

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

Objective

This presentation outlines the requirements for maintaining NEM integrity and clarifies complex utility metering solutions for interconnection requirements (Decision 19-03-013).

Note: This document does not include all interconnection requirements.

The presentation is broken down into the following parts:

Part 1:

- Net Generation Output Meter NEM Paired Storage Requirements
- Examples for NGOM installation
- Cost tables for metering arrangements

Part 2:

- Requirements for non export relays
- Requirements for controls for solar plus storage systems to protect NEM integrity
 - Power control-based firmware or software options shall be certified to a national standard.

Please reference the NEM handbook and Interconnection handbook for all interconnection requirements. (Decision 19-03-013) - Rule 21 WG OIR Issue #3 decision orders clarifying complex utility metering solutions for interconnection requirements.

Part 1:

- Net Generation Output Meter NEM Paired Storage
- Cost Tables For Meters
- Simple & Complex Metering Examples

What is a Net Generation Output Meter (NGOM)?

A Net Generation Output Meter (NGOM) is an additional meter (in addition to the customer's main service meter) to measure the output of the customer's 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.

Sizing Definitions for NEM Interconnection with Paired Energy Storage (NEM PS)

NEM-Small Paired Storage Systems

Per the CPUC NEM-Paired Storage Decisions (D. 14-05-033 & D. 19-01-030), if the storage device(s) (e.g., batteries, flywheels) are paired with an NEM eligible generator (e.g., solar, wind, etc.), and the storage device(s) have a total rating of 10 kW (AC) and below, there are no sizing restrictions or requirements for the storage device(s) (e.g., no requirement to be sized to the customer demand or the NEM generator). Paired storage systems of this size will be referred to herein as **“NEM-Small Paired Storage Systems.”**

