

Enphase Solar Only systems and Tesla Powerwall 2 with backup (EPS)

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Enphase Solar Only systems and Tesla Powerwall 2 with backup (EPS)

This technical brief investigates three different scenarios where an Enphase Solar Only system is deployed with a Tesla Powerwall 2 to ensure the solar will produce power in backup mode (with sufficient sunlight). The technical brief only considers backup situations, as non-backup situations will be a similar setup but without the inclusion of the Tesla Gateway and will, therefore, not affect the design and deployment of the Enphase Solar Only system.

The three scenarios that are detailed within this technical brief are:

- Single-phase site with single-phase Enphase Solar Only system installed on the backup circuit
- Three-phase site with three-phase Enphase Solar Only system installed on the backup circuit
- Multiple-phase site with multi-phase Enphase Solar Only system partially installed on the backup circuit



NOTE: The Tesla Powerwall 2 is an AC-coupled battery that incorporates a DC-to-AC inverter within the battery. Therefore, site noise that affects the Enphase PLC between IQ Gateway and microinverters could become an issue. Therefore, we recommend one TDK ferrite core per Powerwall installed up to a maximum of six ferrite cores for 10 Powerwall 2s. More information on how to install ferrite cores can be found on the [Enphase Tech Brief for ferrite core installation](#).

Scenario 1: Single-phase site with single-phase Enphase Solar Only system installed on the backup circuit

In this scenario, the Tesla Powerwall 2 will supply power to the backup circuits when the connection to the grid is lost. When the Tesla Gateway 2 senses a loss of grid, it will island the site (or backup circuits) and produce a grid reference in a backup mode that allows the solar to keep producing (in sufficient sunlight). The customer will need a Tesla Gateway 1 (single-phase) or Tesla Gateway 2 (three-phase). An IQ Relay is not required when the Tesla Gateway is connected to the backup (grid) side of the solar supply main switch(s).

This configuration can also be utilised for multi-phase sites with solar on one of the phases, and the solar must be connected to the same phase as the Tesla Powerwall 2. For this scenario, the correct grid profile to deploy is the standard AS/NZS 4777.2:2020 (Region A/B/C/NZ) grid profile. This has the correct frequency shift and power control parameters that ensure smooth ramp rates and avoid overcharging the Tesla Powerwall 2 in backup mode. Full backup and partial backup options can be deployed.

The maximum amount of PV inverter capacity to be installed on the same phase and the load side of the Tesla Gateway is 5 kVA (21.7 A) per Powerwall 2. This is a requirement from Tesla. Additional PV inverter capacity can be installed on the grid side of the Tesla Gateway 2, but it will not keep running in backup mode, or you can set up a voltage reference from the Tesla Gateway 2 auxiliary contactor to the IQ Gateway as per the details explained at the end of this document.



NOTE: For power export limited systems: Consumption CTs must be placed at the incoming mains (loads + solar) for power export limiting to function. This may cause a metering error notification when coupled with Tesla Powerwall 2 which we can remotely disable. The Tesla consumption data should be used by the homeowner as this will account for battery charge and discharge and therefore be more accurate.

Full backup: Single-phase supply, single-phase solar, and full backup wiring diagram

