

# Generator integration with the Enphase Energy System

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## Overview

This document provides site surveyors and design engineers with the information needed to evaluate a site and plan the design, installation, and support of AC home standby generators with the Enphase Energy System. This is not a commissioning and operations guide. The information provided in this document supplements the information in the data sheets, quick install guides, and product manuals. Diagrams and information in this document are illustrative examples of system configurations and installations. However, they may not include all requirements from additional state and local codes, standards, and other Authorities Having Jurisdiction (AHJs), applicable to a site.



**NOTE:** Only AC home standby generators that are hardwired and meet the requirements listed in the section “Generators that can be integrated with the Enphase Energy System” are supported. Do not use a portable generator (that is not hardwired) instead of the standby generators. If you need to use a portable generator to recover battery charge in the event of an emergency, follow the instructions in the [“State of Charge Recovery for an Enphase Storage System”](#) technical brief.

**NOTE:** The term “IQ System Controller” when used in this document means both IQ System Controller 1 and IQ System Controller 2, unless otherwise specified.

## Introduction

With the Enphase Energy System, homeowners will have power when the grid goes down and can save money when the grid is up. The Enphase Energy System includes the following Enphase products:

- IQ Battery to store energy and form a microgrid in the absence of the utility grid.
- IQ System Controller to enable the batteries to form a microgrid safely by isolating the home from the utility grid in the event of an outage.
- Envoy S Metered or IQ Gateway communications gateway to talk to the Enphase Cloud. The IQ Gateway includes system controller software.
- Enphase Communications Kit to enable the IQ Battery, the IQ System Controller, and the IQ Gateway to communicate securely.
- M Series or IQ Series solar microinverters to convert DC power from the solar panels to AC power.
- Enphase Mobile Connect cellular modem to provide a backup internet connection in the absence of broadband over Wi-Fi or Ethernet.
- A pair of Enphase’s split-core current transformers (CTs) for monitoring current consumed from the utility grid and an additional pair for monitoring current consumed from the generator.

The Enphase Energy System now supports third-party standby generators. The IQ System Controller includes a built-in generator port, which eliminates the need for an external automatic or manual transfer switch for the generator. The IQ System Controller takes care of turning on and controlling auto-start generators when the utility grid is down, without any intervention from homeowners. The generator reduces dependency on environmental variables (irradiance for solar power production) and provides an additional power source while the system is off-grid. The generator can be used to supply power to loads and/or charge batteries. The ability to use the generator and PV + storage is a key differentiator of the Enphase solution versus competitors, which support either a generator or PV + storage solution. The addition of generator support to the Enphase storage system helps to create a highly resilient, grid-independent solution.

## Key features

- The generator only runs in the off-grid mode and does not operate in parallel with the grid.
- The generator can run in parallel with IQ Series Microinverters and IQ Batteries while the system is off-grid.
- The system supports the following user preferences for starting the generator:
  - a. **Automatic:** The IQ System Controller ensures a seamless transition from an on-grid to an off-grid state without a loss of power. The generator is turned on automatically

when the system is off-grid. The generator supplies power to loads and battery until the utility grid returns and is deemed stable.

- b. **Eco-friendly:** The generator is started and stopped automatically based on the battery state of charge (SOC). This mode reduces generator run time, leading to less fuel consumption, and consequently reduces generator maintenance requirements. For example, the generator is turned on if the battery SOC drops below 20% and is turned off if the battery SOC goes above 40%.
  - The generator configurations can be modified, or the unit can be disabled using the Enphase Installer App.
  - The “Quiet Time” feature provides the user a way to select a period during which the generator stays off unless battery SOC drops below a critical charge threshold.
  - The Enphase Installer App provides a user-configurable Generator Exercise Mode option. For example, the generator runs for 15 minutes occasionally to keep its engine in good operating condition, which may be required by the manufacturer.



**NOTE:** If you use the exercise mode provided by Enphase, you need to disable the manufacturer-provided exercise mode (if present).

## Comparison of Enphase Energy Systems with other solutions

### Generator support with typical competitor solar + storage solutions

The typical solution available in the market is **generator OR PV + storage**, meaning that when there is an outage, the homeowner will get their power from either the generator or the renewables; they cannot get backup power from both at the same time. Such a design is inefficient, complicated, and difficult to operate.

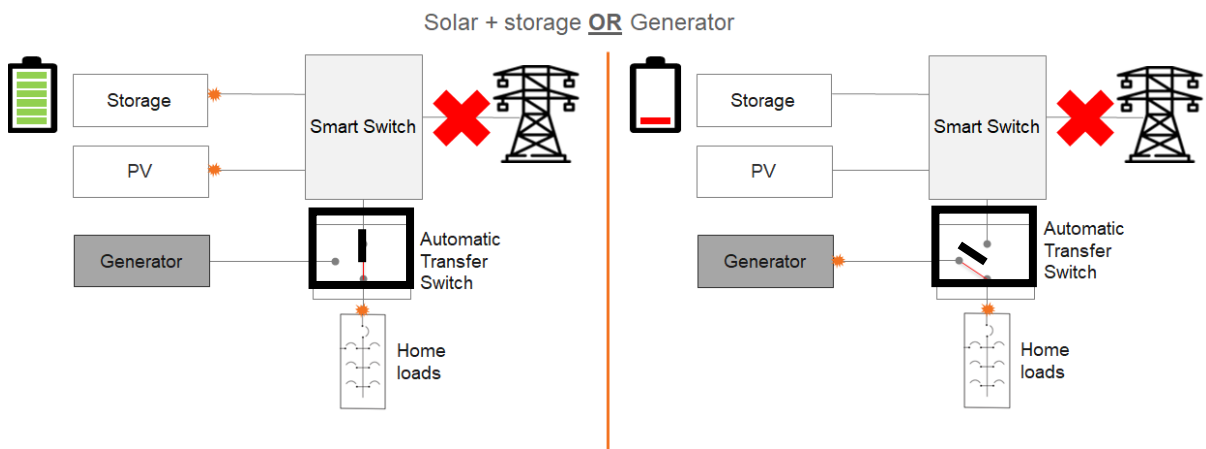


Figure 1: Typical competitor solution: Generator or PV + storage

The typical generator or PV + storage solution requires an external automatic transfer switch (ATS). The external ATS is normally installed between the smart switch and the home loads. The generator powers up the whole house or a backup load panel in the case of a grid outage only, after the battery is fully discharged. These solutions do not allow concurrent operation of the generator and the PV + storage system. In some cases, the PV and battery system is connected to a protected load subpanel via a manual transfer switch. This means the homeowner needs to manually transfer these loads to the generator when the battery can no longer power the loads. The homeowner always experiences a power interruption during transitions with external transfer switch-based generator solutions.

### Generator support with Enphase Energy System

The Enphase generator support solution is **generator AND PV + storage**, meaning the generator and renewables (PV and IQ Battery) can operate at the same time, providing backup power for the homeowners seamlessly. There is no external ATS, as the IQ System Controller has a built-in port for

generator connection. The IQ System Controller ensures that the generator is never connected to the home when the system is on-grid, i.e., connected to the utility grid. IQ System Controller also integrates a control port to signal the generator to turn on based on user preferences. The IQ Gateway in the system measures the generator, the PV, and the battery storage outputs to avoid back-feeding power from PV or storage systems to the generator. The Enphase generator support capability is efficient, simple, and user-friendly.

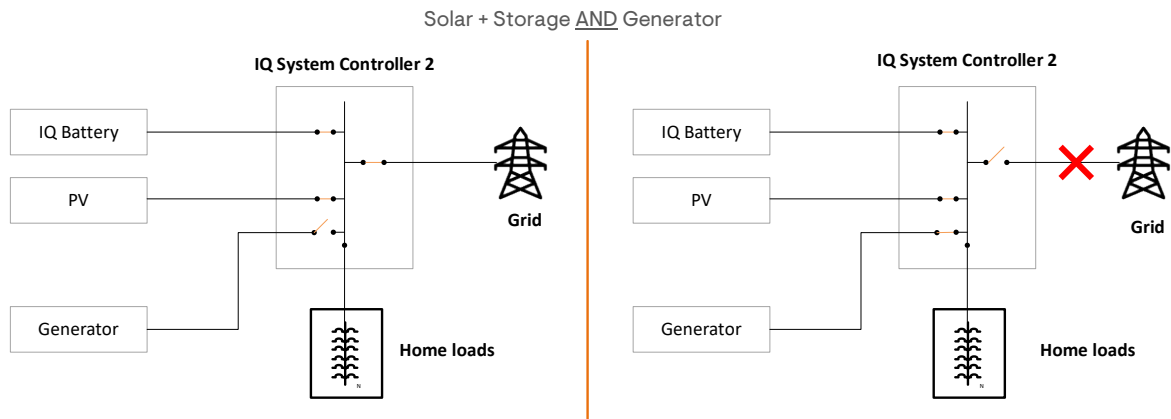


Figure 2: Enphase Energy System: Generator and PV + storage

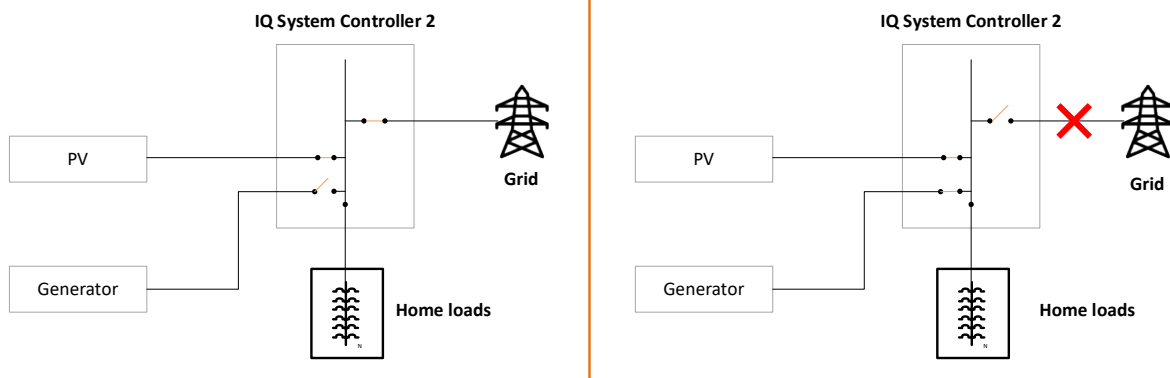
Integrating a generator with the Enphase Energy System has the following benefits:

- Allows the generator to charge batteries and serve loads.
- Enphase Installer App provides a single interface to configure, test, and validate the third-party generator integration.
- Ensures back-feed protection for the generator.
- Integrated warm-up and cool-down periods for generator operation.
- Provides a single integrated interface (Enphase App) for controlling and monitoring PV, storage, and generator at the homeowner’s fingertips.
- Sends maintenance reminders and other important notifications associated with the generator to homeowners via the Enphase App for homeowners.

### Generator support with IQ8 Series Microinverters in Sunlight Backup configuration

The Enphase Energy System Sunlight Backup configuration provides backup using IQ8 Series Microinverters when the sun is shining. The Sunlight Backup system does not include any IQ Batteries. The system can support PV branch circuits rated for up to 64 A continuous current output. Integrating a generator with a Sunlight Backup system provides a reliable source of power that does not depend on the irradiance available.

Sunlight Backup AND Generator



This configuration must be used with an Essential Loads solution. An Essential Loads solution consists of:

- An off-the-shelf panel with a maximum of four 240 V or eight 120 V pre-selected, essential load circuits that are backed up by the system. Additional breakers are needed to power the IQ Load Controllers.
- Up to two IQ Load Controllers, each enabling fine-grained, circuit-level control for two 240 V or four 120 V essential load circuits. Each 240 V load can be controlled independently, but the 120 V loads can be controlled in groups of up to two loads. Sunlight Backup systems need at least one IQ Load Controller to be installed on-site.

Using this configuration to back up an entire home will lead to a poor customer experience and is not a use case supported by Enphase.



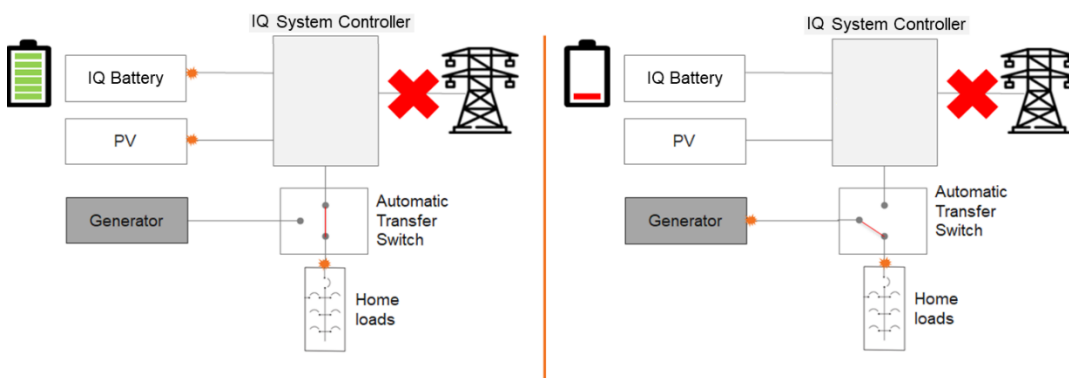
**NOTE:** Only use utility sense generators with Sunlight Backup systems. If a two-wire start generator is used, the system will not be able to start the generator when the system itself is powered off—for example, if the grid fails during the night. Utility sense generators will be able to sense a grid outage and start on their own.

Unsupported or undersized generator connections

If the generator model does not meet the required parameters or minimum sizing requirements, it is considered unsupported for full integration with the Enphase Energy System. In such cases, the unsupported generator can be used only as a backup to the Enphase Energy System.

In this configuration, the system must have an ATS located after the IQ System Controller that will allow the generator to turn on if the microgrid stops providing power. The ATS will also ensure that when the microgrid returns, the generator will be turned off and there will be no parallel power sources in operation.

Enphase Energy System OR Generator



## Generators that can be integrated with the Enphase Energy System

Different generators have different governor responses to changes in load. The Enphase Energy System also responds to changes in loads. To ensure smooth operation in a microgrid, Enphase has tested various generators and tuned its software to ensure that these responses to changes in loads do not destabilize a microgrid. Generators that are compatible with the Enphase Energy System are listed in Table 1. **Installers must pick generators from the table below to ensure that the generator is compatible with the Enphase Energy System.** Enphase requires installers to select a generator make and model during system commissioning using the Enphase Installer App. Only generators that are compatible with Enphase Energy System are available for selection in the Enphase Installer App.



**NOTE:** Depending on the microinverter series used in the system, a minimum generator size may be required based on the number of IQ Batteries in the system. The “Generator nameplate to storage nameplate pairing” section of this technical brief provides the minimum generator size corresponding to the number of IQ Batteries in the system to ensure stable microgrid operation.



**NOTE:** Use only utility sense generators with Sunlight Backup systems. If a two-wire start generator is used, the system will not be able to start the generator when the system itself is powered off—for example, if the grid fails during the night. Utility sense generators will be able to sense a grid outage and start on their own.