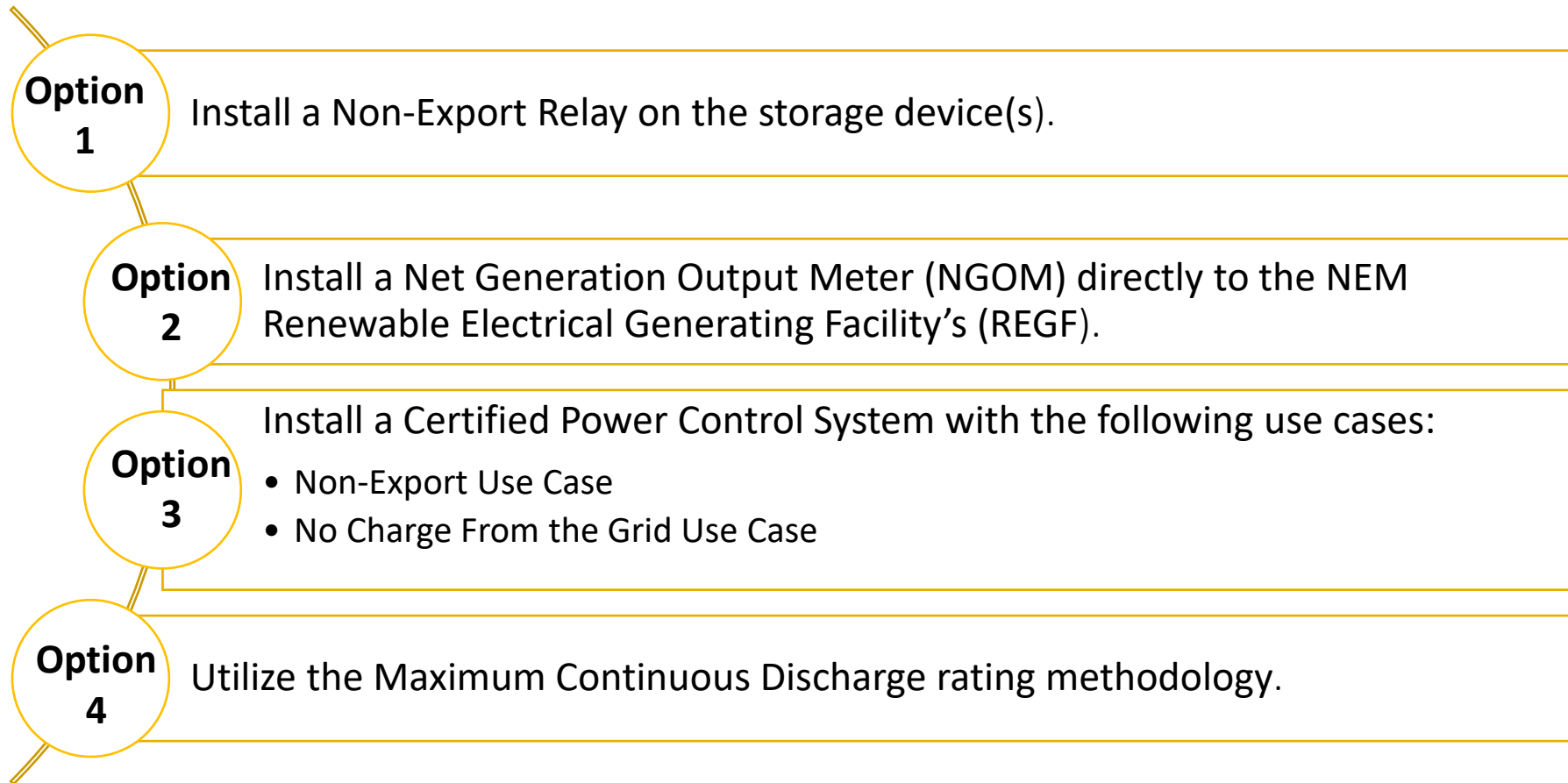
NEM-Large Paired Storage Systems

Paired with storage systems energy storage device(s) that have a total rating larger than 10 kW (AC) are referred to as **“NEM-Large Paired Storage Systems.”** The Customer must adhere to the metering and billing requirements contained within Special Condition 7.b [of NEM Schedule](#) or use power control-based options. Also, NEM large paired storage systems **must comply** with the CPUC NEM-Paired Storage Decisions (D. 14-05-033 & D. 19-01-030) to ensure NEM integrity. For additional details, reference the [NEM FAQs](#).

Large NEM Paired Storage Requirements Options

NEM-Large paired storage facility projects must adhere to metering requirements similar to those found in the NEM-MT section of Schedule NEM.

- These projects are required to comply with one of the four (4) options below: PCI Portal Selection is activated to allow these options.
- Note: See NEM handbook for more information and requirements.



Defining Simple Vs. Complex Meter Solution NEM Paired Storage

For NEM Paired Storage Projects - Pursuant to D.16-04-020, D.16-01-044 and D.14-05-033, and the Schedule NEM ST Special condition 6. The following Metering requirements are required and defined.

Simple Metering.

A NEM-Paired Storage System that utilizes a ***self contained meter*** or no more than two self contained meters. The cost for simple metering shall not exceed \$600.

Complex Metering.

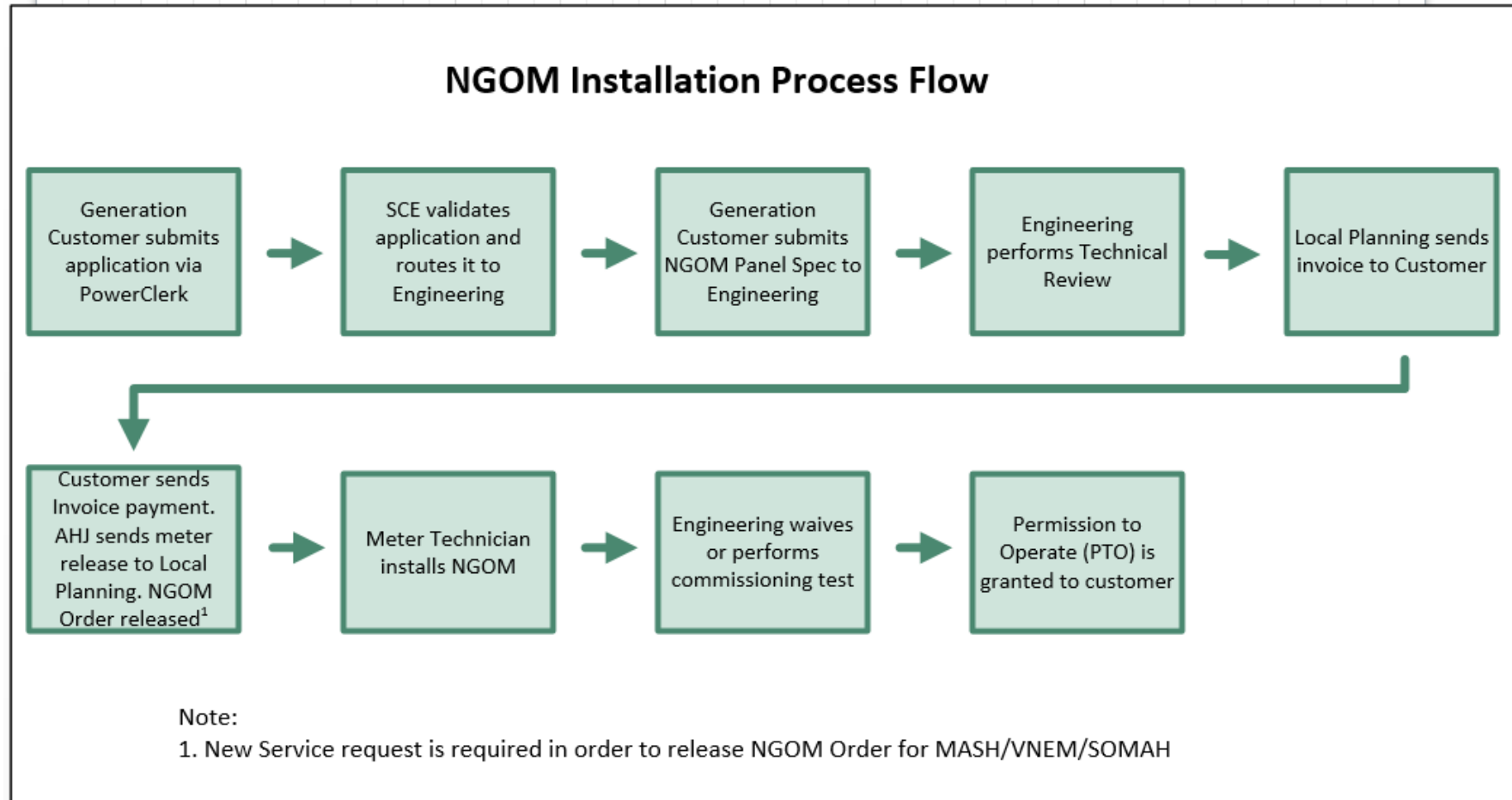
A NEM-Paired Storage System that utilizes more than two self contained meters in addition to SCE revenue meter(s) or any non-self-contained meters (i.e., those that include CTs/PTs) (not including the SCE revenue meter(s)) is considered as having Complex Metering for the purposes of this Special Condition.



