Application Note: Tigo EI Residential (US) Off-Grid Installations

Visit the Tigo Energy Help Center for comprehensive videos, articles, and other resources for all Tigo products.

Introduction

The Tigo EI Residential Solution (US) is an advanced energy system designed to provide grid-tied solar energy generation with backup capabilities. It integrates smart inverters, automatic transfer switches (ATS), batteries, and monitoring tools to deliver reliable energy for residential installations. While its primary function is as a grid-tied solution, the Tigo EI Residential Solution can also be configured to operate in off-grid environments when necessary.

This document outlines the necessary steps, limitations, and technical considerations for installing and commissioning the Tigo EI Residential Solution in an off-grid application. It is intended for installers and technical support teams who may encounter scenarios requiring an off-grid configuration. While the system is not optimized for off-grid use, this guide provides context and instructions for enabling off-grid functionality, ensuring installers understand both the possibilities and limitations of the system.

Failure to follow the requirements outlined in this document will result in installation, commissioning, or operational issues.

Tigo EI Residential Solution Off-Grid Capabilities

Currently, Tigo supports limited off-grid applications for its Tigo EI Residential Solution in the United States with a specific set of products. Two predefined packages – based on either 2 or 4 EI Battery units are available for off-grid use:

Off-Grid Package Products Include:

1. **Tigo TS4 with rapid shutdown capability** (TS4-A-O, TS4-A-S, TS4-A-F, TS4-A-2F, TS4-X-O, TS4-X-S, TS4-X-F) and connected to the Tigo Access Point (TAP)
2. **Tigo 11.4kW EI Inverter**
3. **Tigo 200 Amp ATS (Automatic Transfer Switch) with Generator Support**
4. **Tigo EI Battery Configuration:**
    - 2 x 10kWh EI Batteries (see Figure 1 below), or
    - 4 x 10kWh EI Batteries (see Figure 2 below)
5. **Compatible generator** (not provided by Tigo)
6. **Tigo GO Cellular Kit** (required if internet isn't available)

Key Notes:

- A compatible generator **is mandatory** for off-grid systems.
- **Off grid functionality is only enabled with the Tigo EI Residential products specifically mentioned in this document.** Ensure the system design follows this document before installation. If needed, a review with Tigo personnel can be scheduled in advance here: https://support.tigoenergy.com/hc/en-us
- **Wi-fi or cellular is required for off-grid commissioning.**

