ST GEORGES CAY POWER COMPANY (SGCPC)

CUSTOMER GRID INTERCONNECTION REQUIREMENTS (GIR) FOR

RENEWABLE-ENERGY GENERATION PV SYSTEMS

1. PURPOSE and AUTHORITY

This document describes the general provisions and technical requirements for connecting solar-energy systems (and other renewable-energy generating equipment) to SGCPC's power system. Most of these will be solar energy, or "photovoltaic", referred also as "PV systems", although these requirements of the Bahamas Electricity Act 2024 (also referred to as "EA2024" or "Electricity Act") also apply to wind and other non-fossil- fuel sources.

These requirements ensure:

1. The safety of SGCPC technicians, agents, customers, and the public.
2. The safety and compatibility of the renewable-energy system.
3. High standards of power reliability and quality for all customers.

This document sets out the:

- Capacity limits for PV systems (Section 2).
- Application and interconnection process for all systems (Section 3).
- General conditions for connecting a system to the Grid (Section 4).
- Technical interconnection requirements (Section 5).
- Glossary (Appendix A).

SGCPC is licensed by The Bahamas Utilities Regulation and Competition Authority (URCA) as an Authorized Public Electricity Supplier Licensee (APESL) in accordance with the 2024 Electricity Act. SGCPC has the authority and responsibility to manage the supply of electricity to all customers in the service area that are connected to the SGCPC grid and ensure customers comply with regulations developed by URCA.

All Customer-owned grid-tied systems require SGCPC approval and a permit from URCA.

For definitions and further technical information, please refer to the SGCPC Glossary and Definitions document available on the SGCPC website.

2. CAPACITY LIMITS

The allowable self-generation capacity for a Customer-owned, PV System is based on several factors.

- The maximum allowable power generation capacity for the entire grid.
- The maximum allowable power generation capacity that will ensure that Customers are not producing more energy than they are consuming.
- The integrity of the grid is maintained by limiting the potential for exceeding distribution circuit limitations.

The calculations are equivalent to those approved by URCA for Bahamas Power and Light on Family Islands with equivalent power demand peaks.

This grid-tied PV program is available on a 'first-come, first-served' basis up to a maximum total based on the capacity of PV and ESS installed and operated by SGCPC. of 250 kW-AC (350 kW-DC) of total, combined, grid-tied power capacity. No grid-tied customer-generation facilities will be allowed or approved above this limit until further notice.

The allowable installed capacity for any premise will be the smaller of the following three criteria. Refer to Table 1 for summary.

A. **Maximum Cap**: 30 kW-DC

B. **Net-Consumer**: "Installed Power Capacity" = "Annual Energy Consumption" divided by the "Yield";

where:

Installed Power Capacity is the total nameplate power capacity of the PV modules shown on the submitted plans and confirmed during the installation process, denoted as kW-DC;

Annual Energy Consumption is the total recorded energy consumption recorded by the premise meter for the previous year, denoted as kWh;

Yield is as defined in the Glossary and Definitions, and specified as 2,000 kWh/kW-DC.

For example, if a Customer consumed 10,000 kWh in the previous year, the allowed power capacity for a grid- tied PV System would be 10,000 kWh / 2000 kWh/kW = 5 kW-AC.

Converting that to PV DC power capacity would be 5 kW-AC x 1.3 (DC:AC ratio) = 6.5 kW-DC.

The calculation is intended to ensure that no Customer exceeds their annual expected energy consumption through self-generation.

C. **Distribution Circuit Integrity**:

C.1 Residential customers may install PV Systems with power capacity less than or equal to: 2 kW-AC + Average Customer Demand

"Average Customer Demand" (ACD) is the customer's total consumption in kilowatt hours (kWh) during the preceding 12 months, divided by 8,760 (the number of hours in a year). The calculation for ACD will be rounded up to the nearest whole number in kW.

For example, a customer with ACD of 1.3 kW would be allowed to install a system with a maximum size of 4kW. This is based on:

1.3 kW ACD is rounded up to 2 kW, and 2 kW + 2 kW = 4 kW-AC.

Converting that to PV DC power capacity would be 1.3 kW-AC x 1.3 (DC:AC ratio) + 2 kW = 4 kW-DC.

