A POINT-BY-POINT COMPARISON OF LITHIUM AND LEAD ACID BATTERIES

WHICH IS RIGHT FOR YOUR COMPANY?

From vehicles, to communications systems, instrumentation and medical devices, everything needs power to run — and, often, that power comes from batteries. When you choose a battery, it's common to consider its size, capacity, whether it's single-use or rechargeable, and maybe whether the device's manufacturer recommended it. However, there's one more factor you need to take into account that will impact your equipment's performance, the impact you make on the environment, and your bottom line: battery chemistry.

The difference battery chemistry can make is especially evident when comparing sealed lead acid (SLA) and lithium (LiFePO4) batteries. You can use them interchangeably in many applications — but in terms of operational efficiency and total cost of ownership, there's a significant difference.

What Are SLA Batteries?

Sealed lead-acid batteries are familiar to just about everyone — they've been used since the mid-1800s and are traditionally the most common type of automobile battery.

Cells inside these batteries consist of lead oxide plates separated by porous material and are submerged in a sulfuric acid solution inside a sealed case. The cells are mounted side-by-side, with the positive end of one cell linked to the negative end of the next, connecting the cells in a series to achieve the required voltage.

SLAs are preferred for many use cases because of their ability to deliver large surges and multiple recharges. For example, providing enough power to start a car, then recharging as it runs. SLAs are also used in applications in which they operate on low load or "standby" to maintain uninterrupted power supply (UPS), for example, with alarms, and telecommunications systems.

Although SLAs deliver results, they create two common challenges for system designers.

1. They're heavy. Standard SLA batteries typically weigh 40-60 pounds. While the weight may not make that much of a difference when the battery is installed in a two-ton vehicle, it can impact how easily owners and technicians can maintain it. Furthermore, batteries with substantial weight can be expensive for suppliers that transport them in mass to shops and retail outlets.

2. They use hazardous materials. The sulfuric acid and lead used in SLAs are dangerous, both to the environment and to people. The integrity of the battery case is vital. If the case becomes damaged, the battery acid can damage equipment, and the acid and lead content can cause soil or water contamination and pose a safety risk to people handling it. In addition, SLAs can discharge dangerous gasses, which may also pose a safety risk.

Even though using SLAs creates challenges, they continue to be many operations' go-to solutions to power equipment, vehicles, and devices, with Global Market Insights (GMI) predicting that there will be 1 billion installed by 2027. GMI also reports that the SLA market was valued at $50 billion in 2020 but will see minimal growth in the next few years.

What Are Lithium Batteries?

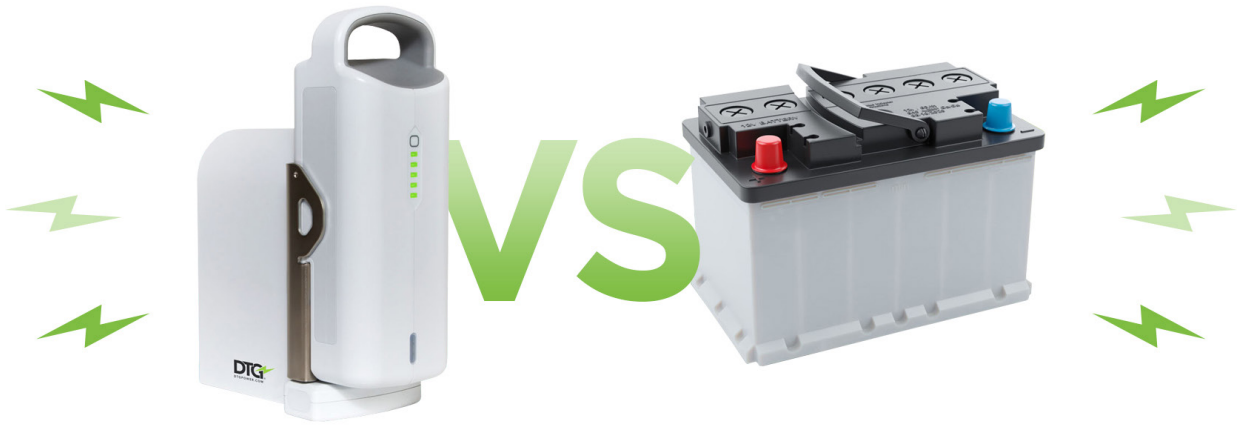
Unlike SLAs, lithium iron phosphate (LiFePO4) batteries are a relatively new option for powering vehicles and equipment. They were introduced in the 1990s, and manufacturers are bringing them to market as purpose-built and affordable options for products such as electric and hybrid cars and hospital and healthcare equipment.