Table 1: List of generators recommended by Enphase

Model	Manufacturer name	Generator type	Start type	Nameplate rating
76153 (48 kW)	Briggs and Stratton	Standby	Auto	48
040336 (20 kW)	Briggs and Stratton	Standby	Auto	20
040590 (12 kW)	Briggs and Stratton	Standby	Auto	12
40586 (20 kW)	Briggs and Stratton	Standby	Auto	20
40303 (15 kW)	Briggs and Stratton	Standby	Auto	15
C20N6H-A061C601 (20 kW)	Cummins	Standby	Auto	20
RS13A/C13N6H (13 kW)	Cummins	Standby	Auto	13
C30N6H (30 kW)	Cummins	Standby	Auto	30
G007171-0, G007172-0 (10 kW)	Generac	Standby	Auto	10
G007173-0, G007174-0, G007175-0 (13 kW)	Generac	Standby	Auto	13

Model	Manufacturer name	Generator type	Start type	Nameplate rating
G007176-0, G007177-0, G007178-0 (16 kW)	Generac	Standby	Auto	16
G007038-1, G007039-1 (20 kW)	Generac	Standby	Auto	20
G007042-2, G007043-2 (22 kW)	Generac	Standby	Auto	22
G007038-3, G007039-3 (20 kW)	Generac	Standby	Auto	20
G007042-3, G007043-3 (22 kW)	Generac	Standby	Auto	22
G0064371 (11 kW)	Generac	Standby	Auto	11
G0055050 (17 kW)	Generac	Standby	Auto	17
G007035-0, G007036-0, G007037-0 (16 kW)	Generac	Standby	Auto	16
G0070400 (22 kW)	Generac	Standby	Auto	22
G0072269 (18 kW)	Generac	Standby	Auto	18
G007226-0, G007228-0 (18 kW)	Generac	Standby	Auto	18
G00072090, G00072101 (24 kW)	Generac	Standby	Auto	24
QT03624ANAX Protector QS Series (36 kW)	Generac	Standby	Auto	36
G0058750 (20 kW)	Generac	Standby	Auto	20
G0062561 (16 kW)	Generac	Standby	Auto	16
G007035-1, G007036-1, G007037-1 (16 kW)	Generac	Standby	Auto	16
G0052141 (25 kW)	Generac	Standby	Auto	25
G007223-0, G007224-0, G007225-0 (14 kW)	Generac	Standby	Auto	14
G0065510 (22 kW)	Generac	Standby	Auto	22
G0052440	Generac	Air-cooled	Auto	16
QT02525ANAN (25 kW)	Generac	Standby	Auto	25
G007163-0 (15 kW)	Generac	Standby	Auto	15
G007223-9 (14 kW)	Generac	Standby	Auto	14



Model	Manufacturer name	Generator type	Start type	Nameplate rating
G007043-10 (22 kW)	Generac	Standby	Auto	22
G0072109 (24 kW)	Generac	Standby	Auto	24
G0060551 (20 kW)	Generac	Standby	Auto	20
G0065512 (22 kW)	Generac	Standby	Auto	22
RG02224ANAX (22 kW)	Generac	Standby	Auto	22
G00072900, G0072910 (26 kW)	Generac	Standby	Auto	26
G0070311 (11 kW)	Generac	Standby	Auto	11
RG027 (27 kW) Protector QS Series	Generac	Standby	Auto	27
RG022 (22kW) Protector QS Series	Generac	Standby	Auto	22
G006244-0, G006250-0 (20 kW)	Generac	Standby	Auto	20
G0072101 (24 kW)	Generac	Standby	Auto	24
G0070430 (22 kW)	Generac	Standby	Auto	22
G007042-9 (22 kW)	Generac	Standby	Auto	22
G007033-0 (11 kW)	Generac	Automatic	Auto	11
0055592 (27 kW) 1800 RPM Model	Generac	Standby	Auto	27
0062810 (15 kW) Centurion	Generac	Standby	Auto	15
G0007042-0 (22 kW)	Generac	Standby	Auto	22
RG02724ANAX Protector QS Series (27 kW)	Generac	Standby	Auto	27
G0070438 (22 kW)	Generac	Standby	Auto	22
G0072100 (24 kW)	Generac	Standby	Auto	24
69981 (7.5 kW)	Generac	Standby	Auto	7.5
G0065511 (22 kW)	Generac	Standby	Auto	22
QTO2224ANAX QS Series (22 kW)	Generac	Automatic	Auto	22
HYW-14M6SAE240 120 V 60 Hz M6 (12 kW)	HiPower	Water-cooled diesel	Auto	12
G0062602 (17 kW)	Honeywell	Standby	Auto	17
G007060 (17 kW)	Honeywell	Standby	Auto	17

Model	Manufacturer name	Generator type	Start type	Nameplate rating
G007065-2 (22 kW)	Honeywell	Automatic	Auto	22
G007063-2 (20 kW)	Honeywell	Standby	Auto	20
G0070580 (11 kW)	Honeywell	Standby	Auto	11
G0070650 (22 kW)	Honeywell	Standby	Auto	22
G0070591 (16 kW)	Honeywell	Automatic	Auto	16
14RESA (14 kW)	Kohler	Standby	Auto	14
20RESA (20 kW)	Kohler	Standby	Auto	20
24RCL (24 kW)	Kohler	Standby	Auto	24
10RESV (10 kW)	Kohler	Standby	Auto	10
12RESV (12 kW)	Kohler	Standby	Auto	12
Kohler 20RESCL (20 kW)	Kohler	Standby	Auto	20
20RESCL (20 kW)	Kohler	Standby	Auto	20
20RCA (20 kW)	Kohler	Standby	Auto	20
20RESC (20 kW)	Kohler	Standby	Auto	20
14RCA (14 kW)	Kohler	Standby	Auto	14
30REYG	Kohler	Water-cooled ADC 2100 digital controller	Auto	27
12 RES (12 kW)	Kohler	Standby	Auto	12
8RESVL (8 kW)	Kohler	Standby	Auto	8
20RESL (20 kW)	Kohler	Standby	Auto	20

A generator that is not listed above will not be supported by the Enphase Energy System. Enphase tests standby generators as part of its system before it lists them above. Generators tested by Enphase are selected based on the criteria specified below:

- 240 V L-L, split-phase with neutral<sup>1</sup>
- Voltage regulation: Within -12% to +10%, i.e., 211.2 V (full load) to 264 V (no load)<sup>2</sup>
- Frequency regulation less than  $\pm 5\%$ , i.e., 58.15 Hz (full load) to 61.85 Hz (no load)<sup>2</sup>
- Generator start-up types:
  - Two-wire start
  - Utility sense-based start
  - Total harmonic distortion < 25%<sup>3</sup>

Generac Guardian models are also white-labeled and sold as Honeywell generators.

<sup>1</sup> Enphase does not support three-phase generators or 120 V single-phase generators. Only 240 V split-phase generators with a 4-wire connection, i.e., L1, L2, neutral, and ground, are supported.

<sup>2</sup> Generator voltage and frequency must not vary erratically in the specified range to ensure seamless operation with the Enphase system.

<sup>3</sup> The generator's total harmonic distortion (THD) must be less than 25% to ensure quality of power and minimize the chances of damaging sensitive electronic equipment in a microgrid.

Enphase cannot test every generator. Installers must select the generators listed above to ensure they can integrate and operate with the Enphase Energy System. Generators not listed above will not be supported. See the “Unsupported or undersized generator connections” section in this document for details on how to incorporate non-supported generators.

## Generator nameplate to storage nameplate pairing

The Enphase Energy System limits the usable generator power based on the type of IQ System Controller used in the system.

**For a system using an IQ System Controller 1**, the maximum generator current is limited to 48 A continuous (60 A overcurrent protection) to protect the associated power relays in the IQ System Controller 1 for the generator position.

**For a system using an IQ System Controller 2**, the maximum generator current is limited to 64 A continuous (80 A overcurrent protection) to protect the associated power relays in the IQ System Controller 2 for the generator position.

Generator sizes beyond the values mentioned above will not result in any improvement in terms of current or battery charging speed.

The system design also puts limits on the minimum generator nameplate for pairing with a given number of IQ Battery units. This limit varies depending on the microinverter family on the roof. **The minimum generator size must be maintained to ensure a stable microgrid when operating with IQ Battery and PV. This is to ensure the generator can be safely operated and does not get damaged by inadvertent back-feed from the PV and/or storage.**



**NOTE:** Sufficiently size the generator power rating to power loads and charge the IQ Batteries at the same time. The minimum generator size should be used as a starting point in the design.

**For systems with IQ8 Series Microinverters** in Sunlight Backup mode, the minimum generator nameplate rating must be at least 100% of the PV array-rated AC power output. The following table shows some examples of this pairing.

Table 2: Minimum generator nameplate rating for a Sunlight Backup system

Microinverter type	Rated output (W) of one microinverter	No. of microinverters	Minimum generator nameplate (kW)
IQ8	240	16 (1 branch circuit)	3.84
IQ8	240	32 (2 branch circuits)	7.68
IQ8PLUS	290	13 (1 branch circuit)	3.77
IQ8PLUS	290	20 (2 branch circuits)	5.8
IQ8H-240	380	15 (2 branch circuits)	5.7

**For systems with IQ8 Series Microinverters and IQ Batteries**, the minimum generator nameplate rating must be a) 100% of the PV array-rated AC power output or b) 143% of the IQ Battery array, **whichever is higher**. The following table shows some examples of generator pairing with an Enphase Energy System with IQ8 Series Microinverters and IQ Battery.

Table 3: Minimum generator nameplate rating for an Enphase Energy Systems with IQ8 Series Microinverters and IQ Battery

Microinverter type	Rated output (W) of one microinverter	No. of microinverters	Rated output power of the PV array (kW)	IQ Battery 3/3T units	IQ Battery 10/10T units	IQ Battery power (kW)	Minimum generator nameplate (kW)
IQ8	240	16 (1 branch circuit)	3.84	1	-	1.28	3.84
IQ8	240	32 (2 branch circuits)	7.68	2	-	2.56	7.68
IQ8PLUS	290	13 (1 branch circuit)	3.77	3	(One IQ Battery 10/10T)	3.84	5.49
IQ8PLUS	290	20 (2 branch circuits)	5.8	4	-	5.12	7.31
IQ8H-240	380	15 (2 branch circuits)	5.7	5	-	6.4	9.14
IQ8H-240	380	40 (4 branch circuits)	15.2	6	(Two IQ Battery 10/10T)	7.68	15.2
IQ8H-240	380	40 (4 branch circuits)	15.2	12	(Two IQ Battery 10/10T)	15.36	21.94

The Enphase Installer App allows you to connect to the system a lower or higher nameplate rated generator than the recommended generator capacity. However, as mentioned earlier, using smaller generators than stated herein may compromise microgrid stability and can damage the generator due to inadvertent back-feed.

**For IQ6/IQ7 or M Series Microinverters**, the minimum generator nameplate rating for pairing with the given number of IQ Battery units is shown in Table 4.



**NOTE:**

- When using IQ System Controller 1 with 20 kWh energy storage (i.e., more than two IQ Battery 10 units), the generator nameplate rating required exceeds the usable power from the generator port (i.e., 11.52 kW or 48 A at 240 V) from the generator.
- When using IQ System Controller 2 with 30 kWh energy storage or more (i.e., three or more IQ Battery 10 units), the generator nameplate rating required exceeds the usable power from the generator port (i.e., 15.36 kW or 64 A at 240 V) from the generator.

The Enphase Installer App allows you to connect to the system a lower or higher nameplate-rated generator than this value of generator capacity. However, as mentioned earlier, using smaller generators than stated herein may compromise microgrid stability and can damage the generator due to inadvertent back-feed.

The nameplate value and maximum continuous generator current can be set in the Enphase Installer App while commissioning the generator. The IQ Gateway will ensure that the system does not draw

more than the generator nameplate rating and keeps generator usage below the maximum continuous generator current.

Table 4: Minimum generator nameplate rating for a given number of IQ Battery units with IQ6/IQ7 Series

IQ Battery 3/3T units	IQ Battery 10/10T units	IQ Battery energy (kWh)	IQ Battery power (kW)	Minimum generator nameplate (kW)
1		3.36	1.28	1.83
2		6.72	2.56	3.66
3	(One IQ Battery 10)	10.08	3.84	5.49
4		13.44	5.12	7.31
5		16.8	6.4	9.14
6	(Two IQ Battery 10)	20.16	7.68	10.97
7		23.52	8.96	12.80
8		26.88	10.24	14.63
9	(Three IQ Battery 10)	30.24	11.52	16.46
10		33.6	12.8	18.29
11		36.96	14.08	20.11
12	(Four IQ Battery 10)	40.32	15.36	21.94

## System configuration

When the system is on-grid, the use of a generator is not allowed. When the system goes into backup mode, the generator can operate. The generator can be used to charge the batteries and/or serve excess loads.

The supported system configurations are:

- Generator with IQ Battery and IQ6/7/8 Series Microinverters
- Generator with IQ Battery and M Series Microinverters
- Generator with IQ8 Series Microinverters in Sunlight Backup

The system works well for Sunlight Backup, Home Essentials, and Full Energy Independence configurations.



**NOTE:** An Enphase Energy System with IQ6/7 Series Microinverters can use both IQ System Controller 1 and IQ System Controller 2. The continuous current rating for the generator port is 48 A for IQ System Controller 1 and 64 A for IQ System Controller 2.



**NOTE:** The system configuration in this section represents a system with IQ System Controller 1. The system configuration will remain the same for a system using IQ System Controller 2. For more details, refer to [IQ System Controller 2 Quick Install Guide](#).



when an IQ Battery system with smaller energy and power capacity and some basic load backup is desired by the customer, or when existing constraints prevent main panel backup or other installation methods. The following figure shows an example of a Home Essentials backup configuration.

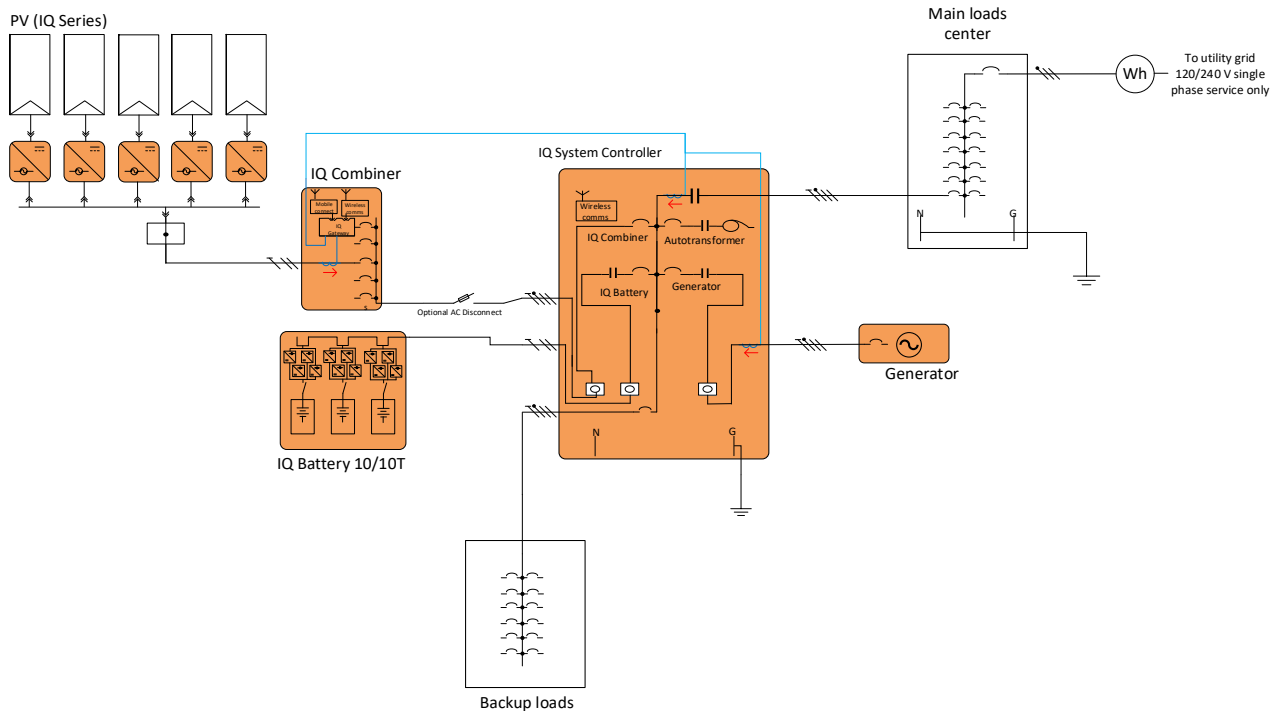


Figure 4: Enphase Energy System in Home Essentials configuration for IQ6/7 Series Microinverters

IQ System Controller is installed on the load side of the main load panel with select loads backed up in a backup subpanel. The generator is wired into the generator port on the IQ System Controller.



**NOTE:** Whenever a generator is installed, the consumption current transformers (CTs) for L1 and L2 must be placed inside the IQ System Controller on the L1 and L2 conductors feeding the grid breaker (if present) or the grid side lugs as described in the [IQ System Controller 2 Quick Install Guide](#). The arrows on the CTs must point upward to ensure correct polarity.

## Generator with IQ Battery and M Series Microinverters

Envoy S Metered must be used as the communications gateway with M Series Microinverters to work with IQ Battery. The generator is wired into the generator port on the IQ System Controller. An overcurrent protection device, i.e., breaker up to 60 A for IQ System Controller 1 and up to 80 A for IQ System Controller 2, must be populated inside the IQ System Controller on the designated spot. Also required is to wire an external double pole contactor (to be purchased separately) to the PV branch circuit connecting to the Envoy S Metered to break the L1 and L2 connection and shed PV when the generator is operating as shown in Figure 5 and Figure 6. This will eliminate the possibility of PV back-feeding the generator in an uncontrolled manner, which could occur with the M Series Microinverters. The system works well for both Full Energy Independence and Home Essentials configurations as shown in Figure 5 and Figure 6.



**NOTE:** Enphase Energy System with M Series Microinverters can use both IQ System Controller 1 and IQ System Controller 2. The continuous current rating for the generator port is 48 A for IQ System Controller 1 and 64 A for IQ System Controller 2.

