

# Application Guide: Time of Use (TOU)

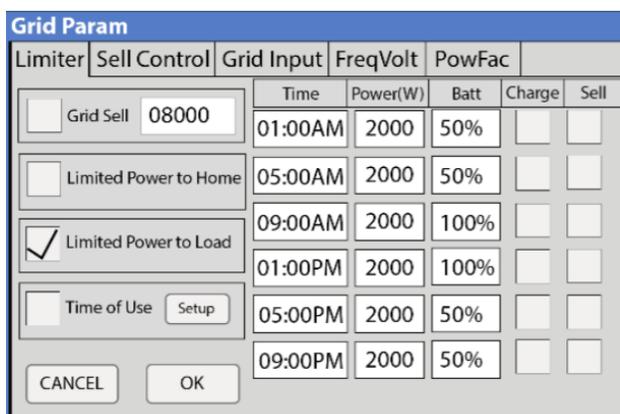
Follow these guidelines for setting up **Time of Use** (TOU) on your residential Sol-Ark inverter.

## Introduction

TOU settings let you choose when to use the battery to supply power while connected to the Grid. This means that you can use your batteries for more than emergency backup. There are **limited use cases** for off-Grid applications involving generator controls as well.

## Set up Time of Use

Go to **Grid Param > Limiter** to see this screen.



Grid Param						
Limiter	Sell Control	Grid Input	FreqVolt	PowFac		
		Time	Power(W)	Batt	Charge	Sell
<input type="checkbox"/>	Grid Sell	08000	01:00AM	2000	50%	<input type="checkbox"/>
<input type="checkbox"/>	Limited Power to Home	05:00AM	2000	50%	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	Limited Power to Load	09:00AM	2000	100%	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Time of Use	Setup	01:00PM	2000	100%	<input type="checkbox"/>
			05:00PM	2000	50%	<input type="checkbox"/>
			09:00PM	2000	50%	<input type="checkbox"/>

The **Limiter** tab controls battery charge and discharge when the inverter is connected to Grid power or other AC power sources.

The settings on the Limiter tab are explained below.

## Time

- The **Time** setting is the chronological start time for each time block
- Because the day (24 hours) is divided into 6 time blocks, Time 1 begins again after Time 6, completing the loop
- Time settings must be in chronological order from 0000 to 2400
- You can change the time format to 12 hours AM/PM at **Basic Setup menu > Display**

## Power (W)

**Power(W)** settings specify the maximum power that the battery will discharge during each time block

- If there is NO solar power, and power loads go higher than the **Power(W)** setting, the Sol-Ark will use other available power, such as Grid power, to cover the rest of the loads

## Batt (% / V)

**Batt** settings specify the battery voltage (V) or percentage (%) to which the inverter can discharge/charge the battery during that time block

- This value depends on the settings in **Batt Setup > Batt menu > Use % / Use V**
- This value changes depending on whether the **Charge** or **Sell** check boxes are selected

## Charge

The **Charge** check box tells the inverter to charge the battery from an AC source connected to the inverter (Grid, Generator, or AC coupled input), at a specified time block, until it reaches the **Batt%** setting.

- Solar Power will ALWAYS charge the battery regardless of whether **Charge** is selected.

## Sell

The **Sell** check box tells the inverter to discharge the battery back to the Grid at the rate of the **Power(W)** setting until it meets the **Batt%** setting value.

**NOTE: DO NOT ENABLE BOTH CHARGE AND SELL BOXES DURING ANY TIME BLOCK, BECAUSE IT MAY CAUSE UNINTENDED BEHAVIOR.**

## Different Operating Modes Affecting TOU

### Grid Sell + Time of Use

*This combination uses available solar power AND battery power to push the set amount of Power(W) back through the Grid terminals.*

If solar power production is enough to equal the **Max Sell** number (the number next to **Grid Sell**), the inverter will not discharge the battery.

In this combination, **Charge** boxes do not need to be checked to sell battery power back to the Grid terminals, because the inverter always sells the programmed **Power(W)** amount back to the Grid terminals. This lasts until either the **Max Sell** amount is reached, or the battery SOC reaches the **Batt%** setting for the time block.

