



Guidance No. 1 for the Interconnection of Electric Storage as Stand-Alone Sources, Parallel Operation for Customers without Generation, and in Parallel with Self-Generation¹

Purpose

This document provides guidance for the interconnection of electric storage batteries as a standby source or for operating in parallel with the utility to provide the customer with desired services such as demand reduction. This document applies to non-renewable generation when existing self-generation is present. Renewable generation requirements are covered in the separate companion Guidance Documents Nos. 2 and 3.

Background

In Proceeding No. 15AL-0048, the Company agreed to terms guiding the installation of customer sited energy storage facilities. This guidance document addresses the term that states:

Customers with stand-alone energy storage interconnection are not required to have an interconnection agreement with the Company if they are in compliance with NEC 702, obtain an appropriate safety inspection, and can provide verifiable proof that those systems are operated such that they do not serve their main electrical panel. Customers with stand-alone battery interconnections are required to have an interconnection agreement when their system is operated in parallel with the grid by serving their main electrical panel.²

This guidance may be modified from time to time to be consistent with the Company's policies for interconnection and operation of customer-sited storage.

Exclusions

This guidance addresses configurations and requirements related to the term above. This guidance does not apply to any situations or configurations where energy storage is operated in parallel with qualifying renewable generation using any form of net metering; generation that is metered under a buy-sell metering arrangement; or situations where there is generated power subject to a Power Purchase Agreement.

¹ Self-generation is a customer supplying part or their entire load from onsite generation with no intent of export or payment for export.

² Attachment A, Decision No. C16-1075, Pages 20-21.



Interconnection Reviews

All electrical sources, including storage, that operate in parallel with Xcel are required to have an interconnection review and an Interconnection Agreement to ensure safety, system reliability, and operational compatibility. For purposes of this guidance, a source is considered to be operating in parallel with the grid when it is connected to the distribution grid and can supply energy to the customer simultaneously with the Company supply of energy. Any source operating in parallel to the grid is required to have an Interconnection Agreement.

When a storage system is installed in conjunction with a generation system, both may be reviewed at the same time and be included in one Interconnection Agreement³. When a storage system is installed after the generation system, the review level will be based upon the combination of the onsite generation rated capacity and the storage nameplate capacity for the selected operating mode⁴ of the storage system⁵. The operating modes will be part of the Interconnection Agreement requirements and any change in operating modes may require another review of the facility and possibly mitigations. If a storage system is installed at the same time as a generation source, a combined review is to be encouraged as the total time and cost will be less than two separate reviews.

Onsite Generation and Energy Storage Configurations

Three onsite storage configurations are achievable under this guidance:

- Standby Energy Storage Interconnections without Generation under NEC 702 (Diagram No. 1a)
- Energy Storage Operation in Parallel without Generation (Diagram No. 1b)
- Energy Storage Operation in Parallel with Non Net Metered Self-Generation⁶ (Diagram No. 1c)

Each diagram provides the representative configuration in principle and may have other features not reflected in the diagram, but the operational principle shall be consistent with the

³ Interconnections are reviewed based on the combined nameplate ratings of the sources that can actually be simultaneously supplied to the grid, such as two inverters. The ongoing operation capacity portion of the review is based on the actual simultaneous performance AC ratings. If the contribution of the energy storage to the total contribution is limited by programming or by some other on-site limiting element, the reduced ongoing capacity will be used.

⁴ Operating Modes includes such requirements as charging the energy storage only from an on-site renewable energy source that is net-metered, non-export requirements, or stand-alone storage systems.

⁵ Interconnections are reviewed based on the combined nameplate ratings of the sources that can actually be simultaneously supplied to the grid, such as two inverters. The ongoing operation capacity portion of the review is based on the actual simultaneous performance ratings. If the contribution of the energy storage to the total contribution is limited by programming or by some other on-site limiting element, the reduced ongoing capacity will be used.

⁶ Self-generation is a customer supplying part or their entire load from onsite generation with no intent of export or payment for export.



operational principle demonstrated by the diagram. The desired functionality may be controlled by inverter or control system programming. The diagrams are attached at the end of the text and are considered a part of this guidance.

Standby Energy Storage Interconnections under NEC 702 (Diagram No. 1a)

NEC 702 provides for optional standby (i.e. backup) systems. Optional standby systems are intended to supply power to public or private facilities or property where life safety systems do not depend on the performance of the system. Optional standby systems are intended to supply on-site generated or stored power to selected loads either automatically or manually. The generators or batteries do not operate in parallel with the utility. The Batteries may be charged from the utility but may not supply power to the customer's load outside of standby operations. The design is in conformance with the National Electric Code (NEC) Article 702 Optional Standby Power. This configuration is commonly used in conjunction with a Protected Load Panel that is normally fed from the main panel and can be fed by the standby system when the utility is unavailable.

