



Zabarang Kalyan Samity

Terms of Reference (ToR)

Project Name: *Promoting Gender Responsive Enterprise Development and TVET Systems (ProGRESS) Project*
Implementing partners: Zabarang Kallyan Samity (ZKS)

Activity Name: Establishment of Solar powered Cold Storage Facility in three Hill Districts.

Locations: Khagrachari

Total Duration: On the basis of work order upon selection

1. Background

The Chittagong Hill Tracts (CHT) comprising Bandarban, Rangamati, and Khagrachari districts represent one of Bangladesh's most important but structurally constrained agricultural production zones. The region produces a diverse range of fruits, vegetables, and spices, including banana, mango, papaya, jackfruit, ginger, turmeric, and seasonal vegetables. Despite strong production potential, the CHT continues to experience **significant post-harvest losses (ranging from 5% to 25%)**, severe **seasonal price volatility**, and limited integration with higher-value markets. These challenges are exacerbated by hilly terrain, poor road connectivity, absence of cold-chain infrastructure, and unreliable electricity supply. As a result, farmers and traders are often forced into distress sales, undermining incomes, enterprise growth, and food system efficiency.

The ILO's ProGRESS project aims to foster green jobs, sustainable enterprises, and inclusive growth in agro-processing, with a strong focus on climate resilience, women's economic empowerment, and SME competitiveness. The introduction of solar-powered smart cooler/cold storage facility in the CHT aligns directly with these objectives. By leveraging renewable energy, the intervention reduces greenhouse gas emissions, addresses energy insecurity, and creates new opportunities for youth and women in operation, maintenance, and service delivery. It also helps SMEs and producer groups access higher-value markets by ensuring better quality and longer shelf life of produce.

Under the ProGRESS project, a feasibility study was conducted by the Global MindLens in 2025 and the feasibility evidence clearly demonstrates that a solar powered cold storage facility **is a high-value, low-risk intervention** for the Chittagong Hill Tracts. When implemented through a **phased, inclusive approach under a cooperative-PPP hybrid model**, the intervention can deliver durable economic, social, and environmental returns. It addresses a critical structural gap in the horticultural value chain, reduces losses, stabilizes incomes, creates green jobs, and supports Bangladesh's broader objectives on climate resilience and inclusive enterprise development.

2. Project Objective:

To supply and install a fully autonomous, off-grid solar cold storage solution for the distribution and multi-day holding of tropical fruits and root crops in the three (3) districts of Chittagong Hill Districts. The system must operate independently of the national grid to guarantee 100% uptime for temperature-sensitive produce.

3. Technical Scope of Work:

- **Off-Grid Power Plant:** Supply and install a stand-alone solar photovoltaic system with sufficient battery capacity for **48-hour autonomy** (operation without sunlight).
- **High-Traffic Cooling:** Integration of a "Distribution Hub" grade cooling system designed for frequent door openings and high-respiration produce (papaya, banana, tomato).
- **Atmosphere Management:** Implementation of active ethylene scrubbing and humidity control to prevent cross-contamination and spoilage during multi-day holding.

Annex A: Detailed Off-Grid Specifications

A.1. Solar Power Plant (Stand-Alone)

- **Solar Array:** 7.5 kWp to 8.0 kWp using high-efficiency Monocrystalline PERC panels. The array must be oversized to allow for simultaneous cooling and full battery recharging during limited daylight hours.
- **Battery Storage: 40 kWh to 45 kWh** usable capacities.
 - **Technology:** Lithium Iron Phosphate (LiFePO₄) for deep-cycle longevity (min. 4,000 cycles).
 - **Configuration:** 48V system to reduce DC line losses.



- **Off-Grid Inverter:** 8 kVA to 10 kVA Heavy-Duty Pure Sine Wave Inverter.
 - **Requirement:** Must have a high surge rating (300%) to handle the startup current of the 2.5 TR compressor.
- **Charge Controller:** Dual MPPT controllers (minimum 100A) to optimize harvesting from the large solar array.

A.2. Refrigeration & Distribution Hub Features

- **Cooling Unit:** 2.5 TR (3 HP) Tropicalized DC-Inverter Split System.
 - **Controller:** Must be original smart cooler controller for low-temperature override (Target: 12°C-13°C).
- **Ethylene Scrubber:** Active fan-powered Potassium Permanganate (\$KMnO_4\$) filtration system (critical for holding bananas and papayas together).
- **Humidity:** Industrial-grade ultrasonic humidifier with an external hygostat set to **85-90% RH**.
- **Ventilation:** Small, timed exhaust fans (both ends and in the middle) to exchange air and prevent CO2 buildup
- **Oversized Evaporator Fans:** High-CFM (Cubic Feet per Minute) fans to circulate air quickly.
- **Dual Sensors:** Place one temperature sensor near the door and one at the back. Link them to a GSM/Wi-Fi Data Logger. (Since this is a hub, there is need for real-time alerts on the phone of storage manager) storage manager if the temperature stays above 15°C for too long.