Self Contained Meter: Defined as a meter that includes the Current Transformer (CT's) internal to the meter.

Net Generation Output Meter Process (High Level)

- A Net Generation Output Meter (NGOM) is a meter (in addition to the customers main service meter) to measure the output of the customers' REFG. The following high level process flow indicates the NGOM installation process. Please See the SCE NEM Handbook for more information



Net Generation Output Meter Cost Table

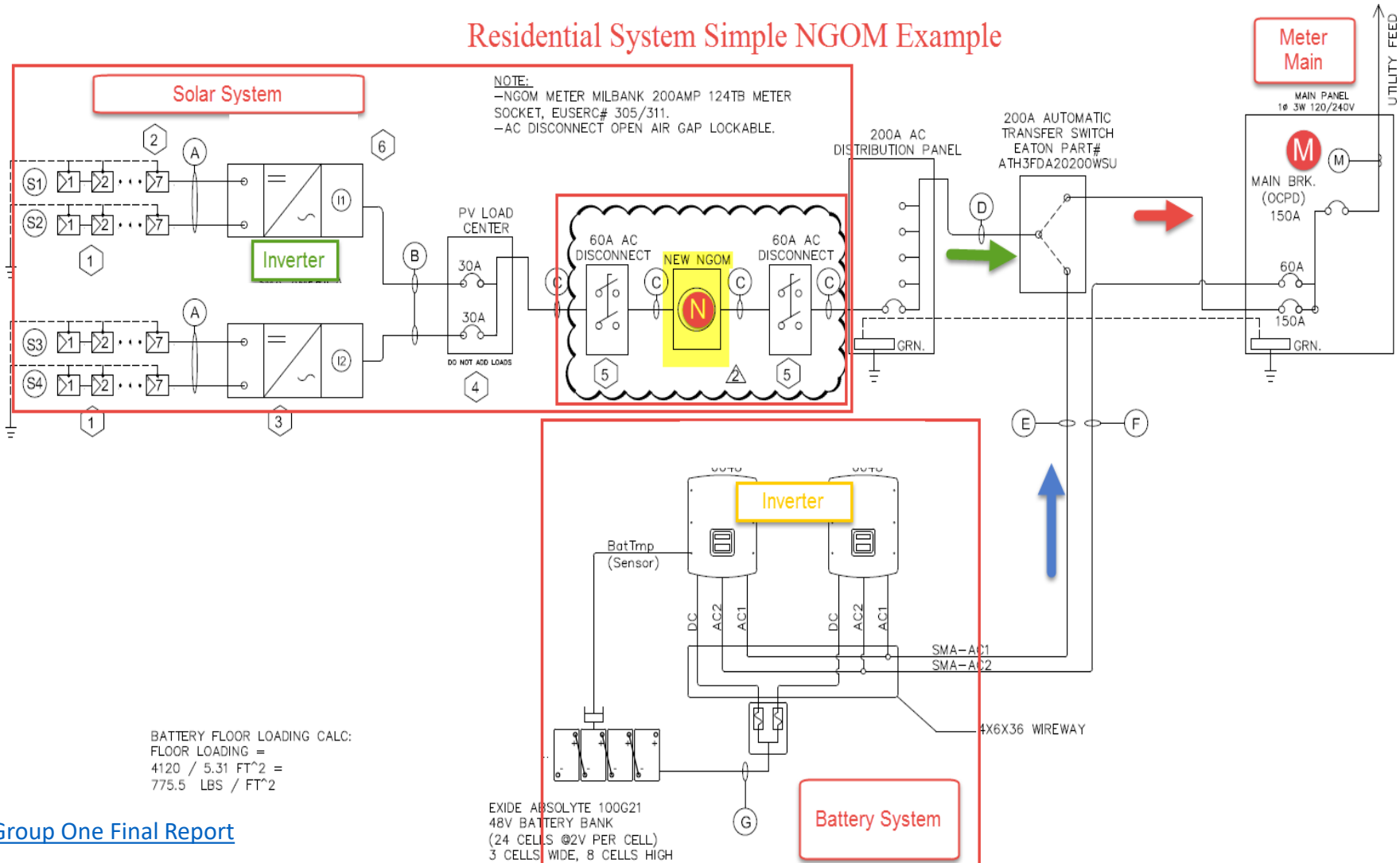
Meter	Arrangement Simple or Complex	Voltage	Ampere Rating (Range)	Smart Meter?	Average Costs
Single Phase Self Contained Meter (NEM PS)	Simple	120/240 Single Phase	Up to 200 Amps	Yes	\$600 Cost Cap
Single Phase Self Contained Meter (Non NEM)	Simple	120/240 Single Phase	Up to 200 Amps	Yes	\$1100
Transformer-rated Meter (600V)	Complex	600 V	Range up to 400 Amps	Yes	\$6000
Secondary Metering	Complex	600 V	Range up to 400 Amps	Yes	\$5300
Primary Transformer-rated Meter (5kV)	Complex	5 kV	1200 Amps	Yes	\$12000
Primary Transformer-rated Meter (15kV)	Complex	15 kV	1200 Amps	Yes	\$13000
Primary Transformer-rated Meter (25kV)	Complex	25 kV	1200 Amps	Yes	\$49000

