardized procedures for data capture, EF updates, QA/QC, verification support, recalculations, and issue management.
- **Training cadence.** Annual national training; sector refreshers each semester; verifier orientation sessions.
- **Change control.** Any methodological or EF change is logged with rationale, impact assessment, and effective date; historical recalculations are documented.

Performance management (MRV KPIs)

- **Timeliness:** % datasets submitted by deadline.
- **Completeness:** % records passing completeness checks.
- **Accuracy:** Verification pass rate; % material discrepancies.
- **Consistency:** Year-over-year variance within expected ranges.
- **Usability:** Dashboard uptime and API availability.

Adaptation MRV Design Features

Sierra Leone's ability to demonstrate progress on climate resilience depends on an adaptation MRV framework that is both systematic and credible. Unlike mitigation, adaptation outcomes are multi-dimensional, context-specific, and often qualitative. The **Adaptation MRV Design Features** therefore establish the institutional, technical, and procedural foundations for measuring, reporting, and verifying adaptation actions across all sectors. These features ensure coherence, comparability, and transparency while recognizing the distinct nature of adaptation results.

System architecture and data integration

- **Central coordination:** EPA-SL, acting as MRV Secretariat, maintains the national digital platform where adaptation data from all sectors converge.
- **Indicator layering:** Data move through four tiers – (i) raw activity inputs (field surveys, hazard maps, expenditure reports); (ii) validated datasets; (iii) resilience indicators (process and outcome-based); (iv) reporting outputs (sector scorecards, NAP/BTR annexes).
- **Interoperability:** APIs connect with municipal development plans, NDMA disaster-loss databases, and line ministry resilience programs, ensuring consistency with both national and local systems.

Indicator catalogue for adaptation

Adaptation indicators must capture changes in systems, processes, and outcomes. Categories include:

- **Process indicators:** e.g., number of sectoral policies integrating climate resilience, share of budgets tagged as climate-relevant.

- **Output indicators:** e.g., km of roads upgraded to flood-resistant standards, hectares of mangroves restored, proportion of energy assets climate-proofed.
- **Outcome indicators:** e.g., reduction in flood-related damages, improved yield stability, reduced number of households displaced by climate events. Each indicator is stored in the catalogue with definition, unit, baseline year, data source, reporting frequency, and link to national/international frameworks (NAP, SDGs, Sendai).

Data acquisition and validation

- **Sources:** Household and community surveys, meteorological observations, disaster-loss assessments, administrative records, remote sensing, and project M&E reports.
- **Validation:** Multi-level checks, including consistency with NDMA disaster data, triangulation between surveys and administrative records, and plausibility checks against historical baselines.
- **Community MRV:** Local councils and community-based organizations act as frontline monitors, using mobile tools to capture data on resilience outcomes (e.g., flood frequency, crop failure rates).

Alignment with international frameworks

- **NAP and NDC 3.0:** Ensures indicators directly map to national adaptation priorities.
- **Sendai Framework:** Incorporates disaster risk reduction measures (e.g., reductions in disaster mortality, damages to infrastructure).
- **SDGs:** Cross-references to SDG 2 (food security), SDG 11 (sustainable cities), and SDG 13 (climate action).
- **UNFCCC ETF:** Adaptation MRV outputs are aligned with Biennial Transparency Report (BTR) requirements for adaptation communication.

QA/QC for adaptation data

- **Consistency checks:** Year-to-year comparisons of resilience outcomes, ensuring reported changes reflect plausible climate trends and interventions.
- **Cross-validation:** Adaptation results are verified against multiple data sources (e.g., reduced flood losses verified through NDMA reports, insurance claims, and municipal records).
- **Qualitative data protocols:** Narrative and case study evidence are coded against standardized templates to allow structured comparison.
- **Audit trail:** Each adaptation dataset includes metadata on source, date, collector, and validation status.

Verification design for adaptation

- **Independent evaluation:** Universities and regional climate centers conduct periodic evaluations of adaptation outcomes.
- **Participatory verification:** Community monitors validate resilience outcomes, ensuring inclusivity and capturing local knowledge.
- **Triangulated review:** Data are verified using a combination of documentary evidence, field visits, and geospatial analysis (e.g., verifying mangrove restoration areas with satellite imagery).

Finance and adaptation tracking

- **Climate budget tagging:** Tracks public expenditures supporting adaptation, ensuring that financial inputs are transparently linked to resilience outcomes.
- **Results-based adaptation finance:** Establishes indicators that can trigger disbursements from donors and RBF mechanisms (e.g., hectares of land rehabilitated, number of households benefiting from early warning systems).
- **Cost-benefit lens:** Where possible, adaptation indicators include economic valuation of avoided losses (USD saved per $ invested).

Institutional roles and responsibilities

- **Line ministries:** Collect sector-specific adaptation data (MoE for energy, MoTA/SLRA for transport, MAFFS for agriculture, MLHCP for urban, NDMA for disaster resilience).
- **EPA-SL (MRV Secretariat):** Consolidates, validates, and harmonizes data across sectors.
- **Statistics Sierra Leone:** Ensures statistical rigor and integration with national development statistics.
- **Local councils and communities:** Serve as primary data sources for grassroots resilience measures.
- **Independent actors:** Academia, NGOs, and development partners provide technical support and third-party validation.

Outputs and reporting

- **Annual sector adaptation MRV reports:** Summarize key indicators and progress by sector.
- **National adaptation scorecards:** Provide cross-sector resilience indicators at the national level.
- **BTR annexes:** Present consolidated adaptation outcomes aligned with UNFCCC reporting templates.
- **Dashboards:** Public-facing digital dashboards display adaptation progress using maps, graphs, and summary indicators for transparency.

Risk management and safeguards

- **Data gaps:** Proxy measures (e.g., modeled flood risk reduction) are used until empirical data become available.
- **Institutional continuity:** SOPs and training ensure that staff turnover does not interrupt adaptation MRV processes.
- **Inclusivity safeguards:** Gender-disaggregated indicators and equity markers ensure adaptation results reflect vulnerable groups' outcomes.

Capacity building and sustainability

- **Training programs:** Annual workshops for government staff, community monitors, and statisticians on adaptation indicators and methods.
- **Toolkits and SOPs:** Manuals for consistent data collection, qualitative reporting, and community validation.
- **South-South cooperation:** Partnerships with other LDCs and regional bodies to share lessons on adaptation MRV practices.

3 Agency-Specific Standard Operating Procedures (SOP) Checklists

In this section we go deeper into the responsibilities of each agency. The MRV framework relies on clear institutional mandates, coordinated data flows, and quality control mechanisms. EPA-SL acts as the MRV Secretariat. MoECC provides policy oversight. Stats SL ensures statistical quality. Line ministries collect and validate sectoral data, while local councils support community MRV. Accredited verifiers and academia provide independent review, while MoF manages finance tracking.

Within the mandates established, each agency has defined weekly, monthly, quarterly, and annual responsibilities to operationalize the MRV framework. For example, EPA-SL conducts weekly QA checks and consolidates data monthly, while MoECC leads quarterly coordination meetings and prepares annual submissions to the UNFCCC. Stats SL harmonizes datasets and conducts uncertainty analysis, line ministries collect site-level data, and local councils coordinate community MRV.

The MRV system requires investment in institutional capacity, digital platforms, equipment, surveys, verification, and training. Estimated costs for 2025–2035 are approximately USD 50–60 million. Financing can be mobilized through GCF Readiness grants, GEF projects, AfDB and World Bank investments in infrastructure and data systems, bilateral donor support, and revenues from Article 6 transactions. Domestic sources will include budget allocations and sector-based levies for sustainability.

Environment Protection Agency - Sierra Leone (EPA-SL) - MRV Secretariat

- **Weekly:** Review datasets submitted by line ministries for completeness and accuracy; conduct routine quality assurance and control (QA/QC) checks on a representative sample; update the national MRV tracking register.
- **Monthly:** Consolidate sectoral data into the national MRV platform; prepare and disseminate feedback reports to line ministries regarding data quality and timeliness.
- **Quarterly:** Convene inter-ministerial MRV coordination meetings; issue quarterly MRV bulletins summarizing progress on mitigation and adaptation outcomes.
- **Annual:** Compile and publish the **National MRV Report**; prepare sectoral annexes for the Biennial Transparency Report (BTR) and submit to the Ministry of Environment and Climate Change (MoECC).

Ministry of Environment and Climate Change (MoECC) - Policy Oversight

- **Weekly:** Review MRV data to ensure alignment with national climate policy objectives.
- **Monthly:** Issue policy guidance to sectoral ministries on integration of MRV results into planning and decision-making.
- **Quarterly:** Chair the MRV Steering Committee and provide oversight of cross-sectoral MRV coordination.
- **Annual:** Endorse Sierra Leone’s consolidated MRV outputs for submission to Cabinet and the UNFCCC.

Statistics Sierra Leone (Stats SL) – Harmonization and Quality Assurance

- **Weekly:** Conduct statistical checks on sectoral datasets and ensure consistency with national statistical standards.
- **Monthly:** Undertake uncertainty analyses in accordance with IPCC 2006 methodologies.
- **Quarterly:** Publish harmonized datasets and provide technical notes on consistency and uncertainty.
- **Annual:** In collaboration with EPA-SL, issue the updated National GHG Inventory.

Ministry of Finance (MoF) - Climate Finance Tracking

- **Weekly:** Record and tag climate-related budget allocations and donor inflows.
- **Monthly:** Update the national climate finance MRV dashboard.
- **Quarterly:** Consolidate climate-related expenditure reports from all ministries and agencies.
- **Annual:** Publish the **National Climate Finance Tracking Report**, including support received and mobilized, consistent with Article 6 readiness requirements.

Line Ministries (MoE, MoTA, MAFFS, MoTI, MoLG, MFMR) -Sectoral Data Custodians

- **Weekly:** Collect sector-specific raw data, including metered readings, field logs, and household or enterprise surveys.
- **Monthly:** Validate and transmit consolidated datasets to EPA-SL.
- **Quarterly:** Produce sectoral MRV progress summaries and submit to the MRV Secretariat.
- **Annual:** Prepare sector-specific contributions to the National MRV Report and BTR annexes.

Local Councils and Community MRV Committees

- **Weekly:** Undertake community-level monitoring of mitigation and adaptation interventions, such as improved cookstoves, mangrove restoration, and mini-grid performance.
- **Monthly:** Facilitate community validation meetings to confirm the accuracy of local MRV indicators.
- **Quarterly:** Report aggregated community data to relevant line ministries.
- **Annual:** Contribute district-level adaptation and mitigation reports to the national MRV process.

Independent Verifiers and Academic Institutions

- **Quarterly:** Conduct targeted verification audits of a representative sample of MRV datasets to ensure credibility.
- **Annual:** Submit independent third-party verification reports, including findings and recommendations, for inclusion in Sierra Leone’s BTR annexes.

Consolidated Outputs

The cumulative outputs of the above SOPs shall include:

- **Weekly:** Updated QA/QC logs and sectoral raw data registers.
- **Monthly:** Consolidated sectoral datasets and agency-level MRV summaries.
- **Quarterly:** Inter-ministerial coordination reports, harmonized statistics, and independent verification findings.
- **Annual:** The **National MRV Report**, sector-specific annexes to the **Biennial Transparency Report**, and the **National Climate Finance Tracking Report**.

The table below:

- Clarifies institutional roles across all emitting sectors.
- Demonstrates accountability and transparency in data collection, QA/QC, and reporting.
- Provides government reviewers with a clear one-page map of who does what and what outputs to expect.

Table 1: Institutional Responsibilities and Outputs for Mitigation MRV

Institution / Actor	Core Responsibilities	Key Outputs
Environment Protection Agency – SL (EPA-SL)	Acts as MRV Secretariat; manages national MRV platform; consolidates sectoral mitigation data; oversees QA/QC and verification processes	Consolidated mitigation MRV reports; BTR mitigation annexes; national dashboards
Statistics Sierra Leone (Stats SL)	Validates statistical quality of activity data and emission factors; ensures consistency across datasets and reporting cycles	Quality-checked datasets; harmonized emission indicators
Line Ministries **(Energy, Transport, Agriculture/Forestry, Waste, Industry)**	Collect sector-specific mitigation data; apply standardized methodologies; maintain sectoral data pipelines	Sectoral mitigation MRV reports; sector-specific dashboards and inventories
National Power Authority (NPA) & MoE	Provide energy generation and fuel consumption data; track renewable and clean cooking interventions	Energy sector MRV datasets; renewable capacity and clean cooking reports
Sierra Leone Roads Authority (SLRA) & MoTA	Collect transport activity and fuel use data; oversee e-mobility and efficiency monitoring	Transport MRV reports; e-mobility performance dashboards
Ministry of Agriculture & Forestry (MAFFS) / REDD+ Unit	Collect forestry and land-use data; manage permanent sample plots and satellite-based MRV	AFOLU mitigation reports; REDD+ MRV and safeguards summaries
Municipal Councils (Waste Sector)	Monitor landfill gas, composting, recycling, and waste-to-energy activities; collect facility-level data	Waste MRV reports; methane capture and diversion records

Ministry of Trade & Industry (MoTI)	Gather data from industrial facilities; track clinker substitution, process emissions, and refrigerant use	IPPU mitigation reports; facility-level emission summaries
Independent Verifiers (third parties)	Conduct audits of sectoral and project-level data; verify high-value mitigation outcomes, especially under Article 6	Verification statements; corrective action reports
Academic & Research Institutions	Provide technical support for emission factors, baselines, and uncertainty analysis	Peer-reviewed emission factor studies; independent methodological reviews
Development Partners	Provide technical and financial support; fund pilots and capacity building	Project MRV evaluations; results-based finance reports

The Table below

- Distills the complex design features into a concise institutional map.
- Shows clearly who is responsible, accountable, and what outputs they must deliver.
- Reinforces transparency and accountability for government reviewers.

