



A HANDBOOK FOR RESTORING DEFUNCT BIOMASS GASIFIER PLANTS

**Village Electrification through Sustainable use of
Renewable Energy (VE-SuRE)**



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Embassy of Switzerland in India



TARA

Contributor(s)

Vineet Singh, Manoj Mahata, TARA

Reviewers

Tejinder Bhogal, Innobridge Consulting Pvt. Ltd.

Acknowledgment

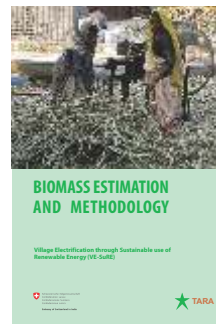
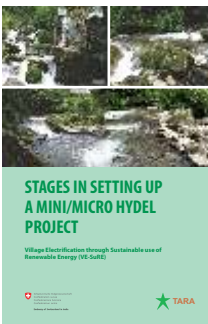
We place on record our gratitude to the Swiss Agency for Development and Cooperation for providing the financial and institutional support, National Thermal Power Corporation (NTPC) and TARA field team for providing field support, local communities of the project villages, local NGOs for their untiring work and enabling us to broaden our understanding of field realities.

Branding and Designing Guidance

Ranjeeta Ghosh, Jay Vikash, Development Alternatives Group

Disclaimer

The views, analysis, interpretations and conclusions expressed herein are those of the contributors and do not necessarily reflect the view of the Swiss Agency for Development and Cooperation (SDC) or NTPC. The information contained herein has been obtained from sources and consultations, which the Contributors believe to be reliable and accurate. The Contributors, editor and the supporting agency associated with the policy brief are not liable for any unintended errors or omissions, opinions expressed herein. The contents of this report may be used by anyone providing proper acknowledgement.



A HANDBOOK FOR RESTORING DEFUNCT BIOMASS GASIFIER PLANTS

**Village Electrification through Sustainable use of
Renewable Energy (VE-SuRE)**



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Embassy of Switzerland in India



TARA

Table of Contents

| | |
|--|----|
| Section A | 1 |
| Introduction | |
| Section B | 3 |
| Critical information required for Gasifier restoration and operation | |
| Section C | 5 |
| Stages of restoration | |
| 1. Technology assessment | |
| 2. Identification and procurement of equipment | |
| 3. Re-commissioning of plant | |
| 4. Testing of Gasifier plant | |
| Section D | 14 |
| Key factors affecting operations | |
| - Biomass supply and quality | |
| - Training of personnel | |
| - Accessing and planning load distribution and management | |
| - Maintenance schedule | |
| Section E | 17 |
| An example of technology assessment | |



Section - A

Introduction

Biomass has always been an important energy source for the country. It is renewable, widely available, carbon-neutral and has the potential to provide significant energy and employment in the rural areas. Realizing this potential, the Ministry of New and Renewable Energy initiated a number of programmes for promoting the use of biomass in the various sectors of the economy. Under these programs, a number of Biomass Gasifier Power Plants were commissioned in rural areas.

Unfortunately, most of these plants are lying defunct. This situation has come about because most operators and plant managers do not know enough about Biomass Gasifier Technology. This handbook tries to remedy this situation: the use of this handbook should help in the restoration of such defunct Biomass Gasifier Plants.

The handbook has been designed to help in the restoration of defunct decentralized Biomass Gasifier Plants of capacity upto 100 kW. The handbook should provide support to Operators, plant managers and other technical persons who want to operationalize a defunct Biomass Gasifier plant.