C.2 Commercial customers may install PV Systems with power capacity less than or equal to: 15 kW + Average Customer Demand

Table 1: PV System Limits

Parameter	Residential	Commercial Customer
A. Maximum Power	30 kW-AC	
B. Net Consumer	Annual Energy Consumption / (1600 kWh/kW-DC)	
C. Distribution Circuit Integrity	2 kW-AC + ACD	15 kW-AC + ACD

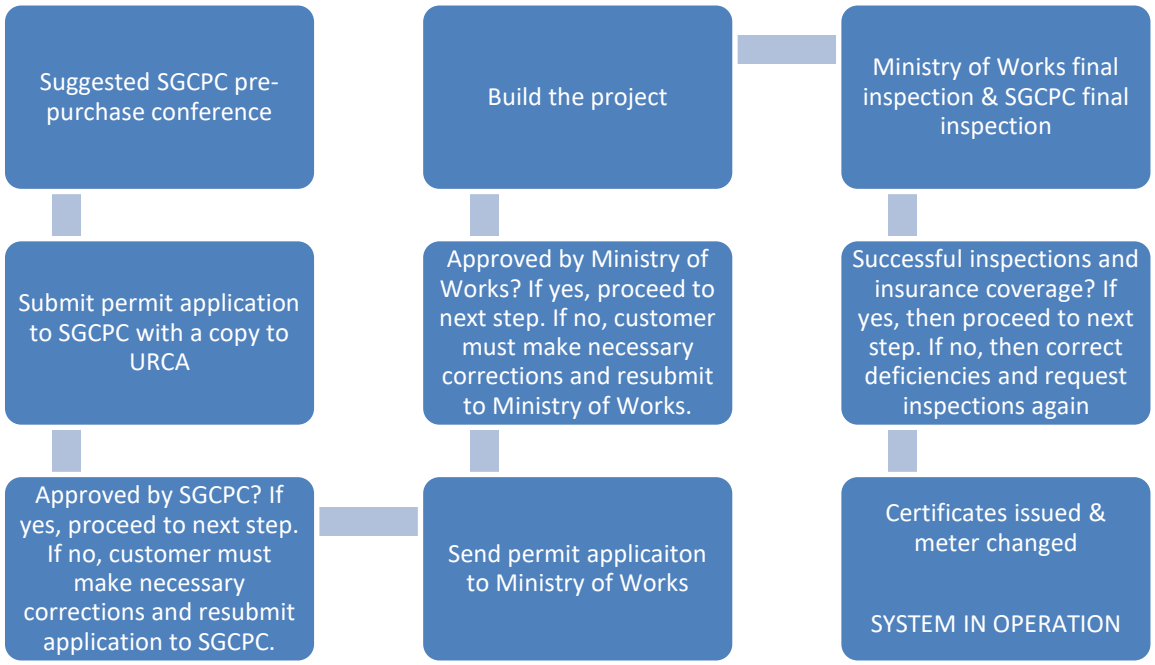
3. APPLICATION AND INTERCONNECTION PROCESS FOR ALL SYSTEMS

This section describes the application and interconnection processes for all customers. ALL customers must submit the SGCPC Grid Interconnection Agreement (GIA) and secure the required written approvals BEFORE installing any PV system.

SGCPC recommends requesting a preliminary conference and opinion BEFORE signing a contract and buying your PV equipment. This approach will help ensure compliance with regulations and not committing your investment until you have confidence in its viability.

Customers are advised that SGCPC may change its customer meter at any time for any purpose.

Customers are required to notify Town Council and secure their Approval for construction.



Off-Grid Systems require URCA written approval. On-Grid PV Systems, with or without ESS, require SGCPC written approval and do not require URCA approval.

All SGCPC forms are available on the SGCPC website. URCA forms are available on the URCA website.

SGCPC supports the installation of Customer-owned systems. SGCPC is not obligated to approve or allow the connection to the Grid of any installation that is non- compliant, unsafe, or unfit for purpose.

Customers should refer to the SGCPC GIA for a listing of the submittal requirements.

SGCPC will review the application and provide its response, either approving or denying the application, within 21 days of receipt of a completed application.

