

ANNEX 11

Monitoring and Evaluation Plan

Contents

1. OBJECTIVE OF THE ANNEX	3
2. STRUCTURE OF THE ANNEX	3
3. MONITORING OF IRMF AND PROJECT-SPECIFIC INDICATORS	3
3.1 QUARTERLY	3
3.2 BASELINE, MID-TERM, AND ENDLINE	4
3.3 MID-TERM AND ENDLINE	4
4. MONITORING ACTIVITIES AND INDICATIVE BUDGET	6
5. RESPONSIBILITIES FOR DATA COLLECTION	6

Acronyms

BPS	Bus Priority Service
CBS	City Bus Service
GCF	Green Climate Fund
ITS	Intelligent Transport System
MoIT	Ministry of Infrastructure and Transport
PSA	Public Services Agreement
RGoB	Royal Government of Bhutan

1. OBJECTIVE OF THE ANNEX

The objective of this Monitoring and Evaluation (M&E) Annex is to provide a detailed framework for how progress, effectiveness, and outcomes of LRCP will be tracked, measured, and reported. This framework will ensure that the implementation of the project aligns with the expected outcomes and goals of both the World Bank and the Green Climate Fund (GCF), particularly with respect to climate adaptation and mitigation. The M&E system is designed to be fully integrated into the operational and institutional arrangements of the project, leveraging digital systems (SCADA, ITS, smartcards), structured surveys, and third-party verification to ensure transparency and reliability. It will inform decision-making, promote accountability, and support learning.

2. STRUCTURE OF THE ANNEX

This annex is organized into several subsections. Section 3 presents monitoring arrangements grouped by data collection frequency, that is, (i) quarterly, (ii) baseline, mid-term, and endline, and (iii) mid-term and endline. Section 4 presents a consolidated table of M&E activities and associated budget lines. Section 5 outlines the roles and responsibilities for data collection, analysis, and reporting, specifying institutional actors and tools.

3. MONITORING OF IRMF AND PROJECT-SPECIFIC INDICATORS

3.1 QUARTERLY

Direct and indirect beneficiaries reached across transport and water activities will be measured using CBS smartcard usage data, structured household surveys, service connection records from Thimphu Thromde, and SCADA logs (IRMF indicator, Core 2). These will track improvements in access to public transport and reliable piped water services. Data will be disaggregated by gender to monitor inclusion. See the Adaptation Beneficiaries Analysis for the approach to avoiding double counting.

Reduced water losses in the city core distribution network, reflecting reduced vulnerability to climate-driven resource and infrastructure stress will be measured through reports generated from the SCADA monitoring system (Outcome 1). NRW will be estimated using flow data from SCADA and bulk meters. This indicator measures reduced vulnerability to, among others, drought-induced scarcity and flood- or landslide-related pipe damage. Field checks including leak detection and night flow monitoring will support the analysis.

Increased supply hours, maintained consistently across seasons including during the dry season and other climate stress periods will be measured through reports generated from SCADA (Output 1.1a). The SCADA system will provide real-time data on water supply hours, while manual logs will cross-verify and ensure accuracy. The dry season runs December through February.

The percentage of distribution network covered by real-time SCADA monitoring, enabling automated detection of leakage and anomalous pressure or flow conditions caused by floods, landslides, or drought-related stress demands will be measured through reports generated from SCADA (Output 1.1b). This will support reduced hours of infrastructure downtime during climate shocks.

The length of improved urban placemaking and NMT infrastructure, with SuDS and roadside drainage installed and verified as operational (Output 1.2) will be measured through construction reports, site surveys, site inspection reports, and post-rain site assessments conducted by PIU

engineers. This includes investments in Norzin Lam as well as improvements along the Bus Priority Corridor.

Direct users that benefit from improved access to low-emission, climate-resilient transport infrastructure and services will be measured through CBS smartcard data and passenger counts (Output 1.3). This includes bus and NMT users.

Number of municipal staff trained in SCADA use, climate-resilient planning, and emergency response will be measured through training reports, attendance records, and staff feedback (Output 2.1). Data collection will track attendance records and training reports from sessions, and the number of staff trained will be verified.