Table 2: Institutional Responsibilities and Outputs for Adaptation MRV

Institution / Actor	Core Responsibilities	Key Outputs
Environment Protection Agency - SL (EPA-SL)	Acts as MRV Secretariat; consolidates sectoral adaptation data; manages national MRV platform; ensures overall coherence	Consolidated national adaptation MRV reports; BTR adaptation annexes; dashboards
Statistics Sierra Leone (Stats SL)	Ensures statistical rigor; validates datasets; integrates adaptation data with national statistics	Quality-checked adaptation indicators; harmonized datasets
Line Ministries **(Energy, Transport, Agriculture/Forestry, Urban Development, Fisheries)**	Collect sector-specific data; apply MRV protocols; ensure sectoral QA/QC processes	Sectoral adaptation MRV reports; sector-specific scorecards
National Disaster Management Agency (NDMA)	Provides hazard, disaster-loss, and vulnerability data; validates climate risk indicators	Annual disaster-loss databases; risk assessment inputs for MRV
Local Councils & Community Monitors	Collect local-level adaptation data (e.g., flood events, resilience practices); support participatory verification	Community reports; grassroots validation of resilience outcomes
Academic & Research Institutions	Conduct independent assessments and evaluations; provide technical support for indicator development	Verification reports; independent evaluation studies
Civil Society & NGOs	Facilitate community-based MRV; ensure inclusivity and gender-sensitive data collection	Equity-focused adaptation reports; qualitative evidence of outcomes
Development Partners	Provide financial and technical support; support capacity building	Results-based finance reports; training modules; donor evaluation reports

4 Sectoral MRV Framework

The sectoral framework provides a comprehensive basis for tracking both sectoral and cross-sectoral interventions. It identifies clear indicators, establishes baselines, specifies data sources, and outlines methodologies consistent with the **2006 IPCC Guidelines** and relevant UNFCCC methodologies. By standardizing approaches across sectors, the framework ensures comparability, credibility, and alignment with the Enhanced Transparency Framework of the Paris Agreement.

Central to the framework is the principle of accountability. Sector ministries act as primary data custodians, while the Environment Protection Agency–Sierra Leone (EPA-SL), in its role as MRV Secretariat, consolidates datasets and ensures consistency with the national GHG inventory. Statistics Sierra Leone validates statistical quality and harmonization, while independent verifiers provide an additional layer of credibility.

The Mitigation MRV Framework is also designed to generate outputs that directly inform both national decision-making and international reporting. Annual sectoral MRV reports, consolidated national summaries, and annexes to the Biennial Transparency Reports (BTRs) will provide the evidence base for assessing progress towards emission reduction targets. In addition, sectoral dashboards will enable real-time tracking of mitigation indicators by policymakers and the public, thereby promoting transparency and accountability.

In sum, the Mitigation MRV Framework equips Sierra Leone with the tools to **systematically track, validate, and communicate emission reductions**, ensuring that mitigation outcomes are robust, verifiable, and aligned with international standards

The sectoral framework establishes also a structured system for tracking adaptation interventions across key priority areas, including energy, transport, agriculture and forestry, waste, coastal and urban systems, and disaster risk management. It defines indicators that capture both process-oriented measures (such as the integration of climate resilience into planning and infrastructure design) and outcome-based measures (such as reductions in climate-related losses, improvements in yield stability, or enhanced coastal protection).

The Adaptation MRV Framework is aligned with the **UNFCCC Enhanced Transparency Framework**, the **Sendai Framework for Disaster Risk Reduction**, and the **Sustainable Development Goals (SDGs)**, thereby ensuring that Sierra Leone's adaptation reporting contributes to multiple international agendas. It also promotes coherence with national policy instruments, including the National Adaptation Plan (NAP) and the Integrated Nationally Determined Contribution (NDC 3.0).

Institutionally, sector ministries and local councils are responsible for collecting and reporting adaptation data, while the Environment Protection Agency–Sierra Leone (EPA-SL), as MRV Secretariat, consolidates and validates the information. Statistics Sierra Leone ensures methodological rigor and harmonization, while independent evaluations and community-based validation processes provide additional credibility and inclusiveness.

The outputs of the framework will include **annual adaptation reports, sectoral resilience scorecards, and adaptation annexes to Biennial Transparency Reports (BTRs)**. These outputs will not only inform national policy and planning but also demonstrate to the international community Sierra Leone's progress in safeguarding communities, ecosystems, and infrastructure from the adverse impacts of climate change.

Energy Sector

4.1.1 Mitigation MRV Framework

The energy sector represents one of the most significant sources of greenhouse gas emissions in Sierra Leone, while also offering the greatest potential for transformative mitigation. As the country pursues its NDC 3.0 commitments, the development of a robust **Mitigation MRV Framework for the Energy Sector** is essential to track, verify, and communicate progress towards a cleaner and more sustainable energy system.

This framework establishes a structured methodology for monitoring emission reductions from key interventions, including the expansion of renewable energy generation, deployment of mini-grids and solar home systems, electrification of rural and peri-urban areas, and the transition to cleaner cooking solutions through improved cookstoves, LPG, and biogas. It defines standardized indicators such as installed renewable capacity, electricity generated from renewable sources, households transitioned to clean cooking technologies, and associated avoided emissions in tonnes of CO_2 equivalent.

The framework is grounded in internationally recognized methodologies, including the **2006 IPCC Guidelines** and relevant **CDM methodologies** such as AMS-I.L for mini-grids and AMS-II.G for clean cooking technologies. By applying these methodologies, Sierra Leone ensures that emission reduction calculations are robust, transparent, and consistent with international standards, thereby facilitating participation in Article 6 mechanisms and other climate finance opportunities.

Institutionally, the Ministry of Energy (MoE) and the National Power Authority (NPA) serve as the primary custodians of sectoral data, supported by project developers and independent monitoring systems such as smart meters and stove use monitors (SUMs). EPA-SL, as MRV Secretariat, consolidates the data into the national MRV platform, while Statistics Sierra Leone validates the statistical integrity of reported indicators. Independent verifiers will provide an additional layer of assurance, particularly for high-value projects linked to carbon markets.

Through this framework, Sierra Leone will produce **annual energy MRV reports, sectoral dashboards, and contributions to the Biennial Transparency Reports (BTRs)**. These outputs will not only guide domestic energy planning and policy but also demonstrate to the international community Sierra Leone's measurable progress in reducing emissions from one of its most critical sectors.

In summary, the Mitigation MRV Framework for the Energy Sector equips Sierra Leone with the tools to **systematically track and verify emission reductions**, ensuring that the transition to sustainable energy is both transparent and credible at the national and international levels.

Indicators and Baselines

The mitigation measures in the sector are: Grid-connected renewables, solar mini-grids, commercial/industrial PV, solar home systems, clean cooking (ICS, LPG, biogas), energy efficiency.

Then the key indicators are:

- Installed renewable energy capacity (MW).
- Electricity generated from renewables (MWh/year).
- Number of operational mini-grids and SHS units deployed.
- % households transitioned
- Number of ICS and LPG/biogas stoves distributed and in use.
- Reduction in biomass consumption per household (%).

- T&D loss rates,
- tCO_2e avoided
- Energy intensity per GDP unit (MJ/USD).

Baselines (2023/24) show less than 100 MW RE, electrification rate <35%, T&D losses >25%, clean cooking penetration negligible.

Indicators	Baselines	Data Sources	Methodologies	Frequency	Institutions
Installed renewable capacity (MW); # of mini-grids; # of ICS/LPG/biogas stoves distributed; energy intensity per GDP	Baseline: 2023 national energy balance and electrification rate	Ministry of Energy, NPA, project developers, household surveys	IPCC 2006 Guidelines; CDM AMS-II.G (cookstoves); AMS-I.L (mini-grids)	Quarterly collection; annual consolidation	Ministry of Energy, EPA-SL, Statistics SL

Data Collection and Methodologies

Data collection will be carried out through national surveys, monitoring logs, remote sensing, and project-specific reporting. Internationally accepted methodologies from the IPCC 2006 Guidelines and relevant UNFCCC CDM methodologies will be applied. This ensures comparability, accuracy, and alignment with global standards.

Primary data sources will include SCADA logs, project reports, import/sales ledgers, household surveys, Stove Use Monitors (SUMs). For GHG accounting and resilience indicators, Sierra Leone will apply IPCC 2006 Guidelines; UNFCCC CDM AMS-II.G (cookstoves), AMS-I.L (mini-grids).

Frequency and QA/QC

Data collection will occur quarterly for pilots and annually for sectoral aggregation. QA/QC procedures will include meter calibration, remote sensing verification, household survey audits, and third-party verification where feasible. EPA-SL will coordinate these processes as the MRV Secretariat.

Data will be collected quarterly collection, annual consolidation. QA/QC procedures will include meter calibration, SUM audits, reconciliation with customs data. Independent verification will be conducted where appropriate.

Institutional Mandates

Each sector is assigned to its respective line ministry for data collection, with EPA-SL serving as the MRV Secretariat. Statistics Sierra Leone will harmonize datasets, MoECC will provide policy oversight, and the Ministry of Finance will ensure integration of climate finance tracking.

Institutional responsibilities are as follows: MoE, NPA, EPA-SL, Stats SL, private developers. EPA-SL will act as the MRV Secretariat, consolidating sectoral data and ensuring alignment with the national GHG inventory and adaptation frameworks.

Outputs

The outputs will include annual MRV reports, annexes to Biennial Transparency Reports (BTRs), and dashboards that display real-time sectoral indicators for decision makers and the public.

The MRV system will generate: Annual Energy MRV Report; Energy Annex to BTR; dashboard indicators. These outputs will feed into the Biennial Transparency Reports and public dashboards.

4.1.2 Adaptation MRV Framework

The energy sector in Sierra Leone is highly vulnerable to the impacts of climate change, with increasing risks from extreme weather events, flooding, and temperature variability affecting both generation and transmission infrastructure. The **Adaptation MRV Framework for the Energy Sector** provides a structured approach for systematically monitoring, reporting, and verifying resilience-building measures designed to safeguard energy systems and ensure uninterrupted service delivery in the face of these challenges.

This framework identifies key adaptation indicators, including the proportion of energy assets screened for climate risks, the integration of resilience standards into the design of new generation and transmission facilities, the extent of substations and distribution infrastructure upgraded to withstand flooding, and reductions in outage hours attributable to climate-related events. By tracking these indicators, Sierra Leone can assess both the effectiveness of resilience interventions and their contribution to broader development and disaster risk reduction objectives.

The framework is aligned with the **UNFCCC Enhanced Transparency Framework**, the **Sendai Framework for Disaster Risk Reduction**, and Sierra Leone's **National Adaptation Plan (NAP)**. It therefore ensures that adaptation reporting serves both national planning purposes and international reporting obligations, while also linking to the Sustainable Development Goals (notably SDG 7 on affordable and clean energy and SDG 13 on climate action).

Institutional responsibilities for implementation are shared across multiple agencies. The Ministry of Energy (MoE) and the National Power Authority (NPA) are responsible for the collection of sectoral data on asset resilience and operational disruptions. The National Disaster Management Agency (NDMA) contributes data on climate-related hazards and their impacts on energy infrastructure, while EPA-SL, as MRV Secretariat, consolidates and validates adaptation information within the national MRV system. Statistics Sierra Leone ensures methodological rigor and harmonization across datasets, and independent assessments provide external validation of reported outcomes.

The outputs of this framework will include **annual adaptation reports for the energy sector, sectoral resilience scorecards, and adaptation annexes to the Biennial Transparency Reports (BTRs)**. These outputs will inform both domestic energy policy—by guiding investments in climate-proof infrastructure—and international processes, by demonstrating Sierra Leone's progress in adapting its energy systems to climate risks.

In essence, the Adaptation MRV Framework for the Energy Sector equips Sierra Leone with the capacity to **systematically track, evaluate, and validate resilience-building actions**, ensuring that adaptation efforts are transparent, credible, and responsive to both national needs and international commitments.

Indicators and Baselines

The adaptation measures in the sector are: Infrastructure resilience upgrades for hydropower, coastal thermal plants, flood-proof substations, decentralized renewable systems.

