



Simple and Complex Interconnection Requirements & Examples: Reference Document In Compliance with CPUC Decision 19-03-013, Ordering Paragraph 4

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Overview

PG&E provides this informational document in accordance with California Public Utilities Commission (“CPUC” or “Commission”) Decision 19-03-013, *Decision Adopting Proposals from March 15, 2018 Working Group One Report*, Ordering Paragraph 4, to outline the requirements for maintaining NEM integrity and to clarify complex utility metering solutions for interconnection requirements.¹

This document is broken down into the following sections:

1. Illustrative metering configurations and cost tables to provide more transparency in the application of complex metering solutions;
 2. Requirements for non-export relays and controls for solar plus storage systems to maintain Commission-required Net Energy Metering Tariff integrity requirements, and
 3. Information about PG&E’s work in support of development of direct current metering standards.
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¹ Note: this document does not include all interconnection requirements. Please see [PG&E's Interconnection Handbook](#) for more information.

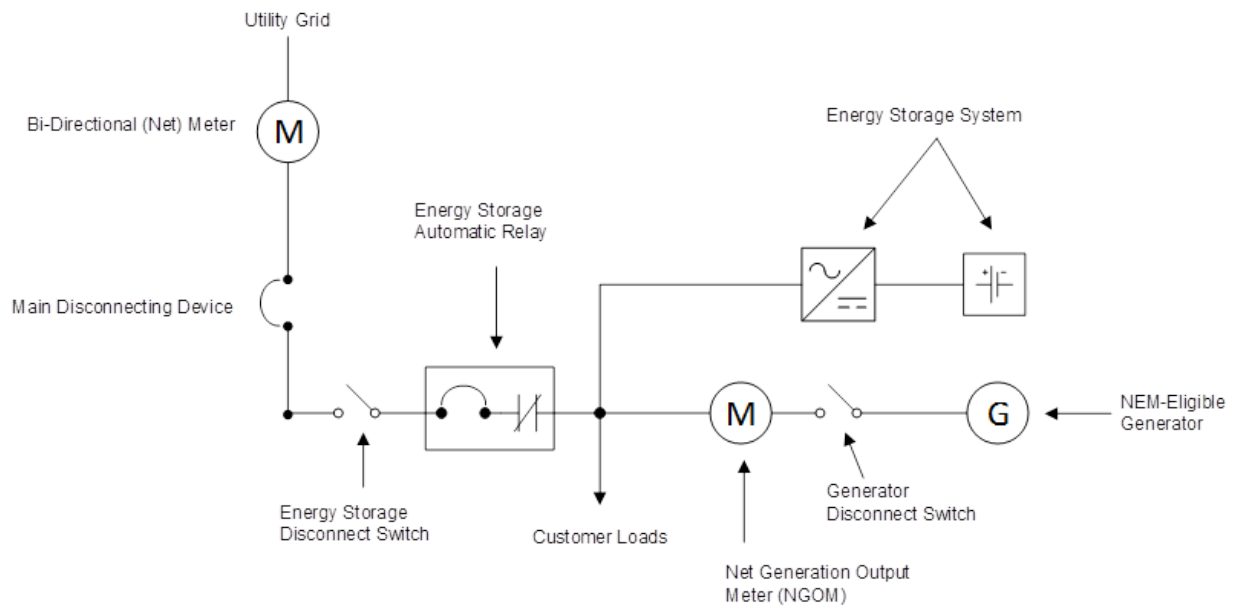


Part 1 - Illustrative Metering Configurations and Cost Tables to Provide More Transparency in the Application of Complex Metering Solutions

PG&E provides this illustrative metering configuration and cost table to provide more transparency in the application of complex metering solutions.

Metering Configuration

Below is an example of a common configuration that typically requires standard or complex metering.





Simple and Complex Interconnection Requirements & Examples

Reference Document In Compliance with CPUC Decision 19-03-013
Ordering Paragraph 4

Cost Table

Below is PG&E’s cost table based upon existing metering arrangements used by PG&E. This table includes the anticipated cost of procuring, installing, and maintaining the required metering arrangements. Costs are based on the voltage, arrangement, amperage limitation, and whether the meter is a smart meter or non-smart meter.