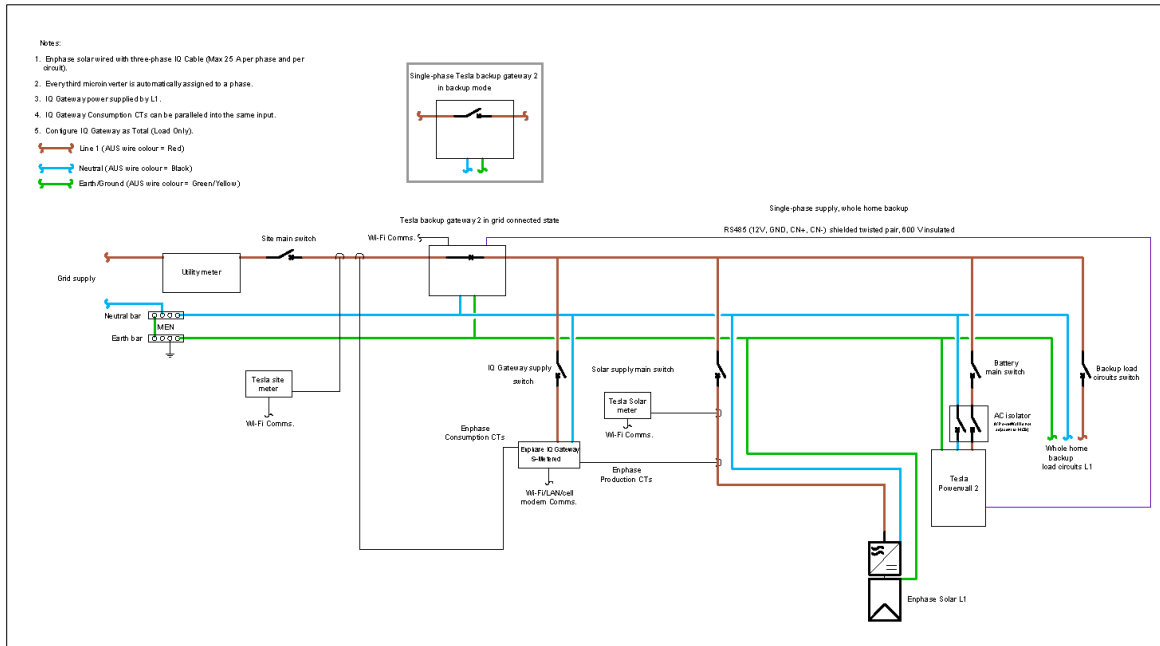


Figure 1: Full backup: Single-phase supply, single-phase solar, and full backup wiring diagram

Partial backup: Single-phase supply, single-phase solar, and partial backup wiring diagram

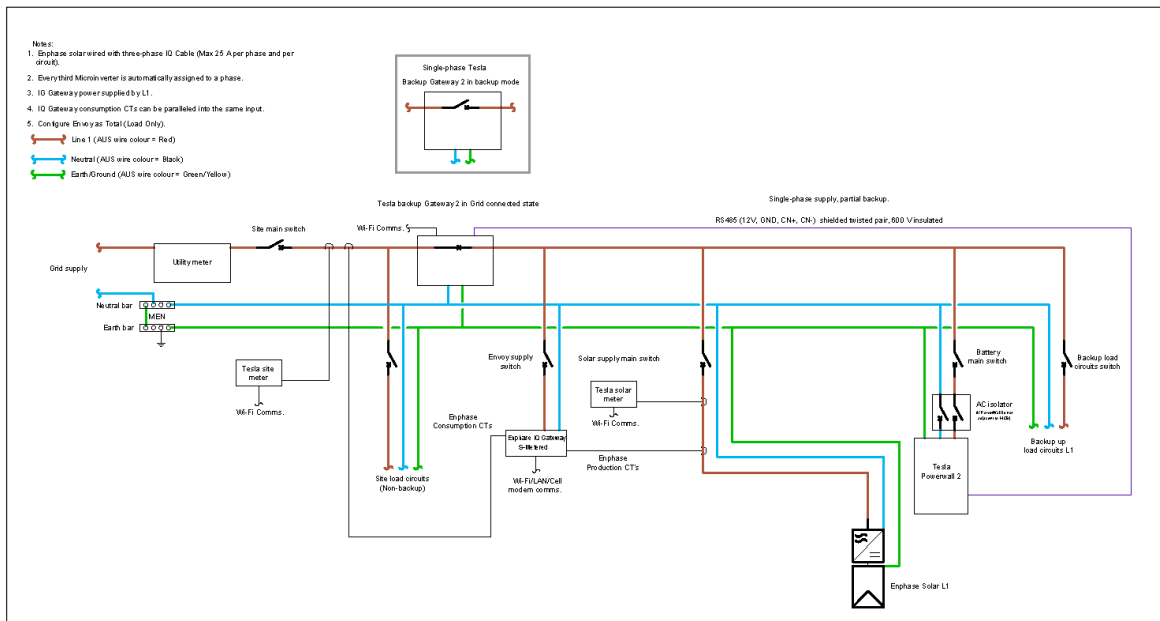


Figure 2: Partial backup: Single-phase supply, single-phase solar, and partial backup wiring diagram

Scenario 2: Three-phase site with three-phase Enphase Solar Only system installed on the backup circuit