After receiving written approval from SGCPC to install the specified system, the Customer must apply to the Ministry of Works for the required permits. In the application to the Ministry of Works, the customer must include a copy of the approved GIA from SGCPC. Ministry of Works may also require approval from the Town Council.

The system shall be installed according to the technical specifications in the SGCPC Interconnection Requirements.

Once the installation is complete and Customer receives approved final inspection from Ministry of Works, Customer shall notify SGCPC and request final inspection to operate the system. Within 21 calendar days after written notice from the Customer, SGCPC will perform inspection and functionality tests to ensure the safe operation of the system.

SGCPC will carry out inspections and tests in accordance with Section 5 of this document and will advise the applicant in writing whether the system qualifies for interconnection to the Grid. SGCPC may, if deemed necessary, apply additional labelling and markers to identify the site as an approved system.

If SGCPC does not carry out these tests within 45 calendar days of receiving the approvals from the Ministry of Works, the system is considered approved, and the customer may interconnect the system to the Grid. SGCPC maintains the right to perform additional inspection and functionality testing for interconnected systems at any time, after providing the Customer-generator with at least 48 hours' notice.

Should SGCPC find during the inspection that the system is not compliant with the requirements of this GIR document or the approved application, SGCPC WILL reject the request to connect to the Grid and WILL disconnect and lock out an interconnected system.

To gain compliance and approval to operate, the Customer may take corrective action to ensure the system complies with the requirements. SGCPC will perform a second inspection and functionality test to ensure the safety of the system no later than 30 calendar days after the Customer requests a second inspection.

Customers with operating installations that are not permitted or approved must also follow this process to secure an approved GIA before continuing to operate that installation.

4. FEES FOR INTERCONNECTION

Non-recurring fees apply only once and are payable before the system is reviewed and inspected by SGCPC. Payment of applicable fees is required before operation will be approved by SGCPC.

5. GENERAL CONDITIONS

This section includes the conditions that apply to all Customers before SGCPC will approve any installation.

5.1 Customers Must Be in Good Standing

Persons seeking to acquire and connect systems to the Grid must be SGCPC customers in good standing.

For rented properties, the applicant must obtain and provide to SGCPC written approval from the property owner authorizing the installation and fully indemnifying SGCPC with respect to damages from the installation, maintenance, operation, or removal of the installation.

5.2 Types of Grid-tied Systems Allowed

Unless otherwise approved by SGCPC, to be eligible to connect and operate in parallel with the Grid, grid-tied systems must be photovoltaic (PV) and/or wind electricity generators and meet the technical requirements in Section 5 of this document.

5.3 Unauthorized Connections

For the purposes of public and utility personal safety and according to URCA regulations and the Electricity Act, SGCPC reserves the right to disconnect any customer who connects or has connected a system to the Grid without written authorization from SGCPC.

Should SGCPC decide to disconnect a system from the Grid, it shall notify URCA within two (2) days of doing so, giving reasons for the disconnection. A customer whose system has been disconnected pursuant to this power may have the matter reviewed by URCA by making a written request to URCA.

5.4 Code Compliance

The system must be located exclusively within the customer's owned or rented property and observe all building codes and property line setbacks.

5.5 System Architecture

SGCPC allows two configurations for non-SGCPC-owned solar-energy systems.

5.5.1 PV System (with or without an ESS). Represented by Figures 1 and 2, below.

Off-grid systems are represented by Figure 3 below. For the avoidance of doubt, Off-grid systems are reviewed by URCA. Customers that are planning their own onsite solar-energy system can evaluate these options to determine which one is the best solution for their needs and goals. SGCPC will not allow other configurations.

Customers are encouraged to consult with SGCPC before signing contracts for purchase and installation of a renewable energy system.

SGCPC encourages Customers to deploy their own solar-energy systems in striving for our national renewable energy goals. It is important to note that Customer-owned systems make more costly electricity than other options for our Community, and these systems may result in the cost of electricity to go up for all other Customers in the Community that do not have their own solar-energy system.

Customers can switch from one architecture to another as their needs may change over time. In that case, a new application shall be submitted to SGCPC and the applicable approval process and fees will be required before that change is approved. SGCPC will inspect all installations at least once a year to ensure the installation is still compliant with the approved GIA.