In order to ensure the sustainable operation of a plant, both technology and management need to be combined effectively. Given this need, this

handbook presents a “techno – managerial approach” required for re-commissioning of defunct Biomass Gasifier Plants. The hand book gives all information about recommissioning, troubleshooting in operation and management of resources that

RESTORATION OF DEFUNCT BIOMASS GASIFIER PLANT

Step-I

Technology Assessment

- Technical Specification of equipment
- Process description through plant layout
- Availability of parts & equipment
- Status of available parts/ equipment /tools (Mechanical & Electrical)

Step-II

Identification and procurement of Equipment

- Make a list of mechanical parts/electrical equipment/tools as per their requirement
 - Procurement
 - Repair
 - Cleaning
- Market survey
- Decision making process

Step-III

Re-commissioning of Gasifier plant

- Re-commissioning & Maintenance of Gasifier plant
- Maintenance of all electrical equipment and wiring (Plant internal wiring, Transmission and distribution line, household and enterprise connections)
- Adherence to safety rules/measures

Step-IV

Testing of Gasifier plant

- Follow Gasifier operation process from Gasifier start-up to shut down
- Check operation performance of Gasifier plant
- Follow Gasifier operation trouble shooting

Step-V

Key Factors affecting Operations

- Biomass
- Training of personnel
- Accessing & planning load distribution
- Maintenance schedule

Source of Information

- Site visit & resource survey
- Purchase order
- Plant layout & equipment list
- Manual of technology
- Discussion with operator/owner / technology supplier/ operation management team
- Past operation and maintenance data
- Market survey



Section - B

Critical Information required for Gasifier restoration and operation

In order to restore a Gasifier plant, it is important to obtain answers to two sets of questions. The first set is to do with the past experiences of running the plant and the second with the present status of the plant. Thus, the first set of questions includes: how did the plant operate in the past? What was the experience of running the Gasifier? Was the system reliable etc. Similarly, the second set includes: is the layout appropriate? Are all the parts available? Who is the operator and is the operator fully equipped to run the plant?

Questions such as the above are best answered through a site visit, and by talking with the owner, the operator, the members of the community and the service provider. The following table describes the information required, the reasons why this information is required, and the best source of obtaining that information:

| Information needed | What is the information required for | Sources of Information |
|--|---|--|
| Plant layout and equipment list | To understand how to position the equipment | Purchase order and manual of technology from Technology supplier |
| Operation manual | To understand the operation and maintenance process | Technology supplier |
| Status of technology | To understand parts availability, the physical status and operational conditions of parts | Inspection of technology through site visit |
| Past operation and maintenance data | To understand the operational performance | Plant operation management team |
| Operator's skill | To know the capacity of operator | Communication with operator |
| Management process/system of the plant operation | To know the reliability and sustain ability of the system | Communication with management team and beneficiaries, market research for equipment availability |



Section - C

Stages of restoration

There are four stages of restoring a plant—Technology Assessment, Gap Identification and Procurement of equipment, Decommissioning of the Plant, and the Testing of the plant. Each of these stages is explained here in a separate sub-section.

1. Technology Assessment

In this step, the technology used in the defunct Biomass Gasifier Plant is assessed. An effort is made to understand the way the biomass plant was expected to be operated, maintained and managed. In the long run, having a thorough knowledge of this technology helps the operator in many ways: -

- It dramatically reduces costs
- It provides potential to expand and grow
- It increases profitability
- It improves products and services
- It helps the operator to respond faster to changing conditions

In the short run, it is critical that the operator should fully understand the technology of a Biomass Gasifier Plant that has been lying defunct for a long time. This is because restarting such a plant is risky: it can be hazardous to health, and cause other damage.

A technology is a combination of various parts/machines. Operation failure can come about irrespective of whether the problem has been caused by a small component or a large one. Consequently, the operator needs to understand the technology comprehensively.

The steps of assessing the technology are as follows:

- 1.1** Understand the kind of technology being used. This can be done by studying the plant layout, the Purchase order, the operation instructions and the technology manuals. These documents will provide the following information:
 - a. Technical Specification along with process description of the main plant sections (including the process flow diagram)
 - b. Contact details of manufacturer
 - c. Procedures for operation and maintenance
 - List of spares and stock information
 - Start-up and shut down procedure
 - Emergency procedures
 - Maintenance schedule
 - Troubleshooting
- 1.2** Check availability of all equipment/parts such as water pump, vibrator motor, battery, inverter, tools etc. The list of equipment required can be taken from the purchase order and manuals



provided by the technology supplier. If some equipment is missing then arrange to buy a replacement.