The Tesla Gateway 2 is a three-phase gateway that provides a significant advantage when deploying a three-phase Enphase and Tesla Powerwall 2 system, especially in backup mode. The system should be wired as a three-phase Enphase Solar Only system, using the three-phase IQ Cable, which is rated at 25 A per phase. Deployment of a three-phase Tesla Gateway 2 negates the requirement for an IQ Relay, as the three-phase gateway now provides the required primary protection as per AS4777.2. However, a Legrand EP-LPC-01 Phase coupler will be required for power line communications between the Enphase microinverters and the IQ Gateway. If a phase coupler cannot be sourced, you can use the three-phase IQ Relay as a phase coupler by connecting L1, L2, L3, and N to the IQ Relay on the grid terminals (where the relay is installed on the backup side of the Tesla Gateway).

The system will isolate the site from the grid using the Tesla Gateway 2, and the backup will only occur on the phase to which the Tesla Powerwall 2 is connected. The other phases will be islanded and disconnected. The solar connected to the same phase as the Tesla Powerwall 2 (for example, L1) will produce power (in sufficient sunlight). The other two phases (for example, L2 and L3) should be wired into the home terminals of the Tesla Gateway 2, which will be islanded from the grid.



NOTE: The installation company should contact Enphase to be given access to the AS/NZS 4777.2:2020 (Region A/B/C/NZ) Tesla Grid Profile.

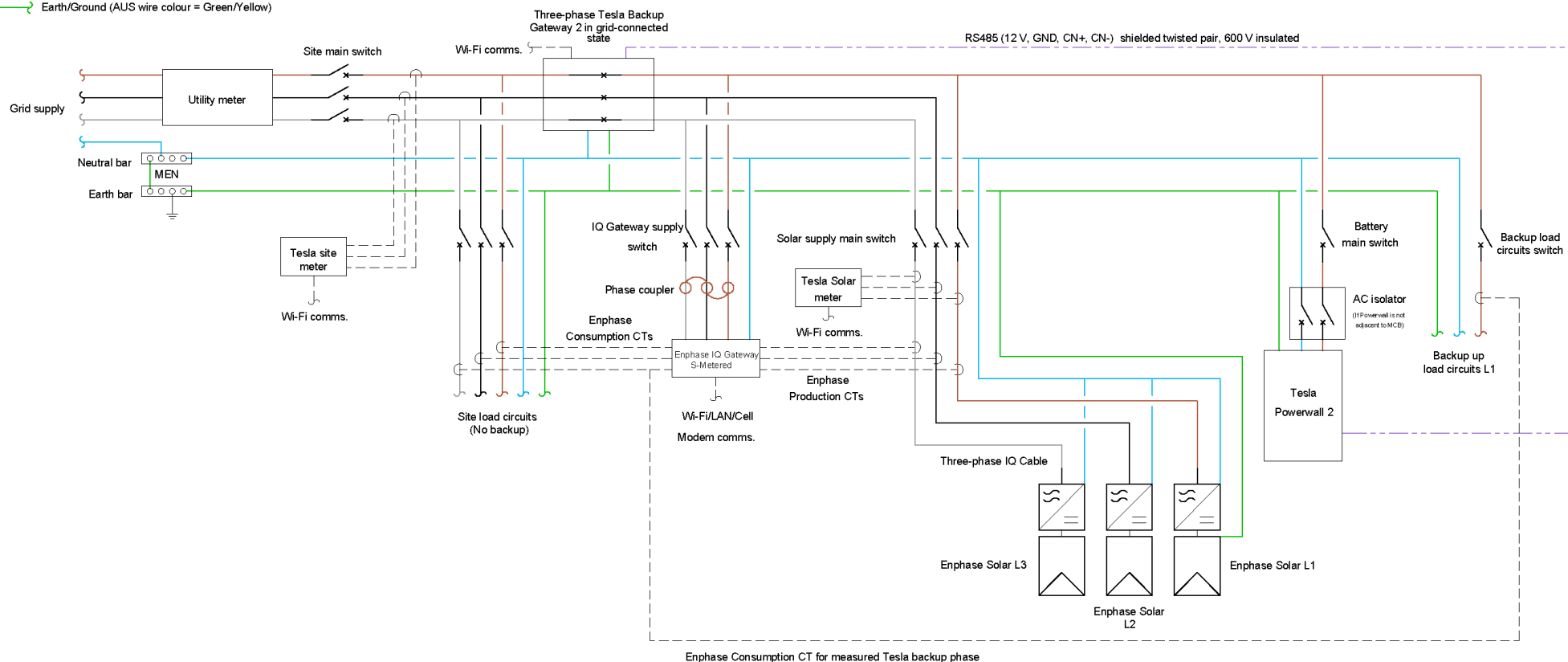
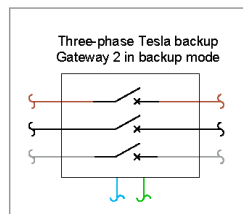
The following wiring diagram provides an example of the Tesla Powerwall 2 deployed on L1.