Then the key indicators are:

- % of energy assets (plants, substations, transmission lines) assessed for climate risks.
- % of new energy projects designed with resilience standards.
- of substations protected against floods/storm surges.
- Hours of power outages due to extreme weather (reduction trend).

Baselines (2023/24) show existing grid vulnerability and frequency of weather-related outages.

Indicators	Baselines	Data Sources	Methodologies	Frequency	Institutions
# of assets climate-assessed; % of new projects resilient; # substations flood-proofed; weather-related outage hours	Baseline: 2023 power system outage reports	Ministry of Energy, NPA, NDMA	IPCC risk assessment; ICRR metrics	Annual; real-time outage monitoring	Ministry of Energy, NPA, NDMA, EPA-SL

Data Collection and Methodologies

Data collection will be carried out through national surveys, monitoring logs, remote sensing, and project-specific reporting. Internationally accepted methodologies from the IPCC 2006 Guidelines and relevant UNFCCC CDM methodologies will be applied. This ensures comparability, accuracy, and alignment with global standards.

IPCC risk assessment framework; Infrastructure Climate Risk and Resilience (ICRR) metrics.

Institutional Mandates

Each sector is assigned to its respective line ministry for data collection, with EPA-SL serving as the MRV Secretariat. Statistics Sierra Leone will harmonize datasets, MoECC will provide policy oversight, and the Ministry of Finance will ensure integration of climate finance tracking.

Institutional responsibilities are as follows: Ministry of Energy, NPA, EPA-SL, NDMA. EPA-SL will act as the MRV Secretariat, consolidating sectoral data and ensuring alignment with the national GHG inventory and adaptation frameworks.

Outputs

The outputs will include annual MRV reports, annexes to Biennial Transparency Reports (BTRs), and dashboards that display real-time sectoral indicators for decision makers and the public.

5 Transport Sector

Mitigation MRV Framework

The transport sector in Sierra Leone is a rapidly growing contributor to national greenhouse gas emissions, driven primarily by reliance on imported fossil fuels and an aging vehicle fleet with low fuel efficiency. At the same time, the sector offers significant opportunities for emission reductions through the deployment of electric mobility, the promotion of fuel-efficient technologies, and the integration of sustainable transport solutions. The **Mitigation MRV Framework for the Transport Sector** has therefore been established to provide a structured and transparent system for measuring, reporting, and verifying emission reductions achieved through these interventions.

The framework defines clear indicators for mitigation, including the number of electric buses and electric tricycles (e-kekeh) deployed, total kilometers traveled using low-emission vehicles, reductions in fossil fuel consumption, improvements in average fleet fuel economy, and associated avoided emissions in tonnes of CO_2 equivalent. These indicators are benchmarked against current baselines, which reflect minimal penetration of electric mobility and continued dependence on fossil fuels across the sector.

Methodologies applied under this framework are drawn from internationally recognized standards, including the **2006 IPCC Guidelines for National Greenhouse Gas Inventories** and relevant **CDM methodologies** such as AMS-III.C for emission reductions from electric vehicle deployment and AMS-III.S for fuel efficiency improvements. The use of these methodologies ensures that emission reductions are calculated in a consistent, transparent, and internationally credible manner.

Institutionally, the Ministry of Transport and Aviation (MoTA) and the Sierra Leone Roads Authority (SLRA) are responsible for the collection and validation of transport data, including fuel consumption statistics, vehicle registration records, and telematics from electric mobility projects. EPA-SL, acting as MRV Secretariat, consolidates sectoral data within the national MRV platform, while Statistics Sierra Leone ensures statistical rigor and harmonization. Independent verifiers will play an important role in auditing high-value projects and confirming the accuracy of reported results.

The outputs of the Mitigation MRV Framework for the transport sector will include **annual transport MRV reports, sector-specific dashboards, and contributions to the Biennial Transparency Reports (BTRs)**. These outputs will provide policymakers with evidence-based insights to guide the scaling up of electric mobility and efficiency programs, while also demonstrating Sierra Leone's commitment to reducing transport-related emissions in line with its NDC 3.0 commitments.

In summary, this framework equips Sierra Leone with the institutional, methodological, and technical tools needed to **systematically track, verify, and report emission reductions in the transport sector**, thereby ensuring that mitigation actions are transparent, robust, and aligned with both national priorities and international obligations.

5.1.1 Indicators and Baselines

The mitigation measures in the transport sector are: E-buses, e-kekeh, improved fuel efficiency standards.

Hence, the key indicators include:

- Number of e-buses and e-kekeh registered and in service.
- Estimated annual km travelled by e-mobility fleet.

- Volume of fossil fuel displaced (liters avoided/year).
- Emissions avoided (tCO_2e) from fleet electrification.
- Average vehicle fuel economy (L/100km).

The baselines (2023/24) show negligible EV deployment, >20 days/year of flood-related disruption in hotspots.

Indicators	Baselines	Data Sources	Methodologies	Frequency	Institutions
# of e-buses/e-kekeh deployed; liters of fuel displaced; emissions avoided (tCO_2e); average fleet fuel economy	Baseline: 2023 vehicle registry and fuel consumption data	Ministry of Transport, Road Safety Authority, fuel import statistics	IPCC 2006 (mobile combustion); CDM AMS-III.C; AMS-III.S	Annual; quarterly for pilots	Ministry of Transport, EPA-SL, Statistics SL

5.1.2 Data Collection and Methodologies

Data collection will be carried out through national surveys, monitoring logs, remote sensing, and project-specific reporting. Internationally accepted methodologies from the IPCC 2006 Guidelines and relevant UNFCCC CDM methodologies will be applied. This ensures comparability, accuracy, and alignment with global standards.

Primary data sources will include vehicle registry, GPS/telematics, fuel imports, SLRA records, NDMA incident logs. For GHG accounting and resilience indicators, Sierra Leone will apply IPCC 2006 Guidelines (Energy, mobile combustion); CDM AMS-III.C (low-emission vehicles), AMS-III.S (e-mobility); PIEVC/CRiSTAL for resilience.

5.1.3 Frequency and QA/QC

Data collection will occur quarterly for pilots and annually for sectoral aggregation. QA/QC procedures will include meter calibration, remote sensing verification, household survey audits, and third-party verification where feasible. EPA-SL will coordinate these processes as the MRV Secretariat.

Data will be collected quarterly data for pilots, annual roll-up, post-disaster verification. QA/QC procedures will include cross-checks of fuel imports with activity data, GPS validation, engineering certification. Independent verification will be conducted where appropriate.

5.1.4 Institutional Mandates

Each sector is assigned to its respective line ministry for data collection, with EPA-SL serving as the MRV Secretariat. Statistics Sierra Leone will harmonize datasets, MoECC will provide policy oversight, and the Ministry of Finance will ensure integration of climate finance tracking.

Institutional responsibilities are as follows: MoTA, SLRA, NDMA, EPA-SL, Stats SL. EPA-SL will act as the MRV Secretariat, consolidating sectoral data and ensuring alignment with the national GHG inventory and adaptation frameworks.

5.1.5 Outputs

The outputs will include annual MRV reports, annexes to Biennial Transparency Reports (BTRs), and dashboards that display real-time sectoral indicators for decision makers and the public.

The MRV system will generate: Annual Transport MRV Report; Transport Annex to BTR; resilience dashboard. These outputs will feed into the Biennial Transparency Reports and public dashboards.

5.2 Adaptation MRV Framework

The transport sector in Sierra Leone is increasingly exposed to the adverse impacts of climate change, including flooding, coastal erosion, landslides, and extreme rainfall events that damage road networks, bridges, and other critical infrastructure. These risks not only disrupt mobility and economic activity but also impose significant social and financial costs. The **Adaptation MRV Framework for the Transport Sector** has been developed to systematically measure, report, and verify resilience-building interventions aimed at safeguarding transport systems against these climate threats.

The framework establishes a set of adaptation indicators, including the number of kilometers of road upgraded to climate-resilient standards, the percentage of bridges and culverts reinforced to withstand flooding, the extent of transport corridors realigned away from high-risk zones, and reductions in the frequency and duration of transport disruptions linked to extreme weather. By monitoring these indicators, Sierra Leone will be able to quantify the effectiveness of adaptation investments and identify areas requiring further action.

The framework is aligned with the **UNFCCC Enhanced Transparency Framework**, the **Sendai Framework for Disaster Risk Reduction**, and the **Sustainable Development Goals (SDGs)**, particularly SDG 9 on resilient infrastructure and SDG 11 on sustainable cities and communities. It also links directly with Sierra Leone's **National Adaptation Plan (NAP)**, ensuring coherence between MRV activities and national adaptation priorities.

Institutional responsibilities are shared among the Ministry of Transport and Aviation (MoTA), the Sierra Leone Roads Authority (SLRA), and the National Disaster Management Agency (NDMA), which together oversee the collection and validation of data on transport resilience. EPA-SL, as MRV Secretariat, consolidates and validates this information within the national MRV system, while Statistics Sierra Leone ensures statistical consistency and quality assurance. Independent assessments, including engineering audits and community-based validation processes, provide additional credibility to reported outcomes.

Outputs from this framework will include **annual transport adaptation reports, resilience scorecards, and adaptation annexes to the Biennial Transparency Reports (BTRs)**. These outputs will not only support domestic decision-making on infrastructure investments but also demonstrate to international partners Sierra Leone's measurable progress in reducing climate vulnerability within the transport sector.

In summary, the Adaptation MRV Framework for the Transport Sector equips Sierra Leone with a comprehensive system to **track, evaluate, and communicate resilience outcomes**, ensuring that adaptation efforts are transparent, verifiable, and aligned with both national priorities and international obligations.

5.2.1 Indicators and Baselines

The adaptation measures for the transport sector are: Climate-proofing roads and bridges, resilient infrastructure standards, integrated transport planning.

Then the indicators are:

- Km of roads upgraded to climate-resilient standards (km/year).
- % of new bridges designed with climate-proof standards.
- % of transport corridors with risk-informed relocation/realignment.
- % reduction in transport service disruptions during extreme weather.

The baselines by 2025 are high % of paved roads climate-vulnerable; bad bridge stock condition.

Indicators	Baselines	Data Sources	Methodologies	Frequency	Institutions
Km of roads climate-proofed; % bridges upgraded; % reduction in transport disruptions	Baseline: 2023 road/bridge stock assessment	SLRA, Ministry of Transport, NDMA	CRiSTAL, PIEVC protocol; Sendai indicators	Annual; post-disaster verification	Ministry of Transport, SLRA, NDMA, EPA-SL

5.2.2 Data Collection and Methodologies

Data collection will be carried out through national surveys, monitoring logs, remote sensing, and project-specific reporting. Internationally accepted methodologies from the IPCC 2006 Guidelines and relevant UNFCCC CDM methodologies will be applied. This ensures comparability, accuracy, and alignment with global standards.

Data will come from Sierra Leone Roads Authority (SLRA), Ministry of Transport and Aviation, NDMA disaster reports and the methods applied will be the climate risk screening tools (CRiSTAL, PIEVC protocol); Sendai Framework indicators on disaster impacts.

5.2.3 Frequency and QA/QC

Data collection will occur quarterly for pilots and annually for sectoral aggregation. QA/QC procedures will include meter calibration, remote sensing verification, household survey audits, and third-party verification where feasible. EPA-SL will coordinate these processes as the MRV Secretariat.

Annual sector reporting, verified after major disaster events

5.2.4 Institutional Mandates

Each sector is assigned to its respective line ministry for data collection, with EPA-SL serving as the MRV Secretariat. Statistics Sierra Leone will harmonize datasets, MoECC will provide policy oversight, and the Ministry of Finance will ensure integration of climate finance tracking.

Responsible Institutions: Ministry of Transport & Aviation, SLRA, EPA-SL, NDMA.

5.2.5 Outputs

The outputs will include annual MRV reports, annexes to Biennial Transparency Reports (BTRs), and dashboards that display real-time sectoral indicators for decision makers and the public.

6 AFOLU / Forestry Sector

Mitigation MRV Framework

The Agriculture, Forestry and Other Land Use (AFOLU) sector is both a major source of greenhouse gas emissions and a critical mitigation opportunity for Sierra Leone. Deforestation, forest degradation, shifting cultivation, and unsustainable agricultural practices continue to drive emissions, while the sector simultaneously offers vast potential for carbon sequestration through reforestation, assisted natural regeneration (ANR), agroforestry, and sustainable land management practices. The **Mitigation MRV Framework for the AFOLU/Forestry Sector** has therefore been established to systematically track and verify emission reductions and removals in this pivotal sector.

The framework sets out clear indicators, including the hectares of reforestation and ANR achieved, the establishment and monitoring of permanent forestry plots, biomass carbon stock changes, the extent of avoided deforestation, and the adoption of climate-smart agricultural practices. By monitoring these indicators, Sierra Leone will be able to quantify emission reductions and removals with credibility and consistency.