5.5.2 PV System (No ESS): The building/property is connected to the grid and the system in parallel at the same time. That is, energy can flow through the SGCPC Meter in either direction and the PV System and Grid can both be connected to the Main AC Panel at the same time and power those loads at the same time. Additionally, the PV System may be isolated from the Grid using an ATS or MTS and supply electricity to the Main AC Panel loads in parallel with a backup genset. Refer to Figure 1.

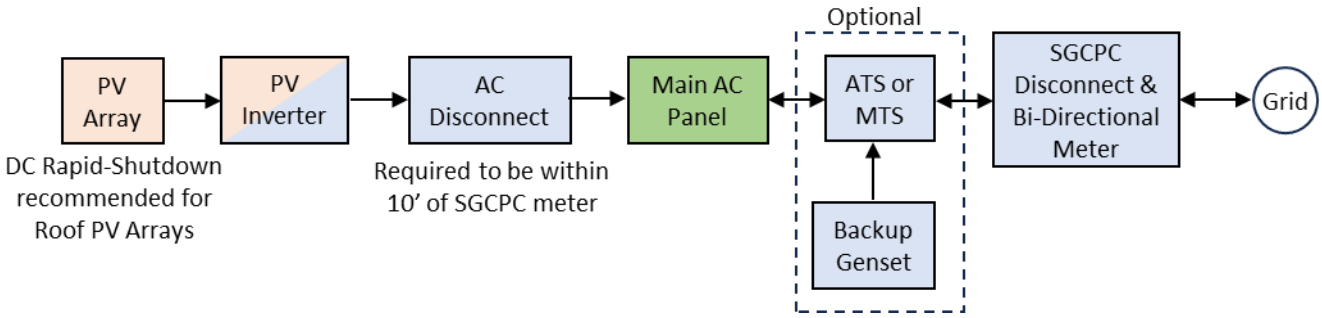


Figure 1: Diagram of Grid-Tied PV System Without ESS Interconnection and Metering Configuration

5.5.3 PV System (With ESS): A PV System with ESS requires a means to isolate the voltage-source equipment (ESS or backup genset) from the Grid in the event the conditional parameters of the grid exceed those listed in Table 2, below. This may be accomplished using the (a) internal circuitry of the power electronics (if the equipment is UL listed for this purpose), or (b) using an external ATS/MTS. Refer to Figure 2.

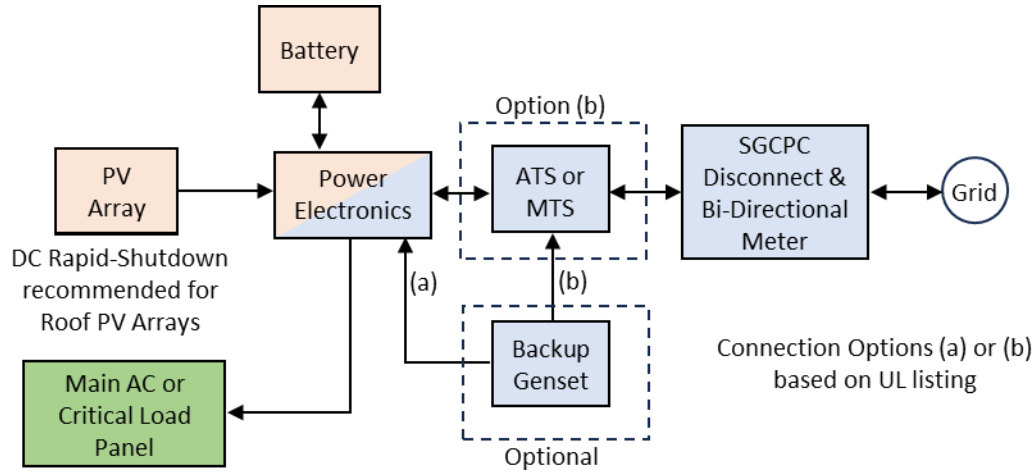


Figure 2: Diagram of PV System with ESS Interconnection and Metering Configuration

5.5.4 Off-Grid: The building/property is disconnected from the Grid. There are no utility service conductors or cables connected to the building or its electrical loads. Refer to Figure 3.

