

Solomon Islands Electricity Authority T/A Solomon Power

Solar PV Arrangements

Technical Arrangements for Grid Connection of Photovoltaic Systems via Inverters



This document explains the technical requirements to connect a photovoltaic (PV) inverter system to the supply system (the grid) of the Solomon Islands Electricity Authority T/A Solomon Power.

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1 Introduction

This document explains the technical requirements to connect a photovoltaic (PV) inverter system to the supply system (the grid) of the Solomon Islands Electricity Authority T/A Solomon Power (herein referred to as Solomon Power).

The PV inverter system will usually consist of a photovoltaic array on the roof of the building and a suitable grid-connect inverter connected to the metering box. This arrangement allows solar energy to be supplied to meet the customer's installation load and be backed up by the Solomon Power electricity grid at night and during bad weather.

The guidelines are broken into the following sections:

- Section 2: Describes the situations this document applies to.
- Section 3: Lists the technical requirements that must be satisfied as part of the installation and ongoing operation of the PV inverter system.
- Section 4: Gives information on the metering arrangements.

This document is to be read in conjunction with the following document:

- SIEA T/A Solomon Power draft 2013, "*Electricity Connection and Metering Manual*", www.siea.com.sb, in particular Chapter 10: *METERING ARRANGEMENTS FOR INVERTER ENERGY SYSTEMS CONNECTED TO THE DISTRIBUTION NETWORK*.

Other related documents are:

- *Photovoltaic Inverter Network Connection Agreement* draft 2013
- *Going Solar? The process of installing a photovoltaic (PV) system in your home*

2 Scope

These technical requirements are limited to the following situations:

- Inverter energy systems that have a continuous rating of no more than 10kVA for single-phase systems or 30kVA for three-phase systems.
- Connections to the Solomon Power grid only.
- Systems without battery storage, although these can be considered for special applications.

3 Installation Requirements

This section details the technical requirements to connect a photovoltaic inverter system to the Solomon Power grid.

3.1 General

These requirements are valid for the following network voltages and maximum power generation capacities (continuous rating):

Voltage	Maximum Capacity
230V single-phase	10kVA
400 V three-phase	30kVA

Higher rated installations may be allowed, but will require a special agreement with Solomon Power.

3.2 Australian Standards

These requirements pertain to Solomon Power specific matters. The installation should as a minimum comply with Australian Standards AS/NZS 3000, AS4777 and AS5033 and all other relevant Australian Standards and Solomon Islands statutory requirements. Installations are exempted from complying with these standards only where stated (for example some clauses of AS4777.1).

The inverter to be used shall be of a model that has passed testing in accordance with the Australian Standard AS4777 guidelines. For a list of approved inverters see the website of the Australian Clean Energy Council, and follow the link to the 'Approved PV Inverters' (www.cleanenergycouncil.org.au)

3.3 Safety

In the event of loss of network supply, the PV inverter system shall be designed to disconnect from the network via its on-board protection systems. Under certain undesirable circumstances, it is possible that PV Inverter systems could continue to provide energy to the network, resulting in a hazardous situation. This situation is known as "islanding" and the Australian Standards are designed to prevent this from occurring.

3.3.1 Applicable Equipment

The permission to operate the installation is restricted to the equipment listed on the application form and approved by Solomon Power. The installation shall not have settings changed from those approved, or be upgraded, or be replaced, or be modified or be tampered with in any way. Systems found to be operating in such a manner will be disconnected from the grid until the matter is resolved.

Should it be necessary to change any parameter of the equipment as installed and contracted, Solomon Power shall be notified for re-approval. Subsequently Solomon Power will determine whether a new application is required.

3.3.2 Competent Designer

The PV Inverter system must be designed or approved by a person competent in this field prior to lodging an application with Solomon Power. For a list of approved designers/suppliers, see the website of the Australian Clean Energy Council (www.cleanenergycouncil.org.au)

3.3.3 Operating Personnel - Operation and Maintenance

The customer is responsible for the operation and maintenance of the PV inverter system. Adequately qualified and licensed persons must carry out all work.

The customer shall maintain the PV Inverter system to Australian Standard AS5033 and AS4777. Equipment directly involved with protecting and controlling the connection to the electricity system must be maintained to the equipment manufacturer's specification or the installer's recommendation.

3.3.4 Installation and Inspections

Installations may be routinely inspected by Solomon Power once construction is completed.

An SI licensed electrician/electrical contractor shall carry out all installation and maintenance work.