[*For the most up to date cost estimates, Reference Rule 21 Unit Cost Guide](#)

Simple & Complex Metering Examples

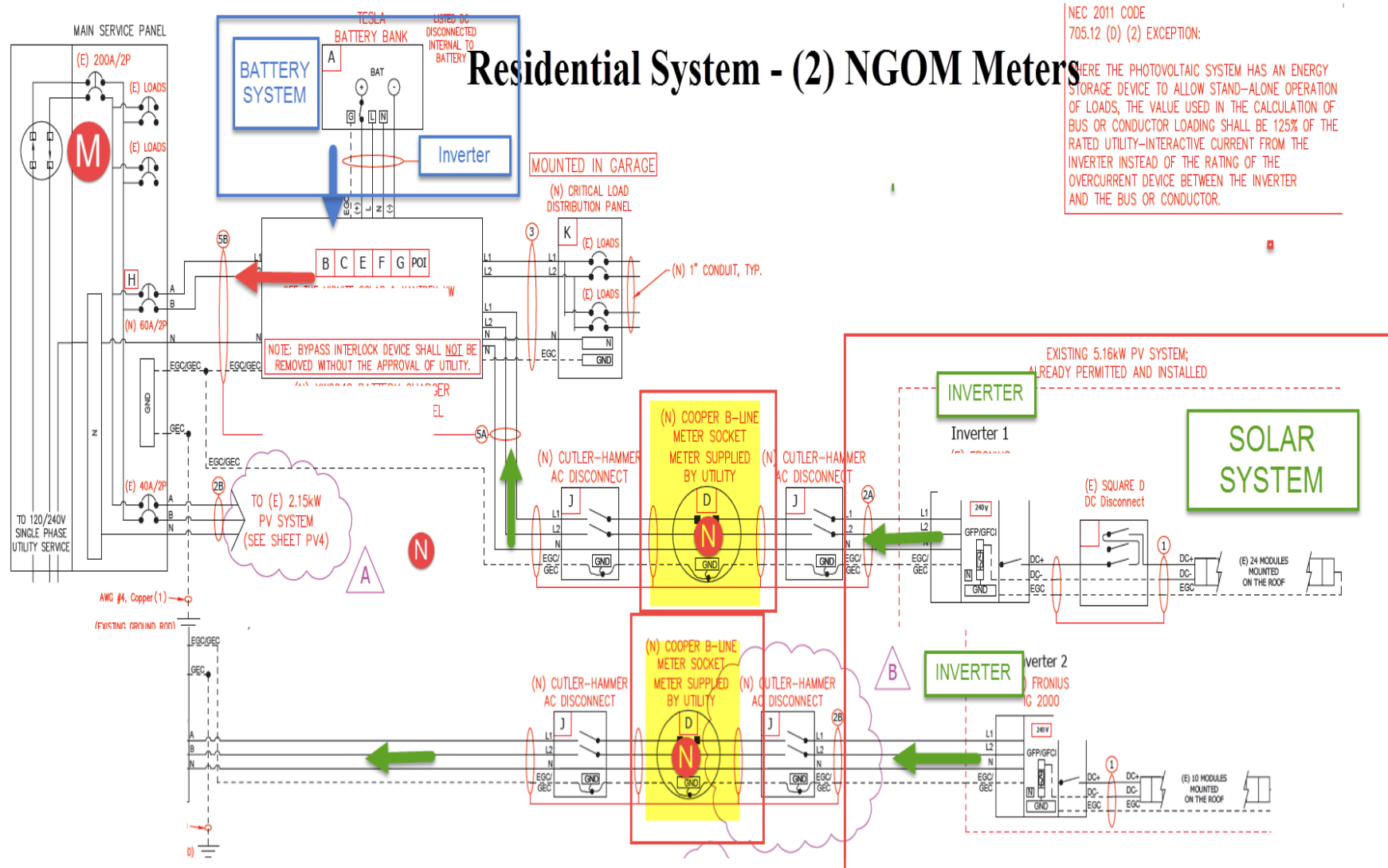
Simple Meter Solution – Residential Self Contained Meter with Less than 200A

- The example below illustrates a “Simple Meter” solution for a residential NEM paired storage project. The maximum amperage for a self contained meter is 200A. This self contained NGOM covers most residential applications (See N Symbol location). Line and load side visible disconnect switches are required.



