

OPERATION & MAINTENANCE (O&M) PLAN

1 Scope for O&M activities

This O&M Plan specifies key system operating parameters and limits, maintenance procedures and schedules, and documentation methods necessary to demonstrate proper operation and maintenance of the equipment that will be acquired under this GCF-funded Project.

It focusses specifically on six activities undertaken under **Output 1.1 The Naatangue family farms developed with Operational and Management plan** and **Output 1.2. Village farms improved with climate-resilient farming systems and new value chains**

The activities concerned are as detailed below.

- **Activity 1.1.2.** Create low-carbon and climate-resilient family farms
- **Activity 1.2.1.** Acquisition and installation of solar equipment
- **Activity 1.2.2.** Establishment and integration of poultry farming
- **Activity 1.2.3.** Establishing of chicken processing units
- **Activity 1.2.4.** Establishment of milk processing units (3)
- **Activity 1.2.5.** Establishment of compost pits for the management and recovery of waste and sale of organic fertilizer

Table 1: List of equipment by activity

Activity 1.1.2 Create low-carbon and climate-resilient family farms	Cutting and bagging machines
Well maximum depth 50m	Tricycles for transport 200CC engine, new load capacity 1500 KG, 2m body length with carboddy and studded tires
Securing wire mesh fence and entrance wall on a 1ha perimeter	
Solar panels and equipment	Activity 1.2.4 Establishment of milk processing units (3)
12m2 chicken coops	6-Panels 320wc, Support Galva 4-Battery 200Ah 12v with rack 1-Ondul 3kva 48v with integrated 60A regulator Connection accessories)
Drip system on 0.25ha	Plate pasteurizer, electrically heated (4-80-4°C), capacity 500 liters/h.
Small equipment	Elbag 600 bags/h automatic filling machine
5000-litre tank	Galvanized milk can, 20-liter capacity
Drinker, feeder, lighting, etc.	
Fishpond	milking pots Length 58 cm, Material aluminium, Height 104 cm Voltage 220 V, 30 l, 50 Kg
Activity 1.2.1. Acquisition and installation of solar equipment	Lactodensimeter, Measuring range: 1.020-1.035 g/ml, Division: 0.0005 g/ml, Length: 210 mm, Temperature calibration: 20°C Small laboratory equipment: milk filter thermometer, measuring cylinder
Photovoltaic fields (260w panels)	
Hybrid controllers (input AC.DC, output AC) and safety accessories	Cold storage room (cooling tank) and ice accumulator (3 farms) Storage tank (500litres (collection))
Village farm fencing (10ha)	Activity 1.2.5. Establishment of compost pits for the management and recovery of waste and sale of organic fertilizer
Drip irrigation network (boom holder, valve, meter, drip)	Pit with 3 compartments closed on three sides for a capacity of 9m3 : (S = 3m2 ; P = 1.5m)
Activity 1.2.2 Establishment and integration of poultry farming	Activity 1.3.1. Introduction of resilient climate-smart crop-livestock agroforestry practices technologies.
200m2 poultry houses	GGC 2047 18 m3 fixed-dome bio-digester
Feeder, trough, etc.	
Upright freezer 340 L high. 1850mm cold negative static -18°C / -22°C - 7450.0570 Combisteel	3 in 1 soil test kit NPK soil fertility nutrient tester; Type = portable; Measuring range = 0-1999mg/kg (mg/l); Accuracy =2%.
Activity 1.2.3 Establishing of chicken processing units	
6-Panels 320wc, Support Galva 4-Battery 200Ah 12v with rack 1-Ondul 3kva 48v with integrated 60A regulator Connection accessories)	
Freezer 340 litres	
Pluck machines	

2 Management system for undertaking O&M activities

The O&M plan will ensure that the equipment is being properly operated and maintained. Early detection of problems may decrease repair and replacement costs, prevent malfunctions and minimize downtime. With proper performance and documentation, an O&M Plan may also be used as an affirmative defense in the case of a malfunction.

2.1 Roles and responsibilities of the stakeholders and responsible parties

1. **Farming cooperatives:** Once the farming cooperatives are established, they will be responsible for carrying out regular O&M activities including annual planning and fundraising meetings, which will be facilitated by the project through training and mentoring activities undertaken during the project period. They will be in-charge of daily monitoring of the infrastructures and equipments, at the family and/or village level. They will need to be responsible for regular weekly monitoring of the drip irrigation systems, the hybrid controllers for the solar system including and overall monitoring of the infrastructures. The Cooperatives responsibility includes minor maintenance tasks such as checking the fences, cleaning the poultry houses and milk processing units. The project will initiate and facilitate, through capacity building and peer-to-peer learning activities (component 3), continued monitoring of the availability and quality of the systems, simple O&M needs. The O&M fees will be covered partly by ANIDA as a co-financing (put the experts here) and partly by the community saving funds. The farming cooperatives will be in charge of annual O&M planning, financial management of saving funds, etc.
2. **Agricultural advisors:** They will be in charge of providing support to the farming cooperatives by giving necessary trainings to make sure this process is carried out in an inclusive and participatory manner.
3. **Technical Team (TT):** It consists of an electromechanical engineer, an electromechanical technician in each coordination and a pump operator in charge of the pumping station (generator and solar panels). The TTs at different levels play the role of technical support in case of technical failure that minor maintenance won't be able to fix.