SmartMeter™ or Non-SmartMeter™	Meter Description	Average Cost as of 2/2022
SmartMeter™	Self-contained meter (600 V)	\$410
SmartMeter™	Transformer-rated meter & Instrument transformers (600 V)	\$1,567
SmartMeter™	Primary Transformer-rated meter & Instrument transformers (5 kV)	\$7,327
SmartMeter™	Primary Transformer-rated meter & Instrument transformers (12 kV)	\$7,640
SmartMeter™	Primary Transformer-rated meter & Instrument transformers (21 kV)	\$14,457
Non-SmartMeter™ (cellular read)	Self-contained meter (600 V)	\$890
Non-SmartMeter™ (cellular read)	Transformer-rated meter & Instrument transformers (600 V)	\$2,652
Non-SmartMeter™ (cellular read)	Primary Transformer-rated meter & Instrument transformers (5 kV)	\$8,411
Non-SmartMeter™ (cellular read)	Primary Transformer-rated meter & Instrument transformers (12 kV)	\$8,725.21
Non-SmartMeter™ (cellular read)	Primary Transformer-rated meter & Instrument transformers (21 kV)	\$15,542

*includes materials and labor, does not include tax and burden



Part 2 – Requirements for Non-Export Relays and Controls for Solar Plus Storage Systems to Maintain Commission-required Net Energy Metering Tariff Integrity Requirements

PG&E provides this information in compliance with CPUC Decision 19-03-013, to clarify requirements for non-export relays and power control systems for solar plus storage systems to maintain Commission-required Net Energy Metering (“NEM”) Tariff integrity requirements.

This guide is for customers choosing equipment to maintain NEM Integrity. Manufacturers seeking to certify their systems should follow the certification process listed in the Underwriter Laboratories Certification Requirements Decision for Power Control Systems and the California Energy Commission (“CEC”)’s listing process.

Net Generation Output Meter (NGOM) directly to the NEM

What is a Net Generation Output Meter (NGOM)?

A Net Generation Output Meter (NGOM) is an additional meter (in addition to the customers main service meter) to measure the output of the customers’ Renewable Electrical Generating Facility (REFG). A NGOM may be required as indicated in the applicable NEM Rate Schedule – see Section 1 for a list of Rate Schedules.

NEM Integrity for NEM Paired Storage: Large NEM Paired Storage Requirements Options

NEM-Large paired storage facility projects must adhere to metering requirements similar to those found in the NEM2MT section of PG&E’s [Electric Schedule NEM2](#).

- These projects are required to comply with one of the four (4) options below:
 - Option 1: Install a Net Generation Output Meter (NGOM) directly on the NEM
 - Option 2: Install a Certified Power Control System with the following use cases:
 - No Charge From the Grid Use Case
 - Non-Export To the Grid Use Case
 - Option 3: Install a Non-Export/Import Relay on the storage device(s).
 - Option 4: Utilize the Maximum Continuous Discharge rating methodology.



Power Control Systems and Non-Export Relays

Certified Power Control Systems

Large NEM-paired storage systems have the option to utilize a Certified Power Control System as an option to maintain NEM integrity.

- The Certified Power Control System Option allows either of the two acceptable use case methods to comply with NEM integrity²:
 - Use Case 1 - No Grid Charging
 - The energy storage device(s) are not capable of charging from the grid, however the energy storage device(s) is allowed to export energy to the grid
 - Use Case 2 – No Storage Export
 - The energy storage device(s) are capable of charging from the grid (as well as the PV), however the energy storage device(s) is not allowed to export energy to the grid.

Requirements for the Certified Power Controls System Option

- If the product is not listed on the CEC website, the customer may either 1) submit the product to the CEC for the CEC to certify and list on the CEC website, or 2) the customer must provide NRTL certification documentation³ to PG&E and specify the associated use case.
 - [CEC Grid Support Inverter List](#) > [Inverter and Energy Storage System PCS List](#)
- A PG&E engineer will verify the provided UL 1741-CRD Certification Requirements Decision (CRD) documentation.
- All other interconnection and smart inverter requirements apply.
- The customer/installer/contractor is responsible for programming and installing all controls requirements per manufacturer.
- Commissioning for verification of programming and any other interconnection requirements will be required at PG&E's discretion.

² Please note – The allowable open loop response time for this method to curtail or stop exporting energy to the grid must be equal to or less than 10 seconds. The open loop response time must be included in the certification documentation.)

³ Please see [Appendix A, "Certification Documentation"](#)