There are several types of lithium batteries, but lithium iron phosphate has a very stable chemistry compared to the others. The cathodes of this battery are comprised of iron phosphate, which produces a strong molecular bond that withstands even extreme high-temperatures and cold-temperatures. Like SLAs, these lithium batteries are composed of cells connected to produce the voltage required.

By using iron phosphate cathodes, these batteries don't pose the health and environmental risks that the SLA's lead plates do. Exposing the amount of iron phosphate in a lithium battery to people or the environment won't cause harm. Additionally, LiFePO4 batteries are lightweight — only weighing about one-fourth of a typical SLA.

It's also important to note that lithium iron phosphate batteries are thermally stable. They don't experience "thermal runaway," which can cause other types of lithium-ion batteries to overheat and cause product fires or explosions, such as those that plagued the Tesla Model S and Samsung Galaxy Note 7 smartphone.

Lithium batteries provide a good alternative to SLA batteries — and users in numerous industries are responding. Grandview Research predicts the market value for these batteries will grow from $4.91 billion in 2019, to an impressive 15.3 percent CAGR through 2027.



How do SLAs and Lithium Battery Installations Compare?

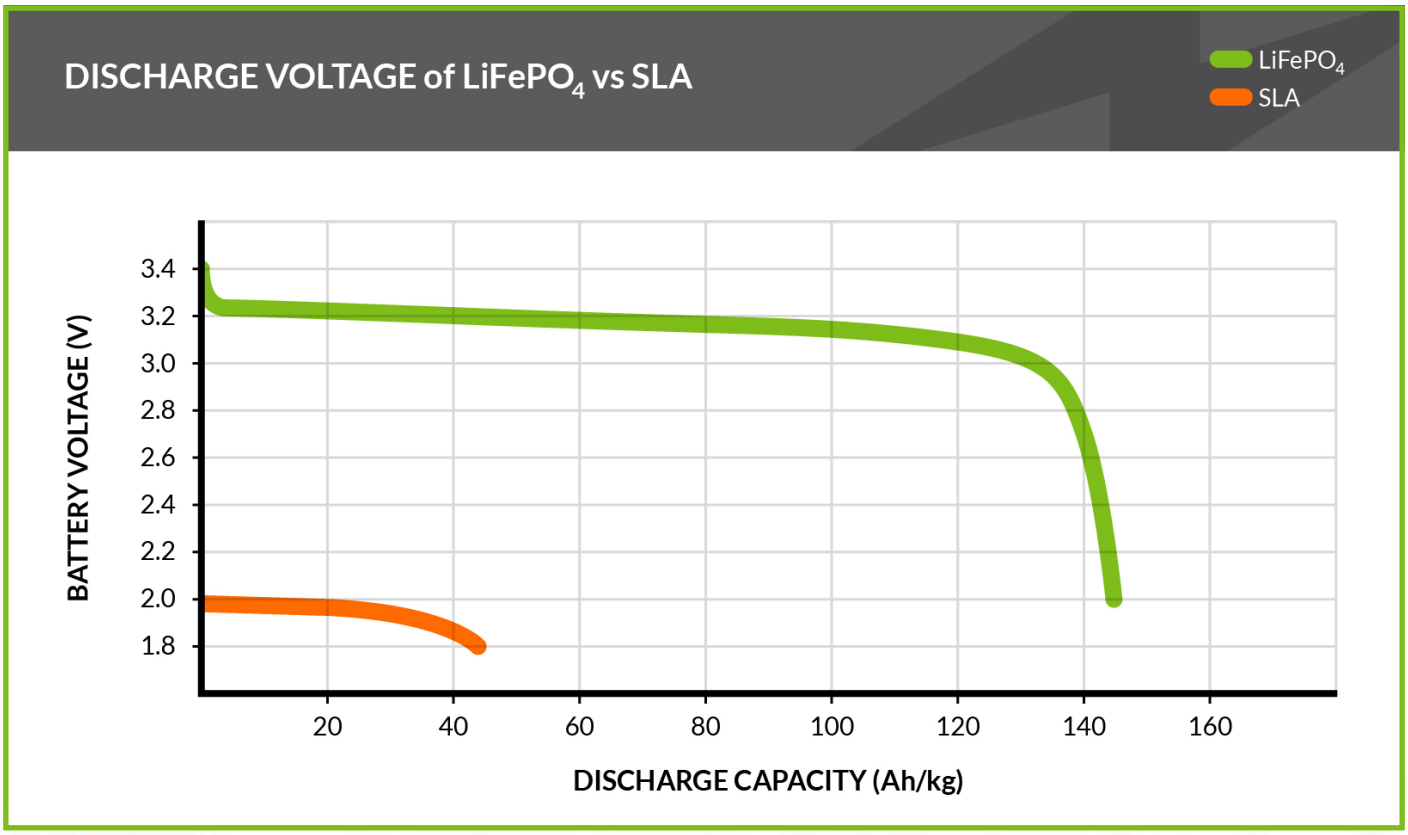
SLAs and lithium batteries offer two very different approaches to powering vehicles and equipment performance and ROI they deliver is also quite different. ***Consider these five points of comparison:***