Non-fare revenue as a share of CBS operating costs will be measured through CBS financial reports (Output 2.2). Total non-fare revenue will be calculated and compared to total operating costs to determine the percentage share. Data will be collected quarterly and aggregated annually to monitor trends and assess the impact of revenue diversification.

3.2 BASELINE, MID-TERM, AND ENDLINE

The percentage of households in target areas experiencing reliable daily access to piped water supply, contributing to improved household hygiene and health will be measured through baseline and endline household surveys, Thimphu Thromde water supply performance reports, and SCADA system logs where disaggregated data are available (co-benefit). The baseline will be confirmed at project inception.

The concentration of PM_{2.5}, NO_x, and SO₂ in Thimphu will be measured through permanent roadside monitoring stations (co-benefit: improved air quality and reduced pollution). A modal shift to public transport, combined with electrification of the bus fleet, will decrease the number of vehicles per passenger-km travelled, reducing emissions and noise pollution. The baseline will be established at project inception following installation of monitoring equipment.

3.3 MID-TERM AND ENDLINE

GHG emissions reduced, avoided or removed/sequestered (IRMF indicator Core 1; MRA2; Outcome 3) through modal shift to public transport will be calculated by a third-party contractor, using the same CDM AM0031 Methodology for Bus Rapid Transit projects (version 8.0) used for the ex-ante GHG analysis approved in Annex 22. Traffic surveys will be undertaken at project inception, midterm (Year 1 of Bus Priority Corridor operation) and project end (Year 3) to measure vehicle-kilometers travelled per mode and other key inputs for AM0031 (load factors, vehicle speeds), while passenger surveys and CBS smartcard data will measure the share of passengers shifting to bus. The same baseline, structure, equations, and core assumptions from Annex 22 will be maintained for APR reporting. Any IPCC or nationally determined emission factors used will be an input into that methodology, and any future methodological adjustment will be disclosed and justified. A more detailed overview of MRV for Core Indicator 1 is provided in Annex 22, section 5.

The value of physical assets made more resilient or more able to reduce GHG emissions will be estimated using project Economic and Financial Analysis, engineering design records, and Thromde's

asset inventories (IRMF indicator, Core 3). This includes climate-resilient investments in roads, bridges, water infrastructure, and NMT facilities. Information will be drawn from construction completion reports.

Percentage peak-period modal shift from private vehicles to public and non-motorized transport will be measured through CBS smartcard data, pedestrian and traffic surveys, and the number of passengers carried on dedicated services (Outcome 2). Modal share will be estimated through a combination of CBS smartcard usage data, passenger counts, and periodic surveys during peak hours. The baseline measurement draws on the technical consultants' work underpinning the Bhutan Green Transport Project (BGTP) traffic model, the LRCP predecessor project, and will be updated at project inception.

Reduction of the average number of closures or restriction days to the Bus Priority Corridor per year due to flooding, demonstrating enhanced climate resilience in the transport sector and contributing to reliable mobility under climate stress (Outcome 3). Baselines will be established in the first project year using CBS operational records, ITS monitoring data, and MoIT maintenance logs, with a target of 50% reduction from baseline by project end. This indicator complements the assessment of physical assets made more resilient (IRMF Core 3).

Thimphu Thromde demonstrates improved water service management will be measured at mid-term and endline through annual maintenance plans, documented disaster and emergency response protocols tested at least annually, annual business plans and budget submissions, and consultant progress reports (Outcome 4). Data will be collected through a capacity assessment conducted by the PMU involving structured review of submitted documents and semi-structured interviews with Thromde staff. The assessment will apply a qualitative rubric along three dimensions: the existence of required tools and systems; the quality of these tools in terms of clarity and relevance to climate resilience; and the degree to which they are applied in operational decision-making.

City Bus Service (CBS) is equipped with internal systems and staff capacity to support State-Owned Enterprise (SOE) operations will be measured at mid-term and endline through CBS annual business plans, internal financial reports and accounting records, documented Standard Operating Procedures (SOPs) for service delivery, and consultant progress reports (Outcome 4). Data will be collected through a capacity assessment conducted by the PMU involving structured review of submitted documents and semi-structured interviews with CBS staff. The assessment will apply a qualitative rubric along three dimensions: the existence of required systems and procedures; the quality of these tools in terms of clarity and alignment with SOE standards; and the extent to which they are applied in day-to-day service planning and delivery.