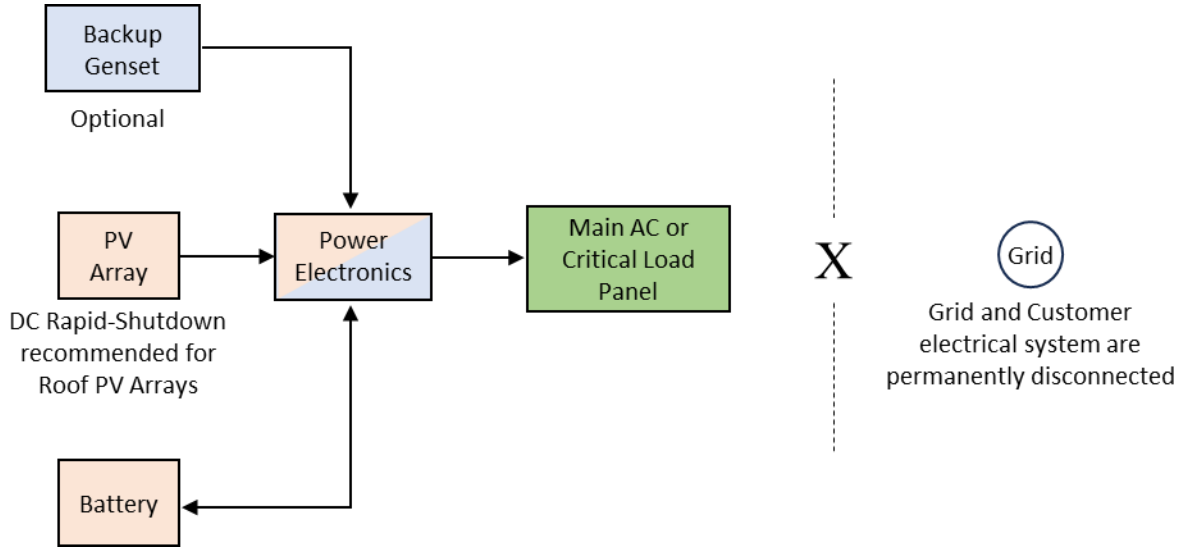


Figure 3: Diagram of Off-Grid PV and ESS Interconnection and Metering Configuration

5.6 Metering

Upon final inspection of a Grid-Tied system and permission to operate is granted by SGCPC, SGCPC will furnish and install a new customer meter at the premises at the Customer's expense. The existing meters do not record energy exported to the Grid. The new bi-directional meter will ensure consumed and exported energy is accurately recorded.

5.7 Labelling

Buildings and structures with a grid-tied PV system must, where practicable, have the disconnecting means grouped (in accordance with SGCPC's Grid Code). Where such an arrangement is not practicable, there must be a permanent plaque posted on or near each disconnecting means, indicating the location of all other service boxes supplying power to the building.

Grid-tied systems that include battery plants or other energy storage systems shall be labelled in a conspicuous, legible, and permanent manner with a suitable warning sign at the location of the service disconnecting means of the premises.

Labeling shall comply with the National Electrical Code (NEC) 2020 Article 690. A graphic summary of labeling requirements is posted on the SGCPC website.

5.8 Insurance

The owner of a PV system or PV Microgrid that is configured as Grid-Tied or Transfer Switch must maintain general liability insurance in amounts not less than:

- $50,000 for systems with capacity less than or equal to 5kW
- $100,000 for systems with capacity greater than 5kW, but less than or equal to 10kW
- $250,000 for systems with capacity greater than 10kW.

An endorsement of a homeowner's policy providing the required amount of coverage is acceptable to meet this insurance requirement. Failure to maintain the insurance coverage will render the Grid Interconnection Agreement invalid. SGCPC does not accept responsibility for the failure of the customer to renew its insurance policy.

Proof of insurance must be provided prior to SGCPC approving the GIA. This coverage is to provide, at a minimum, protection in the event of electrical or mechanical failure or malfunction of the installation that causes loss, damage injury or death to persons or property. SGCPC may from time to time require the homeowner to verify the existence of valid insurance coverage.