1. Capacity and Discharge

SLA batteries are designed for slow, steady discharge — voltage decreases as capacity decreases. You can see this occurring as vehicle lights dim over time if they're powered solely by the battery.

On the other hand, lithium iron phosphate batteries experience only minimal voltage loss until about 90 percent of their capacity is used. Although this is a benefit — batteries can optimize equipment performance throughout the majority of the discharge cycle — users may have little warning that the battery needs to be recharged. For this reason, the best batteries come with a battery management system to prevent downtime of mission-critical

equipment. And, fortunately, when a lithium battery needs to be recharged, it can be ready for use again quickly, as much as four times faster than an SLA.

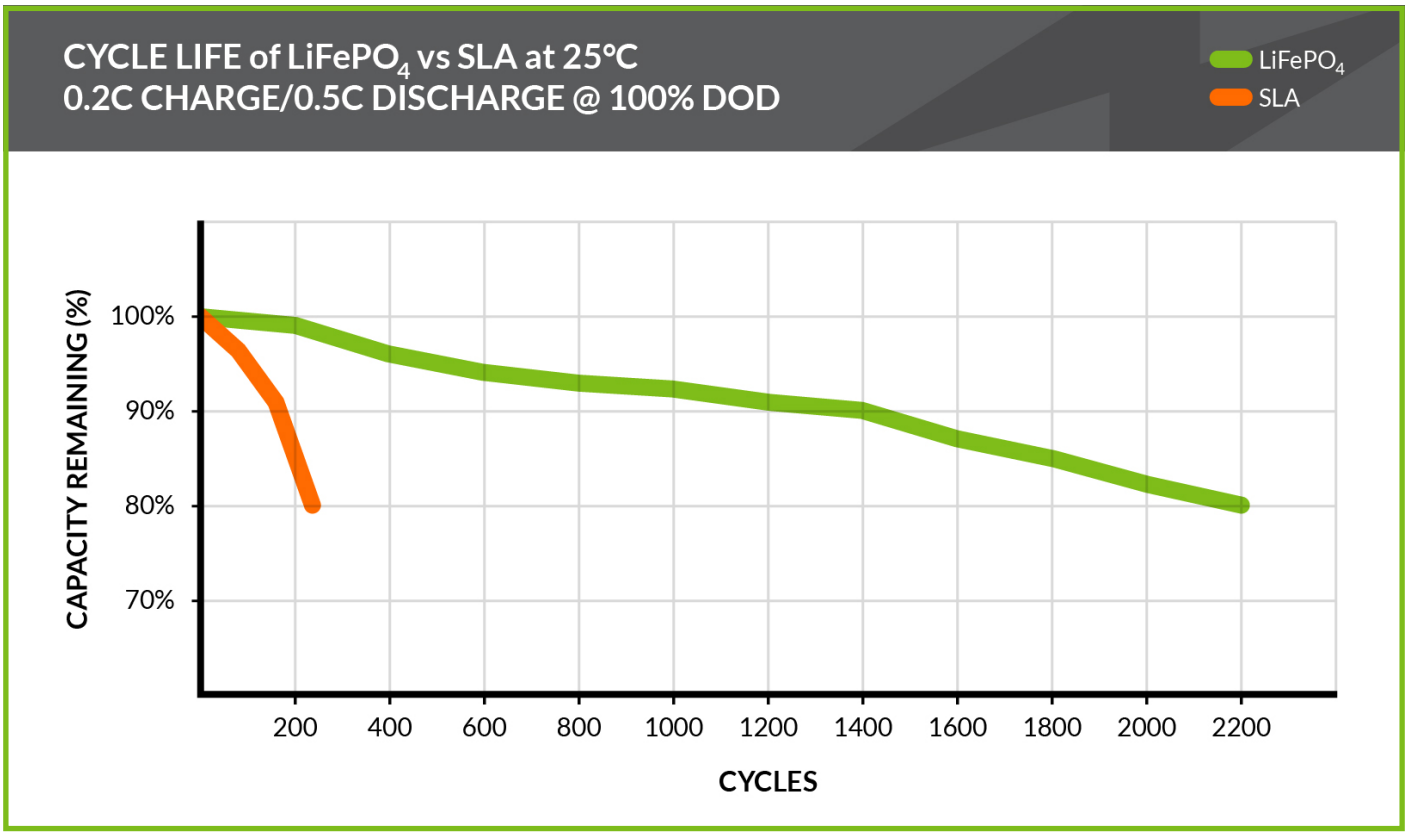


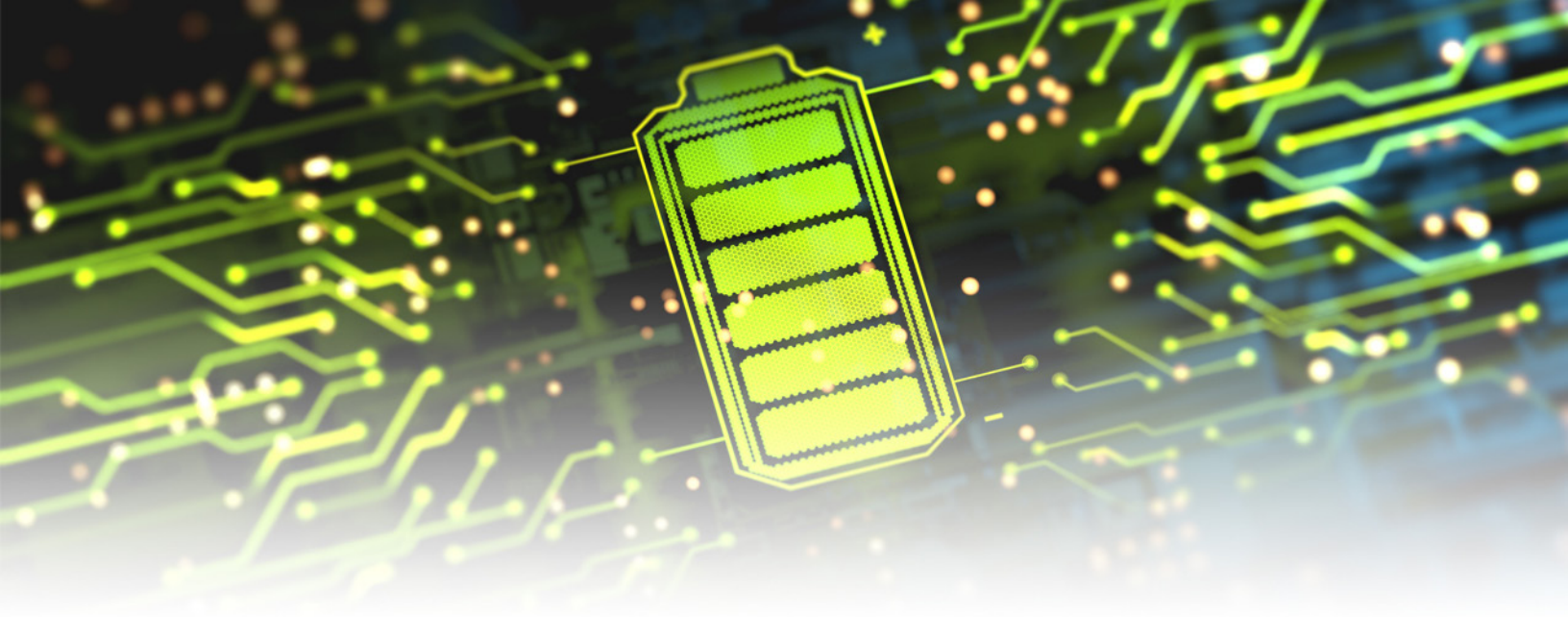
2. Lifespan

In general, SLA batteries have a shorter lifespan than lithium iron phosphate batteries. Deficit cycling, which occurs when batteries can't be fully charged before they're discharged again, is one of the primary reasons. Failing to fully charge an SLA battery can lead to plate degradation, shortening the battery's life. Additionally, deep discharge (less than 20 percent capacity) can also reduce SLA life.