- 1.3 Check physical status of all equipment (mechanical and electrical). Check whether all parts are ok or whether any part has been damaged. Check presence of dust, rust/slag/tar on the equipment. Clean or repair/replace equipment as per requirement.
- 1.4 As the building is also an important part of the system it too needs to be checked. In case of cracks or other damage, repairing should be done. If a building cannot be repaired, give up the task of restoring the plant placed within it.
- 1.5 Transmission and distribution lines and connections to load (household, enterprise connections) need to be checked and verified.

An example of technology assessment is given in Section E.

2. Identification and procurement of equipment

The preliminary assessment of technology helps us to prepare a list of items that need to be cleaned and repaired, and those that need to be purchased. Decisions about which items need to be repaired and cleaned, and which purchased are based on two factors: cost and quality.

A market survey done with respect to the listed items indicates the availability of these items in different markets (local or otherwise), and also indicates whether these are available at reasonable prices. During procurement, care should be taken not to compromise with the quality, as quality affects the plant performance.

The following are some ways by which the cost incurred and time spent in restoring a Gasifier plant can be reduced:

- Before repairing a defective component, check cost and availability of replacing with a new one. If purchasing a component turns out to be the cheaper option, go for it. (The term used for this step is: Cost benefit analysis!) Procure all the components at one go.
- Identify all mechanical and electrical maintenance requirements at the same time

3. Re-commissioning of plant

After procurement and repairing of parts, re-commissioning can commence. The re-commissioning work requires excellent technical skill

of the technician and it is very important that each of the equipment is correctly fitted at its original place to avoid any problems/hazards. The following needs to be done at this point:

- *Installation and maintenance of Gasifier plant:*

Maintenance is a critical task and needs to be done either directly by a highly skilled person or under the guidance of such a person. All parts should be commissioned as per plant layout and this work should be done very carefully, because a little mistake can result in a big problem.

- *Repair and maintenance of all electrical equipment and wiring:*

Hire a competent electrician for electrical maintenance. The electrician needs to complete all repairing and maintenance of plant wiring, transmission and distribution line and Household wiring. During electrical maintenance precaution needs to be taken with respect to naked wires. Alternatively, at the time of maintenance, the electric power needs to be shut down.

During installation and maintenance of the Gasifier plant care should be taken with respect to the following to avoid accidents:

a) Gas leakage

- The use of welded connections is preferred above flanges, in particular for hot pipes. In all cases, proper flange sealing needs to be done with chemical and thermal resistant material.
- All pipes, aggregates and measurement devices have to be of proper quality.



- Proper material should be used with regard to chemical resistance, temperature and pressures, corrosion, particle size.

b) Electrical devices

- All gas conducting parts need to be electrically grounded.
- Gas/air inlet into engines should be grounded, and shielded cables should be used to avoid electrical breakdowns. Such breakdowns are problematic as these could, in turn, cause backfiring in the inlet system.
- There should be safety switches and local circuit breakers on rotating parts.
- There should be switches, access panels, critical valves with access to gas containing equipment such as feeders, and ash outlet.

c) The movable or rotating parts

- The plant's movable parts, such as conveyor belts, motors, engines etc., could generate a risk of gas explosions. These should be shielded and equipped with 'visible' signs and emergency stop mechanisms.
- When the Gasifier is working, the tar coming out from the wood does not condense. But the moment the Gasifier stops working, the tar starts to condense. If the tar is not removed when the Gasifier is in the standby mode, the Gasifier will have trouble re-starting. Consequently, cleaning off the tar during shut down or standby period is critical for the running of the plant.

d) Safety precaution and Safety equipment

The following safety equipment should be present at plant:

- CO detection system;
- Fire fighting equipment;
- Personal protective equipment: ear protectors, eye glasses, gloves, respiratory equipment, helmet etc.
- Emergency equipment: shower, first aid kit.
- Insulator covering all the hot surfaces.

In addition, care needs to be taken that no inflammable material should be brought into the plant area.