5.9 Indemnification

The owner of a grid-tied system must indemnify SGCPC, its agents, and third parties for losses and damages resulting from the operation of the system, except when the loss or damage occurs due to the negligent actions of SGCPC, its agents, or third parties. SGCPC and its agents will indemnify the customer for all loss to third parties resulting from the operation of the Grid except where SGCPC and its agents have used reasonable care in the exercise of their functions or when the loss occurs due to the negligent actions of the customer.
Submission of the GIA implies acceptance of this Indemnification requirement.

5.10 Future Modifications and Expansion

The customer must obtain written approval from SGCPC and the Ministry of Works Electrical Inspection Department, prior to modifying, expanding, or altering the approved system. The customer must present an approved Electrical Inspection Certificate to SGCPC, and must obtain written approval from SGCPC, before interconnecting the modified system to the Grid. The customer may be required to execute a new Grid Interconnection Agreement, if applicable.

5.11 Customer-Owned Equipment Protection

The protection of the facility loads and generation equipment owned by the customer and ensuring compliance with all standards, codes and requirements of local authorities is solely the responsibility of the customer.

6 TECHNICAL INTERCONNECTION REQUIREMENTS

This section provides the technical requirements for SGCPC approval of installations of Grid-tied PV Systems. and lists typical conditions and response to abnormal conditions that the system is required to meet.

6.1 Equipment Certification

Equipment shall be placarded by the manufacturer indicating compliance with the following standards and listings. Documentation provided with the GIA shall include data sheets indicating these listings.

UL-1547 – Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

UL 1741 – Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

UL 9540 – Energy Storage Systems and Equipment

UL 9540A – Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems

(IEC 62933-5-1 and 2 is an accepted alternative for UL-9540)

UL 1998 – Software in Programmable Components

UL 1973 – ANSI/CAN/UL Batteries for Use in Stationary and Motive Auxiliary Power Applications

UL 62109 – Safety of Power Converters for Use in Photovoltaic Power Systems

(IEC 62109 is an accepted alternative for UL-62109)

UL 1703 – Flat-Plate Photovoltaic Modules and Panels

Electrical wiring shall conform with national standards, as set by the Ministry responsible for Building Regulation under Buildings Regulations (Chapter 200).

All components, inclusive of but not limited to inverters, AC panels, charge controllers and batteries, must be accompanied by the manufacturers' specifications sheets, installation/operation manuals, and other details relevant to the inverters function. These documents must be available at the time of application, initial installation inspection, and all subsequent inspections/reviews. Voltage, current and power limits, and operating points are key parameter sets must also be available for review. The year version of each standard or listing shall be 2018 or later year-version that is closest to the year of installation.

All small wind turbine systems must meet UL 6142 requirements as well as any applicable local code requirements.

6.2 Normal Voltage and Frequency

The maximum DC voltage shall not exceed 600 VDC for residential installations and 1000 VDC for commercial installations.

The grid AC voltage at the Point of Common Coupling (POCC) will vary depending on the customer, and the AC Output Circuit voltage shall be set to match that specification. Should the grid voltage deviate, the PV Inverter shall respond as described in Table 2.

The PV Inverter shall operate only in grid-following mode as a current source at a 60Hz frequency. Should the grid frequency deviate, the PV Inverter shall respond as described in Table 2.

6.3 Inverter Response to Abnormal Voltages and Frequencies

A PV System without ESS shall detect and promptly cease to energize the inverter AC Output Circuit(s) when any of the following criteria are exceeded. For three-phase systems, the disconnect shall be proven by certification to successfully disconnect when only one or two phases is out of tolerance, and not necessarily all three phases.

Table 2: Technical Requirements

Voltage Condition (% of Nominal Voltage)	Maximum Time to Disconnect
V <50%	0.16 sec – (10 cycles)
50% < V < 88%	2secs – (120 cycles)
110% < V < 120%	1 sec – (60 cycles)
V > 120%	0.16 sec – (10 cycles)
Frequency	**Maximum Time to Disconnect**
F < 59.4 Hz	0.16 sec – (10 cycles)
F > 60.6 Hz	0.16 sec – (10 cycles)

6.4 AC Disconnect

All systems connected to the SGCPC grid shall include a visible and lockable AC disconnect that will visibly and physically isolate all generating components (PV and/or ESS) from the grid. The AC Disconnect shall be in an accessible location at or near SGCPC's meter and required signage and notices are posted.

