Understanding Sunlight Backup system for homeowners

This document describes the Sunlight Backup configuration using IQ8 Series Microinverters. The following sections are included in this document:
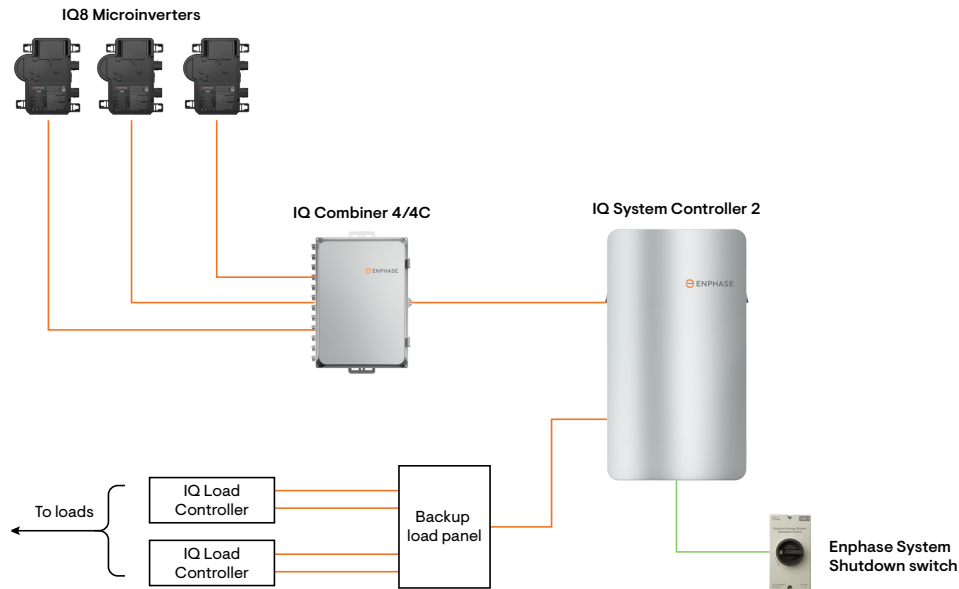
Introduction

An Enphase Sunlight Backup system provides backup power when the sun is shining. The system provides backup for up to four 240 V or eight 120 V circuits. The system consists of IQ8 Series Microinverters, IQ System Controller 2, IQ Combiner 4C, up to two IQ Load Controllers, and other accessories as needed. The Sunlight Backup requires at least one IQ Load Controller to be installed on-site.

> **NOTE:** Sunlight Backup should only be used for the essential loads in the home. Using the solution to back up the entire home will lead to a poor experience and is not supported by Enphase.

System components

The system consists of IQ8 Series Microinverters, IQ System Controller 2, IQ Combiner 4C, up to two IQ Load Controllers, and other accessories as needed.

- **IQ8 Series Microinverters** are our most powerful, software-defined microinverters. They are powered by a proprietary, intelligent chip that makes switching between on- and off-grid virtually seamless.

- **IQ Combiner 4/4C** aggregates the solar microinverter circuits and includes the IQ Gateway. The IQ Gateway provides on-site intelligence and cloud connectivity that enables you to monitor the system remotely via the Enphase App.

- **IQ System Controller 2** automatically detects utility power outages and seamlessly transitions you to backup power. It enables grid-forming IQ8 Microinverters, IQ Batteries, and even third-party AC standby generators to be connected to your home.

- **IQ Load Controller** enables control for two 240 V loads or four 120 V loads. Each 240 V load can be controlled independently, but the 120 V loads can be controlled in groups of up to two loads. Examples of 240 V loads are electric dryers and Level 2 electric vehicle chargers. Most of the loads in your home, including lights, fans, and appliance sockets, are all 120 V loads. A Sunlight Backup system can have up to two IQ Load Controllers to control up to four 240 V or eight 120 V loads. The Sunlight Backup system needs at least one IQ Load Controller to be installed on-site.

- **Enphase System Shutdown Switch** is required by code for remote rapid shutdown of IQ8-based Enphase Energy Systems. Turning the switch to the OFF position connects your home from the utility grid and disables the backup capability of the Enphase Energy System. When the switch is in the OFF position, your home is disconnected from the IQ8 Microinverters and AC standby generator, if present.