If the above standby conditions are met, the applicable state or local safety inspection has been obtained, and verifiable proof that the system operates in compliance with NEC 702 has been provided to Xcel Energy⁷, the installation may proceed to operate without further approval or inspection and will not need an Interconnection Agreement. Xcel Energy reserves the right to conduct an inspection to verify compliance at a later date if problems arise or other indications of possible non-compliance are present.

Energy Storage Operation in Parallel without Generation (Diagram No. 1b)

If the customer has an onsite energy storage operating in parallel with the utility, meter registration will occur for exported power⁸. Subject to the Inadvertent Export provisions below, the customer must provide the control system settings to ensure the power source does not export to the system as a part of the interconnection review. Xcel Energy reserves the right to conduct an inspection to verify compliance at a later date if problems arise or indications of possible non-compliance are present.

Metering for this operating mode will be the standard service meters for the residential and small commercial tariffs. Standard meters register exported power as additional load.⁹ At

⁷ Attestation is required and should include sign-off by installer/developer and customer. Attestations should identify specific hardware and software associated with the installed systems and those settings used to comply with the specified configuration as well as the settings being inaccessible and/or password protection must be restricted to the installer/developer/manufacturer.

⁸ Exported power will be recorded as load.

⁹ De minimis inadvertent power may be exported but substantial export will adversely affect the customer's bill.



some future date, standard service meters may be upgraded to bi-directional meters.¹⁰ Where bi-directional measurement of delivery point power is used, both in and out quantities will be read.

Energy Storage Operation in Parallel with Non Net Metered Self-Generation (Diagram No. 1c)¹¹

If the customer has onsite self-generation, meter registration will occur for exported power regardless of the source providing the power¹². Subject to the Inadvertent Export provisions below, the customer must provide the control system settings to ensure the energy storage power source does not export to the system as a part of the interconnection review. Xcel Energy reserves the right to conduct an inspection to verify compliance at a later date if problems arise or other indications of possible non-compliance are present.

Metering for this guidance will be the standard service meters for the residential and small commercial tariffs. Standard meters register exported power as additional load. At some future date, standard service meters may be upgraded to bi-directional meters. Where bi-directional measurement of delivery point power is used, both in and out quantities will be read.

Inadvertent Export

The customer remains responsible for inadvertent energy exports. The term “no export” allows occasional de minimis “inadvertent export” of power. This recognizes that any parallel operation of a source with the utility may encounter brief upsets due to feeder or customer disturbances, sudden load changes, etc.

Inadvertent export is the unscheduled and uncompensated export of real power generated from a customer’s parallel operation and delivered to the Company. The use of an internal transfer relay, energy management system, or other customer facility hardware or software system(s) intended to prevent the reverse power flow, or net export, from the customer’s energy sources across the point of interconnection is required. The magnitude of export shall be less than the nameplate rating (kW-gross)¹³ and the duration of export of power from the customer’s shall be less than 30 seconds for any single event.

¹⁰ Meters may require upgrading due to changing metering standards, metering technology changes, or new system control installation.

¹¹ The customer may elect to use standby rates to minimize the economic impact that may occur when their generation is not available.

¹² Exported power will be recorded as load.

¹³ The magnitude of export is based on the combined nameplate ratings of the sources that can actually be simultaneously supplied to the grid, such as storage and self-generation. If the contribution of the energy storage to the total contribution is limited by programming or by some other on-site limiting element, the reduced ongoing capacity will be used.



The cumulative amount of energy from the customer and delivered to the Company in any billing month shall be less than the on-site combined nameplate real power source ratings (kW-gross)¹⁴ multiplied by one (1) hour.

Any amount of export of real power across the point of interconnection lasting longer than 30 seconds for any single event shall result in a cease-to-energize or halt of energy production of the customer's energy sources within two (2) seconds of exceeding the 30-second duration limit.

Where applicable, any failure of the Customer's control system for thirty (30) seconds or more, which includes but is not limited to; the internal transfer relay, energy management system, or other customer facility hardware or software system(s) intended to prevent the reverse power flow, shall cause the customer's energy sources to enter a non-export operational mode where no energy will be Inadvertently Exported to the grid.

General Information

Various tariffs measure capacity (demand) and energy (kWh) separately in 15 minute intervals. Some tariffs apply time-of-use rates. Any meter upgrade that is required for directional measurement will employ the same methodology for export measurement as is required by the tariff for delivered power and will be read at the same intervals.