6.5 Electrical Islanding

Customer-owned PV Systems may operate in an islanded condition that does not export power or energy to the grid when he grid is in an abnormal condition as noted in Table 2. In these instances, the onsite system may supply premise electrical loads as follows. (a) A **PV System without ESS** may be physically disconnected from the grid using an Automatic Transfer Switch (ATS) or Manual Transfer Switch (MTS) and thence operate interconnected to an onsite backup genset supplying electricity to premise loads. (b) A **PV System with ESS** may isolate from the grid using its internal UL-listed circuitry or an ATS or MTS and supply electricity to premise loads.

All grid-tied systems shall detect abnormal conditions as noted in Table 2, above, and cease to export power to the Grid within a maximum of two seconds after the excursion of a phase or the service outside voltage or frequency standards, or complete loss of one or any number or combination of phases of the service.

In no case or instance shall a backup genset or ESS export power to the grid when the parameters in Table 2 are exceeded. Customer-owned systems found to be operating outside these requirements will be immediately disconnected and locked out from the SGCPC grid because of the safety risks.

6.6 Communications and Control

Inverters shall comply with IEEE-1547 (year-version 2018 or more current). This includes the ability to allow SGCPC to control the output of the inverter. Installations where SGCPC cannot connect and control the inverter will require a remotely actuated on-off switch owned and controlled remotely by SGCPC to limit excess energy that may be exported to the grid. This capability will be used to periodically limit solar-energy generation and export that could cause stability problems for the SGCPC diesel genset powerplant.

6.7 Rapid Shutdown

It is important to note that PV arrays installed on the roof of residential dwellings represent a potential electrical and fire safety hazard to occupants, residents, and emergency responders. Installation of rapid-shutdown devices for residential installations is required by the Canadian Electrical Code (CEC) in effect on Spanish Wells. ~~has been the industry's best practice since 2018. While the version year of the Canadian Electrical Code accepted by The Bahamas is silent on emergency rapid shutdown capability for residential PV arrays, SGCPC strongly recommends owners of roof-mounted PV arrays install rapid-shutdown devices for their own safety and the safety of neighbors and emergency responders. Until required by our electrical code, this is a best-practice recommendation and not a requirement.~~

6.8 Voltage Flicker

Voltage flicker is an increase or decrease in voltage over a short period of time and is normally associated with fluctuating loads or motor starting. A flicker problem is site-specific and depends on the characteristics of the changes in load. A flicker is considered objectionable when it either causes a modulation of lighting levels sufficient to be irritating to humans or it causes equipment to malfunction. The PV System shall not cause objectionable flicker for other customers on the Grid.

6.9 DC Injection

The system shall not inject a DC current greater than 0.5% of the unit's rated output current at the Point of Delivery after a period of 6 cycles following connection to the Grid.

6.10 Harmonic Distortion

Systems are to employ pure-sinewave inverters and are expected to comply with IEEE Standard 519 current distortion limits regarding harmonic current injection into the Grid. The harmonic current injection arising from the system shall not exceed the values listed in Table 3 – (excluding any harmonic currents associated with harmonic voltage distortion present on the Grid without the system connected).

Table 3: Distortion Limitations

Total Harmonic Distortion Limit (of rated current)		5.0%
Maximum Distortion		
Harmonic Numbers	Even Harmonics	Odd Harmonics
h < 11	1.0%	4.0%
10 < h < 17	0.5%	2.0%
18 < h < 23	0.4%	1.5%
24 < h < 35	0.2%	0.6%
h > 35	0.1%	0.3%

Additionally, the THD shall comply with URCA Mandate, as listed in Table 4.

Table 4: URCA THD Mandate

Level	Bus Voltage at POCC	Individual Harmonic, h ≤ 50	Total Harmonic Distortion, THD
A	V ≤1.0 kV	5.0%	8.0%