The framework is grounded in internationally recognized methodologies, including the **2006 IPCC Guidelines for AFOLU** and REDD+ methodological approaches. Where applicable, approved **CDM methodologies** such as AR-AMS0007 (small-scale afforestation and reforestation) and AR-AMS0003 (restoration of degraded lands) will be applied. These methods provide robust standards for ensuring comparability with international reporting requirements.

Institutional responsibilities are shared across the Ministry of Agriculture and Forestry (MAFFS), the EPA-SL as MRV Secretariat, and the REDD+ MRV Unit. Statistics Sierra Leone ensures statistical robustness, while local councils and community forest user groups play a key role in providing ground-level monitoring data. Independent verifiers, academic institutions, and satellite-based assessments will provide an additional layer of assurance.

Outputs of this framework will include **annual AFOLU MRV reports, REDD+ safeguards summaries, and sectoral annexes to the Biennial Transparency Reports (BTRs)**. These outputs will inform both domestic land-use planning and Sierra Leone’s international climate commitments.

In summary, the Mitigation MRV Framework for the AFOLU/Forestry Sector equips Sierra Leone with a comprehensive system to **measure, report, and verify emission reductions and carbon sequestration**, ensuring transparency and credibility in this vital sector.

6.1.1 Indicators and Baselines

The mitigation measures in the scctor are reforestation, Assisted Natural Regeneration (ANR), agroforestry, avoided deforestation, mangrove restoration.

Then the indicators are:

- Area reforested/under ANR (ha/year).
- Survival rate of planted seedlings (%).
- Above-ground biomass carbon stock change (tCO_2e/ha).
- Area of avoided deforestation (ha/year).
- Area of mangrove forest restored (ha).
- Community forestry projects implemented (#).
- Number of farmers adopting CSA practices
- Yield stability indices

Baselines: As for 2023, Sierra Leone continues to face forest and mangrove cover decline, with limited CSA adoption (<10% of farmers).

Indicators	Baselines	Data Sources	Methodologies	Frequency	Institutions
Area reforested/ANR (ha); biomass stock change (tCO_2e/ha); avoided deforestation area; mangrove restoration (ha)	Baseline: 2020 forest inventory, mangrove maps	MAF, EPA-SL, REDD+ MRV Unit, remote sensing (Landsat/Sentinel)	IPCC 2006 (AFOLU); CDM AR-AMS0007; AR-AMS0003; AR-AM0014	Annual surveys; biennial remote sensing	MAF, EPA-SL, community forestry groups

6.1.2 Data Collection and Methodologies

Data collection will be carried out through national surveys, monitoring logs, remote sensing, and project-specific reporting. Internationally accepted methodologies from the IPCC 2006 Guidelines and relevant UNFCCC CDM methodologies will be applied. This ensures comparability, accuracy, and alignment with global standards.

Data sources include permanent sample plots, allometric measurements, biomass expansion factors, remote sensing (Landsat/Sentinel imagery, SEPAL tools), farmer registries, and crop yield surveys. For mitigation accounting, the IPCC 2006 Guidelines (AFOLU sector) will be applied, supplemented by CDM methodologies such as AR-AMS0007, AR-AMS0003, and AR-AM0014 (mangroves). CSA outcomes will be measured using FAO CSA indicators.

6.1.3 Frequency and QA/QC

Data collection will occur quarterly for pilots and annually for sectoral aggregation. QA/QC procedures will include meter calibration, remote sensing verification, household survey audits, and third-party verification where feasible. EPA-SL will coordinate these processes as the MRV Secretariat.

Field data will be collected annually, with biennial remote sensing updates and seasonal crop reporting. QA/QC procedures include double-entry for plot data, geotagging audits, and leakage monitoring. Independent verification will involve re-measurement of sample plots and community validation to ensure benefit-sharing safeguards are respected.

6.1.4 Institutional Mandates

Each sector is assigned to its respective line ministry for data collection, with EPA-SL serving as the MRV Secretariat. Statistics Sierra Leone will harmonize datasets, MoECC will provide policy oversight, and the Ministry of Finance will ensure integration of climate finance tracking.

The Ministry of Agriculture and Forestry (MAF) and the REDD+ MRV Unit are responsible for primary data collection and consolidation. The Environment Protection Agency–Sierra Leone (EPA-SL) ensures integration with national MRV and safeguards. The Ministry of Fisheries and Marine Resources (MFMR) supports mangrove monitoring, while Statistics Sierra Leone ensures consistency and statistical quality. Community forestry groups and local councils are engaged in data collection and validation.

6.1.5 Outputs

The outputs will include annual MRV reports, annexes to Biennial Transparency Reports (BTRs), and dashboards that display real-time sectoral indicators for decision makers and the public.

Outputs include an AFOLU MRV Yearbook, REDD+ safeguards report, and CSA adoption dashboard, which together feed into the Biennial Transparency Reports.

6.2 Adaptation MRV Framework

The AFOLU/Forestry sector is central not only to mitigation but also to Sierra Leone's resilience-building agenda. Climate change poses increasing risks to agricultural productivity, food security, and rural livelihoods through erratic rainfall, rising temperatures, and soil degradation. The **Adaptation MRV Framework for the AFOLU/Forestry Sector** provides a systematic mechanism to monitor and verify adaptation outcomes, ensuring that interventions contribute meaningfully to national resilience objectives.

The framework identifies a series of adaptation indicators, including the proportion of farmers adopting climate-smart agriculture (CSA), improvements in yield stability and crop diversity, reductions in post-harvest losses, expansion of agroforestry systems, and the restoration of mangroves and forest ecosystems as natural buffers against floods and coastal erosion. Monitoring these indicators enables Sierra Leone to demonstrate the effectiveness of adaptation measures at both household and ecosystem levels.

This framework is aligned with the **National Adaptation Plan (NAP)**, the **Sendai Framework for Disaster Risk Reduction**, and the **Sustainable Development Goals (SDGs)**, particularly SDG 2 on zero hunger and SDG 15 on life on land. It also ensures coherence with REDD+ strategies, thereby linking adaptation monitoring with ongoing forest conservation and landscape restoration programs.

Institutional responsibilities are distributed among the Ministry of Agriculture and Forestry (MAFFS), EPA-SL as MRV Secretariat, and the Fisheries Ministry for mangrove ecosystems. Local councils, farmer associations, and community forest management groups play a critical role in generating ground-level data. Statistics Sierra Leone ensures methodological rigor, while academic and research institutions provide independent evaluations and technical validation.

The outputs of this framework will include **seasonal crop resilience reports, CSA adoption dashboards, and adaptation annexes to the Biennial Transparency Reports (BTRs)**. These outputs will inform national agricultural policies and demonstrate to international partners Sierra Leone's commitment to building resilience in one of its most climate-sensitive sectors.

In essence, the Adaptation MRV Framework for the AFOLU/Forestry Sector enables Sierra Leone to **systematically track, evaluate, and report resilience outcomes**, ensuring transparency, inclusivity, and credibility in adaptation monitoring.

6.2.1 Indicators and Baselines

The adaptation measures for this sector are: Climate-smart agriculture (CSA), soil restoration, agroforestry, mangrove protection, resilient seed systems.

Then, the indicators are:

- of farmers adopting CSA practices (e.g., conservation agriculture, drought-resistant seeds).
- Hectares of land under CSA/agroforestry (ha/year).

- Crop yield stability under variable rainfall (% change vs. baseline).
- % reduction in post-harvest losses in target districts.
- Area of mangroves restored and protected (ha).

And the baselines are: Current agricultural productivity levels, soil fertility, mangrove coverage.

Indicators	Baselines	Data Sources	Methodologies	Frequency	Institutions
# of farmers adopting CSA; ha under CSA/agroforestry; yield stability; post-harvest loss reduction; mangroves restored	Baseline: 2023 agricultural production & soil fertility levels	MAFFS, Feed Salone, FAO, remote sensing	FAO CSA indicators; IPCC AFOLU guidance	Seasonal reporting for yields; annual CSA adoption	MAFFS, EPA-SL, Fisheries Ministry, local councils

6.2.2 Data Collection and Methodologies

Data collection will be carried out through national surveys, monitoring logs, remote sensing, and project-specific reporting. Internationally accepted methodologies from the IPCC 2006 Guidelines and relevant UNFCCC CDM methodologies will be applied. This ensures comparability, accuracy, and alignment with global standards.

Data will be collected from the Ministry of Agriculture, Forestry and Food Security (MAFFS), Feed Salone program, FAO field surveys, remote sensing (Sentinel, SEPAL). And the methodology to used are FAO CSA indicators, IPCC AFOLU guidance, Community-based Adaptation tracking.

6.2.3 Frequency and QA/QC

Data collection will occur quarterly for pilots and annually for sectoral aggregation. QA/QC procedures will include meter calibration, remote sensing verification, household survey audits, and third-party verification where feasible. EPA-SL will coordinate these processes as the MRV Secretariat.

Reporting frequency should be: Seasonal (harvest cycle) reporting for yields; annual reporting for CSA adoption.

6.2.4 Institutional Mandates

Each sector is assigned to its respective line ministry for data collection, with EPA-SL serving as the MRV Secretariat. Statistics Sierra Leone will harmonize datasets, MoECC will provide policy oversight, and the Ministry of Finance will ensure integration of climate finance tracking.

Responsible Institutions: MAFFS, EPA-SL, Ministry of Fisheries, local councils.

6.2.5 Outputs

The outputs will include annual MRV reports, annexes to Biennial Transparency Reports (BTRs), and dashboards that display real-time sectoral indicators for decision makers and the public.

7 Waste Sector

7.1 Mitigation MRV Framework

The waste sector is an important and growing contributor to greenhouse gas emissions in Sierra Leone, primarily through methane released from unmanaged landfills and open dumping sites. At the same time, it offers substantial opportunities for emission reductions through improved waste management practices, methane capture, composting, recycling, and waste-to-energy initiatives. The **Mitigation MRV Framework for the Waste Sector** has therefore been developed to systematically measure, report, and verify emission reductions achieved through these interventions.

The framework establishes clear indicators such as the volume of methane captured from landfills, the proportion of organic waste diverted to composting and recycling, the amount of energy generated through waste-to-energy systems, and reductions in open burning of solid waste. These indicators will be benchmarked against current baseline conditions, which are characterized by limited formal waste collection and reliance on open dumpsites.

The framework applies internationally recognized methodologies, including the **2006 IPCC Guidelines for Waste** and relevant **CDM methodologies** such as ACM0001 (landfill gas capture) and AMS-III.F (methane avoidance through composting). These ensure that emission reductions are calculated consistently, transparently, and in line with global best practice.

Institutional responsibilities are shared between the Freetown City Council (FCC) and other municipal councils for primary data collection, supported by the Ministry of Local Government and Rural Development (MLGRD). EPA-SL, as MRV Secretariat, consolidates and validates data within the national MRV platform, while Statistics Sierra Leone ensures statistical rigor. Independent verification will be carried out for high-value projects, particularly those linked to carbon markets.

The outputs of this framework will include **annual waste sector MRV reports, landfill gas monitoring summaries, and mitigation annexes to the Biennial Transparency Reports (BTRs)**. These outputs will guide domestic policy on waste management and demonstrate Sierra Leone’s contribution to global emission reduction efforts.

In summary, the Mitigation MRV Framework for the Waste Sector provides the tools to **systematically track, verify, and report emission reductions**, transforming waste management from a source of emissions into a driver of low-carbon development.

7.1.1 Indicators and Baselines

The mitigation measures in the waste sector are landfill methane capture, composting, waste-to-energy.

Hence, the indicators are

- Volume of methane captured (Nm^3/year).
- Amount of waste diverted from landfill to composting (tons/year).
- Energy generated from waste-to-energy projects (MWh/year).
- tCO_2e avoided from improved landfill management
- Methane captured (Nm^3);
- tons of organic waste composted;
- Number of sites with leachate control;
- Reduction in flood-related waste blockages.

Baseline (2023) assessments show reliance on open dumps, negligible methane capture, and frequent urban flooding due to blocked drains.

Indicators	Baselines	Data Sources	Methodologies	Frequency	Institutions
Methane captured (Nm³); waste composted (tons); waste-to-energy output (MWh)	Baseline: 2023 landfill and municipal waste assessments	Municipal councils, Ministry of Local Gov., private waste operators	IPCC 2006 (Waste); CDM ACM0001; AMS-III.E	Semi-annual monitoring; annual reports	EPA-SL, Ministry of Local Gov., municipal councils

7.1.2 Data Collection and Methodologies

Data collection will be carried out through national surveys, monitoring logs, remote sensing, and project-specific reporting. Internationally accepted methodologies from the IPCC 2006 Guidelines and relevant UNFCCC CDM methodologies will be applied. This ensures comparability, accuracy, and alignment with global standards.

Data will be collected through landfill weighbridges, gas meters, compost facility logs, flare/generator meters, and municipal drainage inspections. The IPCC 2006 Guidelines for Waste (Waste sector, solid waste disposal on land) will provide methodological consistency, with reference to CDM ACM0001 (landfill gas) and AMS-III.E (composting). Adaptation measures will be monitored using Sendai urban resilience indicators.

