

STAR-CENTRE

# User Manual



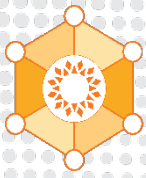
[A user manual for operation and maintenance (O&M) of an off-grid solar project provides information on how to operate, maintain and troubleshoot.]

<b>A. Introduction</b>
<ul style="list-style-type: none"><li>- Project overview including goals, technology used and expected benefits</li><li>- Scope of the manual</li></ul>
<b>B. System Description</b>
<ul style="list-style-type: none"><li>- Types, specification and layouts of system components</li><li>- Schematic drawings showing physical layout and electrical connections</li><li>- Technical data sheet for each component</li></ul>
<b>C. Operations</b>
<ul style="list-style-type: none"><li>- Startup procedures</li><li>- Shutdown procedures</li><li>- Daily operations including monitoring of system performance, record of daily energy production and consumption</li></ul>
<b>D. Maintenance</b>
<ul style="list-style-type: none"><li>- Routine maintenance including cleaning of solar panels, checking electrical connections for wear or corrosion, etc.</li><li>- Preventive maintenance including batteries conditions, inverter and charge controller tests for proper operations</li><li>- Corrective maintenance including diagnose and repair any faults in the system</li></ul>
<b>E. Safety Procedures</b>
<ul style="list-style-type: none"><li>- Safety guidelines including PPEs, lockout/tagout procedures</li><li>- Emergency procedures</li><li>- Emergency procedures including use of fire extinguisher, fault management, etc.</li></ul>
<b>F. Troubleshooting</b>
<ul style="list-style-type: none"><li>- Step by step instructions for diagnosing and fixing issues</li><li>- Flowcharts to guide through the troubleshooting process</li></ul>
<b>G. Record Keeping</b>
<ul style="list-style-type: none"><li>- Keeping maintenance log</li><li>- System performance log</li><li>- Maintenance of incident reports</li></ul>

**Note:** The content in the document is intended to only provide guidance to prepare the report

## **H. Appendices**

- Manuals from system component manufacturer
- List of contacts for technical support, emergency services and suppliers
- Glossary with definitions of technical terms



# Maintenance Log Template



[A solar project maintenance log is a document used to record maintenance activities for a solar project. It serves as a tool to track all maintenance work performed, ensuring the project remains in good working condition.]

A. General Information			
<ul style="list-style-type: none"><li>- Project name</li><li>- Location of the project</li><li>- Inspection officer's name and contact details</li><li>- Weather conditions</li><li>- Inspection date and time</li></ul>			
B. Inspection and Actions Taken			
Component	Description	Inspection Status	Actions Taken
PV Modules	Dust and debris on module surface		
	Physical damage		
	Loose or disconnected cables		
	Shading obstructions		
	Discoloration, burn marks or rust		
Inverters	Functionality check		
	Ventilation condition		
	Operating temperature		
	Abnormal noise		
	Rusted or damaged structure and enclosure		
Cables	Wear and tear		
	Burn marks or loose connections		
Combiner Boxes	Terminal wear and tear		
	Physical damage		
	Blown fuses		
	Water leaks		
Grounding/Bonding	Condition of grounding cable and bonding connections		
	Continuity of grounding		



Racking System	Corrosion		
	Physical damage		
	Settlement of birds, insects, etc.		
Transformers	Fluid levels		
	Alarms or alerts		
General	Vegetation control		
	Fence or gate security		
<b>C. Additional Observations</b>			
<ul style="list-style-type: none"> <li>- Report of any unusual findings or conditions</li> <li>- Recommendations for future maintenance</li> </ul>			
<b>D. Sign-Off</b>			
<ul style="list-style-type: none"> <li>- Inspector Signature</li> </ul>			



# Troubleshooting Guide



[A Troubleshooting Guide provides a general approach to troubleshooting common issues in off-grid solar systems. While specific solutions may vary depending on the system configuration, these steps can help identify and resolve problems efficiently.]