3.3.5 Logbooks

For safety reasons all customers are required to maintain a logbook detailing inspections and operating activities. This log is an important document and it must be kept in a secure place (typically in the meter box) and be available for inspection by Solomon Power staff.

Further, any change/modifications done in the PV system will need a Certificate of Compliance. An example of logbook pages is shown below.

INVERTER	Make/Model:	Serial No.	Rating: W
Service provider		Service details	Date

PV PANELS	Make/Model:	Serial No.	Rating: W
Service provider		Service details	Date

3.4 Signage

Care must be taken to label switchboards and relevant equipment as per the Australian Standards.

3.4.1 Signage for Type 1 Connections

Main switchboard and distribution board(s).

Quantity: 1
Lettering height:
"WARNING" 8mm
Other text 4mm
Colour: Red, white letters
Size: 120 x 60 mm

WARNING
DUAL SUPPLY
ISOLATE NORMAL SUPPLY TO THIS
SWITCHBOARD AND "SOLAR" SUPPLY
AT MAIN METER BOX BEFORE
WORKING ON THIS SWITCHBOARD

Main meter box where the private generation plant is connected

Quantity: 1
Lettering height:
"WARNING" 8mm
other text 4mm
Colour: Red, white letters
Size: 120 x 60 mm

WARNING
DUAL SUPPLY
ISOLATE BOTH SERVICE FUSES AND
"SOLAR" SUPPLY BEFORE WORKING
ON THIS METER BOX

3.4.2 Signage for Type 2 Connections

Consumer switchboard or distribution boards connected to Solar Meter Box where private generation plant is connected.

Quantity: 1
Lettering height:
"WARNING" 8mm
other text 4mm
Colour: Red, white letters
Size: 120 x 60 mm

WARNING
DUAL SUPPLY
ISOLATE BOTH NORMAL AND SOLAR
SUPPLIES BEFORE WORKING ON THIS
SWITCHBOARD

Main switchboard and distribution board(s) upstream of distribution board connected to Solar Meter Box where the private generation plant is connected.

Quantity: 1
Lettering height:
"WARNING" 8mm
other text 4mm
Colour: Red, white letters
Size: 120 x 60 mm



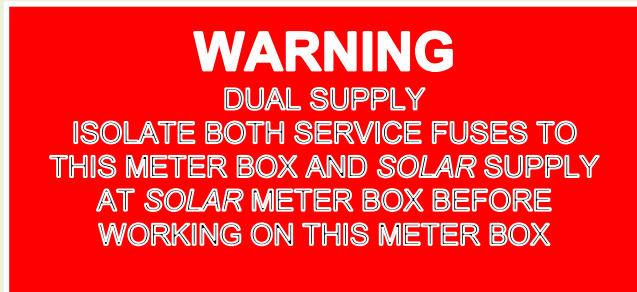
Solar meter box where the private generation is connected.

Quantity: 1
Lettering height:
"WARNING" 8mm
other text 4mm
Colour: Red, white letters
Size: 120 x 60 mm



Main Meter Box

Quantity: 1
Lettering height:
"WARNING" 8mm
other text 4mm
Colour: Red, white letters
Size: 120 x 60 mm



3.5 Protection Arrangements and settings

Solomon Power requires protection equipment to achieve the following safety objectives:

- to disconnect the inverter from the Solomon Power system in the event of loss of Solomon Power supply to the installation; and
- To prevent the inverter from back-energising a de-energised Solomon Power circuit.

The protection arrangements should be as per AS4777 guidelines. The following specific voltage and frequency settings must be programmed into the inverter. **Note** These settings may need to be changed in "off the shelf" inverters.

For a single-phase system:

- Maximum voltage trip point will be 255V phase to neutral;
- Minimum voltage trip point will be 210V phase to neutral;

- FreqMAX will be 54Hz; and
- FreqMIN will be 46Hz.

For a three-phase system:

- Maximum voltage trip point will be 440V phase to phase;
- Minimum voltage trip point will be 370V phase to phase;
- FreqMAX will be 54Hz; and
- FreqMIN will be 46Hz.

In addition to any protection integrated into the inverter design, short circuit and/or over-current protection must be provided by fuses or circuit breakers. This back up over-current protection function can be provided by the metering fuses or by a circuit breaker located at the connection point of the inverter within the meter box.

All protection settings shall be such that satisfactory coordination is achieved with Solomon Power's protective system for the network.

In certain circumstances, Solomon Power may require the new exported energy to be limited to a specified amount. Any such limit will be advised to the Customer before a Network Connection Agreement is signed.