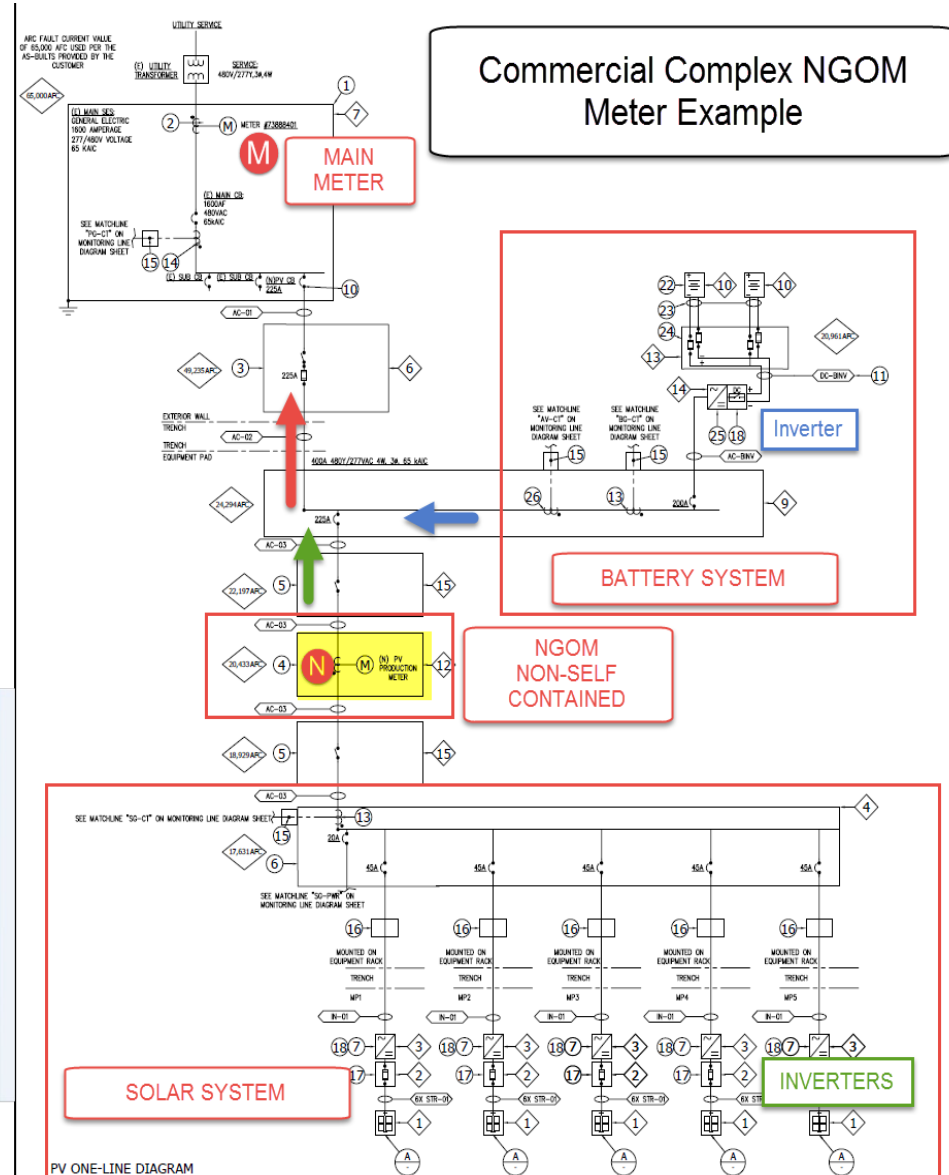
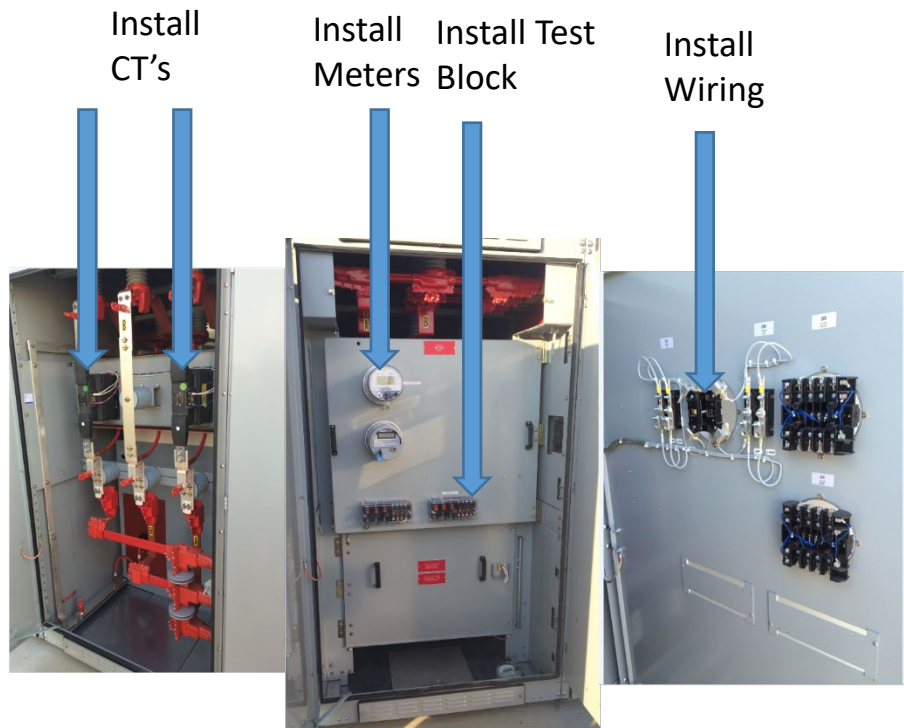
Simple Meter Solution – Residential Example