Degree to which GCF investments contribute to strengthening institutional and regulatory frameworks for low emission climate-resilient development pathways will be assessed at mid-term and endline through institutional capacity assessments, document reviews, and interviews with project stakeholders (IRMF Core 5). The two Outcome 4 indicators above, covering water service management improvements in Thimphu Thromde and the CBS transition to an SOE, constitute the primary means of measurement for this core indicator.

Degree to which GCF investments contribute to technology deployment, dissemination, development or transfer and innovation will be measured at mid-term and endline through documentation of system implementation, training records, and operational reviews (IRMF Core 6). This covers the

deployment of the SCADA system across the city's water distribution network and the ITS and MIS systems for transport management. Capacity-building programs will ensure that municipal staff are trained in the use, maintenance, and interpretation of data from these systems.

4. MONITORING ACTIVITIES AND INDICATIVE BUDGET

This portion has been redacted in accordance with the GCF Information Disclosure Policy, as the portion is confidential under the disclosure policy of the Accredited Entity.

4. Evaluation plan

The project will undergo independent mid-term and final evaluations to assess performance, inform decision-making, and ensure accountability and to assess the project's effectiveness, impact, and sustainability in achieving its climate mitigation and adaptation outcomes. The scope covers all physical investments and institutional reforms across the transport and water sectors. The evaluations will assess the project's success in reducing GHG emissions, strengthening the climate resilience of infrastructure and beneficiaries, and institutionalizing a paradigm shift in urban service delivery. The evaluations will use a mixed-methods approach grounded in the project's M&E framework (Annex 11). This includes quantitative analysis of data from SCADA systems, smartcards, and traffic counts, alongside qualitative methods such as institutional capacity assessments, household surveys, and stakeholder interviews. Performance will be measured against the indicators in the project's logical framework and the GCF Integrated Results Management Framework (IRMF). A project-wide baseline will be established in Year 1. A mid-term evaluation will be conducted in Year 3 to allow for adaptive management, and a final evaluation will be completed at the end of the project to assess overall achievement of objectives. The Project Management Unit (PMU) will commission and oversee the independent evaluators. The final evaluation reports will be submitted to the Project Steering Committee, the World Bank, and the GCF.

5. RESPONSIBILITIES FOR DATA COLLECTION

Oversight of the M&E system will be led by the Ministry of Infrastructure and Transport (MoIT) through the Project Management Unit (PMU). The designated M&E Officer within the PMU will coordinate all data collection activities, ensure methodological consistency, and oversee integration of findings into official project reporting. The M&E Officer will coordinate with Thimphu Thromde to collect water system performance data, including SCADA logs, NRW measurements, and field monitoring records. S/he will also coordinate with the City Bus Service (CBS) to collect operational and financial data required for monitoring transport performance, farebox and non-fare revenues, and Public Service Agreement (PSA) indicators. CBS will support institutional assessments and reporting on progress on its transition to a State-Owned Enterprise (SOE). Third-party consultants will be contracted to carry out household and traffic surveys, perception and safety assessments, and institutional performance evaluations. Survey instruments will be reviewed and cleared by the PMU.

In order to ensure that the new SCADA system and the ADB-supported SCADA system are well-integrated, baseline performance data from the ADB-supported system will be collected to determine the requirements for new SCADA system integration. The TORs for the SCADA systems will include technical requirements to be able to be integrated with the ADB-supported SCADA systems, while taking care to avoid single source procurement issues, along with direct engagement with the operators of these SCADA systems to test integration of each system. Procured equipment will be tested to be complementary with the ABD-supported SCADA system. A point person in the PIU will be identified to oversee system integration, with the ADB requirements and current performance defining the floor of the expected performance of the new SCADA systems.

All data will be uploaded to the Project Management Information System (MIS), which will serve as the project's central repository. The M&E Officer will validate and compile data for quarterly progress reports and semiannual Implementation Status and Results (ISR) reports for the World Bank and GCF.