A. Problem Identification		
Symptom	Potential Cause	Troubleshooting Steps
No Power Output	Faulty solar panels, inverter, charge controller, or battery	<ul style="list-style-type: none"><li>Visually inspect components</li><li>Check for error codes measure voltage and current</li><li>Replace faulty components</li></ul>
Low Power Output	Shaded panels, dirty panels, wiring issues, battery degradation	<ul style="list-style-type: none"><li>Clean panels, reorient panels</li><li>Check wiring</li><li>Replace battery</li></ul>
Erratic Power Output	Loose connections, faulty components, environmental factors	<ul style="list-style-type: none"><li>Tighten connections</li><li>Replace faulty components</li><li>Check for overheating</li></ul>
Frequent System Shutdowns	Low battery voltage, overcharging, overheating, faulty components	<ul style="list-style-type: none"><li>Check battery voltage, adjust charge controller settings</li><li>Improve ventilation, replace faulty components</li></ul>

B. Performance Issues		
Symptom	Potential Cause	Troubleshooting Steps
Inverter Problem	Inverter faults, shutdowns, or error messages	<ul style="list-style-type: none"><li>Reset/restart the inverter</li><li>Repair or replace the inverter</li></ul>
Underperforming System	Shading, dirt, misaligned panels, inverter issues	<ul style="list-style-type: none"><li>Clean panels, reorient panels</li><li>Check inverter settings</li><li>Replace inverter</li></ul>
Rapid Battery Discharge	Excessive load, inefficient charging, battery degradation	<ul style="list-style-type: none"><li>Reduce load, optimize charge controller settings, replace battery</li></ul>
Short Battery Life	Overcharging, deep discharging, high temperatures	<ul style="list-style-type: none"><li>Adjust charge controller settings</li><li>Avoid deep discharges</li><li>Improve ventilation</li></ul>



PID Effect (Potential Induced Degradation)	High voltage differences between your photovoltaic (PV) cells and the ground.	<ul style="list-style-type: none"><li>• Use an insulation resistance tester to check the panel and ground resistance. Low insulation resistance could be a sign of PID.</li><li>• Inspect the grounding of your solar system. Ensure all components are properly grounded to prevent exacerbating PID.</li><li>• Install a PID recovery device, which applies a reverse voltage to the panels during non-operational hours (like at night) to counteract the effects of PID. This can help restore lost performance and improve your solar panel performance optimization.</li></ul>
Hot Spots (Disruptions in a panel's energy production pathways, it becomes overloaded and radiates excessive heat)	Partial shading, accumulation of dust and dirt in panel pathway	<ul style="list-style-type: none"><li>• Choose panels with integrated bypass diodes to help prevent the formation of hot spots in the first place.</li><li>• Adjust your solar panels to get the most sunlight and avoid shadows that can cause overheating.</li><li>• Allow ventilation and circulation within your panels or install power optimizers, as they automatically reduce power generation as needed for stable production levels.</li></ul>

C. Maintenance and Safety		
Symptom	Potential Cause	Troubleshooting Steps
Water Damage	Exposure to rain, leaks	<ul style="list-style-type: none"><li>• Seal connections</li><li>• Repair damaged components, relocate equipment</li></ul>
Fire Hazard	Overheating, faulty wiring, electrical shorts	<ul style="list-style-type: none"><li>• Inspect wiring, check for overheating components</li><li>• Install fire extinguishers</li></ul>
Electrical Shock Hazard	Exposed wires, damaged insulation	<ul style="list-style-type: none"><li>• Repair or replace damaged wiring</li><li>• Use proper safety equipment</li></ul>
Snail Trail (discoloration of solar panels)	Climatic conditions, exposure to moisture	<ul style="list-style-type: none"><li>• Snail trails are irreversible consult a professional solar technician for possible solar replacement</li></ul>





*\*If your solar panels are connected to the grid, solving problems may involve taking a few additional steps. Because you still depend on the grid to some extent, it is important to contact your utility provider first to see if the issue may be on their side, such as power outages.*

*Make sure that the system is appropriately linked to the grid. In case of a grid outage, your solar system could automatically turn off as a safety precaution. You also need to ensure that your net metering system accurately monitors the energy being sent back to the grid. Inaccurate readings may impact billing and performance tracking.*

*You can troubleshoot right away with off-grid solar systems. However, when dealing with grid-tied systems, it is important to proceed with caution and carefully follow specific steps before attempting to troubleshoot any issues.*