- Solar production will try to match the **Max Sell** value
- Production is dependent on the loads receiving power
- Power sent back to the Grid terminals may not all be sold to the Grid
- Power loads in the main service panel will consume some or all power
- To monitor the actual amount of power sold to the Grid, use “Limited Power to Home” mode with the supplied CTs

#### Example 1 for 12K-2P

*10kW Solar Array | Max Sell Value = 9000W | Crit Loads = 2000W | Home Loads = 1000W | Power(W) value = 4000W on all Time Slots*

\*Assume Full Sun

1. The inverter produces enough power to cover the critical loads (in this example, 2000W) from solar first, since battery isn't needed.
2. After the power leaves the Grid terminals and arrives at the Main Service Panel, home loads use 1000W.
3. The inverter inverts 6000W more than the loads require.
4. 9000W will be sold to the grid (6000W coming from solar after covering the loads, plus 3000W considering Power value of (4000W) in TOU.

### Example 2 for 12K-2P

*10kW Solar Array | Max Sell Value = 9000W | Crit Loads = 2000W | Home Loads = 1000W | Power(W) value = 4000W on all Time Slots*

\*Assume Half Sun (only 5kW solar power available)

1. The Sol-Ark inverts the 5kW and supplies the 2000W critical load on the Load Breaker
2. After the power leaves the Grid terminals and arrives at the Main Service Panel, home loads use 1000W
3. Since this combination will sell back the Grid at a Sell Max Value = 9000W, it will use 4000W from the battery.
4. 6000W will be sold to the grid (2000W coming from solar after covering the loads, plus 4000W value in TOU).

### Example for 15K-2P with Whole Home Backup

*15kW Solar Array | Max Sell Value = 15000W | Home Loads = 9000W | Power(W) value = 4000W on all Time Slots*

\*Assume Full Sun

1. The inverter produces enough to cover the loads (9000W of solar) and powers the home's whole 9000W load.
2. The inverter produces and inverts to match the Max Sell value while keeping within the inverting specifications for a 15kW inverter.
3. With 9000 W being consumed by the loads, the remaining 6000 W will be sold to the grid. The battery cannot be used because the inverter's conversion capacity has been reached. Since the Grid Terminal is directly connected to the grid, all power sent back to it is sold to the grid.

## Limited Power to Home + Time of Use

*This combination requires installing CT sensors at the correct location and polarity.*

This combination uses solar power to charge the battery and power the home's whole load when available.

1. The battery powers the whole home load when PV is no longer available or is not producing enough to match the entire home's load.
2. This continues until the battery SOC reaches the **Batt%** setting at or below the rate of the **Power(W)** setting for the appropriate time slot.

3. If there's not enough solar power and battery to meet the loads, the inverter will draw from the Grid to power the remaining loads.
  - Charge boxes use the Grid to charge the battery.
  - Sell boxes sell battery power back to the Grid terminal at the rate of the **Power(W)** setting until the battery SOC reaches the **Batt%** setting.

## Limited Power to Home + Time of Use + Grid Sell

*This combination requires installing CT sensors at the correct location with correct polarity.*

This mode is very similar to **Limited Power to Home + Time of Use**.

1. Instead of PV production trying to match the home's whole load, PV produces as much power as possible.
2. The inverter uses the generated PV production to power the load, charge the battery, and sell any remaining power back to the Grid.

**Note:** Depending on your installation, there may be loads upstream of the inverter that consume some of the energy produced. If you want to monitor this usage, set up "Limited Power to Home" mode with proper CTs.

## Limited Power to Load + Time of Use

*In this combination, PV is used to charge the battery and power the critical load sub panel connected to the Sol-Ark inverter's load breaker, when available.*

1. The Battery supplies the critical load sub panel on the Load breaker when PV production is no longer available, or the PV system does not produce enough power to meet the critical load sub panel.

The battery will stop discharging once it reaches the **Batt %** or **V limit** specified in the TOU table. The power drawn from the battery is limited by the **Power (W)** setting in the TOU table.

2. This continues until the battery SOC reaches the **Batt** setting at or below the rate of the time slot's **Power(W)** setting.
3. If neither the PV nor the battery can power the loads, the inverter draws from the Grid to power the critical load panel.
4. This continues until the battery SOC reaches the **Batt** setting at the rate of the **Power(W)** setting.