Illustrative diagrams of approved configurations are attached.

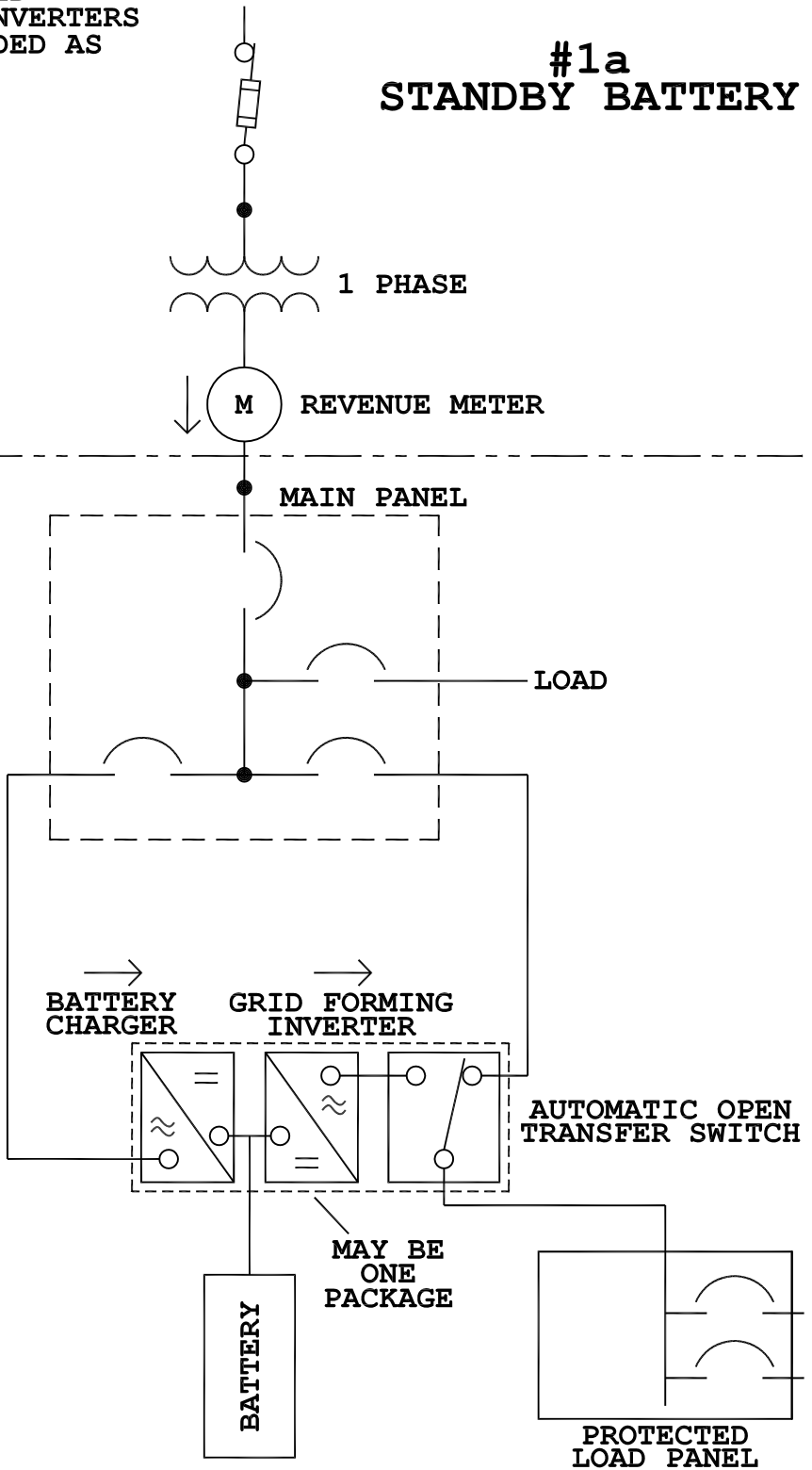
¹⁴ The magnitude of export is based on the combined nameplate ratings of the sources that can actually be simultaneously supplied to the grid, such as storage and self-generation. If the contribution of the energy storage to the total contribution is limited by programming or by some other on-site limiting element, the reduced ongoing capacity will be used.

FIGURE ILLUSTRATES REPRESENTATIVE CONCEPTS & INTENT. PACKAGED SYSTEMS MAY HAVE HYBRID INVERTERS WITH THESE FEATURES PROVIDED AS PART OF THE PACKAGE.