> **NOTE:** Third-party backup generators can be added to a Sunlight Backup system. Refer your installer to the "Generator integration technical brief" to add a generator to the system. Only use utility sense generators with Sunlight Backup systems. The generator must be operated in automatic mode. In this operating mode, the system automatically starts the generator and connects it to the home loads whenever there is a grid outage. Power from a generator is used only when the power produced by microinverters is insufficient to power the home loads.
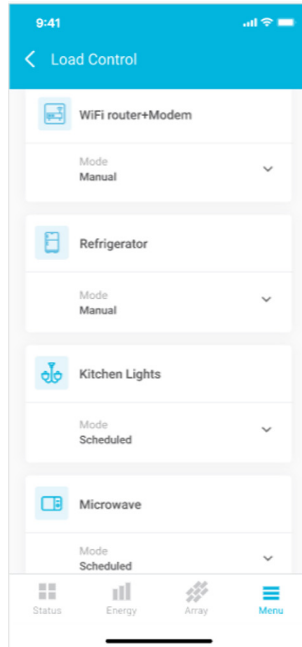
Essential load selection

Work with your installer to select your essential loads. Keep the following points in mind while selecting the essential loads.
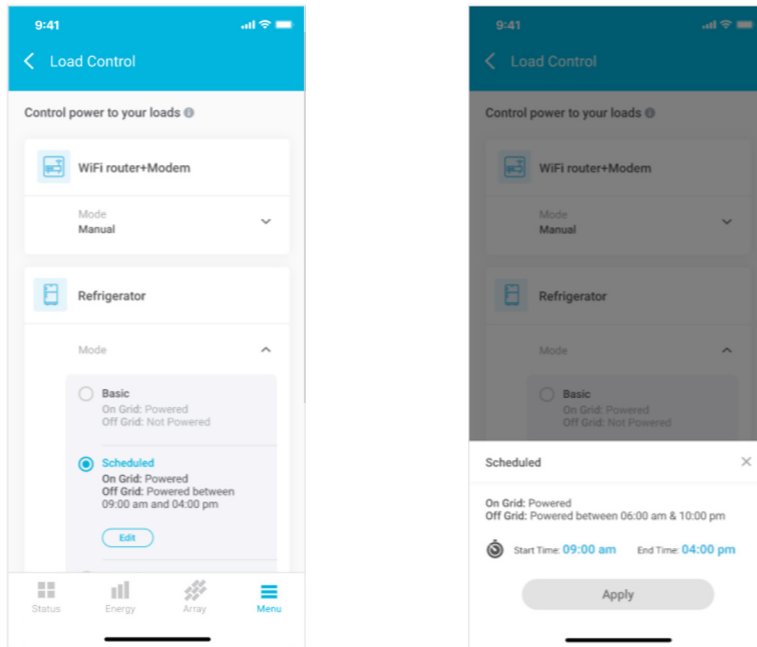
1. Enphase recommends that the backup loads do not exceed 30% of the total rated AC output power of the IQ8 Microinverters on the roof. For example, the rated power output for a system with 24 IQ8 Microinverters is 5.7 kW AC. The backup loads should not exceed 1.7 kW AC (30% of 5.7 kW AC).

2. The system can back up four 240 V or eight 120 V circuits. While backing up four 240 V circuits, it controls each of the backed-up circuits individually. While backing up eight 120 V circuits, the backed-up circuits are divided into four groups with two circuits each, and the system can control each group individually. When there is only a single IQ Load Controller at the site, the system can back up two 240 V or four 120 V circuits. The 240 V circuits are controlled individually, and the 120 V circuits are divided into two groups of two circuits each.

3. Ensure that your Wi-Fi router and modem have the highest priority among the essential load circuits. Your installer will do this by following the guidance provided in the Sunlight Backup Guide for installers and system designers.

4. Having a Wi-Fi router and modem on a dedicated backup circuit will ensure the home internet is available even when the power produced by the solar panels is minimal. If they are not on a dedicated circuit, avoid running other loads on the same circuit during off-grid operation.

