Monitoring & Evaluation (M&E) Plan and Impact Statement Form

Objective of the M&E Plan and Impact Statement:

- The M&E Plan and Impact Statement must be designed based on the Technical Assistance Response Plan and must enable the Implementer to complete the Closure Report at the end of the assistance.

Process for filling in the form:

- The Implementer must identify relevant quantitative and qualitative indicators as specified in the Closure Report. A sub-set of indicators to monitor and assess must be chosen among these.
- The Implementer may also identify other specific, measurable, achievable, relevant, and time-bound indicators suitable to monitor Activities, Outputs and anticipated Outcomes from the technical assistance and add to the M&E Plan and Impact Statement.
- During implementation of the TA or FTA, the Implementer must collect all relevant data as described in the Monitoring & Evaluation Plan. Aggregated data on selected indicators as well as an updated version of the Impact Statement will be presented in the Closure Report at the end of the assistance.

Basic Information	
Title of response plan	Feasibility research of Solar Electric-Based Cold Warehouse equipped with Low-temperature Latent Heat Material for Fruit Storage in Bangladesh Climate Conditions
Technical assistance reference number	CTCN Request ID# 2022000026
Country/ countries	Bangladesh
NDE focal point and organisation	Dr. Abdul Hamid, Director General, Department of Environment (DOE), Ministry of Environment, Forest and Climate Change
Sector(s) addressed	Agriculture / Food systems; Cold chain and storage; Renewable energy
Technologies supported	Solar-powered 20-ft cold warehouse (portable/mini cold storage); low-temperature latent heat material (LHM) thermal storage;

	insulation and refrigeration systems
Implementation period and total duration	12 months (06/03/2025–28/02/2026)
Total budget for implementation	USD 249,584
Designer of the response plan	Korea Institute of Industrial Technology
Implementer of response plan	Korea Institute of Industrial Technology

(A) Outputs and Activities as described in the Response Plan	(B) Indicator	(C) Expected results	(D) Method and frequency for data collection	(F) Comments
Activity 1.1: Establishment of Steering Committee and in-person inception workshop	Steering Committee established (Yes/No); # participants workshop	SC established with agreed TOR; inception workshop conducted with participant list disaggregated by gender	Attendance sheet;	Risk: travel mitigation: early invitations.
Activity 1.2: Diagnostics for cold storage installation in Bangladesh	Site checklist; selected demo site address	candidate sites surveyed; baseline on products (mango + other crops) and infrastructure captured	Field survey forms; photos/GPS notes; document review;	Weather/access constraints; plan buffer time; ensure permissions.
Activity 2.1: Design of 20-ft. cold warehouse for agricultural product by solar power system	Design deliverable submitted (Yes/No)	Design package incl. Excel sizing tools, P&ID, COMSOL module outputs	Design document review	Need access to accurate climate/solar data; ensure datasets and assumptions documented.
Activity 2.2: Manufacturing of 20-ft. cold warehouse for agricultural product by solar power system	Manufacturing completed	Refrigeration & insulation panels manufactured and shipped; LHM modules ready; solar system plan agreed with local partners	Shipping documents; delivery receipts; photo evidence	Customs/clearance delays; engage local logistics agent early.
Activity 2.3: Setup of 20-ft. cold warehouse for agricultural product by solar power system	# days of installation & testing; # operators trained (gender-disaggregated)	Warehouse installed and integrated with solar; basic testing passed; local operators/users trained (≥30% women where feasible)	Installation checklist; photo evidence	Ensuring women's participation may require targeted outreach/time adjustments.

Activity 2.4: Evaluation of 20-ft. cold warehouse for agricultural product by solar power system	Operational dataset collected; optimal operating methodology produced	≥4 weeks of operating data captured; methodology note produced and shared; feasibility of solar+LHM validated	Data logger exports; monitoring system records; analysis report	Risk: sensor failure; maintain spares and data backup.
Activity 3.1: Technical feasibility (commissioning and operational aspects)	Technical feasibility section completed (Yes/No); key barriers identified	Technology overview + performance/cost assessment + challenges/barriers + O&M plan documented	Expert review; report drafting	Need access to operation data; align timeline with Activity 2.4.
Activity 3.2: Socio-economic and financial analysis	Socio-economic + financial worksheets completed	Cost–benefit analysis and financial viability assessed	Worksheet review; key informant interviews	Data on farmer income/market prices may be variable; use ranges and sensitivity analysis.
Activity 3.3: Feasibility report and stakeholder consultations (Communities and government)	# consultation events	≥1 webinar/consultation event	Attendance list	Internet access may limit rural participation; provide offline options.
Activity 4.1: Scale-up project concept note	Concept note submitted (Yes/No)	Concept note ready with best-available data	Concept note review; stakeholder mapping	Dependence on results availability; keep concept note template ready early.
Activity 4.2: Final in-person workshop	# participants (gender-disaggregated)	Final workshop held; final compiled report delivered publicly	Attendance + feedback forms; deliverable review	Scheduling constraints; plan dates with NDE early.