- The example below illustrates a “Simple Meter” solution for a residential NEM paired storage project. This project required two (2) NGOM meters due to customer’s design.



Complex Meter Solution- Non Self Contained NGOM

- The following example shows a complex meter solution for a NEM paired storage. The picture below shows the wiring requirements and the installation of current transformers inside the switchboard bussing.



Part 2:

- Requirements for non export relays
- Requirements for controls for solar plus storage systems to protect NEM integrity

Requirements for Non-Export 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:

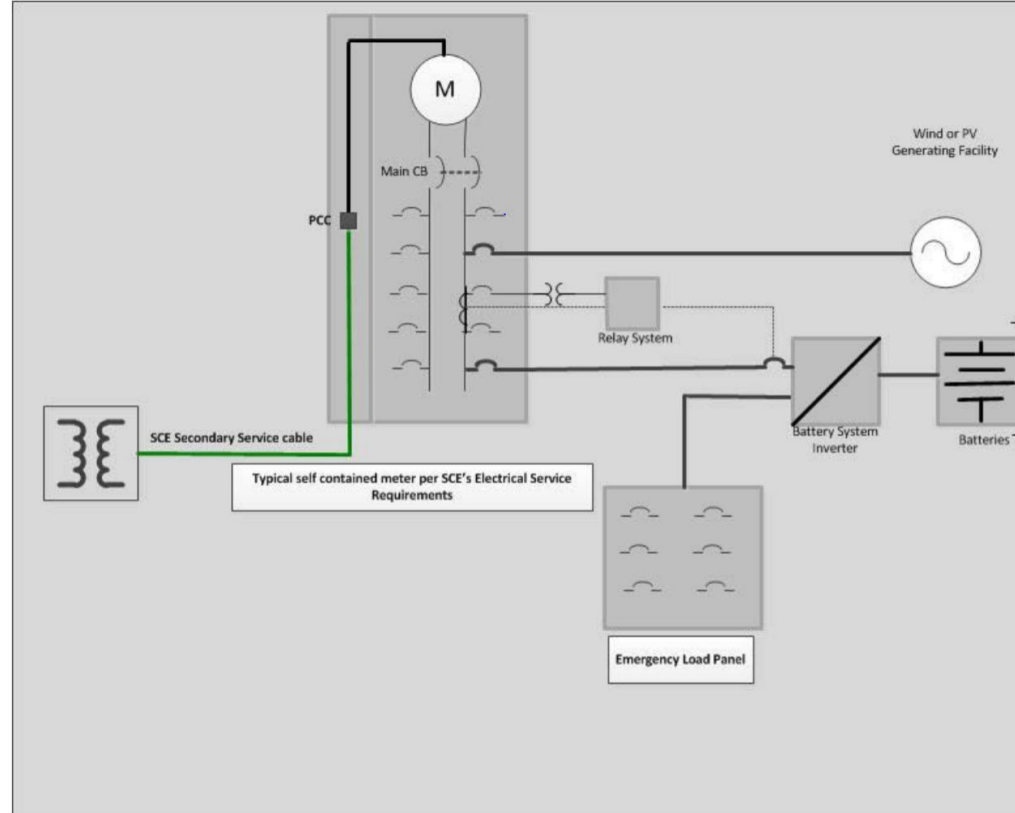
Option 1 (“Reverse Power Protection”): To ensure power is never exported across the Point of Common Coupling (PCC), a reverse power Protective Function may be provided. The default setting for this Protective Function shall be 0.1% (export) of the service transformer’s rating, with a maximum 2.0 second 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 (REGF) is able to export.
- Reference [SCE’s interconnection handbook](#) for additional details on relaying requirements.

See Figure example on the next slide that describes a non-export relay system could be configured for a NEM-Large paired storage system.

Non-Export Relay for NEM-Large Paired Storage Systems- Example is for illustration purposes only



This example illustration shows the non-export relay connected and controlling the non REGF battery system. In the event that power flows (exporting) through the measurement point (Relay CT's) the relay would curtail or halt the operation of the battery system in accordance with the protection option selected by the customer.

Requirements for Controls -NEM Paired Storage Decision 14-05-033

NEM Paired Storage Decision 14-05-033

CPUC [Decision 14-05-033](#) - Decision regarding storage devices paired with net energy metering generating facilities.