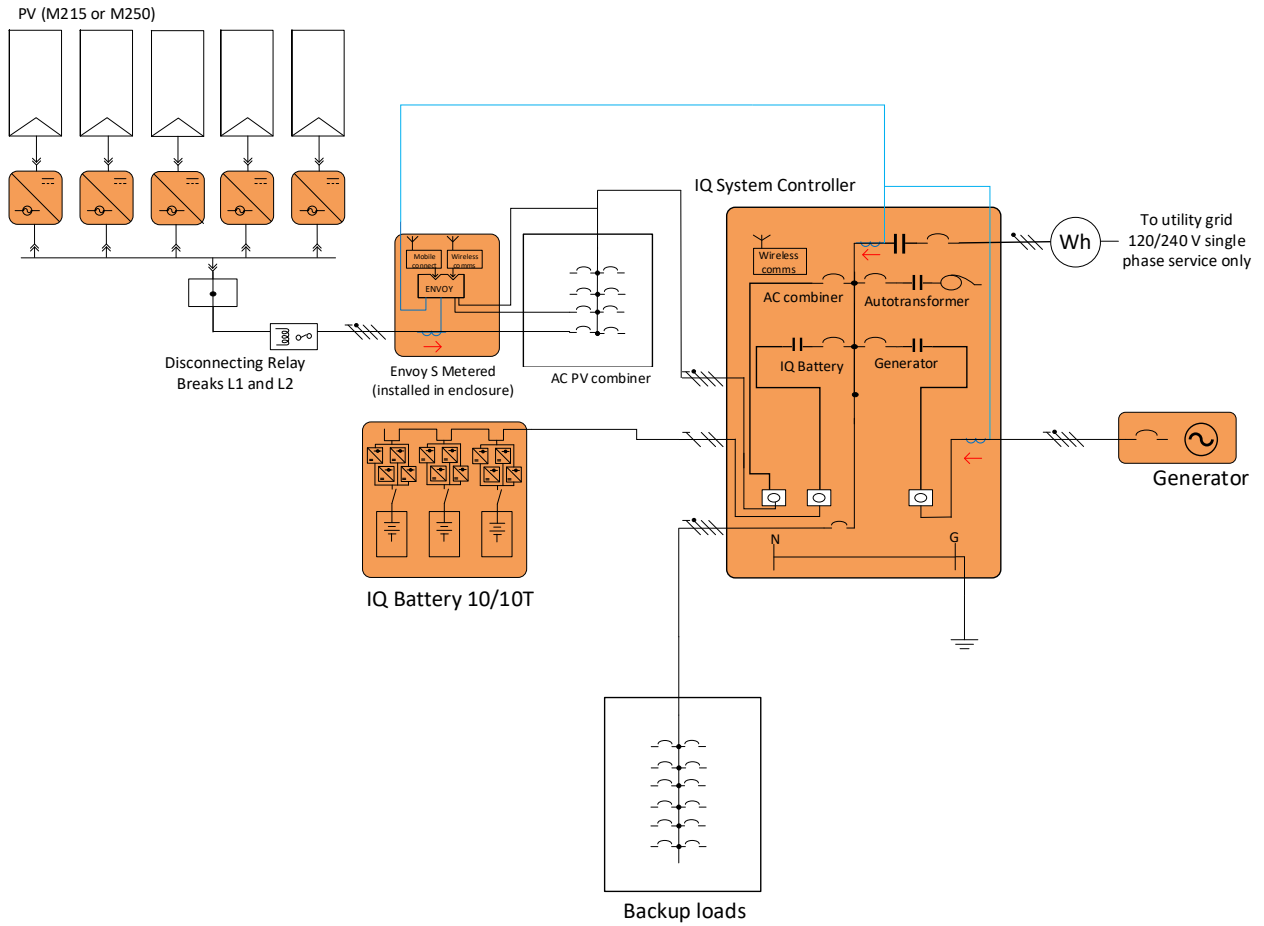


Figure 5: Enphase Energy System in Full Energy Independence configuration for M Series PV Microinverters.

The IQ System Controller is installed on the line side of the main load panel, and PV, IQ Battery storage system, and generator are connected to the IQ System Controller.

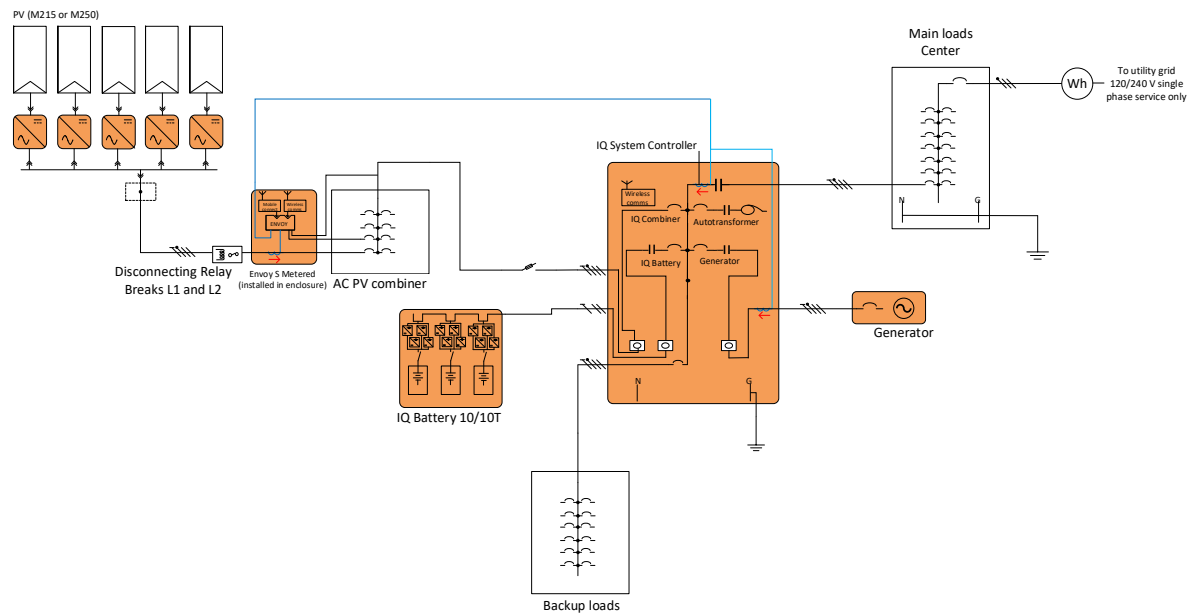


Figure 6: Enphase Energy System in Home Essentials configuration for M Series PV Microinverters.



The IQ System Controller is installed on the load side of the main load panel with select loads backed up in a backup subpanel. The generator is wired into the generator port on the IQ System Controller.



**NOTE:** Whenever a generator is installed, the Consumption CTs for L1 and L2 must be placed inside the IQ System Controller on the L1 and L2 conductors feeding the grid breaker (if present) or the grid side lugs as described in the [IQ System Controller 2 Quick Install Guide](#). The arrows on the CTs must point upward to ensure correct polarity.

## Generator with IQ Battery and IQ8 Series Microinverters



**WARNING:** IQ8 Series Microinverters in backup configurations need IQ System Controller 2 to function properly. **IQ System Controller 1 will not work and is not safe to use with IQ8 Series Microinverters.**

A generator can be added to an Enphase Energy System that has IQ8 Series Microinverters on the roof, IQ Combiner 4C (or a stand-alone IQ Gateway), IQ Batteries, and **IQ System Controller 2**. It can be connected in Home Essentials or Full Energy Independence configurations.

In the Full Energy Independence backup configuration, the IQ System Controller 2 is installed on the line side of the main load panels rated up to 200 A. This allows a properly sized Enphase Energy System to provide power to all loads in the event of a grid outage. In this configuration, you can configure the IQ System Controller with the main breaker to act as the service disconnecting means. You can interconnect the PV system to the IQ System Controller on a dedicated breaker or interconnect it to the load panel. A generator is also wired into the generator port on the IQ System Controller 2. An overcurrent protection device, i.e., a breaker up to 80 A, must be populated inside the IQ System Controller 2 on the designated spot. This configuration typically supports larger PV and storage system sizes and may allow you to avoid expensive utility service and/or main service panel upgrades. One example of this Full Energy Independence backup configuration is shown in the following figure:

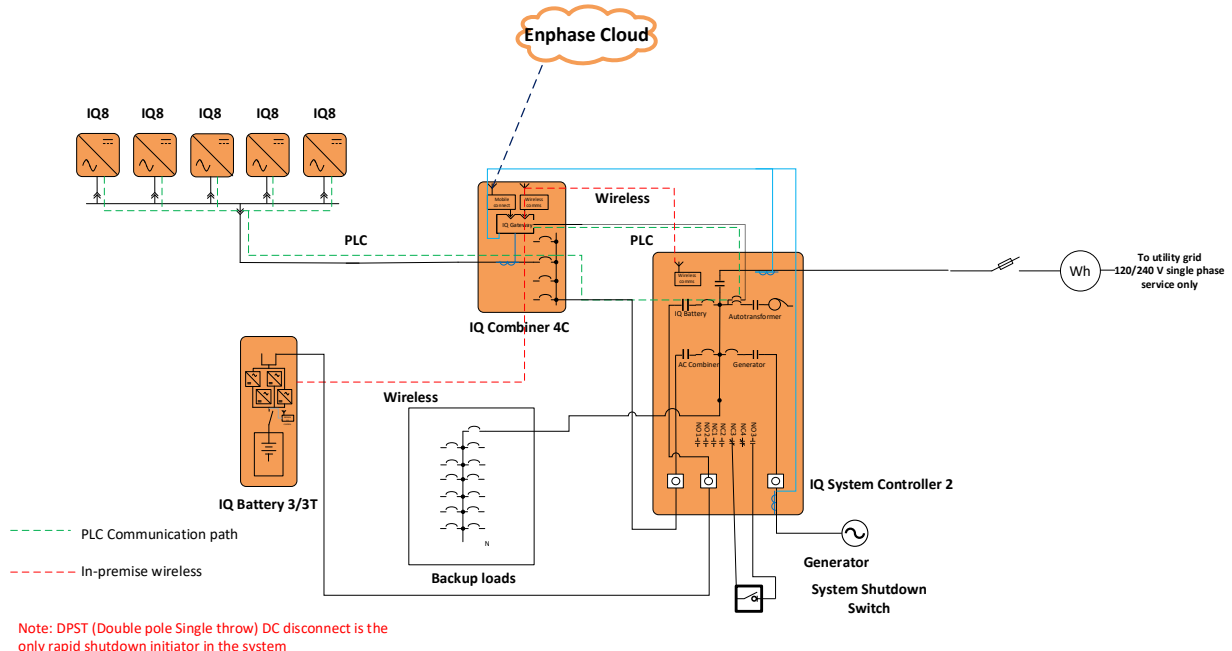


Figure 7: Enphase Energy System in Full Energy Independence configuration for IQ8 Series PV Microinverters

The IQ System Controller 2 is installed as service equipment on the line side of the main load panel, and PV, IQ Battery storage system, and generator are connected to the IQ System Controller 2.

You can also install the Enphase Energy System in the Home Essentials configuration. In this configuration, IQ System Controller 2 is on the load side of the existing main load panel or service equipment. The generator is connected to the IQ System Controller 2 in the same way as in the Full

Energy Independence backup configuration. Use this configuration when the Enphase Energy System is configured to provide backup to several preselected load circuits. This configuration is recommended when an IQ Battery system with smaller energy and power capacity and some basic load backup is desired by the customer, or when existing constraints prevent main panel backup or other installation methods. The following figure shows an example of a Home Essentials backup configuration.

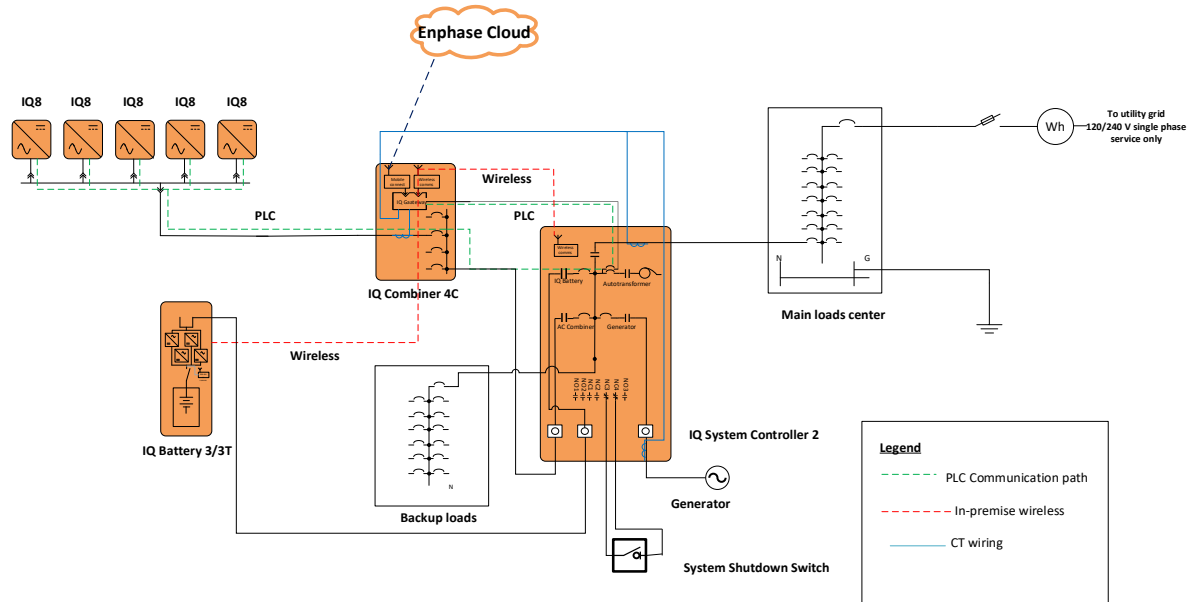


Figure 8: Enphase Energy System in Home Essentials configuration for IQ8 Series PV Microinverters  
 IQ System Controller 2 is installed on the load side of the main load panel with select loads backed up in a backup subpanel. The generator is wired into the generator port on the IQ System Controller 2.

## Generator with IQ8 Series Microinverters in Sunlight Backup configuration

You can also install an IQ8 backup system in Sunlight Backup configuration, where the Enphase Energy System provides backup using IQ8 Series Microinverters when the sun is shining. The system does not include any IQ Batteries. The system can support PV branch circuits rated for up to 64 A continuous current output. The IQ System Controller 2 is installed on the load side of an existing main load panel.

This configuration must be used with an Essential Loads solution. An Essential Loads solution consists of:

- An off-the-shelf panel with a maximum of four 240 V or eight 120 V pre-selected, essential load circuits that are backed up by the system. Additional breakers are needed to power the IQ Load Controllers.
- Up to two IQ Load Controllers, each enabling fine-grained, circuit-level control for two 240 V or four 120 V essential load circuits. Each 240 V load can be controlled independently, but the 120 V loads can be controlled in groups of up to two loads. A Sunlight Backup system needs at least one IQ Load Controller to be installed on-site.

Using this configuration for backing up an entire home will lead to poor customer experience and is not a use case supported by Enphase. Refer to [“Understanding Sunlight Backup system for installers and system designers”](#) for details on Sunlight Backup system design and limitations.



**NOTE:** Use only utility sense generators with Sunlight Backup systems. If a two-wire start generator is used, the system will not be able to start the generator when the system itself is powered off—for example, if the grid fails during the night. Utility sense generators will be able to sense a grid outage and start on their own.



**NOTE:** The generator’s AUTO/OFF/MANUAL switch must be in the AUTO position to ensure it automatically starts up.

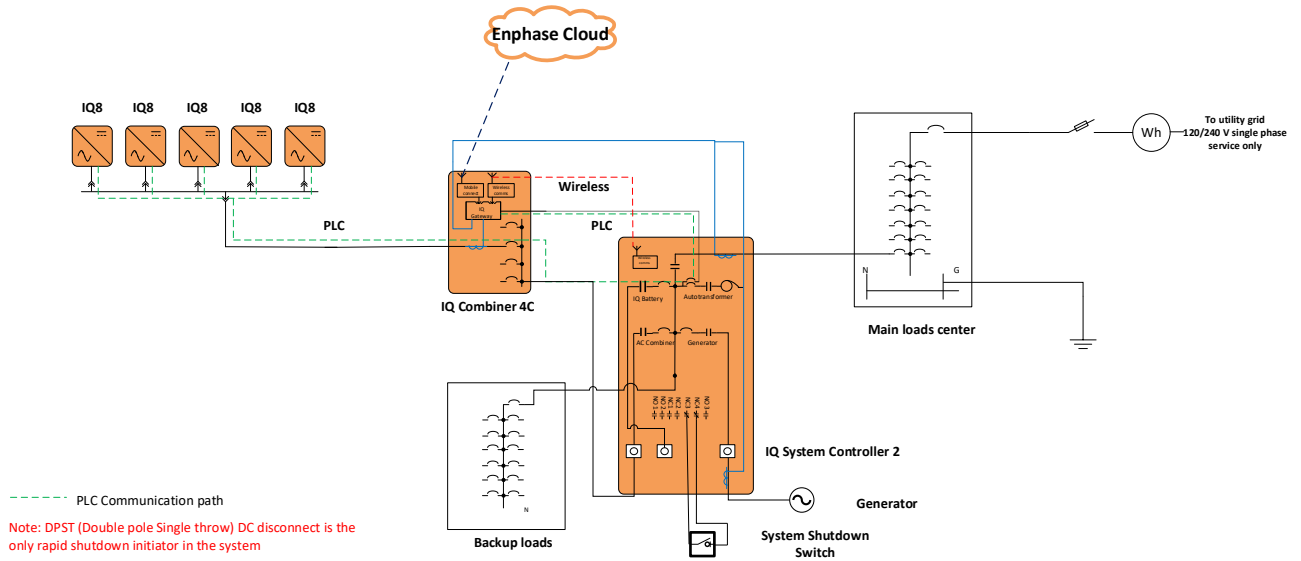


Figure 9: Enphase Energy System in Sunlight Backup configuration for IQ8 Series PV Microinverters

IQ System Controller 2 is installed on the load side of the main load panel with select loads backed up in a backup subpanel. The generator is wired into the generator port on the IQ System Controller 2.



**NOTE:** Whenever a generator is installed, the consumption CTs for L1 and L2 must be placed inside the IQ System Controller on the L1 and L2 conductors feeding the grid breaker (if present) or the grid side lugs as described in the [IQ System Controller 2 Quick Install Guide](#). The arrows on the CTs must point upward to ensure correct polarity.