7.1.3 Frequency and QA/QC

Data collection will occur quarterly for pilots and annually for sectoral aggregation. QA/QC procedures will include meter calibration, remote sensing verification, household survey audits, and third-party verification where feasible. EPA-SL will coordinate these processes as the MRV Secretariat.

Facility logs will be updated monthly, with quarterly municipal reports and annual national summaries. QA/QC will include calibration of meters, random site audits, and reconciliation of mass balance. Verification will involve independent audits for landfill gas capture and waste-to-energy facilities.

7.1.4 Institutional Mandates

Each sector is assigned to its respective line ministry for data collection, with EPA-SL serving as the MRV Secretariat. Statistics Sierra Leone will harmonize datasets, MoECC will provide policy oversight, and the Ministry of Finance will ensure integration of climate finance tracking.

The Ministry of Local Government and municipal councils lead data collection. EPA-SL serves as the MRV Secretariat, consolidating data and ensuring consistency with the national GHG inventory. Private waste operators provide facility-level data. NDMA supports adaptation monitoring of flood risks.

7.1.5 Outputs

The outputs will include annual MRV reports, annexes to Biennial Transparency Reports (BTRs), and dashboards that display real-time sectoral indicators for decision makers and the public.

Outputs include a Waste MRV Annex to the national inventory, city-level resilience scorecards, and methane reduction dashboards.

7.2 Adaptation MRV Framework

The waste sector also plays a critical role in climate adaptation, particularly in urban areas where poor waste management exacerbates flooding, health risks, and environmental degradation. The **Adaptation MRV Framework for the Waste Sector** has been established to monitor and verify resilience-building measures that reduce vulnerability and protect communities.

This framework defines key indicators such as the percentage of municipal drainage systems cleared of waste blockages, the establishment of climate-resilient waste bylaws, the number of waste collection centers built in flood-prone communities, and the reduction in flood-related damages linked to improved waste management. By monitoring these indicators, Sierra Leone can assess the contribution of waste management interventions to climate resilience, public health, and disaster risk reduction.

The framework is aligned with the **National Adaptation Plan (NAP)**, the **Sendai Framework for Disaster Risk Reduction**, and the **Sustainable Development Goals (SDGs)**, particularly SDG 11 on sustainable cities and SDG 6 on clean water and sanitation. This ensures that adaptation monitoring in the waste sector is coherent with broader development and resilience goals.

Institutional responsibilities are led by municipal councils and the Ministry of Local Government and Rural Development (MLGRD), with technical oversight from EPA-SL as MRV Secretariat. The National Disaster Management Agency (NDMA) provides critical data on flood risks and disaster impacts, while Statistics Sierra Leone ensures methodological rigor and data consistency. Independent audits and community-based validation processes provide additional layers of assurance.

The outputs of this framework will include **annual adaptation reports for the waste sector, community resilience dashboards, and adaptation annexes to the Biennial Transparency Reports (BTRs)**. These outputs will inform national policy on urban resilience and demonstrate Sierra Leone's progress in reducing vulnerability through improved waste management.

In essence, the Adaptation MRV Framework for the Waste Sector enables Sierra Leone to **systematically track, evaluate, and communicate resilience outcomes**, ensuring that adaptation interventions are transparent, credible, and aligned with national priorities and international obligations.

7.2.1 Indicators and Baselines

The adaptation measures in the waste sector includes institutional capacity building, resilient landfill management.

Hence, the indicators are:

- % of municipalities integrating climate risk into waste bylaws.
- % reduction in flood-related blockages caused by solid waste.
- # of sites with methane/leachate monitoring systems.
- % of urban population covered by improved waste services.

The baselines are: low waste collection rates, none-resileant landfill conditions, urban flood hotspots.

Indicators	Baselines	Data Sources	Methodologies	Frequency	Institutions
# of councils with climate-resilient bylaws; % reduction in flood blockages; # methane/leachate monitoring sites	Baseline: 2023 municipal waste systems assessment	Municipal councils, Ministry of Local Gov., EPA-SL	IPCC Waste MRV; Sendai urban resilience metrics	Quarterly; annual consolidation	Ministry of Local Gov., municipal councils, EPA-SL

7.2.2 Data Collection and Methodologies

Data collection will be carried out through national surveys, monitoring logs, remote sensing, and project-specific reporting. Internationally accepted methodologies from the IPCC 2006 Guidelines and relevant UNFCCC CDM methodologies will be applied. This ensures comparability, accuracy, and alignment with global standards.

Data will be collected from Municipal councils (Freetown, Bo, Kenema), Ministry of Local Government, EPA-SL, community-based monitoring. The methodology to be used are IPCC Waste MRV (for methane); Sendai Framework urban resilience indicators.

7.2.3 Frequency and QA/QC

Data collection will occur quarterly for pilots and annually for sectoral aggregation. QA/QC procedures will include meter calibration, remote sensing verification, household survey audits, and third-party verification where feasible. EPA-SL will coordinate these processes as the MRV Secretariat.

The frequency of reports is: Quarterly municipal data; annual national consolidation.

7.2.4 Institutional Mandates

Each sector is assigned to its respective line ministry for data collection, with EPA-SL serving as the MRV Secretariat. Statistics Sierra Leone will harmonize datasets, MoECC will provide policy oversight, and the Ministry of Finance will ensure integration of climate finance tracking.

Responsible Institutions: Ministry of Local Government, municipal councils, EPA-SL.

7.2.5 Outputs

The outputs will include annual MRV reports, annexes to Biennial Transparency Reports (BTRs), and dashboards that display real-time sectoral indicators for decision makers and the public.

8 IPPU Sector

8.1 Mitigation MRV Framework

The Industrial Processes and Product Use (IPPU) sector, while currently a smaller contributor to Sierra Leone's greenhouse gas emissions compared to energy and AFOLU, is expected to grow in significance as the country industrializes. Emissions arise primarily from cement production, lime use, and other mineral processes, as well as the consumption of industrial products such as refrigerants. The **Mitigation MRV Framework for the IPPU Sector** has therefore been designed to establish a structured system for measuring, reporting, and verifying emissions and mitigation outcomes within this emerging sector.

The framework identifies clear indicators, including clinker and cement production volumes, lime and other mineral product outputs, and the use of hydrofluorocarbons (HFCs) and other high-global-warming-potential gases. Mitigation interventions to be tracked under this framework include improvements in process efficiency, substitution of clinker with alternative materials, adoption of low-carbon industrial technologies, and programs for phasing out high-GWP refrigerants.

Methodologies applied under this framework are consistent with the **2006 IPCC Guidelines for IPPU** and relevant **CDM methodologies** for cement blending, process optimization, and refrigerant management. These methods provide transparent, internationally credible procedures for quantifying emission reductions and ensuring comparability across reporting cycles.

Institutional responsibilities are centered on the Ministry of Trade and Industry (MoTI) and major industrial operators, which serve as primary data providers. EPA-SL, as MRV Secretariat, consolidates and validates sectoral data, while Statistics Sierra Leone ensures statistical rigor. Independent third-party verification will be applied to large-scale facilities and mitigation projects, particularly those seeking access to international carbon markets.

Outputs of this framework will include **annual IPPU MRV reports, sectoral data summaries, and mitigation annexes to the Biennial Transparency Reports (BTRs)**. These outputs will inform industrial policy while ensuring international confidence in Sierra Leone's industrial emission reporting.

In summary, the Mitigation MRV Framework for the IPPU Sector equips Sierra Leone with the tools to **systematically track and verify emissions and emission reductions**, thereby enabling sustainable industrial growth that aligns with national and international climate commitments.

8.1.1 Indicators and Baselines

Mitigation measures in the IPPU sector are sector efficiency, adoption of low-carbon technologies, capacity building for emissions monitoring.

Then, the indicators are

- Volume of clinker and cement produced (tons/year).
- Clinker-to-cement ratio (%).
- Process CO_2 emissions (tCO_2e/year).
- Number of industries adopting low-carbon technologies.

The baseline (2023) are: high clinker ratios and limited risk planning.

Indicators	Baselines	Data Sources	Methodologies	Frequency	Institutions
Cement/clinker production (tons); clinker ratio; CO_2 process emissions; industries with low-carbon tech	Baseline: 2023 cement industry statistics	Ministry of Trade & Industry, cement plants, industrial associations	IPCC 2006 (Industrial Processes); CDM ACM0005	Annual industry reports	MoTI, EPA-SL, Standards Bureau

8.1.2 Data Collection and Methodologies

Data collection will be carried out through national surveys, monitoring logs, remote sensing, and project-specific reporting. Internationally accepted methodologies from the IPCC 2006 Guidelines and relevant UNFCCC CDM methodologies will be applied. This ensures comparability, accuracy, and alignment with global standards.

Data will be sourced from plant production logs, QC systems, and import/export records. Confidentiality will be managed through MoUs. IPCC 2006 Guidelines for Industrial Processes will be applied, with CDM ACM0005 used for cement blending and clinker substitution. UNIDO resilient industry metrics will guide adaptation monitoring.

8.1.3 Frequency and QA/QC

Data collection will occur quarterly for pilots and annually for sectoral aggregation. QA/QC procedures will include meter calibration, remote sensing verification, household survey audits, and third-party verification where feasible. EPA-SL will coordinate these processes as the MRV Secretariat.

Data will be compiled quarterly, with annual submissions verified by accredited third parties. QA/QC procedures include recalculation checks and documentation of emission factors.

8.1.4 Institutional Mandates

Each sector is assigned to its respective line ministry for data collection, with EPA-SL serving as the MRV Secretariat. Statistics Sierra Leone will harmonize datasets, MoECC will provide policy oversight, and the Ministry of Finance will ensure integration of climate finance tracking.

The Ministry of Trade and Industry (MoTI) and individual plants are responsible for reporting. EPA-SL consolidates and validates. The Standards Bureau ensures technical consistency and metrology.

8.1.5 Outputs

The outputs will include annual MRV reports, annexes to Biennial Transparency Reports (BTRs), and dashboards that display real-time sectoral indicators for decision makers and the public.

Outputs include an annual IPPU MRV Section in the national inventory, with confidential annexes verified by independent experts.

8.2 Adaptation MRV Framework

Although adaptation in the IPPU sector is often less emphasized than in agriculture or energy, Sierra Leone's growing industrial base faces increasing risks from climate change. Flooding, heat stress, and supply chain disruptions linked to extreme weather events threaten industrial facilities, equipment, and workforce safety. The **Adaptation MRV Framework for the IPPU Sector** has therefore been established to track and verify resilience-building measures that protect industrial operations and ensure long-term sustainability.

The framework defines adaptation indicators such as the percentage of industrial facilities assessed for climate risks, the number of plants that integrate flood and heat resilience into facility design, adoption of occupational health and safety measures to address climate-related risks for workers, and reductions in climate-related production downtime.

This framework is aligned with Sierra Leone's **National Adaptation Plan (NAP)**, the **Sendai Framework for Disaster Risk Reduction**, and the **Sustainable Development Goals (SDGs)**, particularly SDG 9 on resilient industry and innovation. By embedding adaptation monitoring in the IPPU sector, Sierra Leone demonstrates that industrial development and climate resilience can advance together.

Institutional responsibilities rest with the Ministry of Trade and Industry (MoTI) and industrial associations, which are tasked with collecting facility-level data. EPA-SL, as MRV Secretariat, ensures consolidation and quality control, while Statistics Sierra Leone validates the statistical robustness of adaptation data. Independent technical audits and engineering assessments provide additional credibility to reported outcomes.

Outputs of this framework will include **industrial climate risk reports, facility-level resilience scorecards, and adaptation annexes to the Biennial Transparency Reports (BTRs)**. These outputs will guide national industrial policy and investment decisions, while also showcasing to international partners Sierra Leone's commitment to building a climate-resilient industrial base.

In essence, the Adaptation MRV Framework for the IPPU Sector equips Sierra Leone with a comprehensive system to **track, evaluate, and communicate resilience outcomes**, ensuring that industrial development proceeds in a sustainable and climate-resilient manner.

8.2.1 Indicators and Baselines

The adaptation measures are Institutional strengthening, industrial risk assessments, resilient production planning.

Hence, the indicators are:

- %bof industries adopting climate risk management plans.
- % of industrial facilities applying resilient water/energy use strategies.
- # of sector-specific adaptation guidelines developed and adopted.

The baseline is: low level of climate integration in industrial regulation.

Indicators	Baselines	Data Sources	Methodologies	Frequency	Institutions
# industries with risk management plans; % facilities applying resource resilience; # adaptation guidelines adopted	Baseline: 2023 industrial regulation gap analysis	MoTI, Standards Bureau, Chamber of Commerce	UNIDO resilient industry metrics	Biennial industry reports	MoTI, EPA-SL, Standards Bureau

8.2.2 Data Collection and Methodologies

Data collection will be carried out through national surveys, monitoring logs, remote sensing, and project-specific reporting. Internationally accepted methodologies from the IPCC 2006 Guidelines and relevant UNFCCC CDM methodologies will be applied. This ensures comparability, accuracy, and alignment with global standards.