4. Testing of Gasifier plant

Now the plant is ready to run. All safety measures should be followed before and during the operation of the plant. The following procedure should be followed for operating the plant:

A. Gasifier start-up procedure

1. Feed the Gasifier and close the feed door tightly.
2. Check water level in water tank and open all the nozzles.
3. Start water pump.
4. Ignite the fuel in the Gasifier.
5. After the ignition wait for proper gas to come out for about 5 minutes.
6. Check the quality of gas at burner by flaring the gas. The gas should burn with a colourless/blue flame and do so continuously (i.e., without spluttering.)
7. Close flare valve approximately by 50%.
8. Turn on the ignition switch on the engine starter and start the engine opening the gas valve slowly till the engine fires. Do not crank the engine for a long time as it can lead to damaging the ignition coil or starter.
9. Leave ignition switch "ON" and close the flare valve completely. The engine will immediately pick-up speed. Now open the gas valve fully. The engine is now in running mode.
10. Switch on the vibrator motor and comb rotor.
11. Keep feeding wood into the hopper at a regular interval of 1hr or as per the Gasifier designer manual.

B. Gasifier Shut down procedures

1. Cut-off the load from the system.
2. Close the vibrator motor and comb rotor.
3. Open flare valve and close the gas control valve at engine
4. As soon as the engine stops, quickly close the Gasifier nozzles.
5. Switch off the water pump.
6. Disconnect the battery connections.

C. Performance testing of Gasifier

After starting the Gasifier, the performance of the Gasifier needs to be checked. The following Indicators need to be checked for performance(also indicated are the means of checking for performance):

- Gas generation time from hopper: It generally takes 10-15 minutes to generate gas from the hopper
- Quality of gas: The quality of gas is checked by burning it and observing the color of the flame. The color of the flame should be blue. In addition, there should not be any gaps in the flame: it should come out continuously. The gas must have energy content more than 4 MJ/Nm³. The heat (energy) content in gas can be measured by Calorimeter.
- Water discharge rate from pump: The rate of water discharge should match the specifications that are written on the body; as well as what has been written in the purchase order or operation manual.
- Gas flow after filter: There should not be any interruption in the flow of gas. This is checked with the help of a gas flow analyzer.
- Operation performance at various load conditions (Voltage, Current and frequency variation): Gas engine should run without any problem at 80% load of it's rated capacity and frequency of generated electricity should be maintained at about 50 Hz. Gas engine should also be able to perform within the stipulated range both on continuous load as well as on jerk load.
- Biomass consumption: Biomass consumption should be between 1 to 1.5 Kg/kwh.



If the above tests are positive the Gasifier is deemed to be OK. But if test results are negative, then they indicate some or all of the following problems:

- System is taking too much time to generate the gas.
- Gas is not burning properly at burner.
- Gas is not flowing/passing through filters or the flow of gas after the filter is very low
- Engine is not taking load.
- Biomass consumption is high.

D. Troubleshooting guide for Gasifier

The chart given below provides guidance to troubleshoot the various problems which may occur during start up-