5. When the system is running off-grid, avoid connecting other loads to the electrical outlets on the same circuit as the Wi-Fi router and modem.
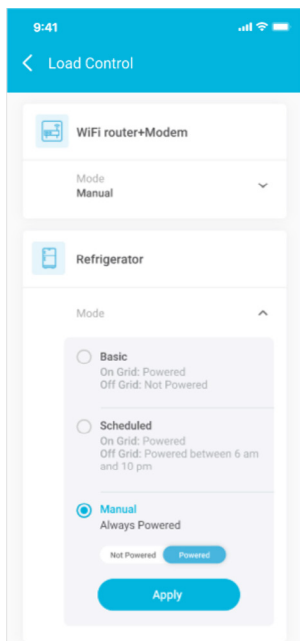
Load control configuration

You can configure the modes for all loads controlled by the system in the Enphase App under "Menu" > "Settings" > "Load control" > Load_Name.
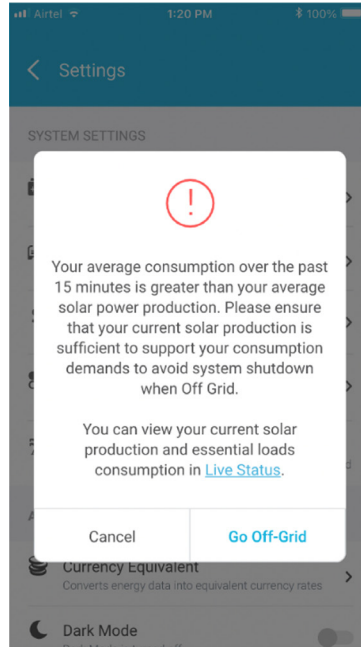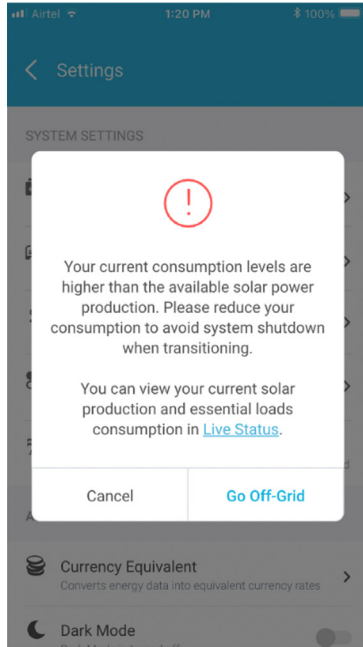

- Your installer will have connected your internet modem, router, cell phone charger, etc., to the highest priority essential load circuit. Change the mode of this circuit to "Manual" in the Enphase App ("Menu" > "Settings" > "Load control" > Load_Name) if not done so already by your installer. This ensures that the circuit is powered on as soon as power is available when running off-grid.

- All the other essential loads will be in "Scheduled" mode. These are scheduled to operate from 9 a.m. to 4 p.m. by default. You can change the time window to any time between 7 a.m. and 8 p.m. to match your local sunrise/sunset conditions using the Enphase App ("Menu" > "Settings" > "Load control" > Load_Name > "Scheduled").

- Enphase recommends that you stagger the turn-on and turn-off times of various loads, so that the heaviest loads operate when the produced solar power is maximum, typically between 11 a.m. and 3 p.m. You can also change these settings to match your system's solar power production. You can see the power production data per day from the Energy tab of the Enphase App.

- At any point, you can change a load to "Manual" mode and turn it on while the system is off-grid. Ensure that the current PV production is sufficient to support the load before you do this ("Menu" > "Settings" > "Load control" > Load_Name > "Manual").

- Do not transition manually to off-grid using the Enphase App ("Menu" > "Settings" > "Grid Control") if the system alerts you that the solar power production is less than the current consumption level.

NOTE: If any load is set to "Basic" mode, it will remain powered off while the system is off-grid. If a load is set to "Generator" mode, it will only be powered on while off-grid if the generator is providing power to the system.
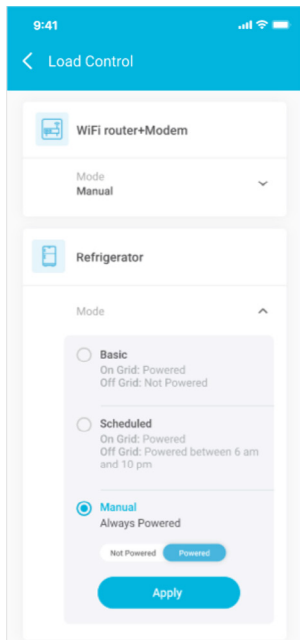
NOTE: The Enphase App and the IQ Gateway require an internet connection to configure loads.