## Connecting a generator to Enphase Energy System

The Enphase Energy System supports the addition of a third-party generator. Note that the system only supports two-wire or utility sense-based auto-start generators. L1 and L2 AC lines from the generator land on the generator lugs on the IQ System Controller shown in Figure 10. Ensure you also connect the neutral and earth lines of the generator to the neutral and earth terminal strips within the IQ System Controller. The generator auxiliary contact for the two-wire or utility-sense-based start is the Gen I/O port also shown in Figure 10. Generator parallel consumption CTs should be connected, maintaining the same polarity and phase assignment as the other CTs in the system. The usage of these ports is described in further detail in the succeeding sections of the tech brief.



**WARNING:** Do not connect a generator directly to the IQ System Controller generator breaker; connect only to indicated terminals. Ensure the neutral of the generator is connected to the IQ System Controller’s neutral bar. Ensure that the ground terminal of the generator is connected to the ground bar inside IQ System Controller. Size the generator’s equipment grounding conductor as per NEC T250.122 and the generator manufacturer’s instructions.

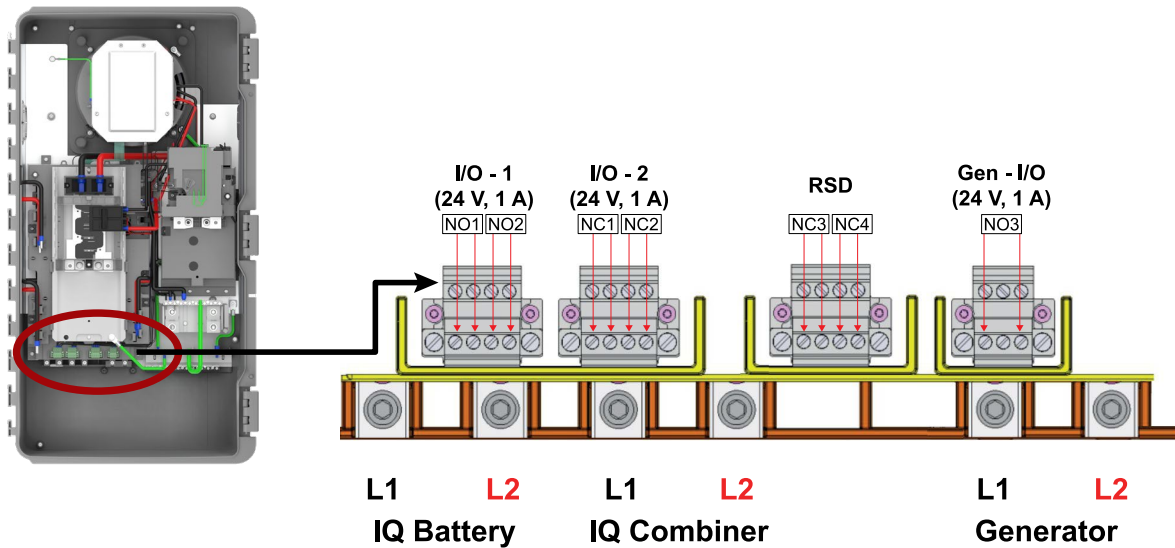


Figure 10: Enlarged view of generator lugs and auxiliary contact

System Controller 2 allows for generator integration with the Enphase Energy System. The breaker on the bottom right slot can be used to integrate the generator and should be sized appropriately.

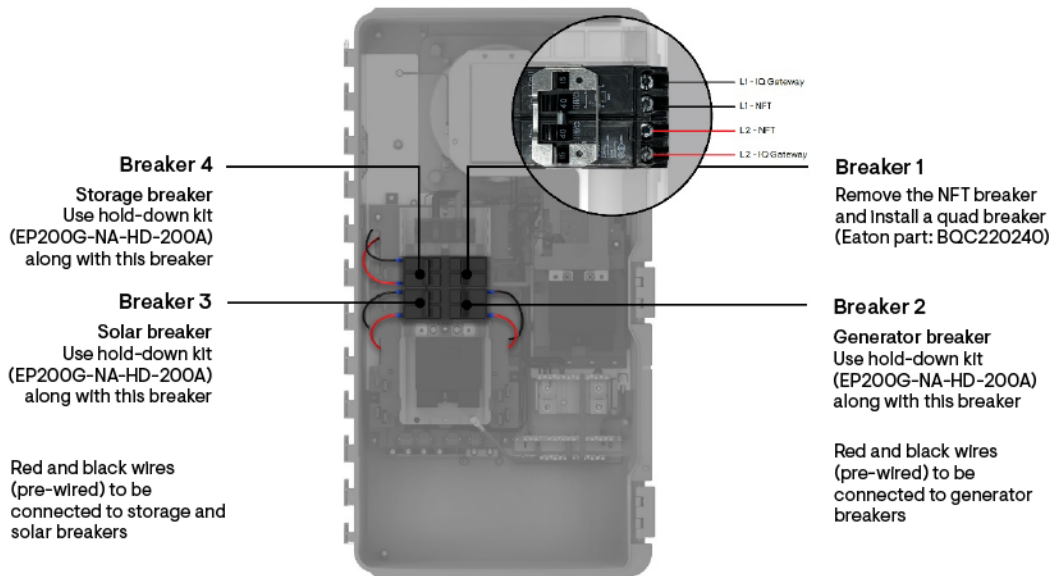


Figure 11: IQ System Controller 2 breaker mounting positions while integrating with a generator

### Auxiliary contact connections

IQ System Controller has auxiliary contact control to shed excess load and excess PV when going off-grid. IQ System Controller also has auxiliary contacts for the generator, which can be wired to the generator for remote start. Steps for using the IQ System Controller Generator auxiliary contacts are listed below:

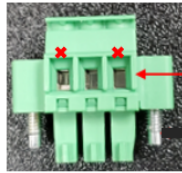
1. Feedthrough headers ship with IQ System Controller as part of the literature kit (EP200G-LITKIT).

2. Generator auto-start via a two-wire interface or utility sense is wired using the Generator I/O port on IQ System Controller.
3. Insert the two wires (supports AWG 28 to AWG 16 wire sizes) from the auto-start interface into feed-through headers and tighten the screws (torque 0.22 N m/(1.9 lb-in) to 0.25 N m/2.2 lb-in)).
4. Insert the feed-through header into the Generator I/O port on IQ System Controller and tighten the screws on the side.



**NOTE:** Ensure you use the Generator I/O or Gen - I/O terminals for generator auto-start. Using I/O - 1 or I/O -2 terminals will not work for generator auto-start.

**Step 1:** Insert wires in the marked terminals



**Step 2:** Tighten screws to hold wires in place



**Step 3:** Insert the feedthrough header into the I/O port in IQ System Controller in the orientation shown



**Step 4:** Tighten screws to secure the feedthrough header to the I/O port



Figure 12: IQ System Controller generator auxiliary contact usage

## Installation of standby generators with two-wire remote start

This system is only compatible with permanently installed generators that are non-separately derived as per NEC 250.35(B).

1. Wire the generator auxiliary contact in IQ System Controller to the two-wire remote-start terminals of the generator.
2. Wire the L1 and L2 AC wires from the generator into the generator lugs on the IQ System Controller.
3. Connect the neutral wire from the generator to an appropriately sized position on the neutral bar inside IQ System Controller.
4. Ensure that the ground terminal of the generator is connected to the ground bar inside IQ System Controller. Size the generator’s equipment grounding conductor as per NEC 250.122 and the generator manufacturer’s instructions.
5. Buy and install an appropriately sized breaker for the generator on the IQ System Controller’s busbar and connect the L1 and L2 generator cables from IQ System Controller’s ATS board to this breaker.



**NOTE:** The maximum allowed breaker size for IQ System Controller 1 is 60 A and for IQ System Controller 2 is 80 A. Select an Eaton BR breaker model that has the hole for the additional fastener as per NEC 480.36(D). Available models: BR220B, BR230B, BR240B, BR250B. Eaton breakers BR260 and BR280 also have a hole for the hold-down kit.

6. Purchase and install an Eaton-type BR circuit breaker hold-down screw kit (model BRHDK125) to secure the generator breaker.
7. If the generator requires a constant 120 VAC for the battery charger, connect this to the backup load panel with a fuse if required as specified by the generator manufacturer.

8. Have a certified contractor install the gas line required to supply the unit.
9. Install parallel generator CTs (CT-200-SPLIT) for L1 and L2 at the IQ System Controller's Generator input terminal for power monitoring when the generator is running. Refer to [IQ System Controller 1 Quick Install Guide](#) or [IQ System Controller 2 Quick Install Guide](#) for how to wire the generator CTs in parallel with the IQ Gateway's Consumption CTs and how to connect the CT leads to the IQ Gateway terminals.
10. Use the Enphase Installer App to commission and program IQ System Controller to control the generator.

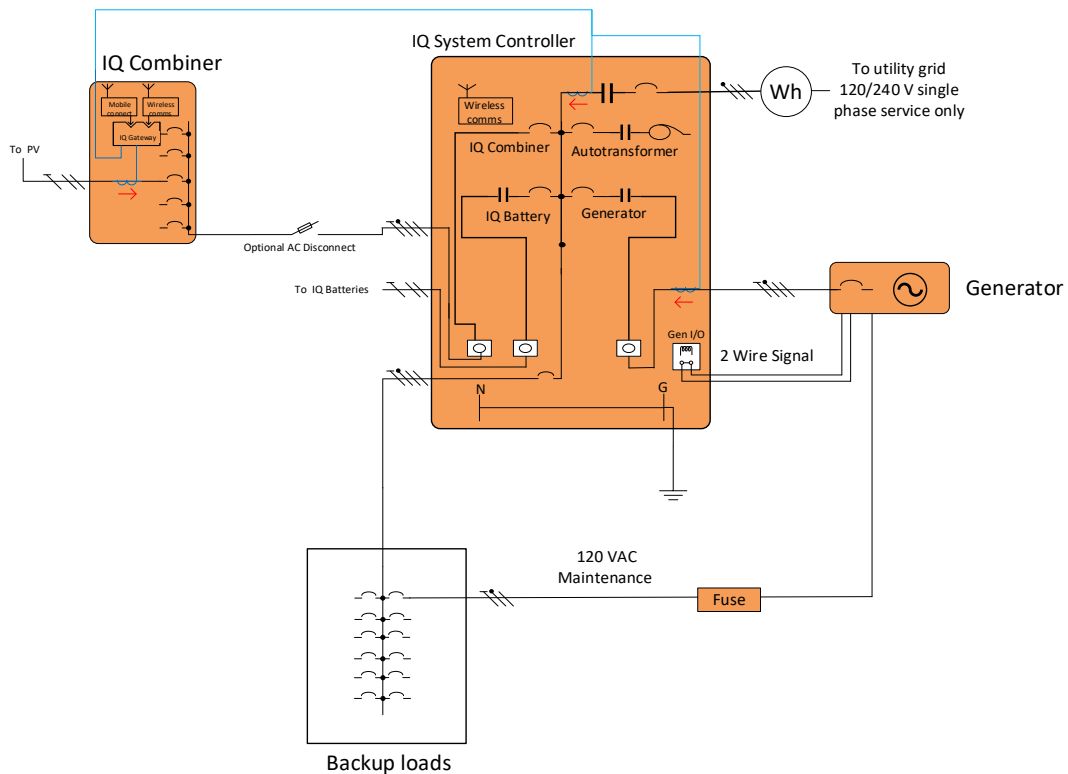


Figure 13: Generator auxiliary contact wiring for two-wire remote-start generator

## Installation of standby generators with utility sense–based remote start



**NOTE:** This system is only compatible with permanently installed generators that are non-separately derived as per NEC 250.35(B).

1. Wire the L1 and L2 AC wires from the generator into the generator lugs on the IQ System Controller.
2. Connect the neutral wire from the generator to an appropriately sized position on the neutral bar inside IQ System Controller.
3. Ensure that the ground terminal of the generator is connected to the ground bar inside IQ System Controller. Size the generator's equipment grounding conductor as per NEC T250.122 and the generator manufacturer's instructions.
4. Buy and install an appropriately sized breaker for the generator on the IQ System Controller's busbar and connect the L1 and L2 generator cables from the ATS board to this breaker.





**NOTE:** The maximum allowed breaker size for IQ System Controller 1 is 60 A and for IQ System Controller 2 is 80 A. Select an Eaton BR breaker model that has the hole for the additional fastener as per NEC 480.36(D). Available models: BR220B, BR230B, BR240B, BR250B. Eaton breakers BR260 and BR280 also have a hole for the hold-down kit.

5. Purchase and install an Eaton-type BR circuit breaker hold-down screw kit (model BRHDK125) to secure the generator breaker.
6. If the generator requires a constant 120 VAC for the battery charger, connect this to the backup load panel with a fuse if required as specified by the generator manufacturer.
7. Review the utility sense-based generator diagram shown in the following figure and make the connections for the utility-sensing generator start/stop control circuit as outlined in the next section.
8. Have a certified contractor install the gas line required to supply the unit.
9. Install parallel generator consumption CTs (CT-200-SPLIT) for L1 and L2 at the IQ System Controller’s generator input terminal for power monitoring when the generator is running. Refer to [IQ System Controller 1 Quick Install Guide](#) or [IQ System Controller 2 Quick Install Guide](#) for how to wire the generator CTs in parallel with the consumption CTs and how to connect the CT leads to the IQ Gateway terminals.
10. Use the Enphase Installer App to commission and program IQ System Controller to control the generator.

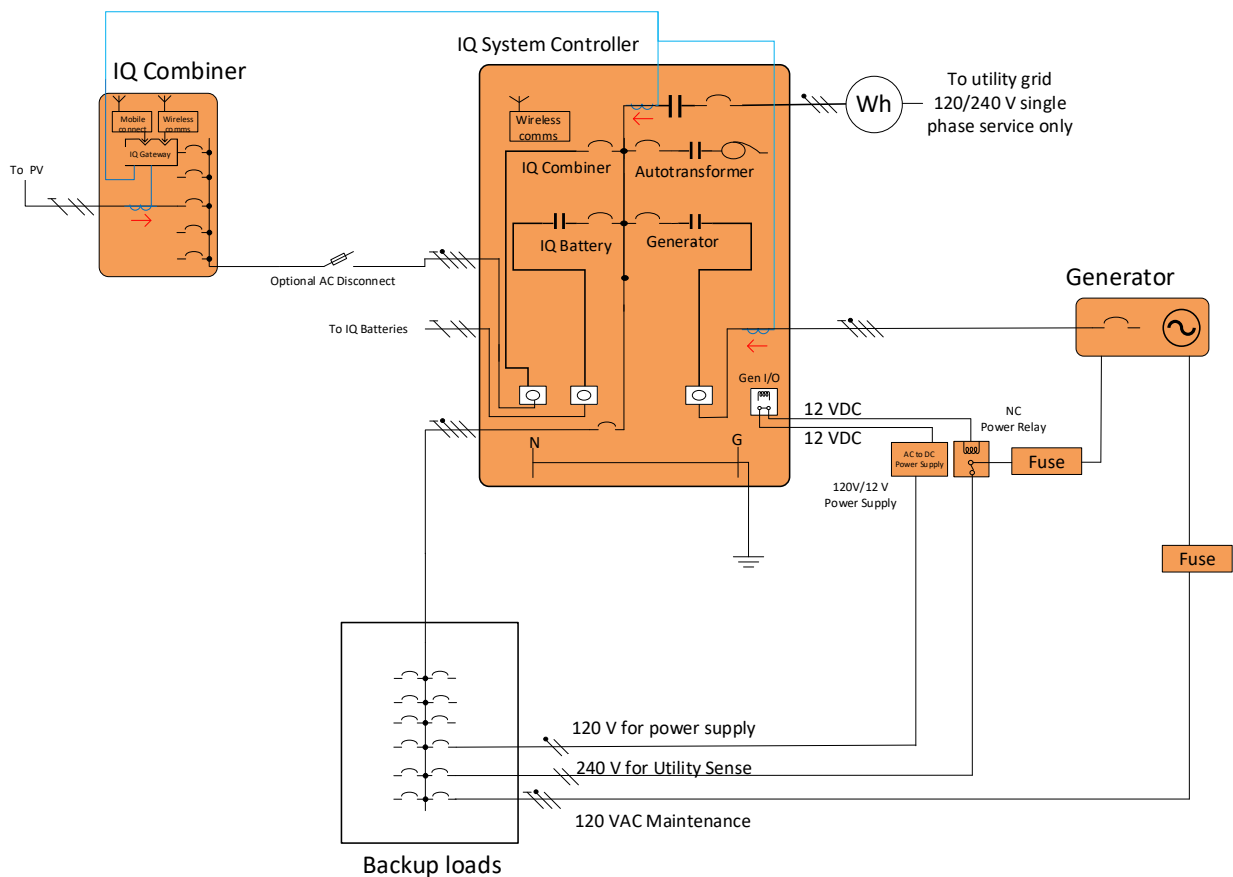


Figure 14: Generator auxiliary contact wiring for utility sense-based remote-start generator



**NOTE:** The above figure represents a system with IQ System Controller 1. The system configuration will remain the same for a system using IQ System Controller 2. For more details, refer to [IQ System Controller 2 Quick Install Guide](#).