4. Maintenance of Key Activities

• Activity 1.1.2. Create low-carbon and climate-resilient family farms

Maintenance tasks

Key tasks for are likely to include:

- monitoring of the infrastructures and equipment
- monitoring of the drip irrigation systems
- monitoring of the hybrid controllers for the solar system including and overall monitoring of the infrastructures
- minor maintenance tasks such as checking the fences, cleaning the poultry houses and milk processing units

O&M Schedule

Table 1: O&M schedule detailing tasks and frequency for activities to be undertaken

Task	Description/Details	Frequency
Overall monitoring of the infrastructures and equipment	Checking for integrity Checking the fences, Cleaning the poultry houses and milk processing units	Daily
monitoring of the drip irrigation	Flushing the system Cleaning the system (disinfestation) Monitoring system performance	weekly

Funding of O&M activities

A total of USD 38,325 is expected to be incurred for O&M to maintain and operate equipments in the family farms. During the procurement process for the equipments, options for extended warranty and service agreements will be explored with the suppliers to finance O&M and replacement part costs during the project period.

- **Activity 1.2.1. Acquisition and installation of solar equipment**

Maintenance tasks

Key tasks for this activity include:

- Monitoring and maintenance of solar panels and control devices
- Functionality verification and oil change for certain parts of the PV system

O&M Schedule

Table 1: O&M schedule detailing tasks and frequency for activities to be undertaken

Task	Description/Details	Frequency
Solar panels	Panels cleaning	Every week
Panel support	Verification : <i>check if it's well fixated</i>	Every two weeks
Anti-theft device	Verification : <i>check if it's functional</i>	Every two weeks
Grounding the panels	Verification : <i>check if it's well installed</i>	Every two weeks
DC Box	Functional check: <i>(lightning protection, fuses, fuse holders, 2-pole DC modular and DC solar cables 1x16mm)</i>	Every two weeks
Technical room and solar panels	Check the cables connecting the technical room to the solar panels: <i>(check that the AC/DC variation is in phase, that the parameters are not out of phase, and the status of the solar fan).</i>	Every two weeks
AC Box	Verification: <i>(operating condition of probes, continuity of modules if AC/DC in phase, condition of cables, but also whether inverter screws are tight and assess cable heat).</i>	Every two weeks
Power generator	Oil change:	Every 250 hours

Funding of O&M activities

A total of USD 41,875 is expected to be incurred for O&M to maintain and operate solar Panels. During the procurement process for the solar equipment, options for extended warranty and service agreements will be explored with the suppliers to finance O&M and replacement part costs during the project period

- **Activity 1.2.2. Establishment and integration of poultry farming**

Maintenance tasks

Key tasks for this activity include:

- Overall maintenance of the poultry houses (cleaning etc..)
- Maintenance of the freezer

O&M Schedule

Table 1: O&M schedule detailing tasks and frequency for activities to be undertaken

Task	Description/Details	Frequency
Maintenance of Poultry houses	Downtime between flocks Pre-placement preparation Environmental monitoring Mortality checks Flock health management	Daily
Freezer maintenance	Regular Cleaning and Inspection Optimal Temperature Control Efficient Airflow Management	Daily

Funding of O&M activities

A total of USD 15,000 is expected to be incurred for O&M to maintain and operate poultry farms. During the procurement process for the equipment, options for extended warranty and service agreements will be explored with the suppliers to finance O&M and replacement part costs during the project period.

• Activity 1.2.3. Establishing of chicken processing units Maintenance tasks

Key tasks for this activity include:

- Overall maintenance of chicken processing units
- Freezer maintenance

O&M Schedule

Table 1: O&M schedule detailing tasks and frequency for activities to be undertaken

Task	Description/Details	Frequency
Maintenance of chicken processing units	Maintenance of plucking machines Maintenance of cutting and bagging machine	Daily
Freezer maintenance	Regular Cleaning and Inspection Optimal Temperature Control Efficient Airflow Management	Daily

Funding of O&M activities

A total of USD 15,000 is expected to be incurred for O&M to maintain and operate chicken processing units. During the procurement process for the equipments, options for extended warranty and service agreements will be explored with the suppliers to finance O&M and replacement part costs during the project period.

• Activity 1.2.4. Establishment of milk processing units

Key tasks for this activity include:

- Maintenance of milk processing units
- Freezer maintenance

O&M Schedule

Table 1: O&M schedule detailing tasks and frequency for activities to be undertaken

Task	Description/Details	Frequency
Maintenance of milk processing unit	Keeping milking area and equipment clean Monitor all rubber component for holes in air tube Maintenance of Milk Pouch Filling Machine	weekly
Freezer maintenance	Regular Cleaning and Inspection Optimal Temperature Control Efficient Airflow Management	Daily

Funding of O&M activities

A total of USD 15,000 is expected to be incurred for O&M to maintain and operate milk processing units. During the procurement process for the equipment, options for extended warranty and service agreements will be explored with the suppliers to finance O&M and replacement part costs during the project period

Activity 1.2.5. Establishment of compost pits for the management and recovery of waste and sale of organic fertilizer

Maintenance tasks

Key tasks for this activity are likely to include:

- Overall maintenance of compost pits

O&M Schedule

Table 1: O&M schedule detailing tasks and frequency for activities to be undertaken

Task	Description/Details	Frequency
Maintenance of compost pits	Temperature control	Daily

Funding of O&M activities

A total of USD 7,600 is expected to be incurred for O&M to maintain compost pits. During the procurement process for the equipment, options for extended warranty and service agreements will be explored with the suppliers to finance O&M and replacement part costs during the project period.

5. Design Lifespan and replacement assumptions for equipment

The following tables provide details on expected lifespan of equipment for the project and estimated major replacements expenses that are expected to be incurred post project implementation up to the year 2049.

Table 5: Assumption for the replacement frequency of equipment

Equipment type	Expected useful life
Solar panels	25 years
drip irrigation network	15 years
Freezers	16 years
Compost pits	10 years
Pluck machines	15 years
Fix dome biodigester	>20 years



Annex 2 c – Operations & Maintenance (O&M) Plan

GREEN CLIMATE FUND FUNDING PROPOSAL