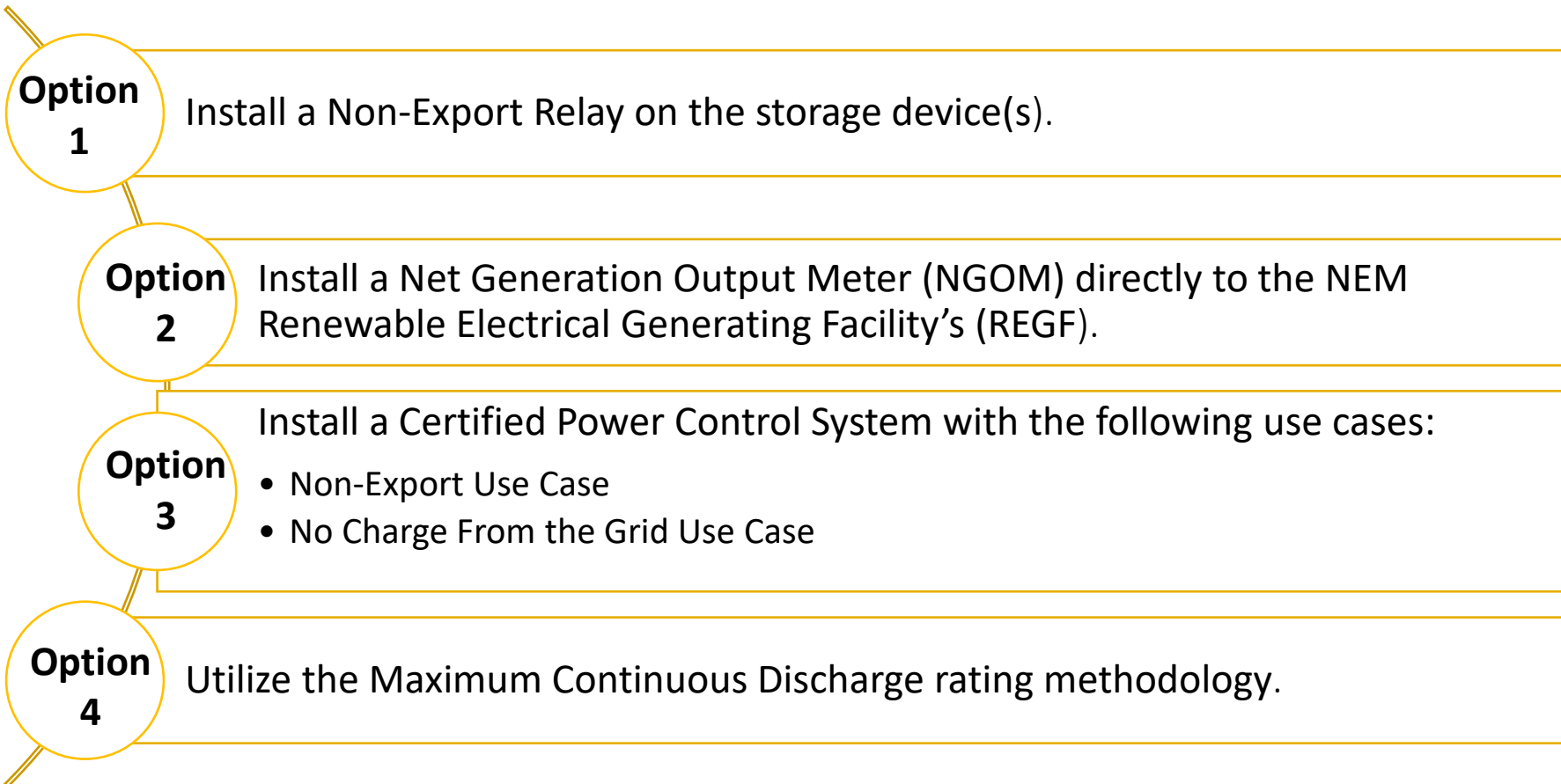
This decision allows Large Net Energy Metering (NEM) paired storage systems to comply with the metering requirements in the NEM-MT section of schedule NEM with two additional options:

- Certified Power Controls System Option
- Maximum Continuous Discharge DC Sizing Option

Large NEM Paired Storage Requirements Options

For NEM-Large paired storage facilities, the project must adhere to the metering requirements similar to those in the NEM-MT section of Schedule NEM.

- These projects are required to comply with one of the four (4) options below: PCI Portal Selection is activated to allow these options



Certified Power Controls System Option

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

- The Certified Power Control System Option allows either of the two acceptable use case methods to comply with NEM integrity:

Controls Use Case 1 - No Export to the Grid Operation -

The energy storage device(s) are capable of charging from the grid (as well as the PV or REGF), however the energy storage device(s) is not allowed to export energy to the grid*.

Controls Use Case 2 - No Charge from the Grid Operation -

The energy storage device(s) are only capable of charging from the PV (or REGF).



** 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.*

Requirements for Certified Power Controls System Option

Requirements



- The customer must provide NRTL certification documentation in the interconnection portal and specify associated use case.
- SCE engineer will verify the provided UL 1741-CRD Certification Requirements Decision (CRD).
- 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 SCE's discretion.