A.3. Container & Insulation (Thermal Mass)

- **Structure:** 20ft High Cube Shipping Container refurbished and treated with anti-corrosive paint.
- **Insulation:** **120mm PIR/PU Panels** (upgraded from 100mm to reduce the energy required for off-grid holding).
- **Thermal Barrier:** Heavy-duty, industrial PVC strip curtains (double-ribbed) to minimize "cold spill" during order picking.
- **Exterior:** painted white reflective ceramic paint. This is to reduce the internal "skin" temperature by up to 10°C before the cooling system even kicks in
- **Zoning with Internal Dividers:** Insulated PVC Strip Curtains or a Moveable Internal Partition.
- **Internal Lighting:** 12V/24V DC LED strips (IP65 rated for moisture).
- **Sanitation:** the floor must have a sloped drain to allow for weekly washdowns with a mild chlorine solution to prevent cross-contamination of molds between batches.
- **Pre-Cooling Zone:** Designate the area closest to the evaporator for "incoming" warm produce to pull the heat out quickly before moving it to the "holding" area at the back.

Annex A.4 (Internal Infrastructure):

- **Racks:** Modular, 4-tier wire-mesh shelving units made of Grade 304 Stainless Steel or GI.
- **Dimensions:** 1200mm (L) x 600mm (W) x 1800mm (H).
- **Capacity:** Minimum load rating of 200kg per shelf.
- **Features:** Food-grade finish, adjustable shelf heights, and 4-inch polyurethane swivel casters with brakes.
- **Safety:** Must include "ledge" or "lip" edges to prevent plastic crates from sliding off during movement.

Annex B: Performance & Support Standards

- **Autonomy Guarantee:** The vendor must certify that the battery bank can maintain an internal temperature of 13°C for **48 hours** starting from a full charge with zero solar input, assuming 10 door openings per day.
- **Remote Monitoring:** Mandatory GSM-based data logger. Since the site is off-grid and remote, the system must send daily SMS/Data alerts regarding battery SoC (State of Charge) and internal temperature.
- **Spares Kit:** Handover must include a "Remote Site Kit" containing:
 - 2x Replacement smart cooler sensors.
 - 1x Set of high-capacity DC fuses.
 - 1x Spare evaporator fan motor.
- **Warranty:** 2 years on the total system, 5 years on the Inverter, and 10 years on the Battery



Additional Scope of Work

The cold storage system shall be designed, installed, and commissioned in accordance with internationally recognized standards, including relevant ISO, IEC, ASHRAE, Codex/HACCP, and container safety standards. Components such as refrigeration units, insulation panels, solar equipment, and containers shall comply with applicable international certifications. Documentary evidence of compliance shall be provided at commissioning.

Site verification and engineering finalization

The Service Provider shall:

- a) Conduct site inspection to verify drainage, shading, access, safety risks, and constructability conditions.
- b) Confirm utility readiness, including grid presence, voltage conditions, and earthing feasibility.
- c) Confirm regulatory pathway status and documentation readiness (DoE category/clearance where applicable and local authority endorsements).
- d) Prepare execution-level technical drawings including layout drawings, solar array configuration, electrical single-line diagram (SLD), earthing and lightning protection design.
- e) Submit a Site Readiness and Method Statement Report for approval prior to commencement of installation works.

4. Permits, approvals and responsibilities:

Permits and approvals shall be managed as follows:

Contracting authority Responsibilities

- Ensure site clearance and access to the site
- Ensure MoU with landowner or formal site authorization to establish the smart cooler system/cold storage facility
- Facilitate local coordination and endorsement letters where required

Service Provider Responsibilities

- Prepare and submit all required technical documentation for inspections and clearances
- Support site inspections and verification processes
- Ensure compliance with applicable technical standards

Cost Responsibility

All documentation preparation, testing, and compliance reporting costs are included in the Service Provider's contract price (BoQ).

5. Quality assurance, quality control and HSE requirements:

The Service Provider shall submit, obtain approval for, and implement a Quality Assurance/Quality Control (QA/QC) Plan and a Health, Safety and Environment (HSE) Plan as part of mobilization. Installation shall not commence until these plans are approved.

