Grid-connected solar PV systems

The typical GC system will include:

- PV modules;
- inverter; and
- Auxiliary equipment – including meters, switching equipment and system wiring.

1. PV solar modules

The solar array (a number of solar modules mounted alongside each other) is often thought to be maintenance free. This can be the case in many situations, however, with occasional maintenance and inspection, the performance of all the solar modules in the array can be assured.

The most common maintenance task for solar modules is the cleaning of the glass area of the module to remove excessive dirt.

In most situations cleaning is only necessary during long dry periods when there is no rain to provide natural cleaning. To remove a layer of dust and dirt from the modules, simply wash the panel with water. If the module has thick dirt or grime, which is harder to remove, wash with warm water and a sponge.
Washing the modules is similar to washing glass windows but detergents should not be used.

After the modules have been cleaned, a visual inspection of the modules can be done to check for defects in the modules such as cracks, chips and discolouration. If any obvious defects are found, note their location in the system logbook, so they can be monitored in the future in case further deterioration affects the modules' output. In most cases the module output will not be affected.

When inspecting the solar modules, the condition of the array mounting frame (if used) should also be noted. Items to observe should include the array mounting bolts (eg. bolts rusting) and checks to ensure that the frame and modules are firmly secured.
An example of a PV panel maintenance log sheet is shown on page 3.

WARNING

Typically modules are located on a roof hence there is a risk of falling. When performing maintenance, some form of fall protection equipment (eg. harness or scaffolding), MUST be used.

2. Inverters

These items generally require very little maintenance but when maintenance is being performed on other parts of the system then the following should be undertaken:

- keep the inverter clean and minimise the possibility of dust being blown over the equipment — clean with dry cloth when required;
- ensure the area around the inverter is kept clear to allow good air flow for proper cooling;
- ensure the unit is not "infested" by vermin; and
- check that the inverter is functioning correctly by observing LED indicators, metering and/or other displays on the inverter.

An example of an inverter log sheet is shown on page 4.

3. Auxiliary Equipment

These items generally require very little maintenance but when maintenance is being performed on other parts of the system then the following should be undertaken:

- check that all interconnections and cables / conduits are mechanically secure;
- visual check of all switches and circuit breakers; and
- confirm any meters are operating correctly.

Typically grid-connected PV systems are using "plug" cables between the solar modules in the array and when mounted on the roof these are often hidden behind the solar modules.
Therefore the only cables that can be inspected will be the cables and/or conduits:

- from the array to the inverter and
- the inverter to the switchboard.

An example of an Auxiliary Equipment log sheet is shown on page 4.

4. How do I know my system is working?

With a grid-connected PV system there are no moving parts. During the day, when the sun is shining on the modules, they are quietly producing electricity which is either being consumed in your house or exported to the grid.

Since it's so quiet, how do you know it's working?

It is recommended that as a minimum, your system should include a meter that records either the amount of energy being generated by the modules or the amount being exported to the grid.

If it is only measuring the production then you could record the meter reading in the morning and then again that evening. The difference in the reading will determine the day's production.

If it is only measuring what is being supplied to the grid, and you are consuming all your generated power, then this meter will not move very often. In this case, turn off all appliances in the house and then observe whether that meter is moving.

Some systems will include meters that indicate exactly what is being produced at any time, while other inverters will constantly monitor and record the energy generated. It is important that your system supplier explains to you how to know if your system is working.

Black-out Proof System

Grid connected solar power systems will not deliver power during a black-out, unless the system is provided with a back-up battery bank and appropriate back-up inverter. A black-out proof solar power system will work much like a stand-alone power system during a black-out.

If you have a grid connected system with battery back-up you will also need the instructions for a stand-alone system for the instructions for the other components.

GC maintenance log sheets

Solar array log sheet

Date	Time	Name	Cleaned Modules	Array Structure OK	Array Cabling Mechanical	Array Cabling Electrical	Array Output Voltage	Array Output Current	Weather	Comments

GC maintenance log sheets

Inverter log sheet

Date	Name	Cleaned Inverter	No Insects	Cable Connections OK	Inverter Operating Correctly	Comments

Auxiliary Equipment log sheet

Date	Name	Cable Connections OK	All switches and CBs operating	Cable Connections OK	Meter Operating Correctly	Comments

Glossary

240V: 240 volts AC – a lethal voltage
AC: alternating current
ambient: surrounding
array: a number of PV modules electrically interconnected
balance of system: includes regulators, inverters, cables, control board and protection equipment
auxiliary equipment: components other than the solar array and inverter
circuit breaker: an electrical protection device that automatically switches to off when overloaded
DC: direct current
energy generation devices: PVs, wind turbine, genset or pico-hydro generator
forced ventilated: powered by a fan
fuse: protection device that break the overload by burning a wire inside their casing — must be replaced when operated
GC: (grid connect) connected to the mains power grid
heat-sink: finned steel to help dissipate heat
hot joint: poor electrical contact causing heating
incident: striking
insulated: prevents electrical shorting
integrity: components working correctly and in harmony
inverter: converts DC current into 240 V AC
isolate: cut off electrically
LED: light-emitting diode
live: carrying an electrical current
load: appliances drawing electricity
logbook: book recording data sampled by the user
low voltage (LV): 120V DC, 50V AC or greater
microprocessor: using computer chips
module: photovoltaic cells connected in series and sometimes parralel to provide required power
noise: can damage ears
open-circuit: voltage across PV array when there's no load
parallel: electrically connected side by side
photovoltaic: electricity produced from the sunlight
RCD: residual current device
remote monitoring: reading data in another location using a modem
residual current device: circuit breaker triggered by an electrical short to earth
rusting: can be caused by galvanic reaction between dissimilar metals series electrically connected in a line
SG: (specific gravity) measure of the density of the electrolyte in a battery
shorting: when two opposite charged terminals or cable (eg. + and –) are connected together
shunt: electrical current bypasses the load and is supplied to an alternative load
specific gravity: density relative to water
SPS: stand-alone power system – not connected to the grid
tracker: follows the path of the sun
vented: open to the air