- *The [CEC website](#) currently host a UL-1741- CRD equipment list. It is the responsibility of the customer/installer/contractor to ensure the equipment purchased meets all smart inverter requirements and power controls system UL-1741 CRD certification requirements.*



Maximum Continuous Discharge DC Sizing

NEM-Large paired storage systems have the option to measure a storage system size in direct current (DC) configuration in order to determine whether size restrictions and metering requirements apply.

- Therefore, the utility can determine a storage system size as the lesser of:
 - 1) The shared inverter's nameplate capacity or
 - 2) The storage device's Maximum Continuous Discharge DC capacity (kW) listed on the device's technical specification sheets*.



- * Please note - This metric may not be included in the manufacturer technical specification data sheets.*
- *It is the responsibility of the customer/installer/contractor to ensure the equipment purchased meets all of the requirements of this option.*

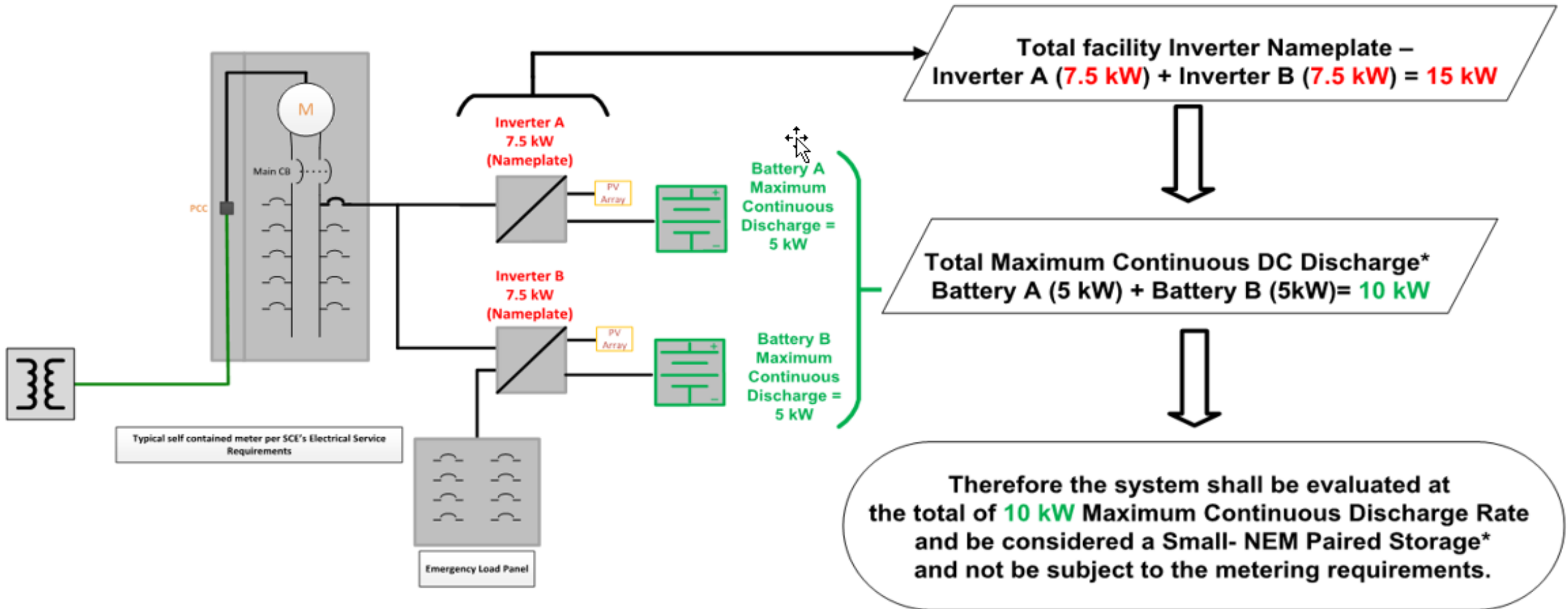
Requirements for Maximum Continuous Discharge DC Sizing Option

Requirements



- The datasheets for the storage system must be submitted and approved by SCE in order to validate the device's Maximum Continuous Discharge Rate through the interconnection portal.
- If no data sheets are submitted for this option, then SCE will evaluate and apply requirements based on the inverter nameplate rating.
- All other interconnection and smart inverter requirements apply
- The project may be required to be commissioned for verification of the interconnection requirements at SCE's discretion.

Maximum Continuous Discharge DC Sizing Option Example NEM Paired Storage (DC Coupled System)



* Maximum Continuous Discharge Rate was verified through
submittal of manufacturer specifications

✓	Max Power [kW]	5.0
✗	Peak Power [kW] (for 3 sec.)	7.0

Reference Links

Useful Links and reference info:

- [SCE Rule 21 Tariff](#)
- [SCE Rule 21 Website](#)
- [SCE NEM Website](#)
- [Decision \(D\)14-05-033](#)
- [Net Energy Metering Interconnection Handbook](#)
- [Grid Interconnections](#)
- [CEC Website](#)
- [SCE's Interconnection Handbook](#)
- [SCE's Electrical Service Requirement](#)

Please send questions related to NEM: NEM@SCE.com

Please send questions related to Non-NEM: InterconnectionQA@sce.com