System behavior

The power produced in a Sunlight Backup system depends on the solar irradiance at your location, which can vary depending on cloud cover, shading on the PV panels, time of the year, and other factors. While running off-grid, the system may shut down if the power produced is less than what is needed to power the loads. To prevent a system shutdown, work with your installer and ensure that the system follows the guidance on load selection provided in the section above.

In the event of a shutdown, the system will automatically recover and restore power to the essential loads. While recovering, the system will try to identify the load causing the shutdown and disconnect it to ensure that the other essential loads can be powered on. This logic is described in detail below:
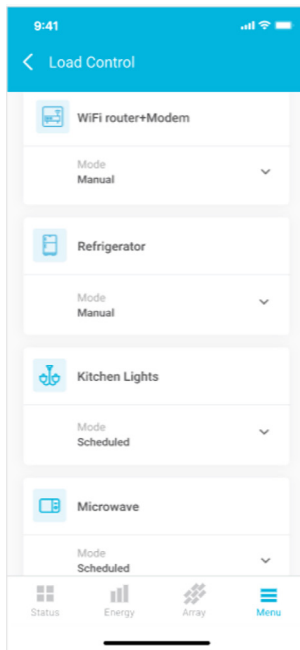
- When the system shuts down while running off-grid—that is, when the microgrid collapses—all the essential loads are powered off.

- If there is sunlight available, the system can take up to two minutes to restart and start restoring power to the essential loads. At this point, the loads that are in "Manual" mode and are configured to be powered on will turn on.

- Next, the system will power the rest of the essential loads in a predetermined order as outlined below:

  - The order in which the loads are powered on is the same as the order in which the loads are displayed in the Enphase App ("Menu" > "Settings" > "Load control").

  - The time interval between loads being powered on is 22 seconds.

- If there is a system shutdown within 22 seconds of a load being powered on, the system considers that load to be responsible for the shutdown.

- If a load causes five system shutdowns, the system fully disables that load—the load is powered off and will not be automatically powered on when the system is off-grid. You can use the Enphase App to turn the load on when irradiance increases (for example, in the afternoon) by changing the load to "Manual" mode ("Menu" > "Settings" > "Load control" > Load_Name > "Manual").

- If the load is successfully powered for more than five minutes, the system resets the collapse/shutdown counter for that load. For example, consider a load that has already caused the system to shut down three times. During the next system start, the microgrid does not collapse for five minutes after adding the load to the microgrid. In this case, the system will reset the shutdown counter for the load and will shed the load only if it causes a fresh set of five system shutdowns.

- All essential loads will be powered on automatically when the system connects back to the grid or connects to a generator.

- If all the loads are blacklisted, the system will retry the above sequence after one hour.

Consider a system with the following loads:

The table below shows a timeline from the system shutdown until all loads are powered back on. Note that this table assumes all loads can be successfully powered on the first try, after the system restart. The sequence below will repeat if there are successive failures. If any load causes up to five system shutdowns, that load will be skipped, and the 22 seconds of delay associated with that load will also be skipped during the next system restart.

EVENT	TIME TAKEN (MINUTES: SECONDS)	TIME ELAPSED SINCE SYSTEM SHUTDOWN (MINUTES:SECONDS)
System shutdown/microgrid collapse	N/A	00:00
System restart with highest priority loads powered on • IQ8 Microinverters restart and provide 240 V output • Wi-Fi router + modem is powered on	00:52 to 01:57	00:52 to 01:57
Refrigerator is powered on	00:22	01:14 to 02:19
Kitchen lights are powered on	00:22	01:36 to 02:41
Microwave is powered on	00:22	01:58 to 03:03

Revision history

REVISION	DATE	DESCRIPTION
USG-00003-2.0	April 2023	Editorial updates
USG-00003-1.0	April 2023	Internal release
Previous releases		