## Limited Power to Load + Time of Use + Grid Sell

This mode is similar to **Limited Power to Load + Time of Use**. Instead of PV (solar) production trying to match the critical load sub panel, the PV produces as much power as possible. The generated PV production powers the critical load sub panel, charges the battery, and sells any remaining power back to the Grid.

**Note:** Depending on your installation, there may be loads upstream of the inverter that consume some of the energy produced. If you want to monitor this usage, set up “Limited Power to Home” mode with proper CTs.

## Off-Grid Generator Control Function

Although TOU is not generally used in off-Grid situations, you could use TOU for precise generator control when charging batteries.

- When using TOU settings off Grid with a 2-wire auto start generator, with the **Charge** boxes checked, the generator control relay opens the circuit to shut down the generator as the battery SOC reaches the **Batt** setpoint.
- The generator start will still follow the charge setpoints (**Batt Setup menu > Charge**), rather than TOU settings, even if the **Charge** check boxes are checked.
- All **Charge** check boxes must be checked to ensure the generator can turn on for any time slot, in order to charge the battery if needed.

## Grid Peak Shaving

If you're using Grid Peak Shaving option on the inverter, TOU will automatically turn on. TOU must be on during Grid Peak Shaving.

Do not make any changes to the TOU setup menu when using Grid Peak Shaving. Doing this may cause unexpected issues with the Sol-Ark inverter.

## TOU Setup—Common Examples

On-Grid: Off-set Loads Overnight, Charge During the Day Without Buying from Grid, and Sell Excess PV

*This is the most common application for TOU: using the Sol-Ark inverter to limit the amount of power imported from the Grid.*

Grid Param					
Limiter	Sell Control	Grid Input	FreqVolt	PowFac	
<input checked="" type="checkbox"/> Grid Sell	09000	Time	Power(W)	Batt	Charge Sell
		01:00AM	9000	30%	<input type="checkbox"/> <input type="checkbox"/>
<input checked="" type="checkbox"/> Limited Power to Home		05:00AM	9000	30%	<input type="checkbox"/> <input type="checkbox"/>
<input type="checkbox"/> Limited Power to Load		09:00AM	9000	30%	<input type="checkbox"/> <input type="checkbox"/>
<input checked="" type="checkbox"/> Time of Use	Setup	01:00PM	9000	30%	<input type="checkbox"/> <input type="checkbox"/>
		04:00PM	9000	30%	<input type="checkbox"/> <input type="checkbox"/>
		09:00PM	9000	30%	<input type="checkbox"/> <input type="checkbox"/>
CANCEL		OK			

### Time

You can adjust the **Time** value to better align with your location's sunrise/sunset for efficiency.

### Power(W)

The **Power(W)** setting will depend on the Ah rating of your battery bank.

For example, if your **Max A Charge/Discharge (Batt Setup menu > Batt)** is 185A, then you can set the **Power(W)** value to 9000W.

### Batt

The **Batt** value (**V** or **%**) depends on the Ah rating of the battery bank and the recommendation of the battery manufacturer.

### Lithium batteries

Generally, lithium (LiFePo4) batteries can be deep-cycled deeply daily without issue (30% in the example above).

## Charge

If the **Charge** check box is selected during a time period, then either the Grid or a generator will charge the batteries until the chosen SOC% or V is reached.

- If the batteries are below the **Batt** value when the charge time period begins, the Grid will immediately begin charging the battery until the **Batt** value is reached.
- Generators begin charging the battery only after the **Gen/Grid Start %/V (Batt Setup > Charge)** value is reached, but it will charge the battery until the **Batt** value is reached.
- During the same time period, the Grid and generator will not charge the battery if the **Batt** value has already been reached, until the **Gen/Grid Start %/V** is reached again, or a new time slot begins with the battery under the **Batt** value.

We do not recommend enabling the **Sell** check box in this case.