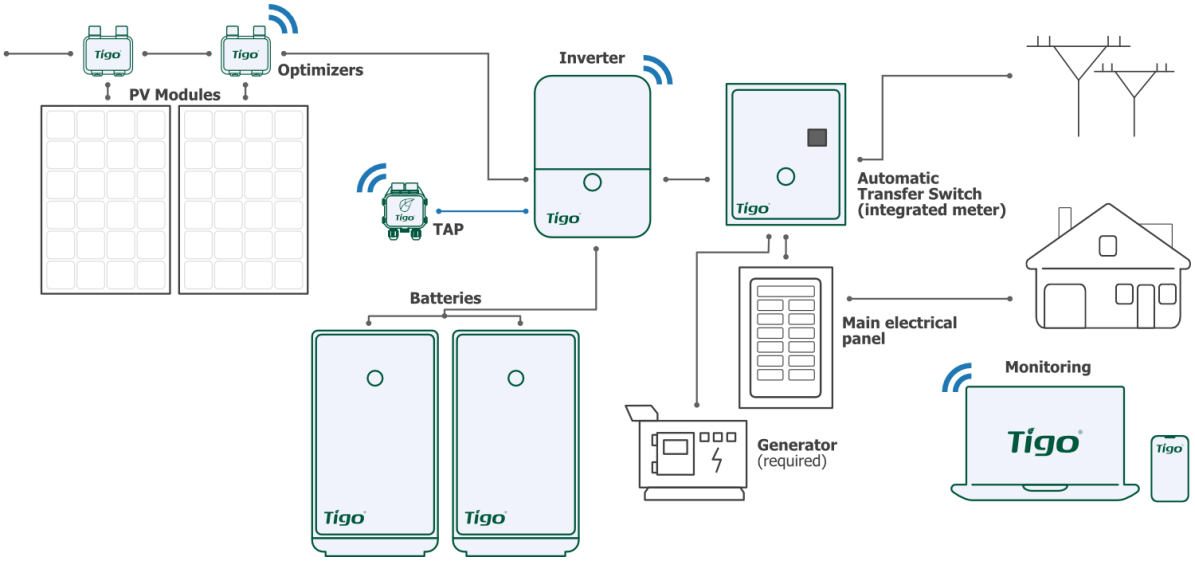


Figure 1: Off-grid application with 2x 10kWh Tigo EI Batteries

-OR-

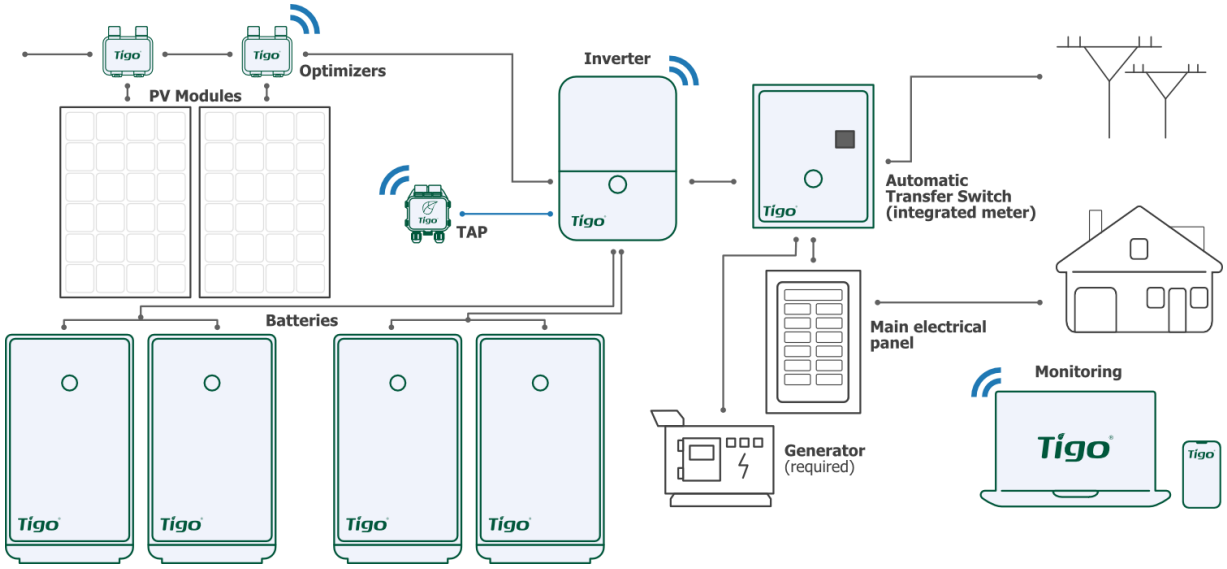


Figure 2: Off-grid application with 4x 10kWh batteries

System Requirements for Off-Grid Use

To ensure stable and reliable operation in an off-grid setting, the following conditions must be met:

Generator Requirements (generator best practices are provided later in this document):

- **Voltage:** 240V
- **Waveform:** Pure sine wave
- **Autostart:** 2-wire autostart capability
- **Total Harmonic Distortion (THD):** <5%

Internet

- Internet or cellular connection via the GO Cellular kit is required for commissioning and operation

Considerations and Limitations

Installers must understand and communicate the following limitations:

1. **Limited System Owner Control:** The system offers restricted homeowner visibility and control when used off-grid.
2. **Power Constraints:** In off-grid mode, power availability is limited to the inverter's capacity and battery reserves.
3. **Generator Control Options:** Generator control capabilities are restricted, and full integration may not be supported.

Recommendation:

If off-grid deployment is unavoidable, clear communication of capabilities and limitations is essential to set appropriate customer expectations.

Step-by-Step Commissioning for Off-Grid Systems

1. Installation of EI Components

Install all necessary components, including:

- Tigo TS4 and TAP
- EI Inverter
- EI Batteries
- Automatic Transfer Switch (ATS)

2. Black Start the Battery

To power up the system:

- Press and hold the battery power button for **2 seconds** to energize the battery.

- Once the battery powers up, the inverter will also start.

3. Connect to the Internet

- An active internet connection is **mandatory** during commissioning.
- A phone hotspot or GO Cellular Kit may be used as an alternative if Wi-Fi or Ethernet is unavailable.