3.6 Surge Protection

The Solomon Power supply system may experience surges during such storms and at other times. The inverter contains many electronic parts and is directly connected to the Solomon Power supply system and may not be able to cope successfully with the surges. The inverter is also directly connected to the PV panels. Being usually mounted on top of the roof, these are directly exposed to the elements and storms and provide an alternative path for surges.

It is the customer's responsibility to include sufficient surge protection for the PV Inverter system. In case of failure of the PV Inverter system, Solomon Power shall not be liable in any way.

4 Network Connection Types and Metering Arrangements

This section details the types of connection arrangement which enable Solomon Power to meter the net electrical energy that Solomon Power supplies to the customer. Billing arrangements are detailed in the Network Connection Agreement.

The customer will meet the cost of installing the additional metering and any modifications to the existing metering arrangement. The meters will remain the property of SIEA.

The customer's licensed contractor will complete the wiring for the meter. When the work is complete and certified, Solomon Power will install and commission the meter and connect the PV system to the Solomon Power Grid.

Replacement of an existing Meter Panel containing Asbestos:

For all PV installations, if the existing meter panel contains asbestos, the panel must be replaced with a meter panel without asbestos before any work on the panel.

Replacement of the Meter Panel:

There may not be enough space on the existing meter panel for the additional meter. In this case, the customer shall provide and meet the cost of an additional meter box or relocation of fuses/circuit breakers within the existing meter box to accommodate the new meter.

4.1 Standard (Type 1) scenario

In this scenario, the inverter generation cable is connected at the existing meter box. All energy consumed from the grid at the premises will be metered by an import-only meter and billed to the customer under the applicable tariff(s). It is only any 'excess' energy will be exported to the Solomon Power grid. This energy will be metered, but will NOT be paid for by Solomon Power. This is a "net metering" scheme as shown in Figure 1.

This dual element (dual register) meter must be installed before any grid connection is made with a new PV array.

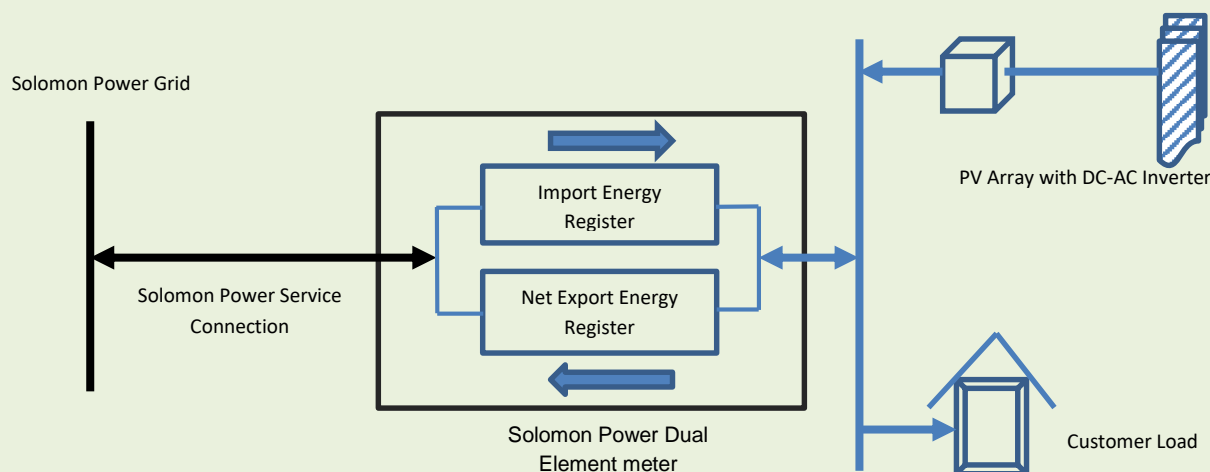


Figure 1 - Schematic Type 1 Single-Phase Metering; Dual-Element Meter

4.1.1 Single-phase customers with single phase PV

The customer must make a provision for installation of a single-phase, bottom-connect, dual-element meter; element 1 for energy consumed from the grid and element 2 for net energy supplied back into the Solomon Power grid.

4.1.2 three-phase customers with single-phase or three-phase PV

The customer must make provision for installation of a dual register three-phase, bottom connect meter for "energy supplied from the grid" metering and for "net energy exported" metering.

If the existing metering arrangement consists of three single-phase meters, they will be replaced by a single dual register three-phase meter (upgrade) with one element for the "energy supplied from the grid" metering, and one element for the "net energy exported" metering.