The maximum amount of PV inverter capacity to be installed on the same phase and the load side of the Tesla Gateway is 5 kVA (21.7 A) per Powerwall 2. This is a requirement from Tesla. Additional PV inverter capacity can be installed on the grid side of the Tesla Gateway 2, but it will not keep running in backup mode or you can set up a voltage reference from the Tesla Gateway 2 auxiliary contactor to the IQ Gateway as explained later in this document.

Notes:

1. Enphase Solar wired with three-phase IQ Cable (Max 25 A per phase and per circuit).
2. Every third microinverter is automatically assigned to a phase.
3. IQ Gateway power supplied by L1.
4. IQ Gateway Consumption CTs can be paralleled into the same input.
5. Configure IQ Gateway as Total (Load Only).

Line 1 (AUS wire colour = Red)
 Line 2 (AUS wire colour = White)
 Line 3 (AUS wire colour = Blue)
 Neutral (AUS wire colour = Black)
 Earth/Ground (AUS wire colour = Green/Yellow)



Scenario 3: Multiple-phase site with multi-phase Enphase Solar Only system partially installed on the backup circuit

In this scenario, each Enphase circuit will be treated as a single-phase system that is installed on each individual phase. For example, a three-phase site (up to 15 kVA) will require; two single-phase IQ Relays for the phases that the gateway is not protecting and a single-phase IQ Cable for each phase of solar that is connected. A Legrand EP-LPC-01 Phase Coupler will be required for power line communications between the Enphase microinverters and the IQ Gateway. If a phase coupler cannot be sourced, you can use the three-phase IQ Relay as a phase coupler by connecting L1, L2, L3 and N to the IQ Relay on the grid side only terminals.

In backup mode, the Enphase Solar Only system connected to the selected backup phase as the Tesla Powerwall 2 will continue to produce power (with sufficient sunlight). For example, if the Tesla Powerwall 2 is wired into L1 and enters backup mode, the gateway will island just L1 of the site, and the Powerwall will form a grid on L1 only. If the Enphase Solar Only system on L1 is on the backup terminal of the Tesla Gateway 2, it will continue to run in backup mode (with sufficient sunlight).



NOTE: The installation company should contact Enphase to be given access to the AS/NZS 4777.2:2020 (Region A/B/C/NZ) Tesla Grid Profile.

In this solution, it may be advantageous to connect additional solar capacity to L1. In Australia, you are allowed a 5 kW (21.7 A) phase imbalance between phases. If additional solar capacity is connected to the same phase as the Tesla Powerwall 2, the amount of power that can be produced in a backup situation will be greater. This can be utilized while also taking advantage of Net Metering in Australia.

The maximum amount of PV Inverter capacity to be installed on the same phase and the load side of the Tesla Gateway is 5 kVA (21.7 A) per Powerwall 2. This is a requirement from Tesla. Additional PV inverter capacity can be installed on the grid side of the Tesla Gateway 2, but it will not keep running in backup mode or you can set up a voltage reference from the Tesla Gateway 2 auxiliary contactor to the IQ Gateway.



NOTE: For power export limited systems: Consumption CTs must be placed at the incoming mains (loads + solar) for power export limiting to function, and this may cause a metering error notification when coupled with a Tesla Powerwall 2 which we can remotely disable. The Tesla consumption data should be used by the homeowner as this will account for battery charge and discharge and, therefore, be more accurate.

Notes:

1. Enphase Solar must be wired as 3 x single-phase systems with single-phase IQ Cable.
(Maximum 20 A per circuit when using IQ Relay, L1 and L2. Max 25 A with no IQ Relay, L1.)