Data will be collected from Ministry of Trade & Industry, Standards Bureau, Chamber of Commerce. The methodology to be used is the UNIDO climate-resilient industrial development metrics.

8.2.3 Frequency and QA/QC

Data collection will occur quarterly for pilots and annually for sectoral aggregation. QA/QC procedures will include meter calibration, remote sensing verification, household survey audits, and third-party verification where feasible. EPA-SL will coordinate these processes as the MRV Secretariat.

The frequency of reports would be: Biennial industry reports, integrated into national adaptation monitoring.

8.2.4 Institutional Mandates

Each sector is assigned to its respective line ministry for data collection, with EPA-SL serving as the MRV Secretariat. Statistics Sierra Leone will harmonize datasets, MoECC will provide policy oversight, and the Ministry of Finance will ensure integration of climate finance tracking.

Responsible Institutions: Ministry of Trade & Industry, EPA-SL, Standards Bureau.

8.2.5 Outputs

The outputs will include annual MRV reports, annexes to Biennial Transparency Reports (BTRs), and dashboards that display real-time sectoral indicators for decision makers and the public.

9 Coastal and Urban Systems

Sierra Leone's coastal and urban systems are highly vulnerable to climate change impacts including sea level rise, coastal erosion, flooding, and storm surges. NDC 3.0 emphasizes mangrove rehabilitation, coastal defenses, wetland restoration, and resilient urban drainage as key adaptation measures.

9.1 Adaptation MRV Framework

Sierra Leone's coastal and urban systems face acute vulnerabilities to climate change, including sea-level rise, coastal erosion, flooding, heat stress, and storm surges. These impacts directly threaten critical infrastructure, housing, livelihoods, and ecosystems, particularly in densely populated areas such as Freetown and along the country's extensive coastline. The **Adaptation MRV Framework for the Coastal and Urban Systems** has therefore been developed to systematically measure, report, and verify resilience-building actions in these high-risk environments.

This framework defines a set of adaptation indicators that capture both process and outcome dimensions. Key measures include the extent of coastal defenses constructed or rehabilitated, the area of mangroves restored as natural buffers, the integration of climate resilience standards into urban planning and building codes, the proportion of drainage systems upgraded to withstand extreme rainfall, and reductions in flood-related damages and displacement. By tracking these indicators, Sierra Leone can provide transparent and evidence-based assessments of the effectiveness of adaptation actions in safeguarding urban and coastal populations.

The framework is aligned with Sierra Leone's **National Adaptation Plan (NAP)**, the **Sendai Framework for Disaster Risk Reduction**, and the **Sustainable Development Goals (SDGs)**, notably SDG 11 on sustainable cities and SDG 13 on climate action. It also complements coastal zone management strategies and municipal development plans, thereby ensuring coherence between national policy and local-level implementation.

Institutional responsibilities are shared among the Ministry of Lands, Housing and Country Planning (MLHCP), the Ministry of Fisheries and Marine Resources (MFMR) for coastal ecosystems, municipal and city councils for urban resilience measures, and the National Disaster Management Agency (NDMA) for risk assessments. EPA-SL, as MRV Secretariat, consolidates and validates data across institutions, while Statistics Sierra Leone ensures methodological rigor and data quality. Independent verifiers, academic institutions, and community-based monitors provide an additional layer of credibility and inclusiveness in the reporting process.

The outputs of this framework will include **annual coastal and urban adaptation reports, municipal resilience dashboards, and adaptation annexes to the Biennial Transparency Reports (BTRs)**. These outputs will not only support evidence-based policymaking and investment decisions at the national and municipal levels but also demonstrate Sierra Leone's commitment to building resilient cities and protecting vulnerable coastal communities.

In essence, the Adaptation MRV Framework for the Coastal and Urban Systems equips Sierra Leone with a comprehensive system to **track, evaluate, and communicate resilience outcomes**, ensuring that adaptation actions in these critical areas are transparent, credible, and aligned with both domestic priorities and international obligations.

9.1.1 Indicators and Baselines

The adaptation measures are coastal defenses, ecosystem-based adaptation (mangroves, wetlands), resilient urban drainage.

Then indicators include

- % reduction in coastal erosion in targeted sites.
- Hectares of mangroves restored
- # of urban flood events recorded annually (trend analysis).
- Households in coastal zones with reduced flood exposure.
- Km of coastline with protective measures (seawalls, mangrove buffers).

The baseline (2023) are: recurrent erosion hotspots and frequent flooding in Freetown.

Indicators	Baselines	Data Sources	Methodologies	Frequency	Institutions
Km of coastline protected; % reduction in erosion; # urban flood events; # households with reduced exposure	Baseline: 2023 coastal erosion and flood risk maps	Fisheries Ministry, EPA-SL, NDMA, municipal councils	IPCC Coastal Adaptation metrics; Blue Carbon MRV	Annual ecosystem assessments; seasonal flood monitoring	Fisheries Ministry, EPA-SL, NDMA, local councils

9.1.2 Data Collection and Methodologies

Data collection will be carried out through national surveys, monitoring logs, remote sensing, and project-specific reporting. Internationally accepted methodologies from the IPCC 2006 Guidelines and relevant UNFCCC CDM methodologies will be applied. This ensures comparability, accuracy, and alignment with global standards.

Data sources include coastal erosion and flood risk maps, municipal drainage inventories, and NDMA disaster loss data. Methodologies include IPCC coastal adaptation metrics and UNEP blue carbon MRV approaches for mangroves and wetlands.

9.1.3 Frequency and QA/QC

Data collection will occur quarterly for pilots and annually for sectoral aggregation. QA/QC procedures will include meter calibration, remote sensing verification, household survey audits, and third-party verification where feasible. EPA-SL will coordinate these processes as the MRV Secretariat.

Ecosystem monitoring will occur annually, with seasonal flood monitoring. QA/QC will involve cross-checking satellite imagery with community surveys and municipal reports.

9.1.4 Institutional Mandates

Each sector is assigned to its respective line ministry for data collection, with EPA-SL serving as the MRV Secretariat. Statistics Sierra Leone will harmonize datasets, MoECC will provide policy oversight, and the Ministry of Finance will ensure integration of climate finance tracking.

The Ministry of Fisheries and Marine Resources, municipal councils, and NDMA are responsible for data collection. EPA-SL consolidates. Communities participate in MRV for mangrove and coastal projects.

9.1.5 Outputs

The outputs will include annual MRV reports, annexes to Biennial Transparency Reports (BTRs), and dashboards that display real-time sectoral indicators for decision makers and the public.

Outputs include annual Coastal Resilience Reports, blue carbon inventories, and municipal flood resilience dashboards.

10 Costing & Financing Instruments

The implementation of the MRV system requires phased investments across institutional strengthening, digital systems, equipment, verification, and capacity building. The costing presented here provides a detailed estimate of needs over the 2025–2035 period, with proposed financing sources.

10.1 Cost Components (2025–2035)

The implementation of Sierra Leone's MRV system will require significant and sustained investment over the period 2025–2035. The costing framework presented herein identifies the financial resources necessary to establish and operationalize institutional structures, digital platforms, verification mechanisms, and community-based monitoring systems. These investments are not discretionary; they represent the essential foundations required to meet the country's reporting obligations under the Paris Agreement and to ensure that climate action is measured, reported, and verified in a transparent and internationally credible manner.

The costing exercise is designed to provide policymakers, development partners, and stakeholders with a realistic estimate of financial needs and a clear roadmap for mobilizing resources. It reflects a phased approach, aligning expenditure with the rollout of institutional arrangements, pilot projects, and the gradual scaling of the MRV framework nationwide.

10.1.1 Justification of Cost Components

Each cost component has been carefully defined to correspond with a critical element of the MRV system:

- **Institutional Setup and Staffing:** Establishing a dedicated MRV Secretariat within EPA-SL, sectoral coordinators in line ministries, and statistical officers in Statistics Sierra Leone is essential to ensure national ownership, coordination, and sustainability of MRV functions. Without this human and institutional capacity, data collection and reporting would remain fragmented and ad hoc.
- **Digital MRV Platform:** A centralized, secure digital platform is the backbone of the MRV system. Investments in databases, APIs, GIS-enabled dashboards, and long-term maintenance are justified by the need for timely, accurate, and interoperable data flows across ministries and with international reporting systems.
- **Sector Pilots and Equipment:** Early investments in smart meters, stove use monitors, forestry monitoring plots, landfill weighbridges, and industrial metrology upgrades are required to generate reliable baseline data and test methodologies. These pilots will inform national roll-out, reducing risks of inefficiency and ensuring sector-specific accuracy.
- **Capacity Building and Training:** Human capacity is a decisive factor for MRV success. Training more than 500 officials and community monitors, combined with fellowships and exchange programs, is justified as a long-term investment to ensure continuity, expertise, and institutional resilience.
- **Verification and QA/QC:** Independent verification contracts and partnerships with academia are critical to ensuring credibility. Verification strengthens the confidence of both domestic policymakers and international partners, which is indispensable for accessing climate finance and participating in carbon markets.

- **Community MRV and Local Councils:** Empowering local councils and community agents to monitor forestry, waste, and coastal ecosystems enhances ownership, increases coverage, and strengthens adaptation reporting at the grassroots level.
- **Contingency and Scaling:** Climate finance landscapes and reporting requirements evolve rapidly. The inclusion of a contingency allocation ensures flexibility, allowing Sierra Leone to adjust to Article 6 requirements, integrate new technologies, or respond to unforeseen challenges without compromising system integrity.

In total, the estimated **USD 61 million investment (2025–2035)** is not an overhead but a strategic allocation to secure Sierra Leone's compliance with international obligations, attract climate finance, and embed transparency and accountability into national climate governance. This investment will yield dividends by strengthening Sierra Leone's reputation as a credible partner in global climate action, while building national systems that support sustainable development.

Cost Component	Estimated Cost	Description
Institutional Setup and Staffing	USD 10 million	Recruitment of 30+ staff for EPA-SL MRV Secretariat, sectoral coordinators in line ministries, and data officers in Stats SL, including IT and office infrastructure.
Digital MRV Platform	USD 12 million	Development of the National MRV Digital Platform, secure databases, APIs, GIS dashboards, and maintenance.
Sector Pilots & Equipment	USD 18 million	Energy smart meters and Stove Use Monitors (SUMs); GPS/telematics for e-mobility; permanent forestry plots and drones; landfill weighbridges and gas meters; industrial metrology upgrades.
Capacity Building & Training	USD 6 million	Training for 500+ officials and community groups, long-term fellowships, and exchange programs.
Verification & QA/QC	USD 6 million	Independent verification contracts, partnerships with universities for re-measurement and audits.
Community MRV & Local Councils	USD 4 million	Equipment and stipends for community MRV agents in forestry, waste, and coastal monitoring.
Contingency & Scaling	USD 5 million	Buffer funds to support scaling after 2030 and adjustments for Article 6 requirements.

Total estimated cost (2025–2035): USD 61 million.

Financing Sources for the MRV System (2025-2035)

The financial sustainability of Sierra Leone's MRV framework depends on a diverse mix of **international, regional, bilateral, market-based, and domestic sources**. Each category of financing serves a distinct role in ensuring that the system is established, scaled, and maintained over the long term. The analysis below provides a detailed justification of the proposed financing sources, with an emphasis on strategic alignment, feasibility, and long-term sustainability.

10.1.2 International Climate Finance

International climate funds will form the backbone of financing during the early phases of MRV development.

- **Green Climate Fund (GCF) Readiness and NAP Support:** These windows are tailored for capacity building, institutional strengthening, and digital system development. They are particularly suited for funding the MRV Secretariat, training programs, and early-stage digital infrastructure.
- **Global Environment Facility (GEF):** GEF provides medium-scale grants that can complement GCF support, particularly for piloting sector-specific MRV methodologies (e.g., forestry and waste).
- **Adaptation Fund:** Resources from the Adaptation Fund can be targeted to MRV systems tracking adaptation outcomes, especially in coastal resilience, agriculture, and community-level monitoring.

These sources are justified not only by Sierra Leone's eligibility as a Least Developed Country (LDC) but also by the alignment of MRV strengthening with the funds' mandates to enhance transparency and adaptive capacity.

10.1.3 Development Banks and Regional Institutions

Multilateral development banks and regional institutions provide an essential financing stream for infrastructure-intensive MRV components.

- **World Bank:** With its strong focus on digital governance and data systems, the World Bank is a key partner for financing the national MRV platform, including database development, API integration, and GIS dashboards.
- **African Development Bank (AfDB):** AfDB financing can be directed to sector-specific MRV pilots, particularly in the transport and waste sectors, which require significant equipment investments (e.g., telematics for e-mobility, landfill gas meters).
- **ECOWAS and regional initiatives:** Regional financing mechanisms can support interoperability of MRV systems, ensuring that Sierra Leone's system is harmonized with broader West African data exchanges.

These institutions offer loans and blended finance packages that complement grant-based support, ensuring scalability of investments beyond the initial phases.