4. Standard Commissioning Process

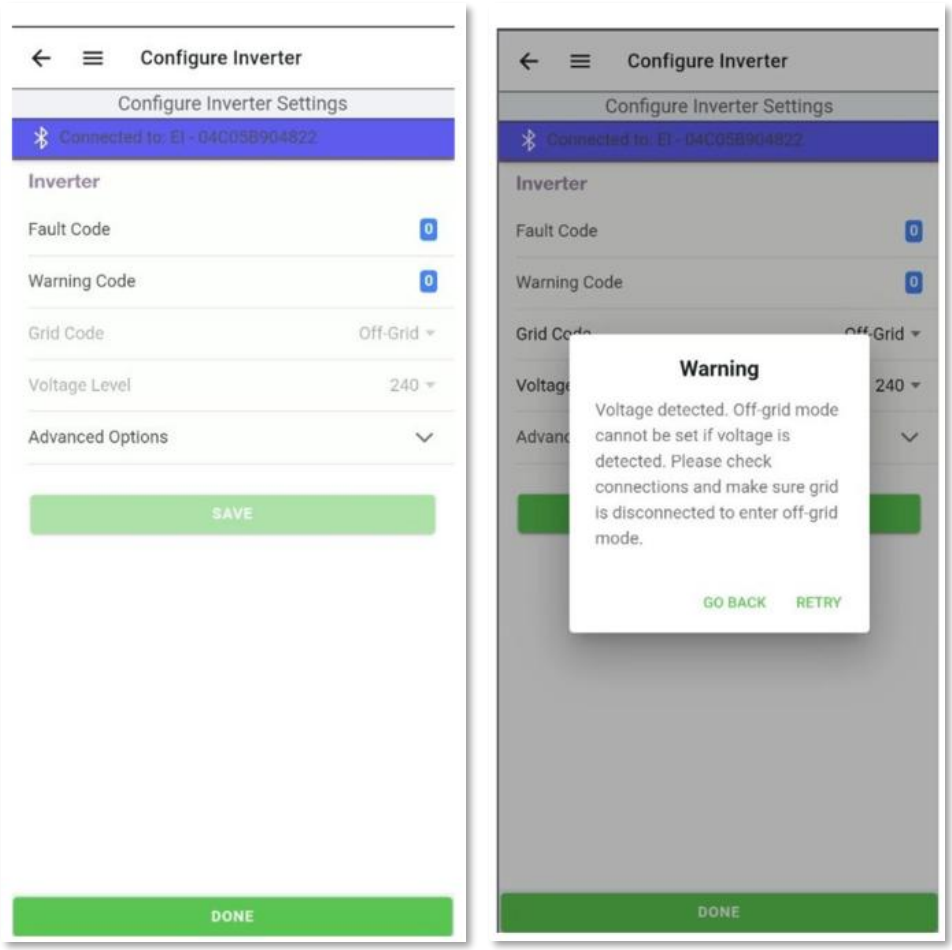
- Follow the standard commissioning steps to:
    - Update the firmware (FW).
    - Commission the inverter and batteries.
- Ensure PV modules are connected during this step to avoid FW update interruptions caused by battery reboots.

5. Scan ATS Barcode

- Use the EI App to scan the ATS barcode and add the ATS to the system.
- At this stage, the ATS communication is enabled (register 3079 will be set to 1).
- Note: The ATS will remain off at this point.

6. Enable Off-Grid Mode

- Navigate to "Configure Inverter Settings". Select "Off-Grid" from the Grid Code options and then "SAVE". If voltage is detected from the grid, you'll see a Warning message (shown below).