Non-Export/Import Relay Options

- **Non-Export Relay Option for NEM-Large Paired Storage Systems**

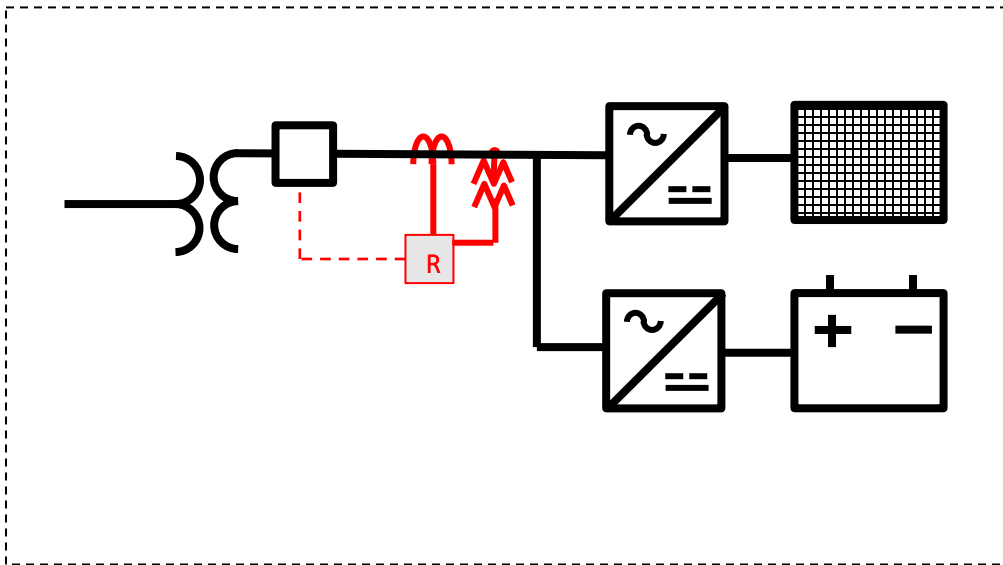
- NEM-Large paired storage systems have the option to utilize a non-export relay to prevent export from the storage device(s) to the grid. In order to comply with NEM-MT non-export provisions, NEM-Large paired storage relays may be configured with either of the following options:
 - Option 1 (“Reverse Power Protection”): To ensure power is never exported across the Point of Common Coupling (PCC), a reverse power Protective Function may be provided. The default setting for this Protective Function shall be 0.1% (export) of the service transformer’s rating, with a maximum 2.0 second time delay. For multiple tariff interconnections refer to Section J.8.
 - Option 2 (“Minimum Power Protection”): To ensure at least a minimum amount of power is imported across the PCC at all times (and, therefore, that power is not exported), an under-power Protective Function may be provided. The default setting for this Protective Function shall be 5% (import) of Generating Facility’s total Gross Rating, with a maximum 2.0 second time delay.
 - Technical requirements for these non-export relay options are found in [Rule 21](#) Section G.1.i.
 - When the customer elects to install a non-export relay, the relay settings must be provided to SCE for verification that they meet the requirements cited in Rule 21.
 - In addition to the relay settings, the customer must also provide a relay test report before a commissioning test may be scheduled and final PTO is given.
 - Depending on design and configuration, the storage system may not be able to operate when any other eligible generator is able to export.
 - Reference [PG&E’s interconnection handbook](#) for additional details on relaying requirements.
 - See [Figure examples below](#) that describes ways in which a non-export relay system could be configured for a NEM-Large paired storage system

Examples of a Basic Non-Export Relay Setup

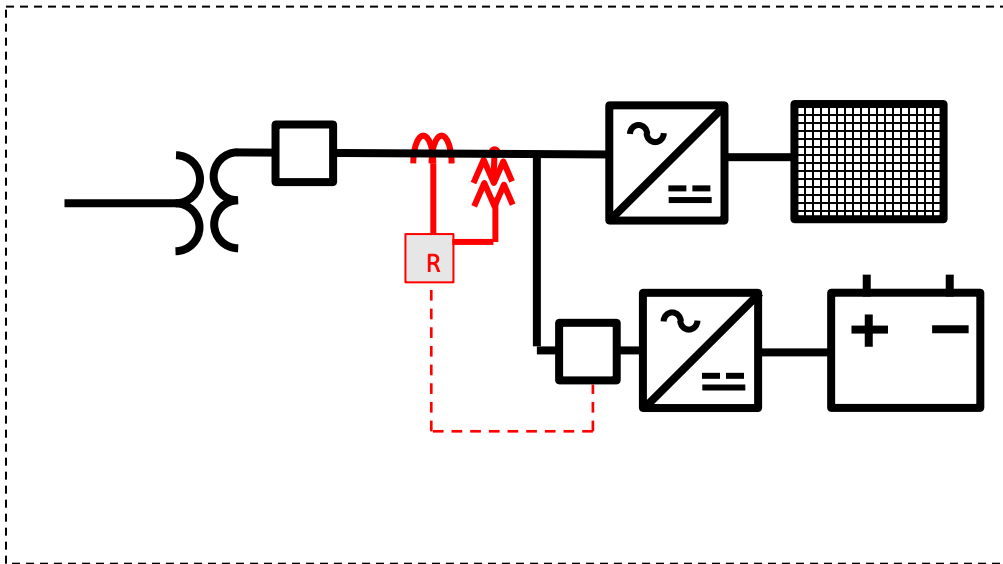
The examples below show the non-export/import relay connected and controlling the non-NEM battery system. In the event that power flows (exporting/importing) through the measurement point (Relay CTs) the relay would curtail or halt the operation of the battery system in accordance with the protection option selected by the customer.