Conversely, lithium batteries don't need to be fully charged to maintain their integrity; in fact, a partial charge could help extend their life expectancy, and overcharging can reduce life. So, using a charging system designed for the battery can help you get the most out of a lithium battery investment.

SLAs typically last over 200 to 1,000 discharges, usually over a one to three year period, while lithium batteries can last through 1,000 to 3,000 charge and discharge cycles and a lifetime that's ten times longer than an SLA.





3. Storage

Some users may need to store a battery occasionally. Unfortunately, SLAs often lose charge when they're sitting on a shelf – usually at about five times a lithium battery's shelf discharge rate. To preserve battery life, users may use trickle chargers to keep the battery at 100 percent capacity while in storage.

On the other hand, it's better not to store lithium batteries at 100 percent charge; keeping the battery fully charged for long periods can decrease battery life.

4. Disposal

Once you purchase a battery, you become responsible for eventually disposing of it. With an SLA, that means responsible management to ensure hazardous materials don't harm the environment. ***SLAs should never be sent to a municipal landfill for disposal, which could result in soil and water contamination.***

In some cases, you may be able to pay a deposit at the time of purchase and receive a refund or credit when you return the SLA batteries to the place of purchase. If your operation uses a large number of batteries, however, you may arrange for collection and recycling. This option may work to your advantage — depending on the market value of lead, recycling could cover labor and transportation costs to manage disposal in an environmentally responsible manner. But, devoting time and resources to battery recycling could become a burden on staff already busy with core job responsibilities.

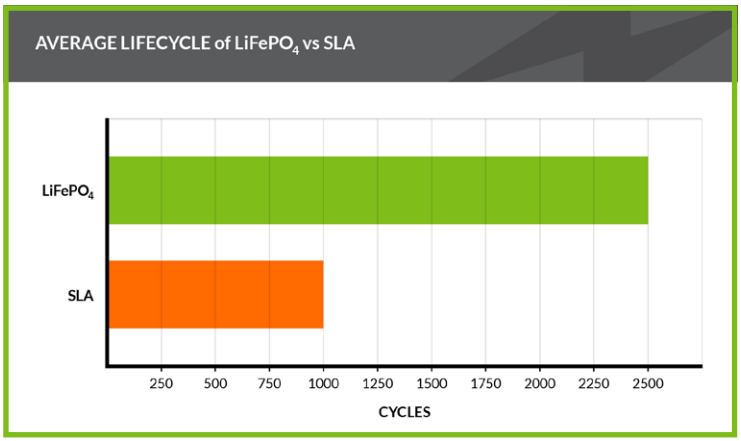
In contrast, lithium batteries are composed of non-toxic materials. And, lithium battery manufacturers sometimes use recycled electrodes, wiring and casings to produce new batteries, resulting in even more sustainable production. Overall, responsibly disposing and recycling used lithium batteries is much easier — and safer — than SLAs.

5. Total cost of ownership

A lithium battery will cost more upfront than an SLA. A top-quality Group 31, deep-cycle SLA costs about $300, while a comparable lithium iron phosphate battery can cost about $1,000.

Based on the sticker price, you may lean toward an SLA purchase, but when you consider factors including shorter battery life, inferior performance, and loss of life during storage, it's clear that a lithium battery has a lower total cost of ownership (TCO).

Over the ten-year lifespan of a single lithium battery, you would have to purchase, on average, four or more SLAs to provide the same amount of power for your application.



1 Lithium battery costs $1,000
4 SLA batteries cost $300 each

Recharge Your Operation

If you thought the only option was an SLA battery to power your equipment, it's time to consider a new cost-effective, environmentally friendly option. You can make the transition at your own pace. Because lithium batteries are designed to easily replace SLAs in many applications, it's possible to replace SLAs as they fail and gradually power your entire fleet or equipment with lithium batteries.

You will see ROI quickly with improved performance and reliability – and become even more impressed when you discover how much longer a lithium battery will last before it needs to be replaced.

Contact DTG to explore your options.

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