

What regular maintenance is required of batteries used in solar systems?

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Just as different types of solar panels change how the overall solar system performs and is maintained, the many types of battery chemistries influence the performance and upkeep required of a solar-plus-storage system. If someone is looking for a cheap and durable storage type, they may choose lead-acid batteries, understanding that there is some hands-on maintenance required. For system owners wanting a hands-off maintenance approach, lithium batteries are a popular choice, but they don't work in extreme environments.

The varying degrees of battery maintenance can influence which energy storage system is chosen for a solar-plus-storage application. We'll explain the maintenance required of four common storage types used in the solar industry: lithium-ion, lead-acid, nickel-cadmium and flow batteries.

Lithium-ion batteries

Lithium batteries have become the preferred storage choice in most solar applications due to their high density, low maintenance and falling cost, said [Eguana Technologies](#) founder and CTO Brent Harris. There are specific applications where lithium is not the best fit, such as in extreme temperature ranges (Arctic remote power) or where long storage durations are required and other technologies are more cost-effective. The largest maintenance item around lithium-ion batteries is their degradation rate. Just as with a cell phone, lithium batteries used in solar wear out after a certain number of charges and discharges. That degradation rate must be planned for. The two most common lithium-ion battery types used in solar-plus-storage are lithium iron phosphate (LFP) and lithium nickel manganese cobalt oxide (NMC).



sonnen LFP battery system

Lithium iron phosphate (LFP)

LFP batteries are safe, long-lasting batteries. Because they don't use cobalt, they do not have thermal runaway (fire) concerns and don't require ventilation or cooling, so they can easily be installed indoors and are great for residential applications. According to LFP manufacturer sonnen, these lithium batteries are ideal for use in stationary energy storage, especially if daily cycling of the batteries for solar self-consumption optimization and grid services is required.

What upkeep is required for normal operation?

LFP batteries require no maintenance, but their installation location could affect performance. All lithium batteries include a battery management system (BMS) that automatically monitors each battery cell for temperature, state of charge, cycle life and more to maximize performance. As long as the storage system is installed in acceptable temperature ranges and altitudes, maintenance is nil.

“With LFP there is no regular maintenance required as long as they are stored and installed in a location that meets the product specifications,” said Carlos Restrepo, VP of technology for sonnen. “However, it is important to maintain battery temperature away from extreme temperatures to ensure proper performance. The batteries do not have to be prepared for seasonal temperature changes.”

This lithium battery type is very resilient and durable.

“LFP batteries can be subjected to overcharging, very high elevated temperatures, and even physical damage and stress—such as running into the battery with a car while it's mounted in

a garage—while remaining safe,” said Brad Hansen, CEO of [EnSync Energy](#). “When using batteries in or next to living spaces, picking the safest chemistry as the basic building block for the system is an important guiding principle.”



Eguana’s storage system with NMC battery

Lithium nickel manganese cobalt oxide (NMC)

NMC batteries are also long-lasting and very safe as long as they’re monitored by a battery management system. By adding nickel and manganese to the battery chemistry, the systems can store more energy than other lithium battery types.

What upkeep is required for normal operation?

As with all lithium battery types, no major maintenance is required of the NMC chemistry. The BMS will monitor cell voltages, currents and temperatures to ensure safety and long life.

“Extreme operation will shorten the life [of the battery], and excursions are recorded by our system through the BMS to inform warranty claims. The BMS shuts the system down in the case of any potentially unsafe operating conditions,” said Eguana’s Harris. The company manufactures an energy storage system equipped with an LG Chem NMC battery.

NMC batteries do not have special instructions for winter usage, as long as safe temperature ranges are acknowledged.

“If seasonal storage is required, they should be stored indoors,” Harris said, citing Canadian winters as an extreme example.



Primus Power ZNBR hybrid flow battery

Flow batteries—specifically, zinc bromine (ZNBR)

ZNBR flow batteries (most commonly manufactured by Primus Power) are great for large-scale long-duration energy storage. Flow batteries use two chemical components dissolved in liquids separated by a membrane to provide a charge. ZNBR flow batteries have a zinc bromide salt dissolved in the electrolyte liquid. Primus Power’s technology is slightly different than traditional ZNBR batteries, and features no membrane that would need to be cleaned or replaced. Primus also uses a single tank (fewer parts), and its flow batteries have unlimited full charge and discharge cycles without degradation. Flow batteries in general have very little maintenance requirements.

What upkeep is required for normal operation?

Flow batteries act like fuel cells, so they’re just boxes with electronics and an electrolyte tank. Primus said its Energy Pods only need an annual maintenance visit from a certified O&M technician for routine inspection, new air filters and topping off the electrolyte. Flow batteries don’t have to be prepped for winter and can be installed in very cold conditions.

“We monitor all of our deployed batteries 24/7 to ensure proper performance and proactively address any potential field issues. The data are available in real time to the owners’ O&M provider as well,” said Jorg Heinemann, CCO of Primus Power. “Our batteries are designed to last as long as the solar (or wind) part of a renewables and storage solution, or longer without augmentation or battery pack replacements that lithium-ion batteries require.”



Trojan Battery gel lead-acid battery

Lead-acid

Lead-acid batteries are known for being dependable and inexpensive. Their grid-like structure is submerged in an acidic electrolyte that may need replenishing for long, successful life. They're heavy because of their materials and some have to be installed in areas that allow for ventilation. Their operating and maintenance requirements are well understood at this point, so they are a good choice for most solar-plus-storage applications but should be stored in dry locations with moderate temperatures.

What upkeep is required for normal operation?

The terminal connections in lead-acid batteries should be checked a few times each year to be certain they haven't loosened over time. Flooded lead-acid batteries will need to have their electrolyte levels periodically replenished with distilled water. AGM and gel lead-acid batteries are sealed so they do not need electrolyte replenishing.

If lead-acid batteries are not being used and placed into storage (often during winter), [Trojan Battery Company](#) said the batteries should be fully charged and have the proper electrolyte level. Lead-acid batteries self-discharge over time and will need to be recharged to minimum levels even if they are not connected to a load. This rate of self-discharge varies with temperature—high temperatures increase the discharge rate while low temperatures slow the discharge rate.

“The maintenance required [for lead-acid batteries] is not very difficult, but some people are not comfortable working around batteries. This is especially true of flooded batteries where acid is exposed when distilled water is added to replenish the electrolyte level,” said Trojan

Battery reps to *Solar Power World*. “We recommend that anyone who is working around batteries wear safety glasses and gloves. If a customer is not comfortable adding water to their flooded batteries, they could request outside help to perform this task.”



EnerSys NiCd batteries

Nickel-cadmium (NiCd)

Nickel-based batteries are ideal for remote, off-grid installations because their makeup is suitable for demanding applications where reliable backup power is essential and maintenance can't be regularly performed. They work well in extreme temperatures and in deep discharge situations.

What upkeep is required for normal operation?

Similar to lead-acid battery maintenance, electrolyte levels should be checked and replenished periodically on NiCd batteries, said [EnerSys](#). Since nickel batteries can work in a wide operating temperature range, they do not have to be prepped for extreme cold in the winter, but the room the battery is stored in should not fall below -22°F. NiCd batteries can be stored (not connected to a load) for up to 12 months as long as the environment is dry and within the appropriate temperature range.

“Voltage readings and electrolyte level checks [of NiCd batteries] can be easily performed by system owners. Water additions can be done by the owner, but they need to be comfortable with the safety precautions outlined in the installation and operating manual,” said Jay Frankhouser, director of reserve power business development and marketing at EnerSys. “Capacity tests or other electronic testing should be done by qualified technicians.”

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