- Use Case #1:
 - A PG&E approved physical non-import relay or a functionally equivalent non-import configuration to prevent grid power from flowing to the storage device is permitted.
- Use Case #2:
 - A PG&E approved physical non-export relay or a functionally equivalent non-export configuration to prevent grid power from flowing to the storage device is permitted.

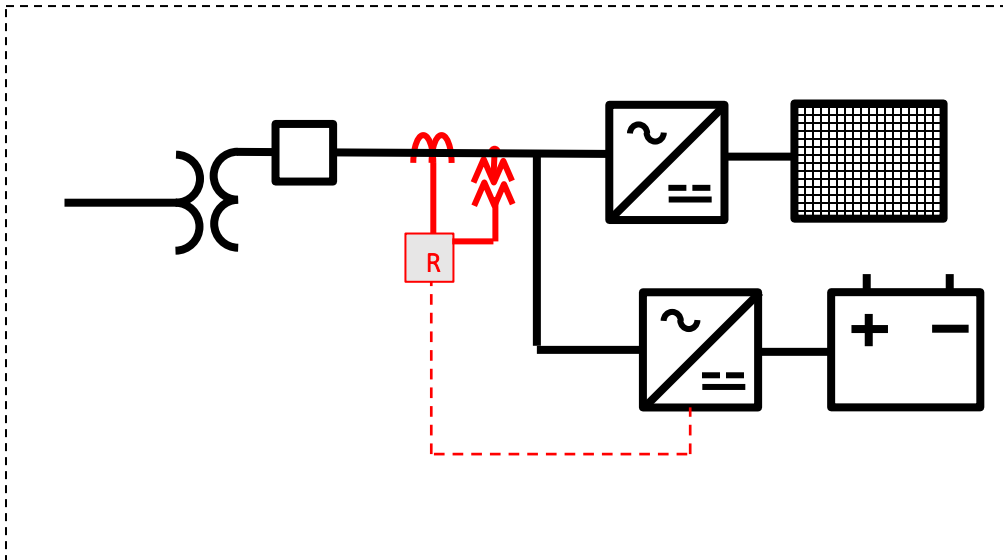
1. Main Breaker



2. Dedicated-storage breaker



3. Direct to Inverter



- **PG&E’s Resources on Approved Protective Relay Models**
 - [PG&E’s Rule 21 Tariff](#)
 - [PG&E’s Transmission Interconnection Handbook](#)
 - See [Table G2-4: RELAYS FOR GENERATION APPLICATION](#), Column labeled “Under, Over, & Reverse Power”
 - [PG&E’s Distribution Interconnection Handbook](#)



Part 3 – Information About PG&E’s Work in Support of Development of Direct Current Metering Standards

PG&E is currently working through various Power Controller CRD use cases, of which NEM integrity assurances are a subset.

PG&E has successfully developed a utility grade Direct Current (DC) that leverages its existing electric AMI network to remotely send energy usage and other measurement data to the UIQ headend system. The meter is in field trial phase (12 pilot locations) as part of the new meter certification process.

The initial purpose of the DC meter development was to support the actual energy usage measurement and remote billing of approximately 500 A15 rate customers (240VDC service) who have been estimated or flat bill for many years. However, this DC meter can be modified to support future microgrid.



Appendix A: Certification Documentation

CRD PCS

To certify if an inverter is CRD-PCS Non Export, please provide the following information:

Required documentation

- UL 1741 CRD test report summary, issued by an NRTL
- Manufacturer's equipment information and instructions document (as required by the UL 1741 CRD)

Information Needed in the UL 1741 CRD Test Report

- Signed or stamped and dated by NRTL whose OSHA Scope of Recognition includes UL 1741.
- Indicates the UL 1741 CRD issued on March 8, 2019, for PCS functionality.
- Specifies the requested model number(s) it is applicable to.
- Defines all the wildcards in the requested model number(s).
- Specifies all the additional devices required and tested for PCS functionality.
- Defines all wildcards in the model number of any required additional devices
- Specifies all the ESS Operating Modes that were tested and certified.
- Specifies the maximum open loop response time for each certified mode.

Information Needed in the "Equipment Information and Instructions":

- Issued by the inverter or ESS manufacturer.
- Submitted on company letterhead.
- Includes all the requested model number(s).
- Identifies the equipment's "current measurement reference point".
- Includes all the required information specified in the UL 1741 CRD, Section 208.