## On-Grid: Utility Charges Rates Based on Worst Hours (4pm-9pm); Sell Power from Batteries to Ensure No Grid Import at Chosen Time

*This application is most commonly used in California where some utility providers charge their customers based on consumption during a specific time period (for example, 4pm - 9pm).*

Grid Param							
Limiter	Sell Control	Grid Input	Freq	Volt	PowFac		
		Time	Power(W)	Batt	Charge	Sell	
<input checked="" type="checkbox"/>	Grid Sell	09000	01:00AM	9000	100%	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	Limited Power to Home	05:00AM	9000	100%	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	Limited Power to Load	09:00AM	9000	100%	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>		01:00PM	9000	100%	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	Time of Use	Setup	04:00PM	9000	30%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>			09:00PM	9000	30%	<input type="checkbox"/>	<input checked="" type="checkbox"/>

CANCEL      OK

## Time

You can adjust the **Time** value to better align with your utility provider's charge period.

## Power(W)

The **Power(W)** setting depends on the Ah rating of your battery bank. For example, if your **Max A Charge/Discharge (Batt Setup menu > Batt)** is 185A, then you may set the **Power(W)** value to 9000W.

## Batt

The **Batt** value (V or %) depends on the Ah rating of the battery bank and the recommendation of the battery manufacturer.

Generally, lithium (LiFePo4) batteries can be cycled deeply daily without issues (as you can see in the example above, showing a **Batt** value of 30%).

## Off-Grid: Precise Generator Control to Conserve Fuel

*This application is used in off-Grid installations incorporating a generator into either the Grid or Gen breaker of the Sol-Ark.*

Using TOU give you precise control over when the generator turns on and off (assuming the generator is two-wire start compatible).

Grid Param						
Limiter	Sell Control	Grid Input	FreqVolt	PowFac		
<input type="checkbox"/>	Grid Sell	09000				
		Time	Power(W)	Batt	Charge	Sell
		01:00AM	9000	60%	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Limited Power to Home	05:00AM	9000	60%	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	Limited Power to Load	09:00AM	9000	60%	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	Time of Use	01:00PM	9000	60%	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		04:00PM	9000	60%	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		09:00PM	9000	60%	<input checked="" type="checkbox"/>	<input type="checkbox"/>
CANCEL		OK				

## Time

You can adjust the **Time** value to better align with your preference.

## Power(W)

The **Power(W)** setting depends on the Ah rating of your battery bank.

For example, if your Max A Charge/Discharge (**Batt Setup menu > Batt**) is 185A, then you can set the **Power(W)** value to 9000W.

The **Power(W)** rating does not affect the rate at which the generator will charge the batteries. This is controlled by the **Gen/Grid Start A (Batt Setup menu > Charge)**.

## Batt

The **Batt** value depends on your preference, since this is the cutoff for generator charging. The battery will always discharge down to the **Shutdown %/V (Batt Setup menu > Discharge)** while off-Grid. In the example, the generator will cut off at 60% battery SOC.

## Sell

DO NOT select the **Sell** check box for any time period; doing so will cause the Sol-Ark to push battery power into the generator if it is on the Grid breaker.

## TOU Pro Tips

Here are some additional tips for Time of Use:

- TOU controls only the battery's discharge while the Grid is available.
- In case of a Grid loss event or if you are off-Grid, the battery will always discharge down to the **Shutdown %/V (Battery Setup menu > Discharge)**.
- If you intend to use your batteries to offset as many loads as possible while the Grid is available, then you will likely set your **Batt** value in TOU equal the **Low Batt %/V** value (**Batt Setup menu > Discharge**).
- **Low Batt** is the lowest possible value to which batteries are discharged while the Grid is available.
- If you intend to use the batteries as a backup power source in a Grid loss event, set your **Batt** value in TOU accordingly.

If you set the **Batt** value to be equal to the **Low Batt %/V**, there might be times when the battery reaches the **Low Batt** value and has only minimal capacity left until it reaches **Shutdown %/V**.

This may not allow time for a two-wire start generator to kick in to charge batteries above the shutdown threshold. Such battery faults usually happen in a Grid loss event during inclement weather or in the middle of the night.

- Depending on your installation, there may be loads upstream of the inverter that consume some of the energy produced. If you want to monitor this usage, set up "Limited Power to Home" mode with proper CTs.

## Document Revision History

Rev.	Date	Author	Description of Changes
000	03/01/2022	Fernando Flor	Document Created
001	03/06/2025	Genaro Marquez	Minor updates and examples added
002	06/19/2025	Jan Falcona	Remove references to lead acid batteries