## Equipment needed and wiring instructions for controlling a utility-sensing generator using an external relay

The auxiliary contacts within the IQ System Controllers 1 and 2 have a maximum input voltage of 24 V AC or DC and a maximum of 1 A current limit. Exceeding these parameters will damage the circuitry within the IQ System Controller and is not a warranted failure. The bill of materials below contains tested power supplies in the 12 VDC range that can be used to provide the power needed to control the utility sense relay for control of those units. Also below is a diagram that will assist in the wiring needed for the utility sense connections. Note that the power for all the utility sense devices must come from the backup loads panel to have proper operation. This will ensure that a loss of power or microgrid collapse will also start the generator. The generator's AUTO/OFF/MANUAL switch must be in the AUTO position to ensure it automatically starts up.

Make the connections for the utility-sensing generator start/stop control circuit as outlined below:

1. Wire the input of a 12 VDC power supply to the backup loads panel.
2. Wire one end of the DC power supply output to one of the terminals of the generator auxiliary contact (NO3) on the IQ System Controller.
3. Wire the other terminal of the generator auxiliary contact (NO3) to the coil of an external Normally Closed (NC) power relay.
4. Wire the other end of the DC power supply output to the other end of the coil of the NC power relay.
5. Wire one terminal of the external NC power relay to one of the poles of a double pole breaker on the backup loads panel.
6. Wire the other terminal of the external NC power relay to one of the utility sense terminals on the generator through a fuse.
7. Wire the second pole of the double pole breaker on the backup loads panel to the second utility sense terminal on the generator via a fuse.



**WARNING:** During IQ System Controller service, it will be necessary to put the generator soft key from AUTO to OFF for safety.

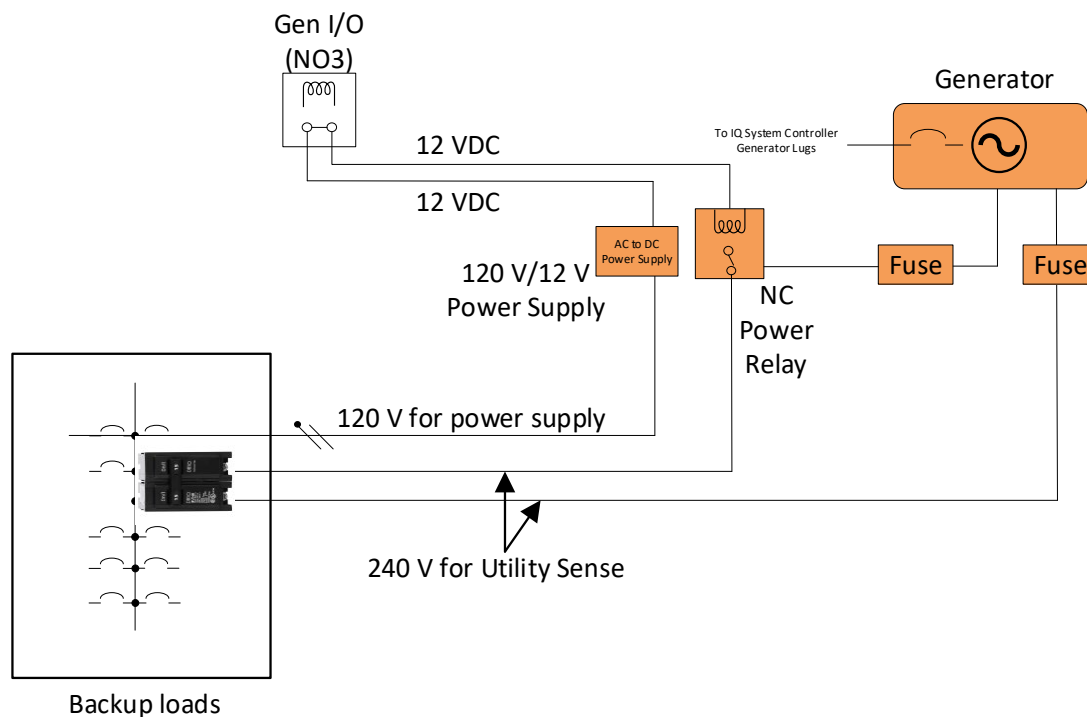


Figure 15: Utility sense wiring



Table 5: Equipment needed for utility sense generator support

Equipment	Recommendations
Power relay	<ul style="list-style-type: none"> <li>American Zettler AZ2280-1C-12DEF</li> <li>Schneider W9AS5D52-12</li> </ul>
12 V DC power supply	<ul style="list-style-type: none"> <li>Meanwell Apv-12-12</li> </ul>
Mounting box	<ul style="list-style-type: none"> <li>Kraloy JBOX JBX12128</li> <li>Cantex Junction Box 5133713</li> <li>NEMA 3R 8 in. x 8 in. x 6 in. Carbon Steel Weatherproof Screw Cover Wall-Mount</li> </ul>
Fuse	<p>Use generator manufacturer-specified rated fuse.</p> <p>For example,</p> <ul style="list-style-type: none"> <li>You can select a class G fuse from Eaton with the appropriate rating as recommended by the manufacturer <a href="#">here</a></li> <li>Or you can select 2AG, 3AG, or 5x20 mm fuses for inline fuse holders from Little Fuse</li> </ul>
Fuse holder	<p>You can select</p> <ul style="list-style-type: none"> <li>Fuse blocks from Little Fuse compatible with class G fuses. Examples: LFR250301P (single pole), LFR250302P (double pole), LFR250303P (three pole), or choose a Class G fuse block from Eaton <a href="#">here</a></li> <li>150 Series - In-Line Fuse holder for 2AG, 3AG, or 5x20 mm fuses</li> </ul>

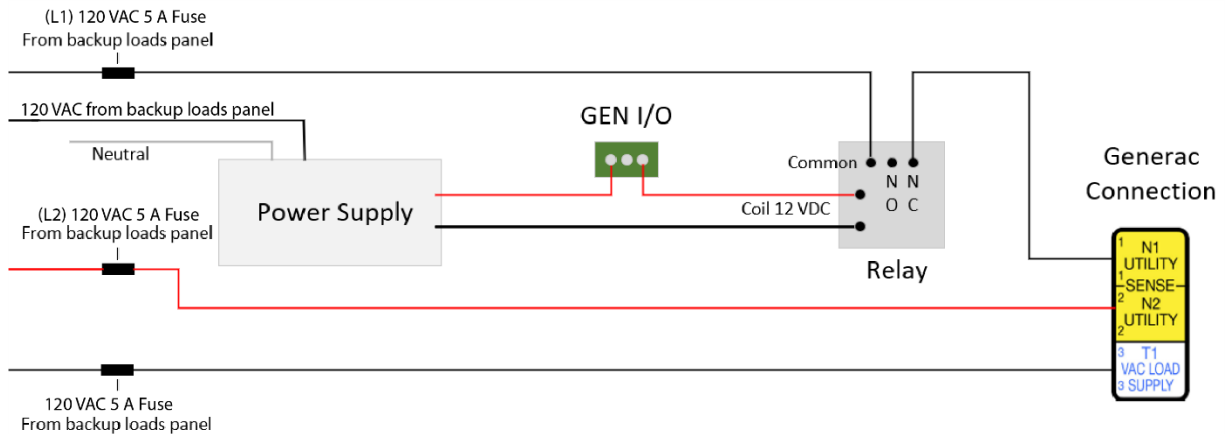


Figure 16: Wiring diagram for utility sense generator support

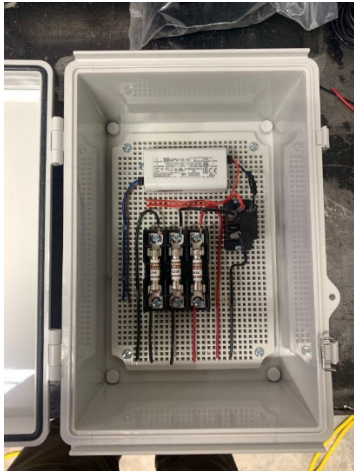


Figure 17: Sample equipment for utility sense generator support

## Back-feed protection for remote start generator with M Series

This section provides information to enable installers to understand and plan for generator support for M Series Microinverter-based systems.

You will need to wire an external double pole contactor to the Envoy-S Metered to enable the shedding of PV when the generator is operating. This is to eliminate the possibility of generator back-feeding that could occur with M Series Microinverters. The normally open contact within the Envoy-S Metered can be used to drive an external contactor to provide this protection.

The L2 from the backed-up loads panel comes into the normally open contact terminal of the Envoy-S Metered via a 3 A fuse. The C-terminal of the Envoy-S Metered is connected to one of the ends of an external contactor's coil, enabling the Envoy-S Metered to control the external contactor/power relay. The other end of the external contactor's coil must be connected to the Neutral bar in the backed-up loads panel. The L1 and L2 terminals of the aggregate PV output going into the IQ System Controller are switched by the external contactor. Normally, open terminals are utilized on the external contactor. When Envoy-S Metered closes the internal contact/pilot relay, the external contactor's coil is energized. The external contactor then closes and ensures the M Series Microinverters can see the grid reference signal and therefore produce power. When required, Envoy-S Metered opens the internal contact that in turn results in the external contactor disconnecting L1 and L2. This results in the M Series Microinverters stopping power production as they cannot see the grid reference signal.

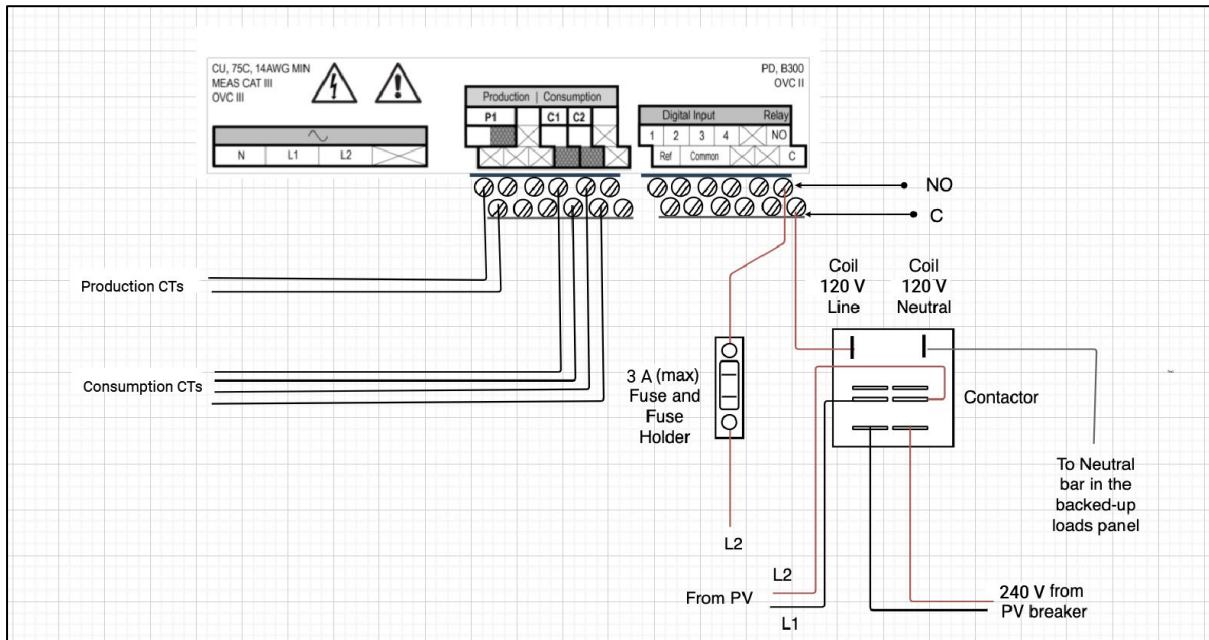


Figure 18: Wiring Envoy-S Metered for back-feed protection

Relay examples:

1. Dayton 1EJG7A (DPDT), double-pole, double-throw, 30 A, encapsulated relay
2. Dayton 5X847N (DPDT), double-pole, double-throw, 40 A, open contact relay

## Configuration of different generator models

Remote-start generators can be connected to an Enphase Energy System. Remote-start generators can be either two-wire start or utility-sense. The following sections contain the schematics from the manuals of supported generators that have been tested with the Enphase Energy System. These diagrams show the location and type of signaling needed to work with the auxiliary contacts from the IQ System Controller.

Always consult the generator’s installation manual before installation. Supported generator models are:

- Kohler
- Generac
- Briggs & Stratton



**NOTE:** The configurations of different generator models given in this document represent a system with IQ System Controller 1. The system configuration will remain the same for a system using IQ System Controller 2. For more details, refer to [IQ System Controller 2 Quick Install Guide](#).

## Kohler

All models of the generator from Kohler are two-wire start generators. The line diagram for connecting a Kohler generator to an Enphase Energy System is shown in the following figure. Connect two-wire remote-start terminals of the generator (pins 3 and 4) to the generator auxiliary contact in IQ System Controller. Wire the generator output into the IQ System Controller’s generator input lugs. Supply 120 VAC from the backup loads panel to the utility terminals for the battery charger and accessories.

Example of a compatible Kohler generator model:

14RESAL: <https://kohlerpower.com/en/residential/generators/product/14resal>

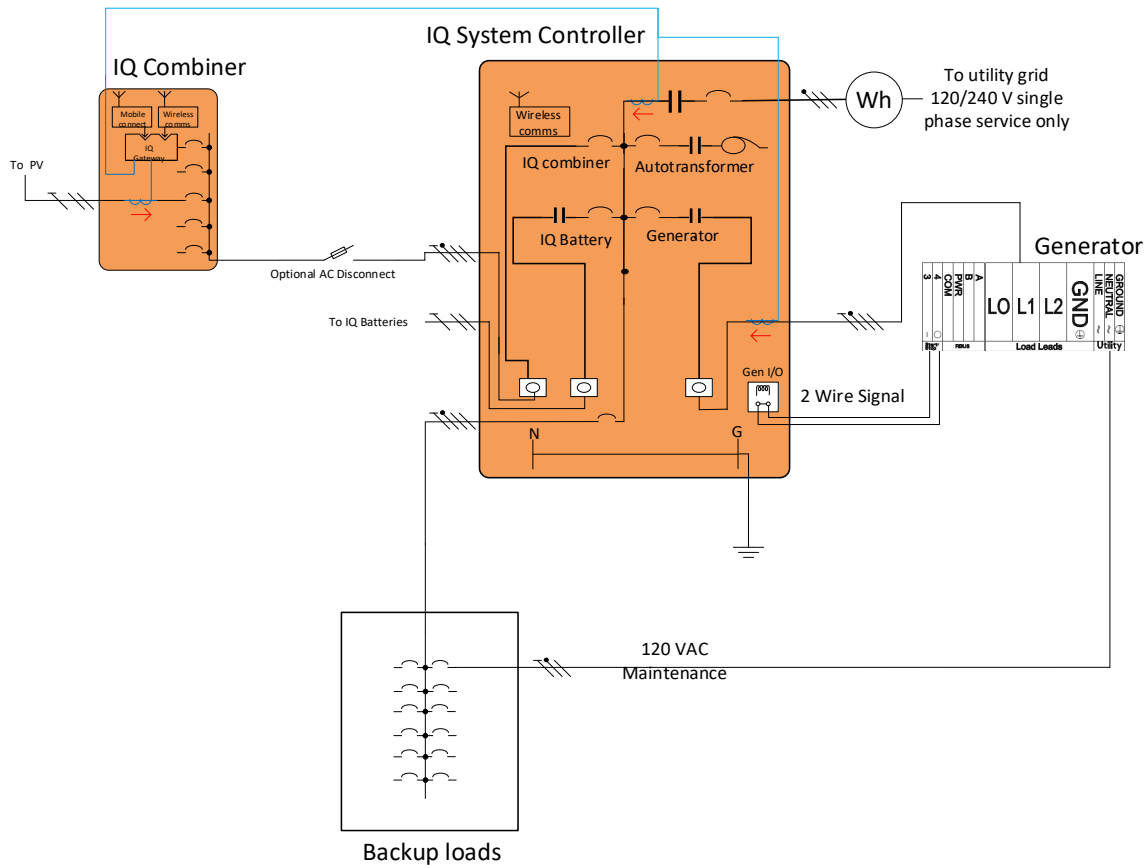


Figure 19: Kohler two-wire connection

## Generac

Generac provides a wide range of remote-start generators that automatically supply power to the house in case of a grid outage. The two main series of generators from Generac that we have considered here are the Guardian series and the EcoGen series.

### Generac Guardian

The Generac Guardian series are utility sense-based start generators. Examples of compatible Generac Guardian generators are listed in Table 4. The line diagram for the connection of these generators to an Enphase Energy System is shown in the following figure.

Generac provides a remote-start kit ([Part number 7109](#)) that allows their generators with an LCD display to be converted to a two-wire start. You can buy this kit to convert your Generac Guardian to a two-wire start generator to simplify the installation of controls for the generator. You can also purchase a Generac-recommended kit for a 120 V Maintenance/Battery charger from [here](#).

Generac QT and QS Series generators can be operated as either a utility sense or two-wire start. The generators come configured as grid sense by default. Refer to Generac instructions or contact Generac support on how to convert the generator to a two-wire start.

If an external ATS is being used at a site along with the generator then the wires 195, 23, and 0 need not be connected.