#1a STANDBY BATTERY

UTILITY

CUSTOMER



1. THE PROTECTED LOAD PANEL COULD BE A SEPARATE LOAD PANEL AS SHOWN IN THE DIAGRAM OR COULD BE THE ENTIRE MAIN PANEL.
2. BATTERY NOT ALLOWED TO PARALLEL WITH OR EXPORT TO GRID.

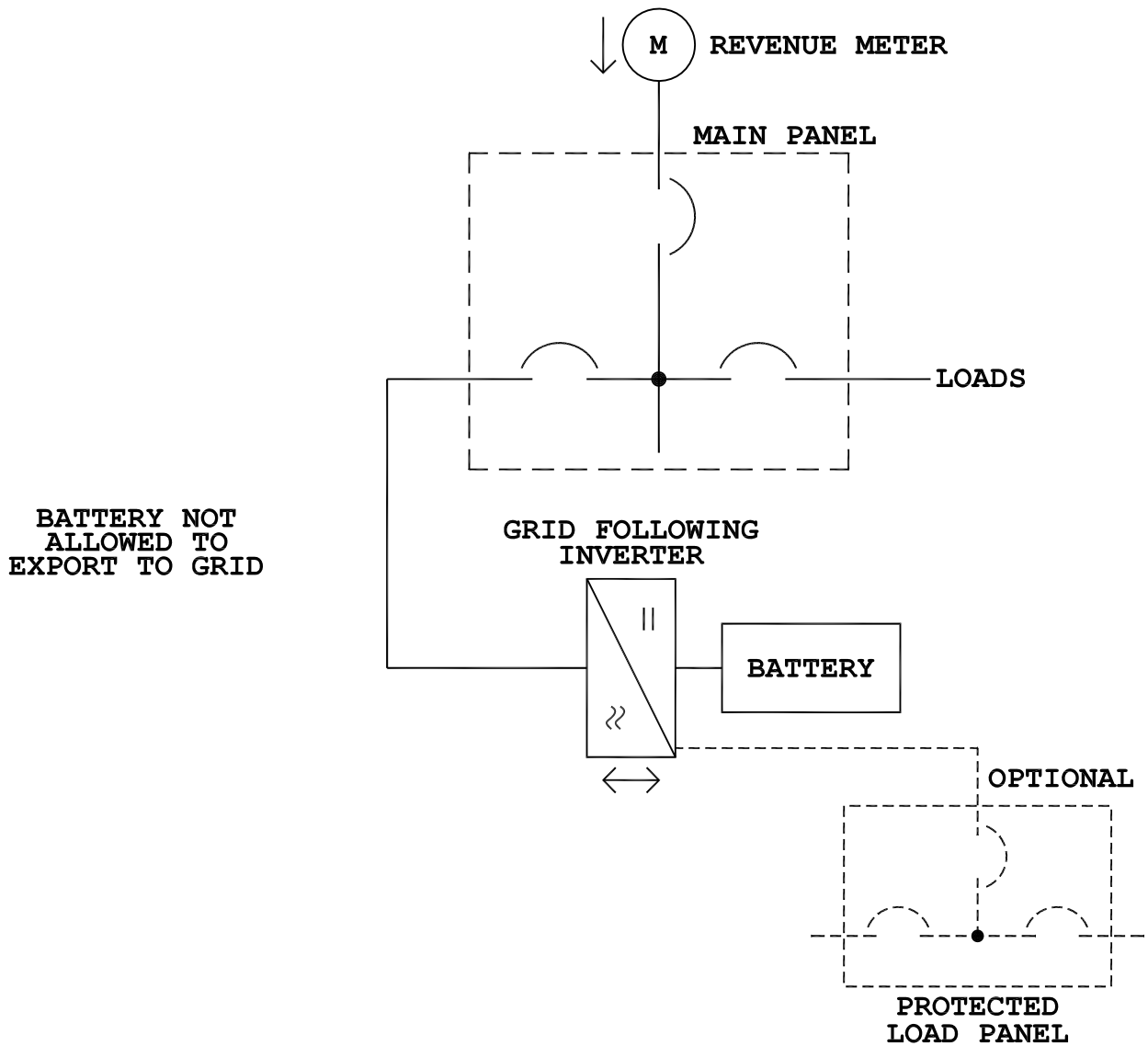


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BATTERY CONFIGURATION

FIGURE ILLUSTRATES REPRESENTATIVE CONCEPTS & INTENT. PACKAGED SYSTEMS MAY HAVE HYBRID INVERTERS WITH THESE FEATURES PROVIDED AS PART OF THE PACKAGE.