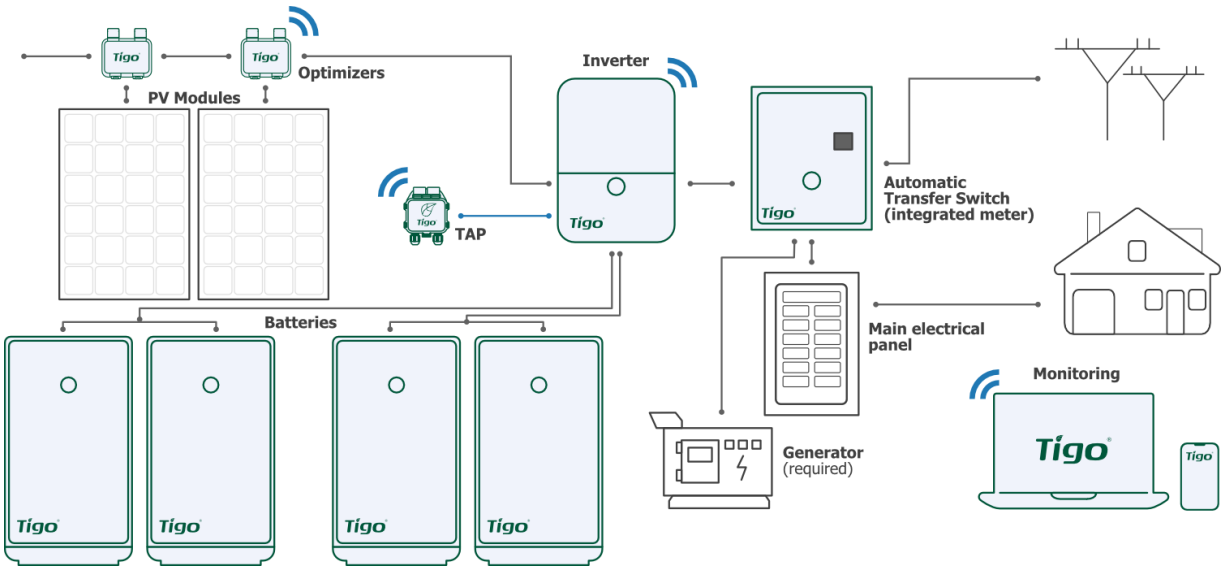

Configure Inverter
Configure Inverter Settings
Connected to: EI - 04C05B904822
Inverter
Fault Code
0
Warning Code
0
Grid Code
Off-Grid
Voltage Level
240
Advanced Options
SAVE
DONE
Configure Inverter
Configure Inverter Settings
Connected to: EI - 04C05B904822
Inverter
Fault Code
0
Warning Code
0
Grid Code
Off-Grid
Voltage
240
Advanced Options
Warning
Voltage detected. Off-grid mode cannot be set if voltage is detected. Please check connections and make sure grid is disconnected to enter off-grid mode.
GO BACK
RETRY
DONE

Generator Integration and Best Practices

Overview

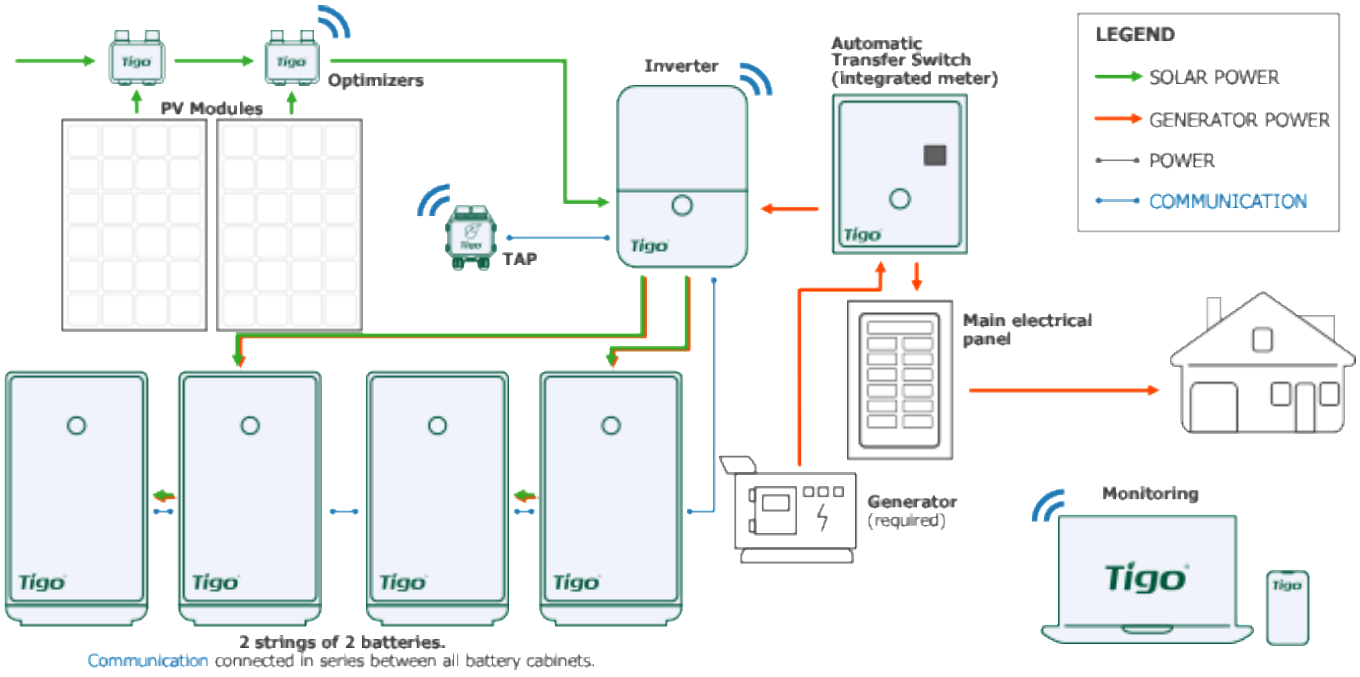
This section provides detailed guidance for selecting, integrating, and operating a backup generator using the Tigo EI Residential Solution in off-grid configurations.