If you choose to use the above-mentioned method, contact Generac for any technical support needed.

Table 6: Examples of compatible generators from the Generac Guardian Series

Model Number	Details
7173	<a href="https://www.generac.com/all-products/generators/home-backup-generators/guardian-series/13kw-7173-wifi-enabled">https://www.generac.com/all-products/generators/home-backup-generators/guardian-series/13kw-7173-wifi-enabled</a>
7176	<a href="https://www.generac.com/all-products/generators/home-backup-generators/guardian-series/16kw-7176-wifi-enabled">https://www.generac.com/all-products/generators/home-backup-generators/guardian-series/16kw-7176-wifi-enabled</a>
7038	<a href="https://www.generac.com/all-products/generators/home-backup-generators/guardian-series/20kw-7038-wifi-enabled">https://www.generac.com/all-products/generators/home-backup-generators/guardian-series/20kw-7038-wifi-enabled</a>
7042	<a href="https://www.generac.com/all-products/generators/home-backup-generators/guardian-series/22kw-7042-wifi-enabled">https://www.generac.com/all-products/generators/home-backup-generators/guardian-series/22kw-7042-wifi-enabled</a>

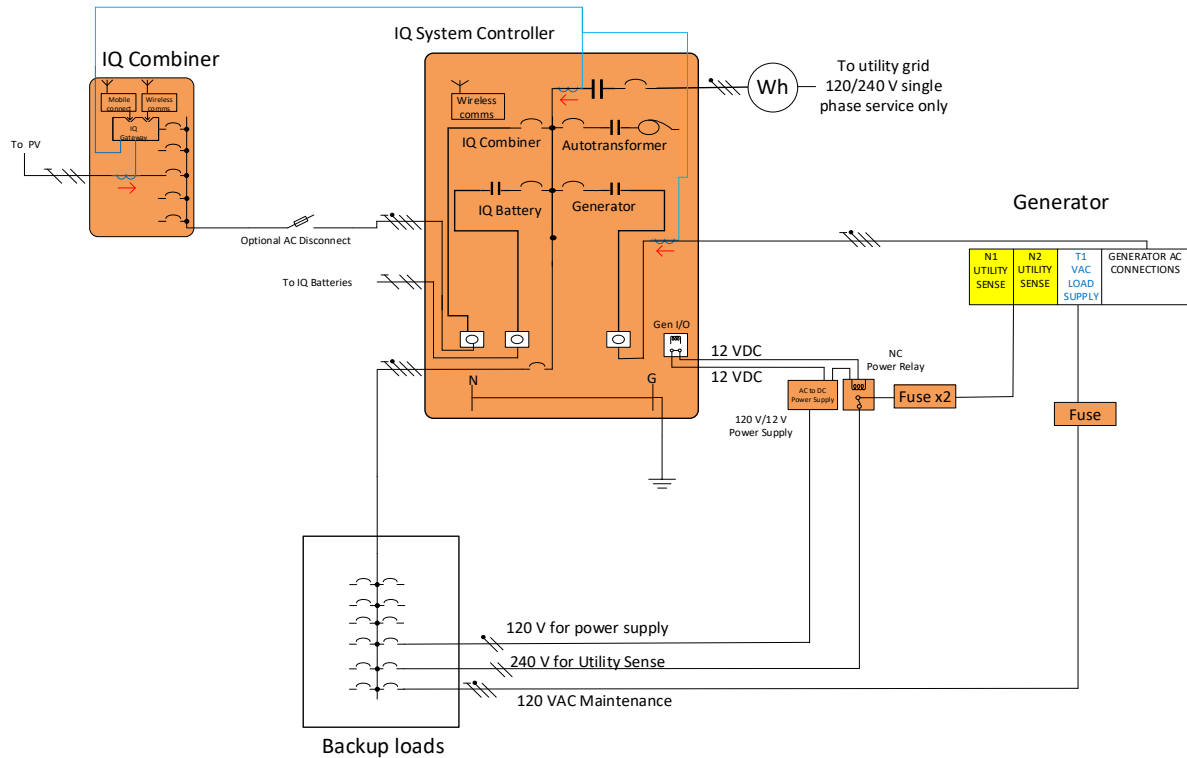


Figure 20: Generac Guardian utility sense connection

## Generac EcoGen (two-wire or utility sense)

The Generac EcoGen model generator can be started by a two-wire start or utility sense-based start. The utility sense-based start connections are the same as that for Generac Guardian connections shown in the following figure.

Example of a compatible generator model:

7163: <https://www.generac.com/all-products/generators/home-backup-generators/ecogen/15kw-7034-wifi-enabled>

Table 7: Location of two-wire remote-start connection in Generac 7163 Eco-Gen

Remote-start connection		
Wire	Connection	Location
178	Female Faston	Hanging from the controller above the battery compartment
183	Female Faston	

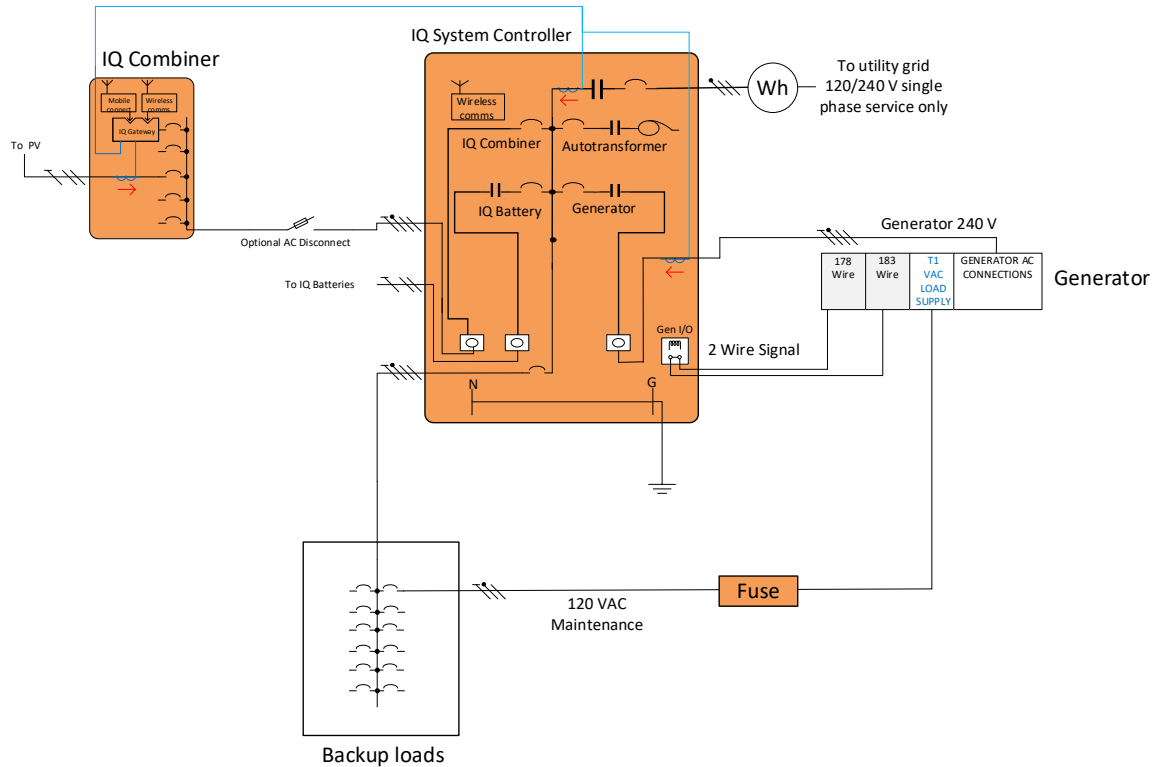


Figure 21: Generac EcoGen two-wire connection

## Briggs & Stratton

The generators from Briggs & Stratton are auto-start based. The 040590 Series of generators from Briggs & Stratton have two-wire remote-start capability. The terminals 4/5 on the generator are reserved for TxRx, which can be used for communication with an Automatic Transfer Switch (ATS).

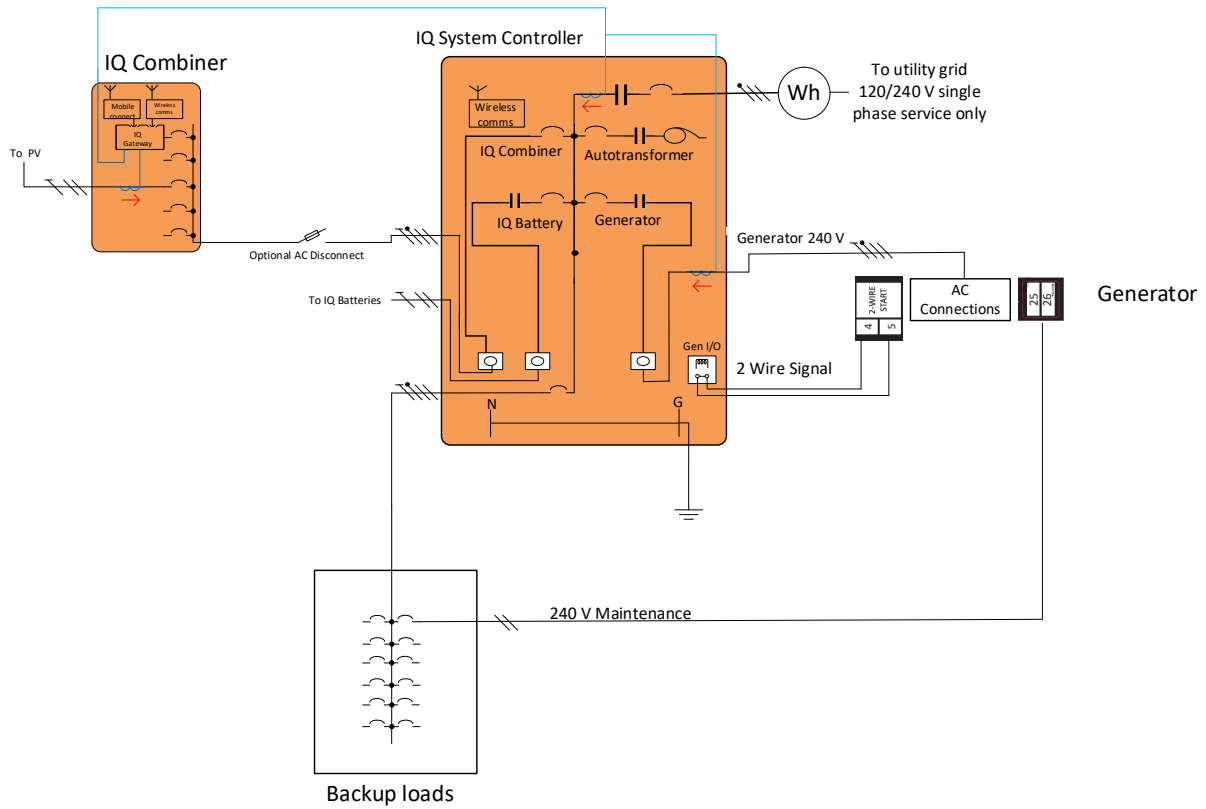


Figure 22: Briggs & Stratton two-wire connection

## Generator settings

For remote-start generators, the various settings provided in the Enphase App are:

- Two mutually exclusive smart profiles are selectable in the app:
  - Eco-friendly – Turns on the generator based on the battery charge level.
  - Automatic – Turns on the generator immediately when the grid is down.
- User overrides:
  - User can use the Automatic smart profile to start the generator anytime while the system is off-grid.
  - User can stop/disable the generator at any time.
- Maintenance Window: Predefined by the installer and editable by homeowners. Enables scheduling exercise cycles for the generator.
- Live real-time monitoring capability for generator, PV, and storage using “**Live status**”.

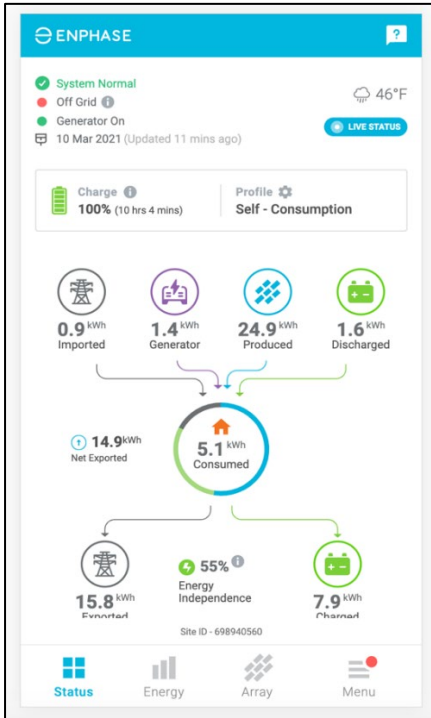


Figure 23: Status screen with generator



Figure 24: Live status screen with generator

## Smart profile

The Enphase App provides various options that homeowners can use to configure the generator operation as per their needs. The generator has two mutually exclusive smart profiles—Automatic and Eco-friendly—which are selectable in the app.



**Note:** Generator “Enabled” means that the generator will turn ON and turn OFF based on the selected profile and grid availability.



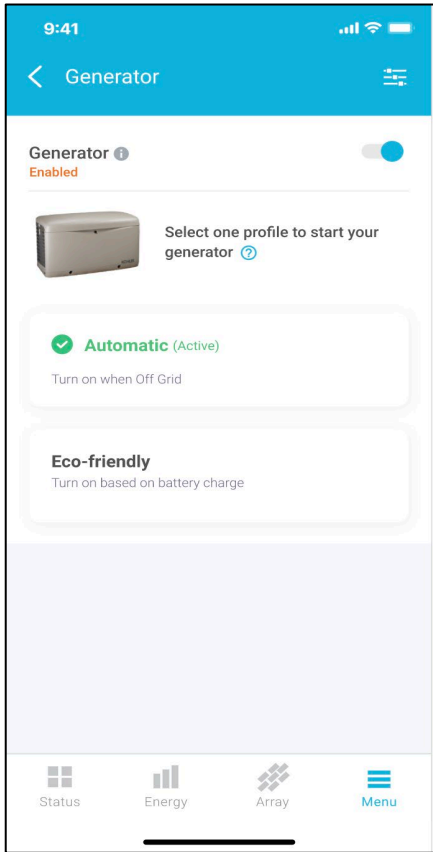


Figure 25: Smart profiles in the Enphase App

## Automatic

Select the “Automatic” smart profile and tap on “Activate” to turn on the generator immediately when the system goes off-grid. If the backup loads running during this duration are greater than the PV + Storage capacity, then there is a possibility of microgrid shutdown. To avoid this situation, use external contactors with IQ System Controller’s auxiliary contacts (i.e., Load Control feature) to ensure all large loads are shed when going off-grid. These loads can be reconnected when the system is back on the grid.



**NOTE:** Transfer to the generator can take up to 30 seconds after the grid is down.

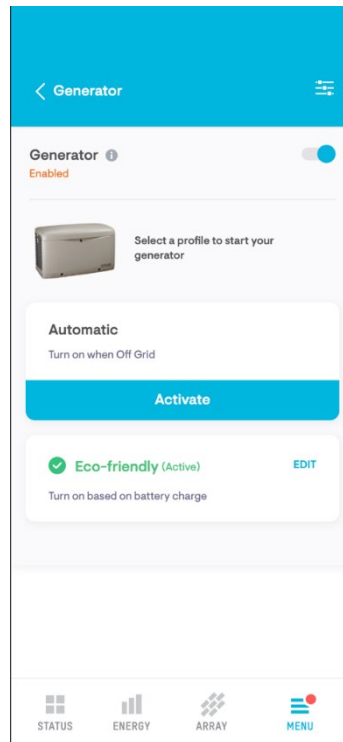


Figure 26: Automatic smart profile in Enphase App

## Eco-friendly

Select the “Eco-friendly” smart profile to turn on the generator based on the battery charge. Homeowners set the lower and upper limits for battery charge. The lower limit corresponds to the generator start condition and the upper limit corresponds to the generator stop condition. When the system goes off-grid, the generator is automatically started if the battery charge is less than or equal to the lower battery charge limit set by the homeowner. The generator in this scenario continues serving loads and charging batteries. When the battery charge equals the upper limit set by the homeowner, the generator is automatically stopped. The generator is also automatically stopped if the grid is back during this time and the system goes on-grid.

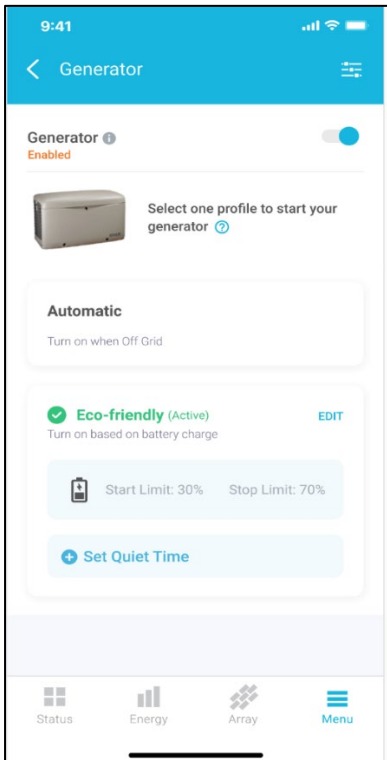


Figure 27: Eco-friendly smart profile in Enphase App

## Quiet time

Under the Eco-friendly smart profile in the Enphase App, there is an option given to the homeowner called “Set Quiet Time” to add periods during which generator operation is allowed only when the battery charge falls below a critical limit. This feature is especially useful during the night to avoid noise that arises from generator operation. In this feature, the homeowner can set the critical charge settings, i.e., the homeowner can set the battery charge threshold at which the generator may be started, even during quiet time, to ensure the homeowner does not lose power. The generator turns off when the battery charge reaches the upper limit set by the homeowner.