10.1.4 Bilateral Development Partners

Bilateral cooperation will be an important enabler of technical assistance, co-financing, and specialized expertise.

- **European Union (EU):** The EU has a strong track record of financing transparency frameworks and digital governance reforms. It can provide technical support for MRV standardization and integration with SDG and Sendai indicators.
- **United Kingdom (FCDO/DFID):** Support can be channeled to capacity-building programs and MRV policy integration, leveraging the UK's expertise in climate finance accounting.
- **Japan (JICA):** JICA's experience in digital systems and energy efficiency projects makes it an ideal partner for MRV in the energy and industrial sectors.
- **Germany (GIZ and KfW):** German cooperation can provide both technical expertise and financing for community-based MRV pilots, particularly in forestry and mangrove restoration.

Bilateral partners not only provide financing but also offer opportunities for long-term partnerships, technology transfer, and knowledge exchange.

10.1.5 Market Instruments

Market-based financing is a critical pillar for long-term sustainability, particularly under the Paris Agreement's **Article 6**.

- **Article 6 Revenues:** By establishing MRV systems that meet international verification standards, Sierra Leone can generate Mitigation Outcomes (MOs) eligible for transfer under Article 6. Revenues from these transactions can be reinvested into MRV operations.
- **Voluntary Carbon Markets:** Verified emission reductions from forestry, mangrove restoration, and improved cookstoves can be sold in voluntary markets, providing an additional revenue stream for MRV.
- **Results-Based Finance (RBF):** Programs such as the World Bank's Carbon Initiative for Development (Ci-Dev) and others can provide payments upon verification of emission reductions, directly linking MRV outputs with financing inflows.

This financing stream incentivizes robust MRV practices while creating a self-sustaining revenue mechanism.

10.1.6 Domestic Financing

Domestic contributions are indispensable for ensuring national ownership and long-term sustainability.

- **Budget Tagging:** The Ministry of Finance will integrate climate budget tagging to ensure that climate-related expenditures are tracked and aligned with MRV operations.
- **Levies on Project Approvals:** Small fees on project approvals (e.g., Environmental Impact Assessments) can provide a steady revenue stream for MRV operations without significant burden on developers.
- **Waste Tipping Fees:** Municipal waste collection and disposal fees can be partially earmarked to finance MRV systems monitoring waste flows and methane capture.
- **Fuel Import Surcharges:** A modest levy on imported fossil fuels could serve as a sustainable domestic financing source while incentivizing the energy transition.

These mechanisms ensure that, by 2035, Sierra Leone's MRV system is no longer fully dependent on donor support but is instead supported by predictable domestic financing streams.

10.1.7 Conclusion

The proposed financing mix, spanning **international climate funds, development banks, bilateral partners, market mechanisms, and domestic resources**, ensures both immediate operationalization and long-term sustainability of Sierra Leone's MRV system. Each source has been aligned with specific cost components, thereby creating a coherent financing strategy. This diversified approach reduces reliance on any single channel, strengthens resilience to external shocks, and ensures that Sierra Leone can maintain a credible and transparent MRV system well beyond 2035.

11 Integrated Roadmap (2025–2035)

This section presents the MRV roadmap with detailed yearly milestones, workstreams, responsibilities, quality assurance procedures, and risk management measures. It is designed to be operational: each line can be converted into annual work plans and procurement packages.

Phase I (2025–2027) - Foundations & Pilots

01

Phase I of the MRV Roadmap (2025-2027) represents the foundational stage upon which the entire national system of Measurement, Reporting, and Verification will be built. The emphasis during this period is on establishing the institutional, legal, technical, and human resource structures required to operationalize Sierra Leone's MRV framework in line with the Enhanced Transparency Framework of the Paris Agreement.

This phase will focus on the creation of the **National MRV Secretariat** within the Environment Protection Agency–Sierra Leone (EPA-SL), supported by the Ministry of Environment and Climate Change (MoECC) and other line ministries. Legal and governance frameworks will be formalized to ensure that MRV activities are grounded in national policy and regulatory instruments. Standardized methodologies, protocols, and indicators will be developed across the energy, transport, AFOLU, waste, IPPU, and adaptation sectors to provide consistency and alignment with international reporting obligations.

Equally important, Phase I will initiate the design of the **national MRV digital platform**, integrating data systems from ministries, local councils, and project developers. Pilot initiatives will be launched in priority sectors such as renewable energy, clean cooking, forestry restoration, and resilient transport corridors. These pilots will allow the country to test MRV methodologies, refine indicators, and build experience in data collection, quality assurance, and reporting.

Capacity building is a cornerstone of this stage. Training programs will target government officials, statisticians, local councils, and community monitors, ensuring that the skills base required for MRV is established nationwide. Partnerships with academic institutions and regional experts will further strengthen national capacity.

By the end of Phase I, Sierra Leone aims to produce its **first consolidated National MRV Report (2027)**, supported by a functioning institutional framework, a pilot-tested digital platform, and a cadre of trained professionals. This will mark the transition from fragmented monitoring efforts to a coherent, nationally owned MRV system, laying the groundwork for scaling up in Phase II.

Year/Phase	Workstream	Key Activities	Deliverables/ Milestones	Lead & RACI	Dependencies/ Risks & Mitigation
2025 (Q1–Q2)	Governance & Legal	Constitute National MRV Unit (EPA-SL); formalize Inter-Ministerial MRV Steering Committee; draft MRV Regulation (Article 13 TF alignment).	MRV Unit operational (org chart, TORs); Steering Committee ToR; Draft MRV Regulation.	Lead: EPA-SL; R: MoECC; A: EPA-SL DG; C: MoF, MoE, MoT, MAFFS, NDMA, Stats SL; I: local councils, private sector.	Delay in approvals → Mitigate via ministerial directive; legal review support from AG's office.
2025 (Q2–Q4)	Methods & Protocols	Develop sector MRV protocols/templates (Energy, Transport, AFOLU, Waste, IPPU; Adaptation sectors); define indicators & baselines; align with NAP/Sendai.	Sector MRV handbooks; indicator dictionary; baseline plan with 2023/24 references.	Lead: EPA-SL (MRV Secretariat); R: line ministries; C: Stats SL, academia; I: CSOs.	Data gaps → Plan targeted surveys; adopt proxy methods consistent with IPCC/UNFCCC.
2025 (Q3–Q4)	Data Systems & Digital	Design MRV data architecture; select open-source stack; develop APIs for sector data; data-sharing MoUs; privacy & QA/QC policy.	System design doc; signed MoUs; QA/QC manual; API specs.	Lead: EPA-SL; R: Stats SL, ICT Ministry; C: line ministries; I: developers.	IT capacity limits → Outsource initial build; embed vendor training clauses.
2025 (Q3–Q4)	Capacity & HR	Training needs assessment; design curricula for GHG inventory, AFOLU remote sensing, adaptation M&E, QA/QC.	Training plan; certified cohorts (≥50 staff).	Lead: EPA-SL; R: Civil Service Training College, universities; C: UNDP/FAO/UNEP.	Staff turnover → Create MRV focal points in each ministry; training-of-trainers model.
2026 (Q1–Q2)	Sectoral Pilots	Launch pilots: Energy (renewables & cookstoves), Forestry (reforestation/mangroves), Transport (resilient corridors).	Pilot MRV datasets; lessons-learned brief.	Lead: Line ministries; R: EPA-SL; C: local councils, developers; I: donors.	Pilot delays → Use simple templates; phased site onboarding.
2026 (Q2–Q4)	Finance & Budget Tagging	Align MRV with climate budget tagging; design project-level finance tracking (capex/opex, results).	Finance tagging guide; pilot on 3 ministries (Energy, MAFFS, Transport).	Lead: MoF; R: EPA-SL, line ministries; C: Auditor General.	Inconsistent coding → Standardized chart of accounts codes for climate activities.
2026 (Q3–Q4)	Verification & QA/QC	Contract third-party verifiers for high-value mitigation; set peer-review panels for adaptation.	Verification plan; QA/QC checklists; first verification reports.	Lead: EPA-SL; R: verifiers; C: academia; I: project owners.	Verification bottlenecks → Framework agreements with multiple firms.
2027 (Annual)	Reporting & Communications	Publish MRV Annual Report; dashboard public launch; stakeholder validation workshops (district & national).	2027 MRV Annual Report; live dashboard; workshop proceedings.	Lead: EPA-SL; R: Stats SL; C: MoECC, line ministries; I: public.	Low data literacy → Simplified visuals; infographics; bilingual summaries.

Phase II (2028–2030) – Scaling & International Reporting

02

Phase II will build upon the foundations established during 2025–2027 by expanding the MRV system to cover all mitigation and adaptation sectors comprehensively. The primary objective of this phase is to ensure full sectoral integration, operationalization of independent verification, and readiness for international reporting under the Enhanced Transparency Framework.

During this stage, Sierra Leone will roll out standardized MRV protocols across all six sectors, extend the digital platform nationwide, and launch community-based MRV pilots to enhance data coverage at the local level. The Ministry of Finance will operationalize climate budget tagging, thereby integrating finance tracking into the MRV system. Importantly, Phase II will enable Sierra Leone to prepare and submit its **first Biennial Transparency Report (BTR)** to the UNFCCC, demonstrating compliance with global reporting obligations and readiness for Article 6 mechanisms. By the end of Phase II, the MRV system will have transitioned from pilot operations to a fully institutionalized framework capable of generating internationally credible results.

Year/Phase	Workstream	Key Activities	Deliverables/ Milestones	Lead & RACI	Dependencies/Risks & Mitigation
2028 (Q1–Q2)	Scale-up: Sectors	Roll out MRV to all mitigation (Energy, Transport, AFOLU, Waste, IPPU) and adaptation sectors; enforce mandatory templates.	100% sector coverage; compliance circular issued.	Lead: EPA-SL; R: all line ministries; C: Stats SL; I: councils, private sector.	Compliance gaps → Link MRV to budget releases and licensing conditions.
2028 (Q2–Q4)	Digital Platform	Deploy national climate data platform (ingest, ETL, dashboards); mobile data collection for councils & communities.	Platform go-live; user manuals; mobile apps in 6 districts.	Lead: EPA-SL/ICT; R: vendor; C: Stats SL; I: councils.	Connectivity issues → Offline-first apps; periodic sync.
2028 (Q3–Q4)	BTR Preparation	Compile national inventory; aggregate sector MRV; adaptation outcomes mapped to Sendai/SDGs; uncertainty analysis.	Draft BTR #1 (2029 submission window).	Lead: MoECC/EPA-SL; R: ministries; C: Stats SL, NDMA; I: partners.	Data gaps → Targeted rapid surveys and expert judgment per IPCC guidance.
2029 (Q1–Q4)	Verification & Article 6 Readiness	Scale independent verification; define Mitigation Outcomes (MOs) for potential Article 6; set registry linkages.	Verification statements; MO definitions; Article 6 readiness note.	Lead: EPA-SL; R: MoF (finance registry), line ministries; C: UNFCCC focal point.	Double counting risk → Apply corresponding adjustment policy and registry checks.
2030 (Annual)	Institutionalization	Integrate MRV KPIs into performance contracts of agencies; embed MRV in procurement & licensing; update standards.	Revised sector regulations; MRV KPIs adopted; staff performance clauses.	Lead: MoECC; R: Civil Service Commission; C: line ministries.	Institutional resistance → Executive directive; incentives linked to budget.

Phase III (2031–2035) - Integration, Markets & Sustainability

03

Phase III represents the consolidation and long-term sustainability of Sierra Leone's MRV system. The emphasis will be on upgrading the MRV framework into a fully operational **Climate Data Hub** that provides real-time data integration, advanced GIS-enabled dashboards, and seamless linkages to international reporting platforms.

This phase will also institutionalize **community-based MRV** across all districts, ensuring that local actors are embedded in national monitoring processes. Article 6 readiness will be fully operationalized, with clear procedures for corresponding adjustments, mitigation outcome transfers, and benefit-sharing mechanisms. During this period, Sierra Leone will submit its second and third BTRs, thereby reinforcing its role as a transparent and accountable Party to the Paris Agreement.

By 2035, the MRV system will be fully mainstreamed into national institutions and supported by sustainable domestic financing mechanisms. Independent evaluations will validate its effectiveness, and Sierra Leone will have transitioned from donor-supported pilots to a nationally owned, internationally recognized MRV system. This will ensure that climate action is tracked, reported, and verified in a manner that is transparent, credible, and sustainable for decades to come.