Troubleshooting for Biomass Gasifier

| Problem | Possible Cause | Solution |
|--|---|---|
| Water Pump does not start | Battery Discharge | Recharge battery |
| | Fuse blown in engine starter panel | Replace fuse |
| Hopper does not suck air through air nozzle | Water pump not working | Check water pump |
| | Carbon particles deposit on nozzle and venturi throat | Regularly clean the water nozzle and venturi throat (do so twice a week) |
| Fuel is burning but there is no gas formation in hopper. Or, Gas flame is improper and discontinuous | Moisture in fuel | Use dry biomass |
| | Comb rotor not working | Check motor and start it |
| | Burning is not proper | <ul style="list-style-type: none"> Check water discharge rate of pump, if required do maintenance or replace the motor Check for Moisture presence in wood and dry it |
| | Low density of biomass | Stir wood in hopper with help of a rod so that biomass can be filled tightly in hopper |
| Gas is not reaching to engine | Gas pipe or filter is choked | <ul style="list-style-type: none"> Clean gas pipe Clean/change filters |
| Backfire from Gasifier | Wood/biomass level is less than half in hopper | Fill full hopper with biomass |
| | Air leakage | Check Air leakages, tighten nut and packing |
| | Choked charcoal bed or excessive air entering in to the Gasifier other than through Air Nozzles | Check for ingress of air into the Gasifier other than Air Nozzles. Check rubber sealing cord of the feed door, Hopper-Reactor flange bolts and Air Nozzle flange bolts. |
| Gasifier hot at bottom (Ash Cone) | Comb rotor shaft seal or ash door is leaky | <ul style="list-style-type: none"> Tighten the nuts, Faulty rubber, change it |
| Gas temperature is high after water scrubber | Scrubber Pump faulty or choked Spray Nozzle | Check Scrubber Pump and clean the Spray Nozzle |
| Manometer ¹ indicates very high pressure difference in hopper | Choked charcoal bed | Operate comb rotor in manual mode continuously for 5-10 minutes. If no improvement, stop the Gasifier, allow it to cool and check for excessive ash or clinker accumulation in the bed |
| Manometer indicates very low pressure difference in hopper | Charcoal bed depleted | Stop the comb rotor for 5-10 minutes and observe increase in pressure. If it increases, allow it to reach to recommend value and change the rotor back to auto mode |
| Manometer indicates very High pressure difference in gas filter | Filter choked | Clean the filter |
| Manometer indicates very low pressure difference in gas filter | Filter media is less than the specified level | Fill up the filter media at specified level |

1. Manometer is an U –tube pressure meter filled with coloured water



Section - D

Key Factors affecting Operation

Five key factors affect the working or operation of the Biomass Gasifier Plant: Biomass type and quality; Biomass security; training of personnel; accessing and planning load distribution and Maintenance Schedule.

1. Biomass type and quality

A wide range of biomass fuels are used for biomass gasification. These include wood, charcoal, wood waste (branches, roots, bark, saw dust) as well agricultural residues- maize cobs, coconut shells, cereal straws and rice husks.

Many Gasifier manufacturers claim that any kind of biomass/fuel can be used in a Gasifier. This is not true as there is no universal Gasifier that is suitable for every type of fuel. A Gasifier is very fuel specific.

The quality of biomass fuel depends upon its calorific value, density, ash content, moisture content and dust content.

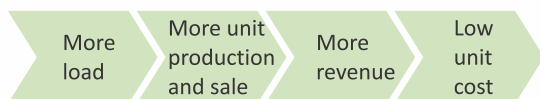
2. Biomass security

That is, the continuous supply of bio-mass to ensure un-interrupted operations - is key to operating the Biomass Gasifier plant in a sustainable manner. One way of ensuring biomass security is to have one's own plantation. Having one's own plantation has the additional benefit of ending dependency upon others for biomass and ensuring its availability at low cost.

3. Identification and training of personnel

The Gasifier cannot be operated effectively without a skilled operator. A skilled operator is one who runs the plant effectively, as well as records all the operation and maintenance data carefully. (Recording of data helps to improve the future performance of the plant).

If a skilled operator is not available at the site, select someone who at least has a good knowledge about the working of engines and of electrical items. Such a person can then be trained to develop skills appropriate for running a Gasifier.

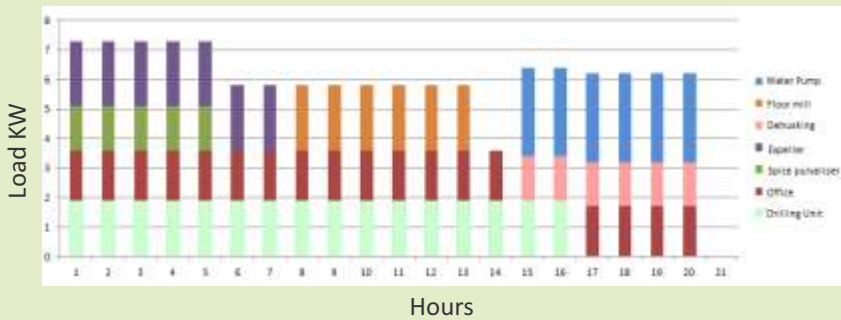


4. Accessing and planning load distribution

A plant runs in a sustainable manner if it uses its maximum capacity. A higher load factor not only leads to increasing the plant's output, it also leads to lowering the per unit (kWh) generation cost of the plant. Care, however, needs to be taken if the load is greater than the given plant capacity. In this case, the plant operation needs to be managed through load distribution management. An example would make that clear.