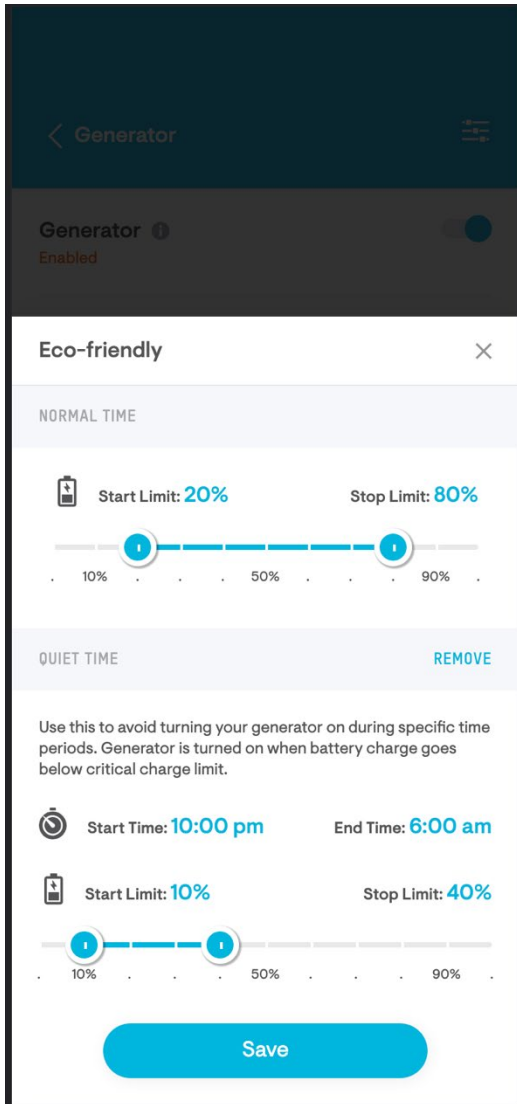


Figure 28: Quiet Time settings in Enphase App

## Advanced settings

Tap on the “Settings” icon on the upper right corner of the screen to access the Advanced Settings options that the Enphase App provides:

- Exercise Settings:** This option allows exercise cycles to be scheduled to run the generator at regular intervals to keep it in good working condition. The generator is started and exercised as per these settings. The exercise mode is with no load and the generator is not connected to the microgrid.

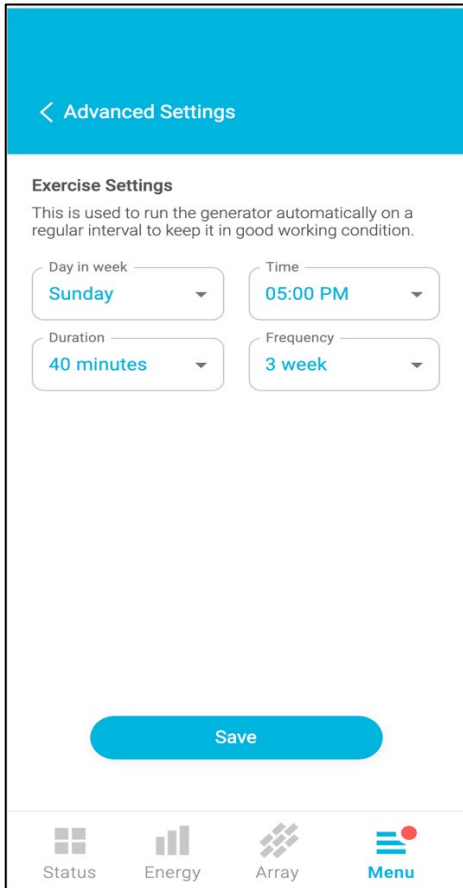


Figure 29: Advanced Settings in Enphase App

## Disable or suspend the generator

There is an option to disable or suspend an auto-start generator at any time using the Enphase App. Click the toggle button to disable the generator. If this option is used while the generator is running, then the generator stops immediately. This feature is useful when undertaking any maintenance work such as generator servicing, replacement, and so on. This option works only for generators that were auto-started. If an auto-start generator was turned on manually, then it must be turned off manually.



**NOTE:** In case of a microgrid collapse, utility-sense generators will turn on and try to black-start the system even if the generator was disabled from the app.

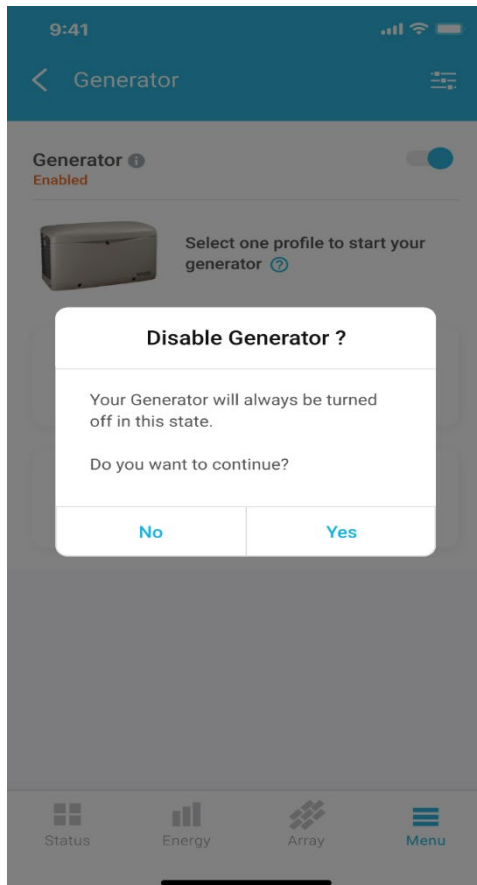


Figure 30: Disable the generator option in Enphase App

## Adding a generator to a system using the Enphase Installer App

To add a generator to the Enphase Energy System using Enphase Installer App:

1. Launch the Enphase Installer App and tap “Systems”.
2. Select the system you are working with or tap [+] to add a system.
3. Make sure that the system details are added (Enphase Installer App Step 1).
4. Go to Devices & Array (Enphase Installer App Step 2) and add the total number of devices of each type in the system. Tap “Add Device” if you need to edit previously entered data.
5. Tap on the device type “Generator”. Map the Enphase trained crew member and provide confirmation on following best practices.
6. A per-system activation fee applies for systems with a generator. Installers can enable the feature with a generator digital token purchased from a distributor or at the Enphase Store.
7. Map the generator digital token to unlock the generator integration feature. All the available tokens in your account will be displayed in the drop-down menu. If you have not purchased tokens yet, then contact your nearest Enphase distributor or visit the [Enphase store](#). Refer to Installer Quick Reference Guide for steps to purchase generator tokens in the Enphase store.
8. Map the Generator manufacturer and the model and provide the acknowledgment that the selected generator is an Enphase-supported generator.
9. On the Devices & Array page, tap on the generator and click to enter the maximum continuous gen amps value, generator efficiency set point 4, and generator nameplate rating.
10. If you select a generator of auto-start type, you need to select the mode of operation and can also set values for advanced settings such as exercise mode, etc.
11. Tap “Done”.

12. Connect to the IQ Gateway/Envoy-S Metered and start provisioning devices. Once provisioned, you can see the line “Generator details updated” in Enphase Installer App.
13. In step 6, “Meter Configuration”, follow the wizard to enable the generator meter.



**NOTE:** You must wait for the IQ Battery firmware upgrade to finish before you start enabling the generator meter.

14. In Step 7, “Complete Functional validation” by following the steps shown in Enphase Installer App.
15. Confirm that the system summary report generated in step 8 includes generator details.

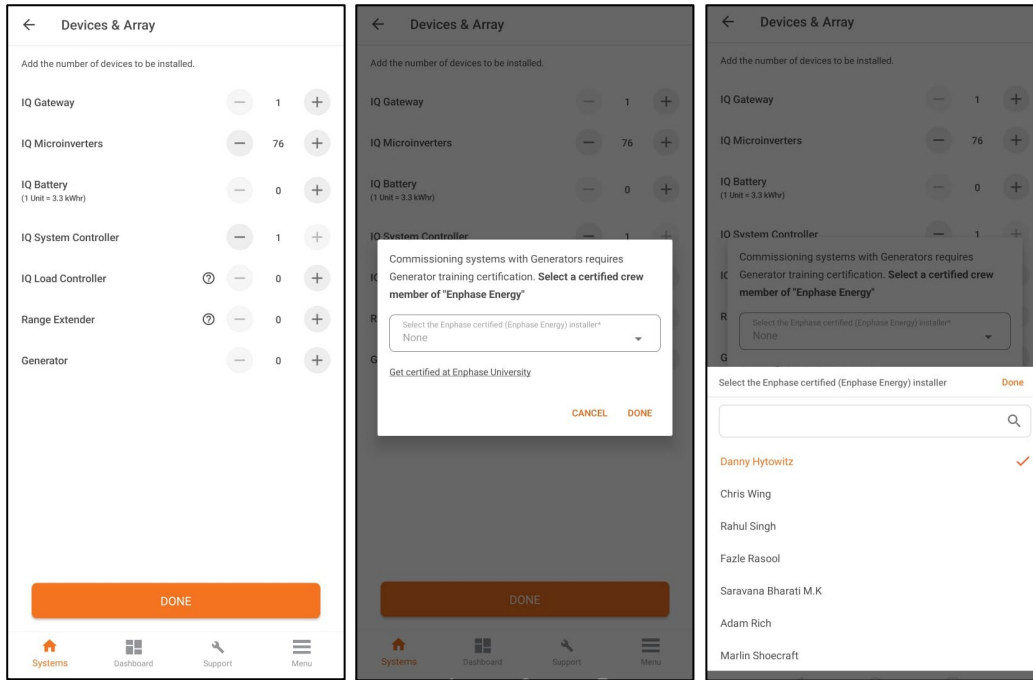
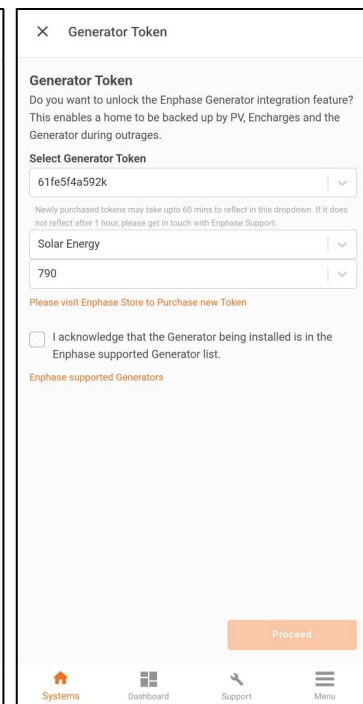
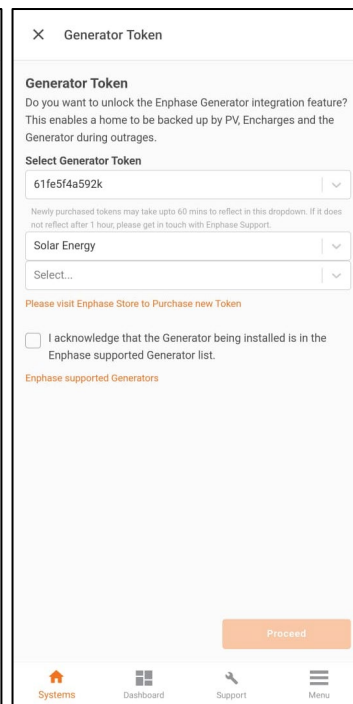
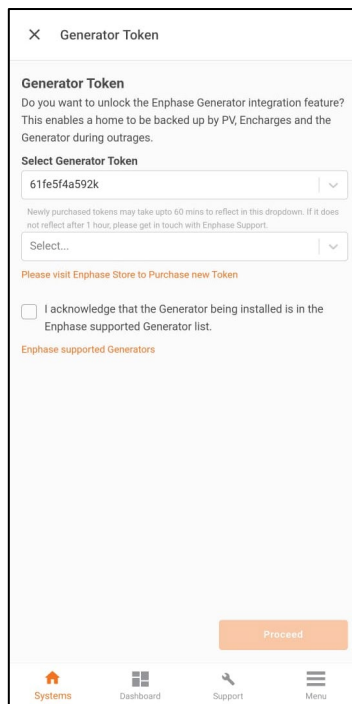
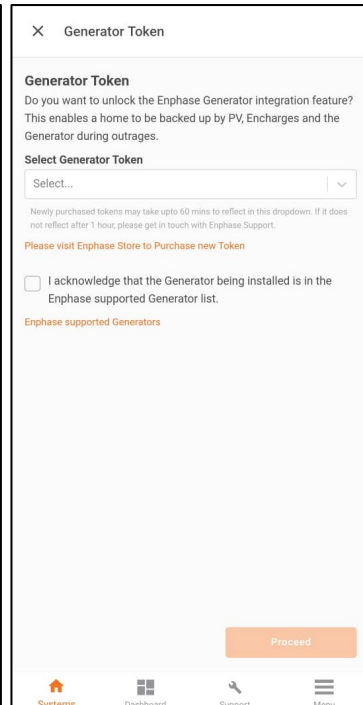
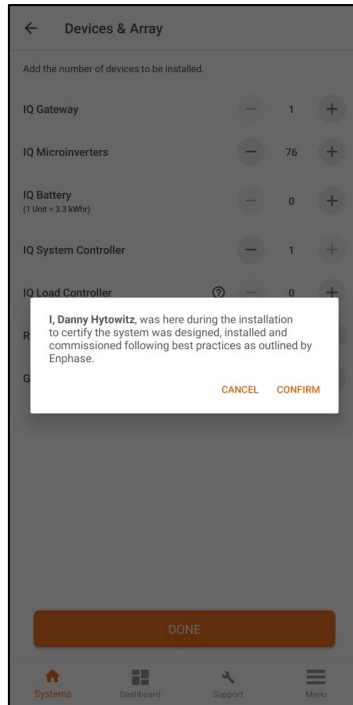
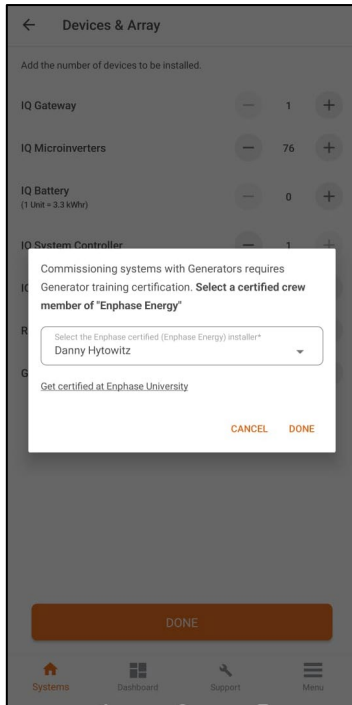


