

ENERGY STORAGE SOLUTIONS: LITHIUM-ION BATTERIES IN THE DATA CENTER



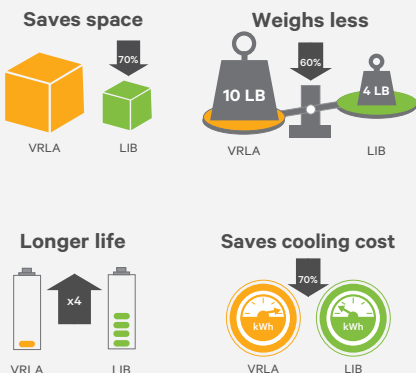
OVERVIEW

Providing power to critical loads requires a UPS (Uninterruptible Power Supply) to working in tandem with an energy storage solution. Given the advancements in energy storage technologies, design professionals have several viable options to consider. Each option brings a unique set performance of characteristics.

We will overview several viable DC energy storage solutions for the critical data center beyond the standard VRLA batteries, with emphasis on the fast-advancing Lithium-ion batteries.

Key Lithium-ion Battery Performance Factors:

- Runtime
- Power density
- Footprint
- Weight
- Usable / Lifespan / Cycle count
- Reliability
- Initial cost
- Maintenance cost
- Operating temperature



Lithium-ion Batteries

Lithium-ion (LIB) – These energy storage systems are becoming an effective alternative in some data center applications. Offerings vary, depending on the selective chemistry of the batteries utilized. In general, LIBs can provide effective performance by providing a greater power density, thus reducing the footprint and weight involved and in some cases extending the cycle count lifespan when compared to the more standard valve regulated acid battery (VRLA). In some situations, LIBs can effectively operate at higher temperatures than VRLA batteries, without significant degrading.

These benefits come with a higher initial acquisition cost. But in most cases, savings begin to occur after the first comparable VRLA replacement cycle.

The experience of Vertiv with LIBs have validated these benefits. As to specific types, our engineers recommend lithium iron phosphate and manganese oxide/nickel cobalt manganese oxide as the chemistries best suited for data center use.

Our experts have been engaged directly with LIBs since 2011. In fact, we were among the first to deploy a UL listed lithium-ion battery system in a large data center UPS application in the United States.

Of course, these LIB battery solutions are in addition to our extensive experience with VRLA technologies from the key providers.



Lithium-ion Battery Cabinets

Application Reference Chart

STORAGE ENERGY SYSTEM	TYPE	UPS COMPATIBILITY
Lithium-Ion Batteries	Samsung SDI	Liebert® EXL™ S1, Liebert EXL, Liebert NX™ 225-600, Liebert NXL™, Liebert 610**, Liebert EXM™ 480V
VRLA Batteries	Valve Regulated Lead Acid (numerous offerings)	Liebert EXL S1, Liebert EXL, Liebert NXL, Liebert NX 225-600, Liebert 610, Liebert EXM
Flywheel	Vycon VDC	Liebert NXL, Liebert EXL, Liebert 610

** Check with a local Vertiv partner for any new additions to this list.



Liebert® EXL™ S1 UPS and Lithium-Ion Battery Racks



Vycon VDC flywheel system

Flywheel

Flywheel technology has been commercially available in the data center for over 15 years. Today, it still offers viable energy storage benefits for various situations.

At its core, this battery-less solution involves deploying kinetic energy (created by an internal rotating mass) which can be utilized to provide a short power discharge for appropriate applications.

Units can be connected in parallel to add power and runtime. But, the high initial cost and modest cycle runtime tends to limit general use. These energy storage

solutions can also be used independently or in conjunction with VRLA batteries.

Vertiv has offered tested and approved flywheel solutions since 2005. Our current offering utilizes the Vycon VDC technology.

Support and Maintenance

With the nature of critical power industry, an expert service and support team is always vital. Our local customer engineers are fully trained on Vertiv power and energy storage solutions. You can expect planned and 24x7 emergency response to ensure your availability is maximized. Additionally, remote monitoring and

management solutions are available and provide the ultimate peace of mind.

Contact Vertiv to discuss your power solution needs.

Vertiv designs, builds and services critical infrastructure that enables vital applications for data centers, communication networks and commercial and industrial facilities. Vertiv supports today's growing mobile and cloud computing markets with a portfolio of power, thermal and infrastructure management solutions including the Chloride®, Liebert®, NetSure™ and Trellis™ brands.