Battery Behaviour during Wintertime

In this article, you will learn more about handling batteries and their behaviour during the winter months.

In winter, battery behaviour in conjunction with solar inverters can vary significantly from that in warmer seasons due to low temperatures that can affect battery performance. Here are some key points and recommendations:

1. **Temperature Effects on Batteries**: Cold weather can impact battery performance as low temperatures can slow down chemical reactions within the battery. This can result in reduced capacity and diminished performance.

2. **Battery Preheating/Insulation**: Some advanced battery storage systems feature heating systems that can preheat the batteries at low temperatures to enhance their performance. Check if your battery storage system supports this feature and activate it if necessary. Insulate the battery to protect it from extreme temperatures. This can help stabilize the battery's operating temperature and improve its performance.

3. **Optimization of Charging and Discharging Settings**: In cold winters, it may be beneficial to adjust the charging and discharging settings of your solar inverter to preserve the battery and maximize performance. It is advisable to set the maximum discharge limit to 30-40%.

4. **Regular Monitoring and Maintenance**: Regularly monitor the condition of your battery and solar inverter, especially during the winter months. Ensure that all components are functioning properly and there are no issues that could affect performance.

5. **Ensuring Adequate Charging Capacity**: Since sunlight exposure may be lower in winter compared to summer, it is important to ensure that your battery is adequately charged during sunny hours to meet energy demands. You may need to adjust your energy consumption patterns or rely on additional grid charging to ensure the battery is sufficiently charged.

6. **Consult Your Installer or Our Support**: If you are unsure or have specific questions about your battery storage system and solar inverter, it is best to consult a solar installer or our support team. We are happy to assist you in optimizing and adjusting your systems for winter.

7. **Plan for Emergency Power Operation**: If your battery storage system is also used for emergency power operation, ensure that it is fully charged and ready to reliably function in case of a power outage during winter.

8. **Use preheating function**: If your battery storage system has a preheating function, activate it to bring the battery to an optimal operating temperature before charging. This can help improve battery performance in cold weather.

Battery Healing

What is Battery Healing?

This innovative function allows your battery to charge to a pre-set percentage directly from solar energy, bypassing consumption until the desired charge level is reached.

Addressing the Challenge of Charging Current

One of the most significant hurdles in solar-powered systems is the issue of charging current, particularly in colder climates. If the Battery Management System specifies a charging power of 0 amps, the battery will not charge, regardless of the charging settings set on the inverter. However, our firmware's Battery Healing feature offers a solution by prioritizing solar charging until the battery reaches the specified charge percentage.

Adapting to Environmental Conditions

In regions where cold weather poses a challenge to battery charging, our innovative approach offers a practical solution. While conventional methods might falter when faced with suboptimal temperatures, Battery Healing ensures that your battery receives the charge it needs, even in adverse conditions. Additionally, we recommend covering the battery to provide extra insulation, further enhancing its performance during colder periods.

The reason why winter is such a problem for batteries is as follows:

The measurement of the state of charge (SOC) is never perfect: It involves calculating the current consumption (power) from the battery over time (energy). Current sensors, especially direct current sensors, are not 100% accurate. Any tolerance can make, for example, 19% (actual) look like 20% (reported from BMS to inverter).

This is exacerbated under low current conditions:

Measuring low currents is much more difficult than measuring high currents. When the battery is idle in winter, there is parasitic discharge. The inverter power supply discharges at around 30 W, and the BMS discharges at 5 W.

The battery does not reach 100% for weeks (in many cases, months): This is because the tiny bit of solar energy received is initially sent to local consumers (to reduce imports, standard mode called self-consumption), meaning the battery never sees any of the solar energy.

Definitions:

"Overdischarge_SOC": A parameter within the inverter settings that instructs it to cease discharging the battery for self-use.

"Forcecharge_SOC": A parameter within the inverter settings that directs the inverter to forcibly recharge the battery back up to the specified "Overdischarge_SOC."

Example:

To illustrate this concept with a 5 kWh battery and a 50 W standby discharge (even if it falls below the "Overdischarge_SOC"), consider the following scenario. The batteries discharge to the "Overdischarge_SOC" (set at 20%, potentially reaching 19%) through self-consumption at 5 pm. Subsequently, the battery continues discharging at a 50 W standby rate, reaching the "Forcecharge_SOC" (10%) after ten hours (10 hours x 50 W = 0.5 kWh = 10% of the battery). The inverter then forcibly charges the battery back to 20%, acknowledging that the precise value may vary due to imperfect SOC calculation based on energy inflow and outflow. The following day, all solar energy

caters to household loads without involving the battery. Consequently, the battery oscillates between the "Overdischarge_SOC" and the "Forcecharge_SOC," deviating from actual SOC values.

Eventually, the presumed 10% corresponds to the critical 5%, leading to an automatic shutdown of the battery. Addressing this issue requires technical intervention for a reset. In cases where resolution is delayed, external charging may be necessary, or, in severe instances, the battery may sustain damage.

Detection of this issue often involves monitoring the battery voltage over time against SOC. When it first reaches 10%, the voltage may read 46 V. Subsequent occurrences may show slightly lower voltages like 45.9 V and so forth. Unfortunately, the voltage measured across all cells in series cannot precisely determine SOC; it serves as a reliable indicator.

We are actively developing winter features that could potentially alter priorities, placing emphasis on the battery before other consumers. Additionally, selecting the "forced charging SOC" ensures that only local loads are supplied until the battery reaches 100%.

As long as we don't have winter features yet:

- **Option 1**: To avoid deep discharge and keep the battery durable, we recommend regularly charging the battery from the grid using the "Time Charging" function.
- **Option 2:** Avoid setting the overdischarge State of Charge (SOC) and Forcecharge SOC too low. During the cold season, we recommend setting the Overdischarge SOC to 30% and the Forcecharge SOC to a minimum of 20%. These settings should help prevent a deep discharge of the battery.
- **Option 3**: Charge the battery to 30-40% once over the winter months and then set it to "No Battery" under settings. Only put the battery back into operation when the days become sunnier again.

By following these recommendations and adjusting your battery storage system and solar inverter accordingly, you can maximize the performance of your solar system in winter and ensure reliable power supply even in cold temperatures while maintaining the longevity of your battery.