Figure 31: Adding a generator to a system using the Enphase Installer App





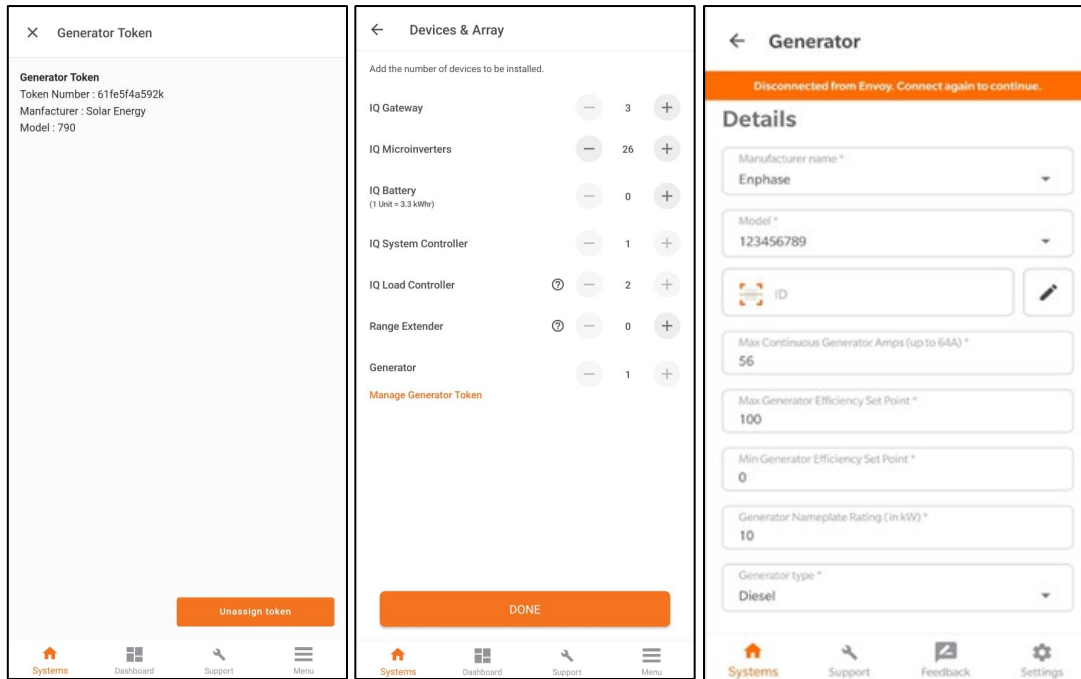
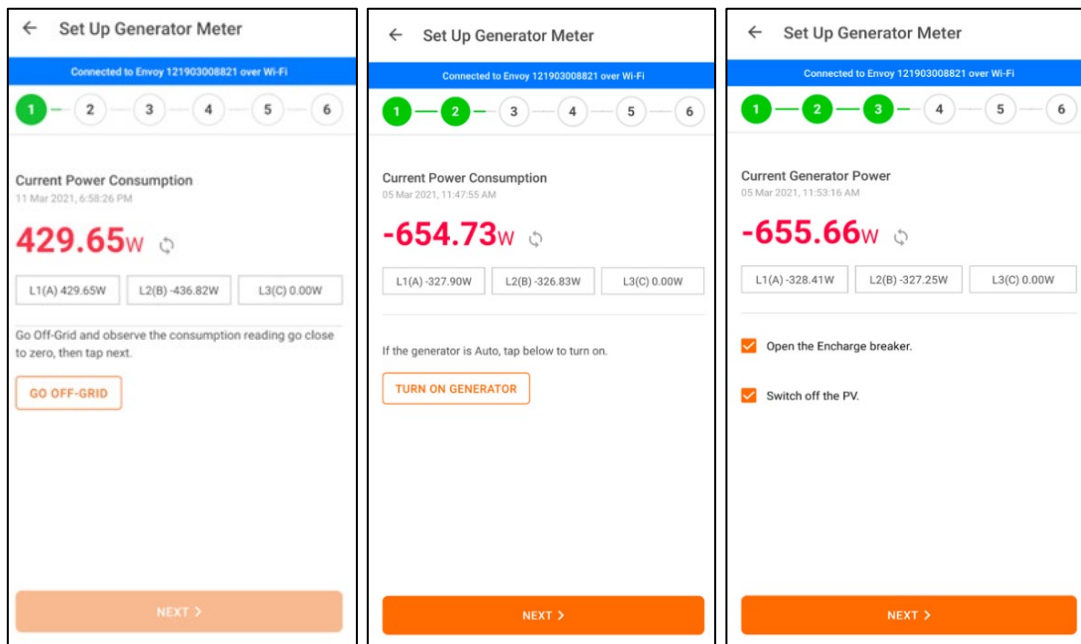
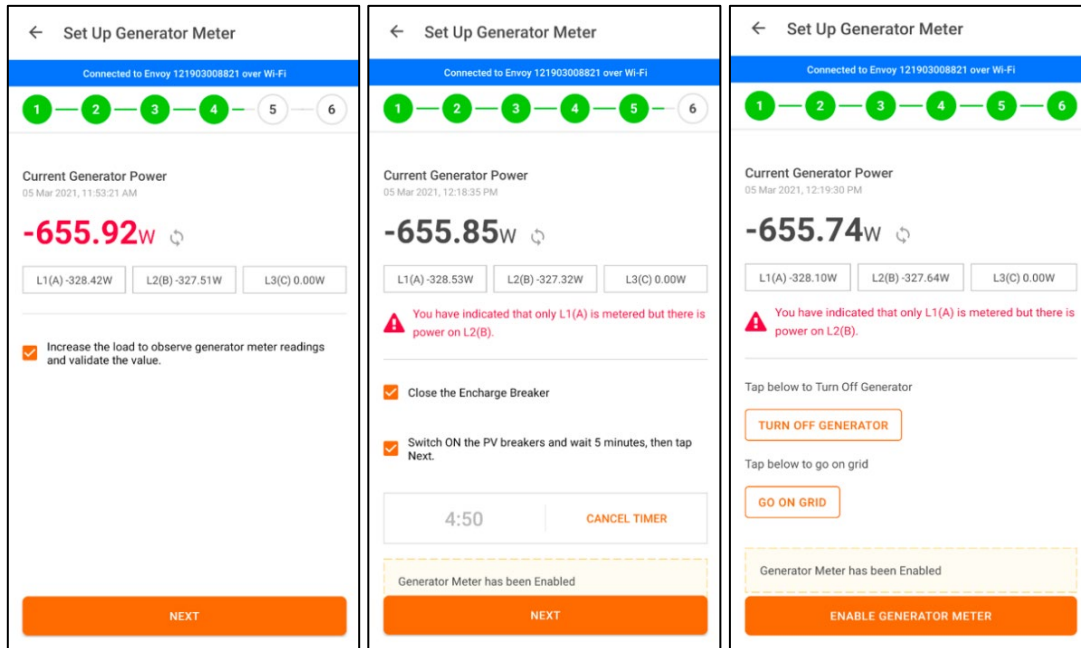


Figure 32: Adding a generator to a system using the Enphase Installer App continued

## Generator meter configuration in the Enphase Installer App





Generator meter configuration steps:



**NOTE:** You must wait for the IQ System Controller firmware upgrade to finish before you start enabling the generator meter.

1. Ensure the DC switch on IQ Batteries is turned ON before going to the generator meter.
2. Go to Step 6, “Meter configuration” in the Enphase Installer App, and tap on the “Generator Meter” to configure it. Tap on “Go off-grid” and observe the consumption reading dropping close to zero. Tap on “Next” once it is enabled. The “Next” button gets enabled once the system goes off-grid. It might take up to 40 seconds for the system to go off-grid.
3. If the generator is not ON, tap on “Turn On Generator” to automatically turn on the generator. If the generator is not turning on, set the mode to “Autostart” in Step 2 and re-provision.
4. Open the IQ Battery breaker and switch off the PV. Select the checkboxes on the screen and tap on “Next”.
5. Increase the load and observe the generator meter readings rising. Validate the readings, select the checkbox, and tap on “Next”.
6. Close the IQ Battery breaker and select the checkbox. Switch ON the PV breakers and wait for 5 minutes. Once the timer expires, tap on “Next”.
7. Tap on “Turn off generator” > “Go on grid” > “Enable generator meter”.

## Generator details and settings in the Enphase Installer Platform

The generator that is added in the Enphase Installer App will be available in the Enphase Installer Platform in the Devices section.

Production Meter						
Meter Type	Part Number	Serial #	Lifetime Energy	Last Report	Status	
Enphase Integrated Production Meter Single-Phase (L-L)	800-00655-r08	202040004942EIM1	2.19 MWh	12/22/2020 03:00 AM PST	Normal	

Consumption Meter						
Meter Type	Part Number	Serial #	Config Type	Lifetime Energy	Last Report	Status
Enphase Integrated Consumption Meter Single-Phase (L-L)	800-00655-r08	202040004942EIM2	Load with Solar production	678 kWh	12/22/2020 03:00 AM PST	Normal

Request access to consumption data You already have access to this system's consumption data.

Generator Meter						
Meter Type	Part Number	Serial #	Lifetime Energy	Last Report	Status	
Enphase Integrated Generator Meter Single-Phase (L-L)	800-00655-r08	202040004942EIM3	186 kWh	12/18/2020 05:30 PM PST	Normal	

Figure 33: Generator details and setting in the Enphase Installer Platform (Production Meter, Consumption Meter, and Generator Meter)

Generator								
Model	Manufacturer	ID	Generator Type	Start Type	Status	Max Continuous Gen Amps	Nameplate Rating	Created
generac	generac		auto	Auto	Auto	55	4	2020/11/30 20:39:54 -0800 (PST)

Figure 34: Generator summary

Click the model name, and the generator details section will open.

Status	: Auto	<a href="#">Edit Details</a>
ID	:	
Operation Mode	: Battery Optimization	
Max Continuous Gen Amps	: 55 A	
Max Generator Efficiency SetPoint	: 70 %	
Min Generator Efficiency SetPoint	: 10 %	
Nameplate Rating	: 4 kW	
Generator Type	: auto	
Start Type	: Auto	
Manufacturer	: generac	
Model	: generac	
Created	: 2020/11/30 20:39:54	

<b>SOC threshold value</b> Start SOC : 55 % Stop SOC : 70 %	<b>Quiet time</b> Start time : Stop time : Start SOC : Stop SOC :	<b>Exercise mode</b> Day in a week : Monday Time : 09:00 AM Duration : 2 mins Interval : 4 weeks
<b>Cool down period</b> Minutes of cool down before : 1 min shutting down	<b>Warm up period</b> Minutes of warm up before: 1 min starting up	

**Generator control settings**

Figure 35: Generator details

“Enable Generator” and “Disable Generator” will act like the functionality in the Enphase Installer App. “Remove Generator” will delete the generator from the system.

Click “Edit Details” to configure operation mode. All the settings on the page below will act like the settings in the Enphase Installer App.

Name	Value
Manufacturer Name	<input type="text" value="generac"/>
Model	<input type="text" value="generac"/>
ID	<input type="text"/>
Operation mode	<input type="text" value="Battery Optimization"/>
Max Continuous Gen Amps (up to 64A)	<input type="text" value="55"/>
Max Generator Efficiency Set Point (up to 100%)	<input type="text" value="70"/>
Min Generator Efficiency Set Point (up to 100%)	<input type="text" value="10"/>
Nameplate Rating (in kW)	<input type="text" value="4"/>
Generator type	<input type="text" value="auto"/>
Start type	<input type="text" value="Auto"/>
<b>EXERCISE MODE</b>	
Day in a week	<input type="text" value="Monday"/>
Time	<input type="text" value="09:00 AM"/>
Duration(up to 60 mins)	<input type="text" value="2"/>
Interval	<input type="text" value="4"/>

Figure 36: Generator edit table

<b>COOL DOWN PERIOD</b>	
Minutes of cool down before shutting down (up to 60 mins)	<input type="text" value="1"/>
<b>WARM UP PERIOD</b>	
Minutes of warm up before starting up (up to 60 mins)	<input type="text" value="1"/>
<b>SOC THRESHOLD VALUE</b>	
Start SOC	<input type="text" value="55"/>
Stop SOC	<input type="text" value="70"/>
<b>QUIET TIME</b>	
Start Time	<input type="text"/>
Stop Time	<input type="text"/>
Start SOC	<input type="text"/>
Stop SOC	<input type="text"/>
<input type="button" value="Save"/>	

Figure 37: Generator edit table continued

## Generator troubleshooting

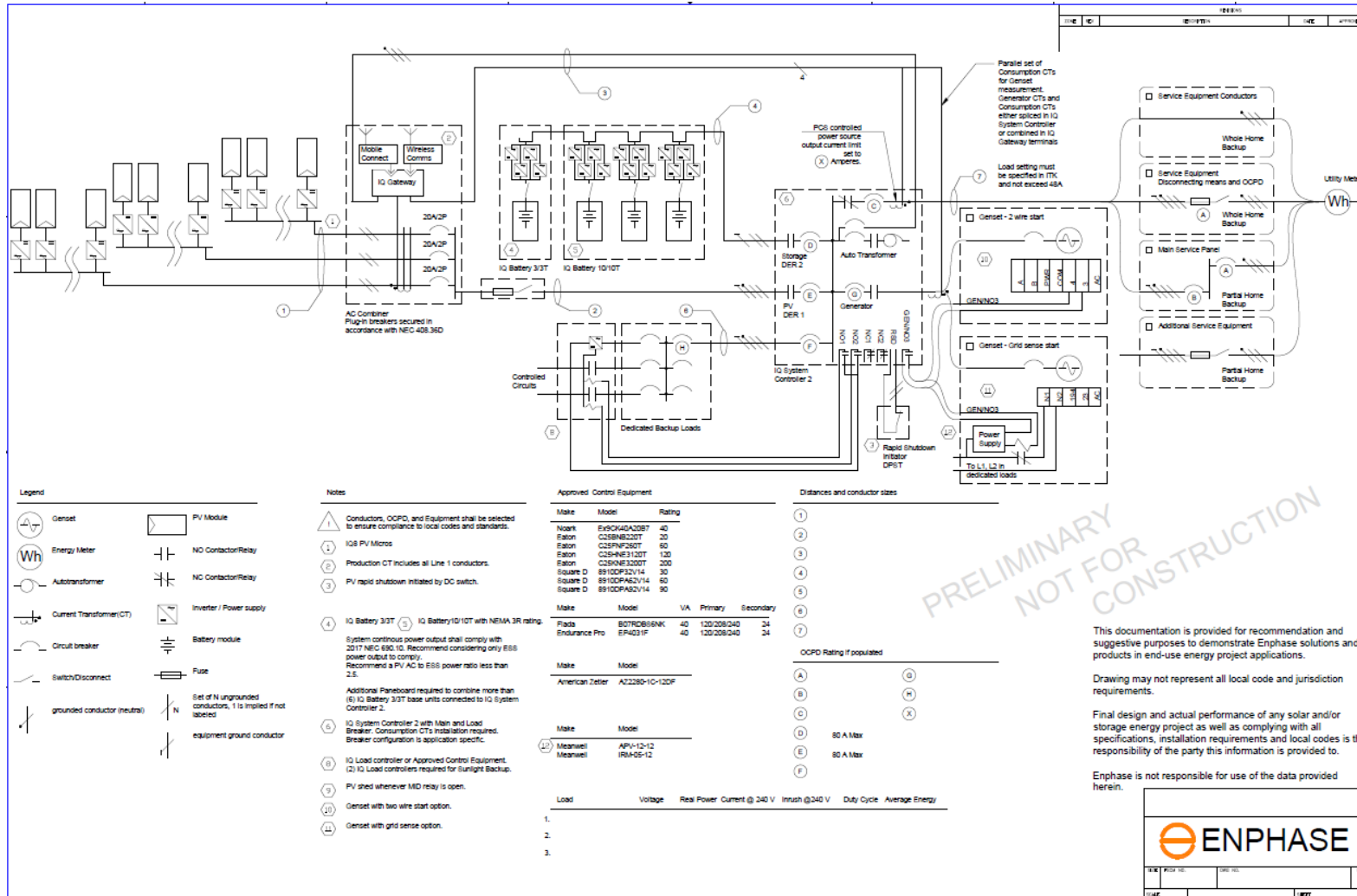
#	Error/Event	Impact	Recommended action
1	Event: <ul style="list-style-type: none"> <li>GeneratorVoltageImbalance</li> <li>OR</li> <li>GeneratorComBusPhaseDifference</li> </ul>	The generator was overloaded.  The generator breaker in IQ System Controller tripped, and the generator is disconnected. The homeowner would see a loss of power for 6 seconds. The system will then restart using IQ Battery and power should be restored.	The system will try to reconnect the generator in 5 minutes. You should: <ul style="list-style-type: none"> <li>Open the IQ System Controller door, turn off the generator breaker, and turn it on again. (When you open IQ System Controller, the generator breaker lever will not be in the ON position.)</li> <li>Ensure you do not overload the system while the generator is running.</li> </ul>
2	Generator voltage and/or frequency out of spec while in generator mode and the generator is connected  Event: <ul style="list-style-type: none"> <li>EnpowerGeneratorVoltageHighTrip</li> <li>EnpowerGeneratorVoltageLowTrip</li> <li>EnpowerGeneratorFrequencyHighTrip</li> <li>EnpowerGeneratorFrequencyLowTrip</li> </ul>	The generator gets disconnected.	Generator maintenance is required.
3	Generator not starting  Event: GeneratorStartFailed	The generator does not start as selected in user preferences.	Check if the generator 2-wire start/stop wiring to IQ System Controller is loose.  Check whether the generator breaker at the unit was tripped (if so turn the breaker off and then on, plus switch the controller to the auto position), whether the generator is out of fuel, or the starting battery of the generator was dead.  Contact your installer or Enphase customer support if the problem persists.

4	Generator not stopping  Event: GeneratorStopFailed	The generator continues to run even though user preferences indicate it should have stopped.	Check if the generator 2-wire start/stop wiring to IQ System Controller is loose.  Turn off the generator manually and contact the installer or Enphase customer support.
5	High Total Harmonic Distortion (THD)  Measured THD is above 25%  Event: GenTHDHigh	Generator power output is not stable and has high THD (THD means total harmonic distortion, which is a metric to measure the power quality. If the THD is high, the performance of your electronics will be affected; for example, you may see flickering lights).	The generator is connected to the system, but to protect your home appliances, disable the generator and contact the generator manufacturer or installer to get the generator checked or switch to another generator.
6	The generator load is above the allowed limit  Event: HighLoad	The generator power output has exceeded the optimum efficiency point specified. Fuel consumption will be higher than usual, and if the grid comes back the system may collapse while going back on the grid. This can happen when the power being drawn from the system while the generator is connected exceeds the IQ Battery nameplate.	Reduce loads.
7	Generator CT missing or in error state  Event: EnsembleConsumptionCTError	The generator is connected to the system; however, the system has no way of monitoring the generator's power output since the current transformers (CTs) are missing or have not been properly connected.	The generator CTs must be installed and wired correctly.  Turn off the generator manually and contact the installer or Enphase customer support.

## Revision history

Revision	Date	Description
TEB-00003-2.0	April 2023	Editorial updates
TEB-00003-1.0	April 2023	Internal release
Previous releases		





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