#1b PARALLEL BATTERY



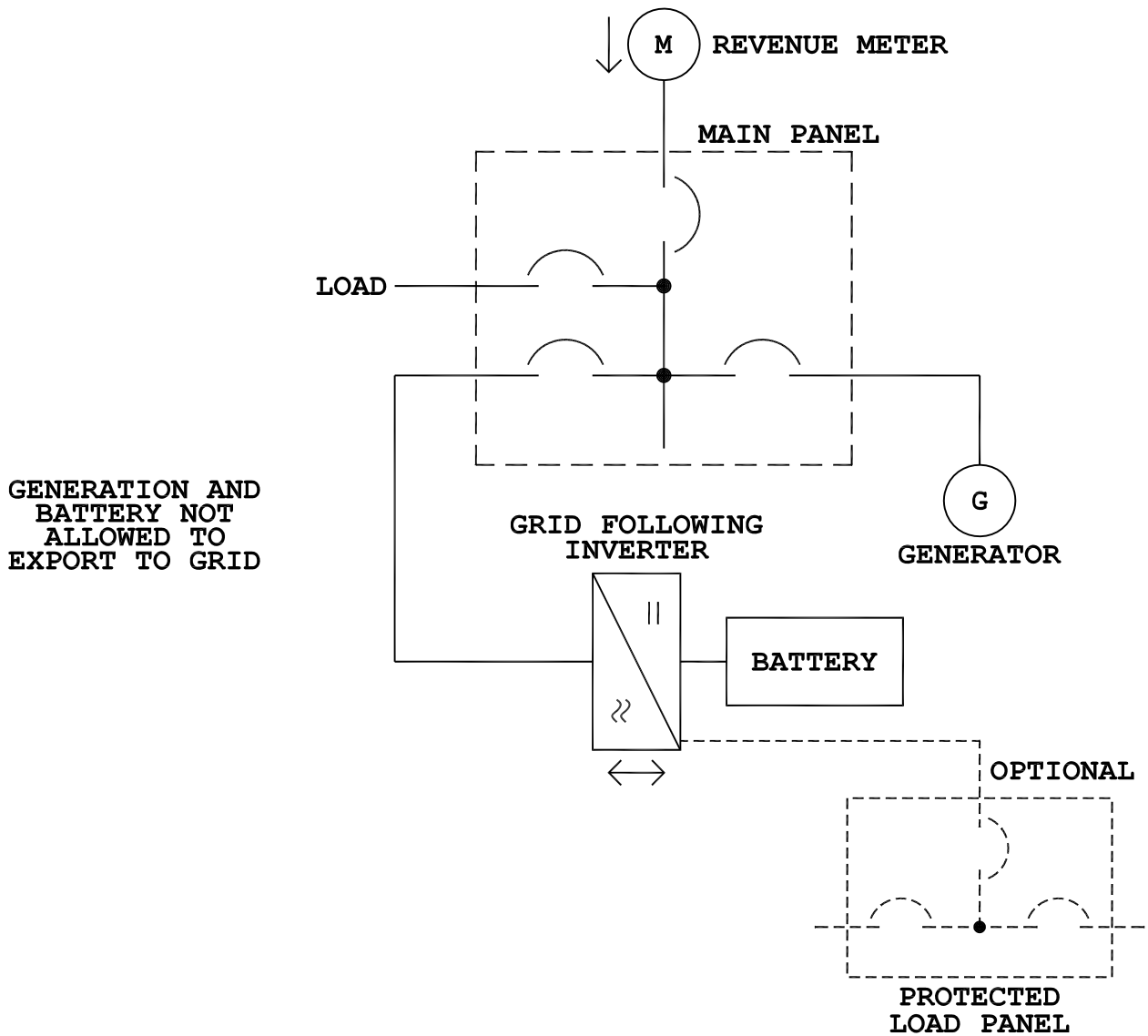
1. THE PROTECTED LOAD PANEL COULD BE A SEPARATE LOAD PANEL AS SHOWN IN THE DIAGRAM OR COULD BE THE ENTIRE MAIN PANEL.



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FIGURE ILLUSTRATES REPRESENTATIVE CONCEPTS & INTENT. PACKAGED SYSTEMS MAY HAVE HYBRID INVERTERS WITH THESE FEATURES PROVIDED AS PART OF THE PACKAGE.

#1c PARALLEL BATTERY + GENERATION



1. THE PROTECTED LOAD PANEL COULD BE A SEPARATE LOAD PANEL AS SHOWN IN THE DIAGRAM OR COULD BE THE ENTIRE MAIN PANEL.



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