Example: Suppose we have a load of 14.09 kW against a plant capacity of 7.5 kW. In other words, the total demand is more than capacity of the plant. In this case the way to manage the load is to arrange to meet the load of different consumers (such as chilling plant, spice pulverizer etc.) in a way that the total load does not go beyond 7.5 kW at any time of the day. A possible way of dividing the load across different consumers is given in the graph below the load sheet.

| Nature of Load | Motor Capacity | | Load | Avg. running hours |
|------------------|----------------|----|-------|--------------------|
| Chilling Plant | 2.5 | HP | 1.87 | 8 |
| Spice Pulveriser | 2 | HP | 1.49 | 2.5 |
| Expeller | 3 | HP | 2.24 | 3.5 |
| De-Husking | 2 | HP | 1.49 | 3 |
| Flour Mill | 3 | HP | 2.24 | 3 |
| 2 Pumps | 4 | HP | 2.98 | 3 |
| Office Load | | | | |
| 3 Fans | 240 | W | 0.24 | 8 |
| 3 Exhaust Fans | 1500 | W | 1.50 | 8 |
| 3 CFLs | 15 | W | 0.05 | 8 |
| Total Load | | | 14.09 | |



5. Maintenance schedule

A proper plant maintenance program is required to ensure all of the following: the consistent production of quality electricity, cost control, an assurance to the customer that their electricity will arrive on time, and finally, an increase in the plant life. Though Mechanical or electrical failures may occur from time to time in a system, proper attention to preventive maintenance will minimize the down time.



Section - E

An Example of Technology Assessment

Introduction:

The chapter provides an example of how a technology and infrastructure assessment is done in practice. The example given is that of the Bahratola Biomass Gasifier Plant in Vindhyachal, the recommissioning of which was done in 2010.

TARA surveyed the sites and resolved technical problems in the plant. It was observed that there were certain technical shortcomings in the plants that were impeding proper operations and power production. Similarly, there was some unfinished work with respect to the Transmission and Distribution Infrastructure in the villages. As a result of this intervention, TARA succeeded in starting operations in three of the plants.

The Assessment

The assessment looked at five aspects of the Gasifier: the Technology specification, the equipment availability and the physical and working status; the plant building and the internal wiring arrangements therein; the status of Transmission and Distribution line; and the status of electrical wiring at the load site.

A. Technology Specification

- 2 x 20kW Biomass Gasifier
- Diesel Generator as a backup
- Battery bank as energy storage

B. Equipment availability, physical and working status

C. Plant building ,internal arrangement and wiring condition

1. Technology rearrangement/repositioning is needed (See picture-1)
2. Wiring connected to all electrical equipment (Water Pump, Vibrator motor, Rotor motor and panel) has been stolen (see pictures- 2,3,4).
3. Building status: there was no crack in building and proper ventilation was provided. The doors and windows were intact and opening and shutting properly