Proper generator configuration ensures battery health, inverter stability, and reliable system operation during prolonged low solar production or high load periods.



Power Flow

When the generator is running, it is the only thing powering loads. However, both the generator and PV can charge the batteries simultaneously. See diagram below in which solar power is shown in green and generator power is shown in red.



Generator Sizing Recommendations

Generator sizing must match the EI Battery system's charging requirements and the Tigo inverter's load capacity. Use the table below for guidance:

System Configuration	Battery Capacity	Recommended Generator Size	Minimum Surge Capacity
2 EI Batteries	20 kWh	8 kW	10 kW
4 EI Batteries	40 kWh	12-15 kW	18 kW

Notes:

- Generator must provide 240V, 60Hz, pure sine wave output
- Total Harmonic Distortion (THD) must be <5%
- Generator must support 2-wire autostart capability
- 1800 vs 3600 RPM Generator Considerations
- 1800 RPM generators are preferred for off-grid applications
- 1800 RPM is built for durability; 3600 RPM is built for portability
- If the budget is tight, a 3600 RPM generator may be used in a grid-tied battery backup application.

Generator Wiring and Integration

Refer to the EI 200A ATS quick start guide for more information on power, starting battery trickle charge, and 2-wire start connections.

Start/Stop Logic

- Start Trigger: Battery SoC drops below 30% (adjustable using EI App)
- Stop Trigger: Generator charges batteries to 95% SoC
- Cooldown Delay: ATS holds the generator under load for 2 minutes post-charge, then disconnects
- Warm-Up Delay: ATS delays load transfer to the generator by 30 seconds after autostart

Charging Behavior

- Generator should be used to bulk charge batteries from low SoC to 95%
- The final 5% should be achieved via solar to ensure SoC calibration (once a month minimum)
- Turn off all loads during the last 5% to facilitate battery charging
- Manual Charging using Manual Start Generator
- The EI App must be used to start the generator manually
- If the generator is manually started, then it must be manually turned off
- The generator will charge to 95% SOC and stop. However, the generator will continue to run until it is turned off or runs out of fuel.

CAUTION! You must change the Generator Start setting to Manual before manually starting the generator.

Maintenance Recommendations

Refer to the generator documentation for recommended preventive maintenance periodicity and actions.

Maintenance Schedule

Generators typically run for 10-15 minutes a month to keep the internal battery charged and exercise the engine. Consult the generator documentation for onboard maintenance charging settings.

If the generator does not have programming for this feature, you must use the EI App to start and stop the generator manually.

Starting Battery for Generator

The EI Automatic Transfer Switch (200A) has a 120V breaker for connection to an external trickle charger, which keeps the generator's starting battery charged. See the EI ATS documentation for more information.

Customer Education

Fuel Supply: Propane/Diesel preferred for longer-term stability vs. gasoline

Duty Cycle: Expect frequent generator use during winter months or poor weather

Monitoring and Alerts

Alert customer if generator fails to start or experiences faults

Use Tigo EI App or 3rd-party remote monitoring for SoC and generator status

Summary

Proper generator selection and integration are critical in off-grid installations. Following the recommendations in this section helps ensure:

- Longer generator lifespan
- Stable battery operation
- Fewer customer callbacks

Tigo Support is available for generator wiring review and commissioning guidance. Visit the Tigo Energy Help Center for additional resources.

Expectation management

While the Tigo EI Residential Solution can be configured for off-grid use, it is important to recognize its limitations and communicate these to customers:

- Power rating: maximum 10kW
- Surge power: maximum 13.6kW surge power (120% for the 11.4kW inverter)
- Communication: internet or cellular required
- Restart: must contact Tigo support if battery SoC (State of Charge) is below 7%
- Generator: auto-start based on SoC or manual activation
- Charging: Generator SoC limit: 95%. System should be recharged to 100% using solar at least once per month to maintain SoC accuracy.
- Generator stops charging battery at 95% SoC
- Smart load controller: currently not available

Key Takeaways:

- The Tigo EI Residential Solution is engineered as a grid-tied solution. With proper design and customer expectation management, it can perform well in an off-grid application.
- The installation and equipment requirements in this document must be followed for a successful installation
- Clear communication and proper planning are essential to ensure system success.

Additional Resources

For further support and documentation, visit the Tigo Energy Help Center, where you can access videos, articles, and technical resources for all Tigo products.