2. IQ Gateway power supplied by L1 on backup circuit.

3. IQ Gateway Consumption CTs can be paralleled into the same input.

4. Configure IQ Gateway as Total (Load Only).

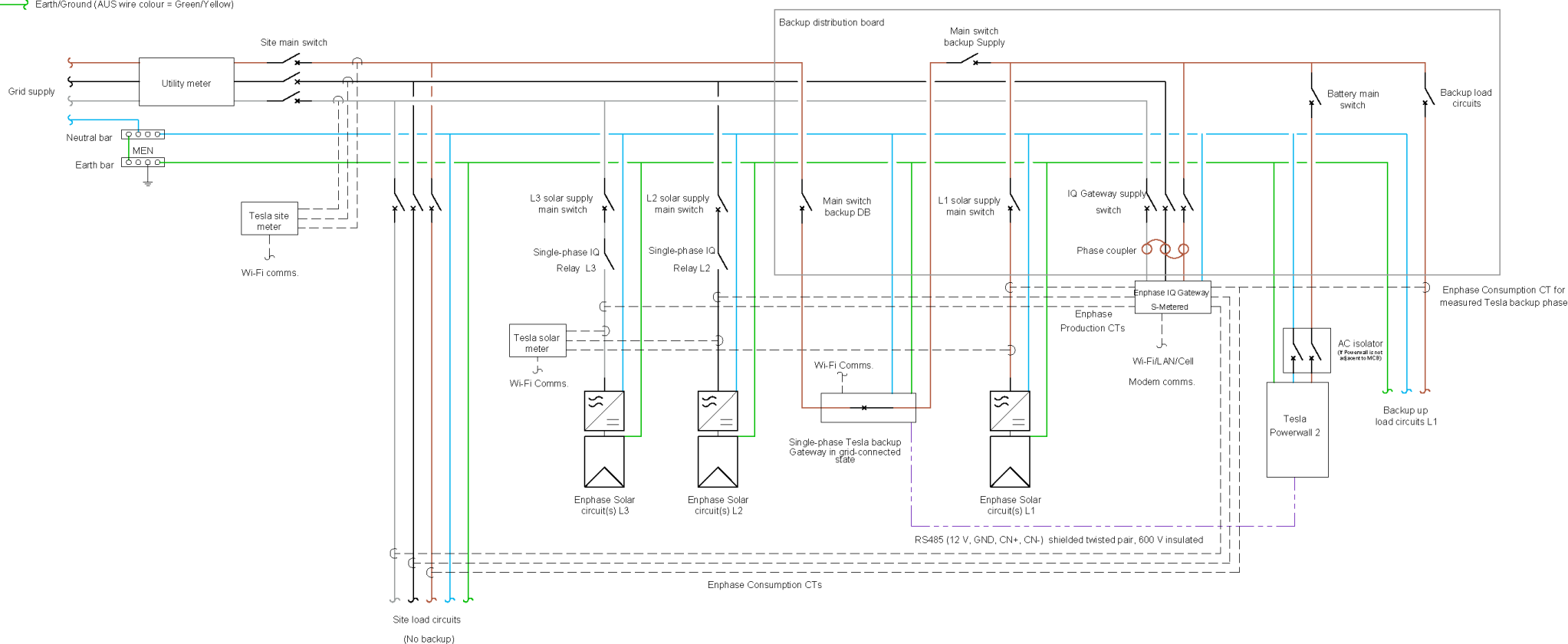
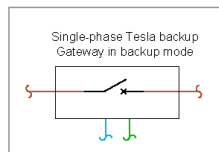
Line 1 (AUS wire colour = Red)

Line 2 (AUS wire colour = White)

Line 3 (AUS wire colour = Blue)

Neutral (AUS wire colour = Black)

Earth/Ground (AUS wire colour = Green/Yellow)



To limit the microinverter power in backup on a Tesla Powerwall 2 setup, refer to “[Setting PV power production limit with Tesla Powerwall 2](#)” in the Enphase Documentation centre.

Revision history

Revision	Date	Description
TEB-00032-2.0	September 2023	<ul style="list-style-type: none">Updated the document with “Setting PV power production limit with Tesla Powerwall 2” Documentation centre link.
TEB-00032-1.0	June 2023	<ul style="list-style-type: none">Renamed Envoy S to IQ Gateway.Updated system setting diagram for setting up a PV production limit during off-grid (in backup mode).Updated three-phase wiring diagrams with L2 and L3 PV phases.
Previous releases		