QA/QC requirements

The QA/QC Plan shall include, at minimum:

- Material verification against approved datasheets (insulation panels, inverter, battery, AC unit, protection devices)
- Installation inspection checklists
- Torque and termination verification records
- Calibration records for smart cooler system/cold storage facility sensors and thermistors
- Commissioning test documentation and sign-off procedures

Health, Safety and Environment (HSE) Requirements

The HSE Plan shall include:

- Electrical safety procedures, including isolation and lock-out/tag-out where applicable
- Safe working-at-height procedures for PV installation



- Mandatory PPE requirements
- Safe tool handling and site housekeeping standards
- Incident reporting and corrective action procedures

Refrigerant Handling

- Only competent and authorized technicians shall handle refrigerant circuits
- Refrigerant shall not be vented
- Handling shall comply with manufacturer guidance and applicable national regulations

6. Training, inclusion and O&M readiness:

Training requirements

The Service Provider shall conduct structured training covering:

- Daily operation and monitoring
- Logbook maintenance
- Loading and door protocol
- Preventive maintenance
- Safety and emergency procedures

The training will be provided for the management committee members suggested by the contracting authority.

7. Grievance and feedback mechanism

The Service Provider shall support establishment of a simple grievance mechanism, including:

- Display of contact information at site
- Grievance register template
- Defined response time aligned with SLA requirements

8. Minimum spares and tools for handover

The Service Provider shall provide, at minimum:

- Spare temperature probes/thermistors
- Essential smart cooler system/cold storage facility sensor components
- Spare fuses or breakers
- Basic consumables (sealing tape, connectors)
- Basic electrical toolkit and multimeter

9. O&M readiness package

The Service Provider shall submit:

- Preventive maintenance schedule (daily/weekly/monthly/quarterly)
- First-year service plan including periodic inspections
- Contact and escalation pathway (operator- technician- provider)

10. Warranty, SLA and Defect Liability

The Service Provider shall:

- Provide documented warranties for all major components
- Maintain a defect liability period of 12 months from acceptance
- Respond to critical system failures within 72 hours
- Respond to major failures within 5 days
- Respond to minor issues within 14 days

Failure to meet SLA response times may trigger contractual remedies as defined in the contract.

11. Performance compliance requirements

The installed system must meet the following benchmarks:

- Temperature deviation within $\pm 3^{\circ}\text{C}$
- Stable hybrid operation
- Functional safety protection systems
- Proper documentation archived onsite

Acceptance will be subject to verification against commissioning tests and documentation submission.



Deliverables

- Deliverable 1:** Site readiness and method statement report
- Deliverable 2:** Execution design pack (signed by qualified engineer)
- Deliverable 3:** Cold room installation completion report (with photo documentation)
- Deliverable 4:** Cooling system installation and calibration report
- Deliverable 5:** Solar hybrid installation report with electrical test certificates
- Deliverable 6:** Commissioning report and signed acceptance certificate
- Deliverable 7:** Training completion report
- Deliverable 8:** Complete handover dossier
- Deliverable 9:** Warranty and SLA compliance agreement

12. Reporting and coordination

Minimum reporting:

- Kick-off meeting minutes and work plan
- Weekly progress updates during installation
- Incident reports (if any);
- Completion/commissioning/handover report.

13. Qualification of potential vendor/service providers:

Legal eligibility:

- Registered company in Bangladesh
- Valid trade license, VAT, BIN and ability to work
- Not blacklisted by any government/donor
- Signed Declaration of Non-Collusion

Technical and professional capacity:

- At least 5 years' experience in cold storage or solar installation in Bangladesh.
- Experience working in CHT will be treated as a value-added qualification
- Provide 1-2 samples of previous work (online link or hard copy of the contract)

Evaluation criteria

- Technical compliance with specs (pass/fail thresholds + scoring)
- Implementation methodology and QA/QC plan
- Warranty and SLA robustness
- Team qualifications and deployment plan in CHT
- Cost and value-for-money

14. Payment Schedule:

All payments shall be made through bank transfer in accordance with the payment ratio/schedule specified below;

- **30%** of the total contract value shall be paid upon signing the contract and mobilization of the contractor.
- **40%** shall be paid upon completion of construction works and delivery of all equipment, duly verified and certified by the Steering Committee.
- The remaining **30%** shall be released upon successful commissioning of the system and submission of the final completion/closure report.
- All payment claims must be submitted and settled within the agreed contractual timeline.

15. Bidding submission deadline:

The deadline for submission of Technical and Financial Proposals is **on 15 June 2026**. Proposals must be duly addressed to the **Executive Director, Zabarang Kalyan Samity, Khagrapur, Khagrachari Sadar, Khagrachari**.