| Equipment as per Original purchase list | Qty# | Availability of equipment at plant ## | Remark on working condition of equipment |
|---|------|---------------------------------------|--|
| 1. Gasifier System | | | |
| Reactor (Gasifier) | 2 | Yes | Slow gas generation, need to be checked |
| Hopper | 2 | Yes | No action required |
| Coarse Filter | 2 | Yes | Need to check whether filter is getting choked |
| Fine Filter Passive Part | 2 | Yes | Need to check whether filter is getting choked |
| Fine Filter Active Part | 2 | Yes | Need to check whether filter is getting choked |
| Bag Filter | 2 | Yes | No action required |
| Saw Dust | 2 | Yes | Need to make available at site for the ease of maintenance (if required) |
| 3" PVC Duct Pipe | | Yes | No action required |
| Water pump | 2 | Not available-theft | Need to buy |
| Rotor motor | 2 | Yes | No action required |
| Filter motor | 2 | Yes | Need to clean the tank |
| Ladder for system | 2 | Yes | No action required |
| Gasifier control panel | 2 | Yes | Need to check during dry run. Position and wiring is yet to be finalized |

| | | | |
|---|-------|-----------------------|---|
| 2. Engine | | | |
| Greaves make Gas Engine (25 KVA) | 2 | Not working | Need to check and fine tune at different load conditions |
| Self system | 2 | Yes | No action required |
| Alternator | 2 | Yes | Need to test in various load conditions |
| Radiator | 2 | Yes | No action required |
| Silencer | 2 | Not available at site | Need to install silencer to reduce noise level at plant |
| Engine Control Panel Greaves | 2 | Yes | Need to test in various load conditions |
| 5 KVA Prakash make diesel engine | 2 | Yes | Need to test in various load conditions |
| 5 KVA Engine spare corrugated Box (Handle, Air Cleaner, silencer) | 2 | Yes | Stock entry is required |
| Saarthi Make Inverter for 5 KVA Diesel Genset | 2 | Yes | Need to test in various load conditions |
| Engine spare corrugated box | 2 | Yes | Stock entry is required |
| Battery | 2 | Yes | Need to check acid level and functionality |
| Earthing Pipe and Earthing Patti (Iron Strip) | 2 | Yes | Earthing Patti (Iron strip) was not connected to the ground. |
| Wood drier Assembly | 2 | Yes | No action required |
| 3. Battery Back up System | | | |
| Battery Back up | 2 set | Yes | Need to test in various load conditions to check functionality |
| Battery Charger | 2 set | Yes | Need to test in various charging conditions to check use potential |
| 4. Other equipment | | | |
| Battery | 2 | Yes | Need to test in various charge conditions to check functionality |
| AVI Inverter | 2 | Yes | Need to repair & test in various charge conditions to check functionality (One inverter is not working) |
| Wood Cutter | 2 | 1 supplied | Need to discuss shortfall in supply with the Managers (NTPC) and suppliers (Ankur) |
| Wood Cutter motor | 2 | 1 supplied | Need to discuss shortfall in supply with the Managers (NTPC) and suppliers (Ankur) |
| Motor starter | 2 | 1 supplied | Need to discuss shortfall in supply with the Managers (NTPC) and suppliers (Ankur) |
| Wood Cutter sitting table | 2 | Yes | No action required |
| Store hardware box wooden box | 2 | Yes | No action required |
| Chain pulley block | 2 | Yes | No action required |

Quantity is taken from the Purchase Order.

The present status of different components is written as per observation or have been experienced during dry run.

D. Transmission and Distribution line status:

Length of T&D Line (Planned): 7.9 Km

Length of T&D Line (Completed as per record): 7.9 Km

Length of T&D Line (Existing as per measurement): 7.9 Km

Total No. of Poles: 176

Poles completed: 176

No. of Poles having T&D wire at present: 176

E. Status of connections (electrical wiring) to load (household, enterprise)

Total number of household(requested connections): 114

Number of household having internal wiring (as per survey): 114

Number of household connected with main T&D line (as per survey): 110

Total number of streetlight (planned): 25

Total number of streetlight (completed): No progress (0%)



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Embassy of Switzerland in India

Climate Change and Development
Chandragupta Marg, Chankayapuri
New Delhi - 110021
Phone: +91 11 4995 9570
Email: delhi@sd.c.net
Website: www.swiss-cooperation.admin.ch/india



TARA

B-32, Tara Crescent
Qutub Institutional Area
New Delhi - 110016 (India)
Tel.: +91-11-26544100
E-mail: tara@devalt.org
Website: www.devalt.org