Year/Phase	Workstream	Key Activities	Deliverables/Milestones	Lead & RACI	Dependencies/ Risks & Mitigation
2031 (Q1–Q2)	Community & Local MRV	Expand community-based MRV for adaptation (coastal, forestry, flood monitoring); train 200 local enumerators.	Community MRV manuals; district scorecards in 12 districts.	Lead: Local Gov Ministry; R: councils; C: EPA-SL, NDMA, NGOs.	Data quality variance → Supervisory audits; random spot checks; simple forms.
2031 (Q3–Q4)	Regional Interoperability	Link Sierra Leone MRV to ECOWAS/WAPP data exchanges; adopt regional metadata standards.	Interoperability MoU; regional data schemas.	Lead: MoECC/EPA-SL; R: Energy & Transport ministries; C: ECOWAS/WAPP.	Standards mismatch → Mapping layer/translation tables.
2032 (Annual)	BTR #2 & Global Stocktake Feed	Produce second BTR with enhanced uncertainty management; feed MRV outputs into Global Stocktake cycles.	BTR #2 submitted; GST brief.	Lead: MoECC/EPA-SL; R: all ministries; C: Stats SL, partners.	Staff turnover → Maintain institutional memory via SOPs and archives.
2033 (Q1–Q4)	Article 6 Implementation	Operationalize Mitigation Outcome transfers where applicable; establish benefit-sharing; grievance redress.	Article 6 transactions recorded; safeguards report.	Lead: MoECC/MoF; R: EPA-SL; C: Attorney General; I: project owners.	Social risks → FPIC; independent oversight committee; transparent registry.
2034–2035	Sustainability & Handover	Transition donor-funded components to domestic financing; periodic system upgrades; 10-year MRV review and update.	Domestic financing plan; MRV v2.0 specification; policy update note.	Lead: MoF; R: MoECC/EPA-SL; C: Parliament (budget); I: partners.	Fiscal constraints → Earmark minor levies in licensing; integrate MRV costs into sector tariffs/budgets.

Quality Assurance & Quality Control (QA/QC) Framework

The credibility of Sierra Leone's MRV system depends on the establishment of rigorous and transparent Quality Assurance and Quality Control (QA/QC) procedures. The QA/QC Framework is designed to ensure that data collected across all sectors is accurate, consistent, and comparable, while meeting international standards under the IPCC Guidelines and the UNFCCC's Enhanced Transparency Framework.

This framework provides the institutional and procedural safeguards necessary to detect, correct, and prevent errors in data collection, processing, and reporting. It establishes systematic checks across the MRV cycle, including double-entry verification for data input, peer reviews of greenhouse gas calculations, independent audits of geospatial and survey data, and triangulation of adaptation outcomes through administrative and community-level sources.

The QA/QC Framework also introduces a multi-layered approach to oversight. At the sectoral level, line ministries and councils are responsible for implementing first-tier checks to ensure data reliability at the source. At the national level, Statistics Sierra Leone validates the statistical robustness of datasets, while EPA-SL, as MRV Secretariat, ensures consistency and prepares the consolidated QA/QC reports. Independent third-party verifiers and academic institutions provide an additional layer of review, further strengthening credibility and alignment with best practice.

Through its structured procedures, the QA/QC Framework will enhance transparency, minimize uncertainty, and ensure confidence in the reported outcomes. By embedding QA/QC processes into every stage of MRV operations, Sierra Leone will be able to demonstrate to domestic stakeholders and the international community that its climate action results are both reliable and verifiable.

Component	QA/QC Procedure	Frequency	Owner
Data entry	Double-entry verification; automated validation rules; outlier flags	Continuous	EPA-SL MRV Unit
GHG calculations	Peer review vs IPCC defaults; uncertainty quantification	Annual	Sector MRV Leads
Geospatial data	Cross-check with independent imagery; GPS-tagged audits	Semi-annual	REDD+ MRV/MAFFS
Adaptation outcomes	Triangulate admin data with household/community surveys	Annual/biannual	NDMA & sector ministries
Public dashboards	Consistency checks vs internal datasets; change logs	Quarterly	EPA-SL/Stats SL

High-Level RACI (Roles & Responsibilities)

The effective implementation of Sierra Leone's MRV system requires clear delineation of institutional responsibilities. To avoid duplication of effort, ensure accountability, and promote efficiency, a High-Level **RACI (Responsible, Accountable, Consulted, Informed)** framework has been developed. This framework assigns explicit roles to each institution across the core functions of data collection, consolidation, verification, finance tracking, and reporting.

The RACI structure provides a transparent mechanism for clarifying "who does what" within the MRV system. Institutions designated as **Responsible (R)** are tasked with the day-to-day execution of MRV activities, while those designated as **Accountable (A)** carry ultimate decision-making authority. Institutions identified as **Consulted (C)** contribute technical expertise, data inputs, or advisory roles, and those identified as **Informed (I)** are kept apprised of progress and results to ensure transparency and broad stakeholder engagement.

By formalizing these roles, the High-Level RACI framework ensures that EPA-SL, as MRV Secretariat, remains central to the coordination and consolidation of MRV outputs, while line ministries retain ownership of sectoral data. Statistics Sierra Leone guarantees methodological rigor, and the Ministry of Finance integrates climate finance tracking into the system. Independent verifiers, academia, and civil society provide external checks and validation, strengthening credibility and inclusiveness.

The introduction of the RACI framework thus ensures that all actors within the MRV architecture understand their mandates and obligations. It provides the institutional clarity required for timely, high-quality reporting to both domestic policymakers and the UNFCCC, reinforcing Sierra Leone's commitment to a transparent, accountable, and well-governed MRV system.

Function	Responsible (R)	Accountable (A)	Consulted (C)	Informed (I)
MRV Secretariat	EPA-SL MRV Unit	MoECC	Line ministries, Stats SL	Public
Sector Data Provision	Line ministries	PS/Directors	EPA-SL, Stats SL	Councils, CSOs
Verification	Accredited verifiers	EPA-SL	Academia	Project owners
Finance Tracking	MoF	MoF	EPA-SL, Auditor General	Partners
Reporting (BTR)	EPA-SL/MoECC	MoECC	All sectors	UNFCCC, public

Top Risks & Mitigation Measures

The successful implementation of Sierra Leone's MRV system depends on anticipating and proactively addressing potential risks that could undermine its effectiveness. The **Top Risks & Mitigation Measures** framework identifies the most critical threats to MRV operations—ranging from data quality challenges to institutional and financial constraints—and prescribes targeted strategies to minimize their impact.

This framework acknowledges that risks are both technical and institutional in nature. On the technical side, data gaps, IT failures, and methodological inconsistencies can compromise the accuracy and timeliness of reporting. On the institutional side, staff turnover, limited financial resources, and weak safeguards could threaten the system's sustainability and credibility. Each risk is assessed according to its likelihood and potential impact, ensuring that the most urgent threats receive priority attention.

For each identified risk, specific mitigation measures have been defined. These include the adoption of standardized templates and proxy methods to address data gaps, the institutionalization of Standard Operating Procedures (SOPs) to manage staff turnover, budget tagging and blended finance mechanisms to counter funding shortfalls, and redundant backup systems to ensure IT reliability. In the case of social and environmental safeguards—particularly under Article 6 mechanisms—the framework prescribes measures such as Free, Prior and Informed Consent (FPIC), benefit-sharing arrangements, and independent grievance mechanisms.

By embedding risk identification and mitigation into the MRV framework, Sierra Leone demonstrates its commitment to maintaining a system that is resilient, credible, and adaptive. This proactive approach ensures that risks do not become barriers to implementation, but instead are systematically managed to safeguard the integrity and long-term sustainability of the MRV system.

Risk	Likelihood/Impact	Mitigation	Owner
Data gaps & low quality	High/High	Standardized templates; training; audits; proxy methods	EPA-SL & sectors
Institutional turnover	Medium/High	SOPs; ToT; embed MRV in job descriptions	MoECC
Funding shortfalls	Medium/High	Budget tagging; blended finance; modest levies	MoF
IT failures	Medium/Medium	Redundant backups; offline data capture; vendor SLAs	EPA-SL/ICT
Social safeguards (Article 6)	Low/High	FPIC; benefit-sharing; grievance mechanisms	MoECC/EPA-SL

12 References

1. IPCC. (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
2. UNFCCC. (2018). Modalities, procedures and guidelines for the transparency framework under Article 13 of the Paris Agreement.
3. UNDRR. (2015). Sendai Framework for Disaster Risk Reduction 2015–2030.
4. FAO. (2013). Climate-Smart Agriculture Sourcebook; FAO (2017) CSA Indicators.
5. UNFCCC CDM methodologies: AMS-I.L, AMS-II.G, AMS-III.C, AMS-III.S, ACM0001, AMS-III.E, AR-AMS0007, AR-AMS0003, AR-AM0014, ACM0005.
6. Government of Sierra Leone. (2023). National Adaptation Plan.
7. Government of Sierra Leone. (2017). National Biodiversity Strategy and Action Plan.
8. Government of Sierra Leone. (2019). REDD+ Strategy.
9. Government of Sierra Leone. (2021). Blue Economy Policy.
10. **General MRV & Transparency Frameworks**

    Intergovernmental Panel on Climate Change (IPCC). (2006). *2006 IPCC Guidelines for National Greenhouse Gas Inventories.* Hayama, Japan: Institute for Global Environmental Strategies. Available at: https://www.ipcc-nggip.iges.or.jp/public/2006gl/

    United Nations Framework Convention on Climate Change (UNFCCC). (2018). *Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement.* FCCC/PA/CMA/2018/3/Add.2. Bonn: UNFCCC Secretariat.
11. **Energy & Transport**

    UNFCCC Clean Development Mechanism (CDM). (2012). *AMS-I.L: Electrification of rural communities using renewable energy.* Bonn: UNFCCC Secretariat.

    UNFCCC CDM. (2014). *AMS-II.G: Energy efficiency measures in thermal applications of non-renewable biomass.* Bonn: UNFCCC Secretariat.

    UNFCCC CDM. (2012). *AMS-III.S: Introduction of low-emission vehicles.* Bonn: UNFCCC Secretariat.

    UNFCCC CDM. (2006). *AMS-III.C: Emission reductions by electric and hybrid vehicles.* Bonn: UNFCCC Secretariat.
12. **Forestry & AFOLU**

    UNFCCC CDM. (2009). *AR-AMS0007: Afforestation and reforestation project activities implemented on lands other than wetlands.* Bonn: UNFCCC Secretariat.

    UNFCCC CDM. (2009). *AR-AMS0003: Simplified baseline and monitoring methodologies for small-scale A/R project activities implemented on lands other than wetlands.* Bonn: UNFCCC Secretariat.

    UNFCCC CDM. (2012). *AR-AM0014: Afforestation and reforestation of degraded mangrove habitats.* Bonn: UNFCCC Secretariat.
13. **Waste**

    UNFCCC CDM. (2012). *ACM0001: Flaring or use of landfill gas.* Bonn: UNFCCC Secretariat.

    UNFCCC CDM. (2006). *AMS-III.E: Avoidance of methane production from decay of biomass through composting.* Bonn: UNFCCC Secretariat.

14. **IPPU**

    UNFCCC CDM. (2012). *ACM0005: Increasing the blend in cement production.* Bonn: UNFCCC Secretariat.

15. **Transport & Infrastructure**

    Engineers Canada. (2011). *PIEVC Engineering Protocol for Climate Change Infrastructure Vulnerability Assessment.* Ottawa: Engineers Canada.

    International Institute for Sustainable Development (IISD). (2007). *CRiSTAL: Community-based Risk Screening Tool – Adaptation and Livelihoods.* Winnipeg: IISD.

16. **Energy Infrastructure Resilience**

    World Bank. (2019). *Lifelines: The Resilient Infrastructure Opportunity.* Washington, D.C.: World Bank.

17. OECD. (2021). *Climate Resilience in Infrastructure Planning and Investment.* Paris: OECD Publishing.

18. **Agriculture, Forestry & Food Security**

    Food and Agriculture Organization of the United Nations (FAO). (2013). *Climate-Smart Agriculture Sourcebook.* Rome: FAO.

    FAO. (2017). *CSA Indicators – Monitoring and Evaluation Framework.* Rome: FAO.

19. **Waste & Urban Systems**

    UNFCCC. (2009). *Technical Guidelines for the Preparation of National Communications from Non-Annex I Parties: Waste Sector.* Bonn: UNFCCC.

    United Nations Office for Disaster Risk Reduction (UNDRR). (2015). *Sendai Framework for Disaster Risk Reduction 2015–2030.* Geneva: UNDRR.

20. **IPPU Adaptation**

    United Nations Industrial Development Organization (UNIDO). (2018). *Industrial Development Report: Demand for Manufacturing Resilience and Resource Efficiency.* Vienna: UNIDO.

21. **Coastal & Blue Economy**

    UNEP. (2020). *Blue Carbon MRV: Guidance on Coastal Ecosystems in National Greenhouse Gas Inventories.* Nairobi: UNEP.

    Intergovernmental Oceanographic Commission (IOC-UNESCO). (2021). *Blue Economy Policy Framework and Implementation.* Paris: UNESCO-IOC.

22. **Cross-Cutting MRV & Verification**

    UNFCCC. (2015). *Paris Agreement.* FCCC/CP/2015/10/Add.1. Bonn: UNFCCC Secretariat.

    UNDP. (2019). *National MRV Systems: Good Practice and Lessons Learned.* New York: UNDP.

    Global Environment Facility (GEF). (2020). *MRV Systems for Transparency and Climate Finance Tracking.* Washington, D.C.: GEF.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