Note: The Response Plan may contain information useful for the section below. The information in the table below will be used by the CTCN for public communication of the achieved and expected results of the Technical Assistance through the CTCN website www.ctc-n.org and other communication channels. See for example: https://www.ctc-n.org/sites/www.ctc-n.org/files/benin_a_ag_forestry.final_.pdf

Impact Statement	
Challenge	Up to 40% post-harvest losses in fruits/vegetables occur due to limited, grid-dependent cold storage concentrated in urban areas. Rural smallholders lack affordable, reliable refrigeration, leading to lower incomes, food insecurity and avoidable GHG emissions from food waste.
CTCN assistance	• Design, build and pilot a solar-powered 20-ft cold warehouse using low-temperature latent heat material (LHM) for off-grid fruit storage. • Conduct diagnostics, site selection and stakeholder engagement, including steering committee and capacity building.

	• Develop monitoring/control system and collect operational data to optimize operation. • Deliver feasibility, business/finance and scale-up concept note for wider replication.
Anticipated impact	• Reduced post-harvest losses for targeted value chains and improved food security (core impact: reduced food loss). • Increased income resilience of smallholder farmers through better price timing. • Lower GHG emissions by reducing food waste and replacing grid/fossil electricity with solar.
Anticipated co-benefits from the TA	Improved rural access to clean energy services; strengthened cold-chain know-how and local technical capacity; improved market access and reduced price volatility for perishable crops; data/learning products to inform policy and investment.
Gender aspects of the TA	A gender expert will conduct a gender mainstreaming analysis and develop a Gender Action Plan (GAP). Data and participation will be gender-disaggregated, and trainings/outreach will be designed to increase women's participation in operation/management and entrepreneurship opportunities around cold storage services.
Anticipated contribution to NDC	• Supports NDC mitigation targets by reducing emissions from food waste and promoting renewable energy use in agriculture. • Enhances adaptation by improving resilience of agricultural value chains to heat and climate variability. • Contributes to improved waste/resource efficiency and energy efficiency in cold storage.
The narrative story	Bangladesh's fruit and vegetable producers face major post-harvest losses because cold storage is scarce in rural areas and typically relies on an unreliable and costly national grid. Perishable produce deteriorates quickly, forcing smallholder farmers to sell at low prices or accept spoilage—reducing incomes and increasing food waste that drives greenhouse gas emissions. This technical assistance will develop and pilot an off-grid, solar-powered 20-ft cold warehouse equipped with low-temperature latent heat material (LHM) to provide stable refrigeration even when solar generation fluctuates. The project begins with a stakeholder-led diagnostics and site selection, then designs, manufactures, installs and commissions the cold warehouse and monitoring/control system, followed by operational evaluation. Evidence and lessons learned will feed into a feasibility report, socio-economic and financial analysis, and a scale-up concept note to mobilize follow-on finance and replication across key production regions—strengthening food security, climate resilience and low-carbon development.
Contribution to SDGs	SDG 2 (Zero Hunger): Reduces food loss and improves availability of nutritious foods by enabling safe storage of perishable produce, improving farmer incomes and market access. SDG 7 (Affordable and Clean Energy): Demonstrates productive use of solar energy for cold-chain services in off-grid/rural areas, reducing dependence on costly grid electricity. SDG 13 (Climate Action): Mitigates emissions by cutting food waste and shifting cold storage energy use toward renewables while strengthening climate resilience of agricultural supply chains.

Reference to knowledge products	No specific UNFCCC TEC knowledge products were cited in the Response Plan. During implementation, the team may reference TEC briefs/tools on technology assessment, innovation and enabling environments to support feasibility assessment and scale-up design