How Batteries Can Assist Data Centers in Overcoming Power Grid Instability

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Human beings are more connected than ever, with data centers playing a pivotal role in storing our data and making it accessible. A report from the IDC ('Data Age 2025') highlights global trends in this regard[1]. They predict that 6 billion connected users will access a data center almost 5,000 times per day by 2025. By that time, we will be generating 275 ZB of data annually as a global society.

At the same time, our global energy consumption is raising concerns. Users are striving to reduce their carbon footprint and operate in more sustainable ways. Data centers are no exception as they already consume 1-1.5% of global energy[2], and the demand for data storage is growing. Reducing consumption and improving energy efficiency is vital for data center operators to meet their regulatory requirements and fulfill their social responsibilities.

However, data center uptime is also a critical performance indicator. Energy solutions, including backup power, must enable data centers to meet customer expectations without excessive power consumption. The Uptime Institute's '2020 Global Annual Data Survey' shows that this is not easy to achieve[3], with 78% of data centers experiencing an outage in the past three years, of which the most common cause is a power failure.

Trends Affecting Data Center Energy Consumption

Data centers rely on Uninterruptible Power Supplies (UPS) for backup power supply during an outage. They provide a window of autonomy to allow generators to come online or for an orderly shutdown of the system. In the past, generators would take 10 to 15 minutes to bring online, but modern technology enables automatic or remote startup. These advances mean that data center backup power needs only supply up to 5 minutes of normal power in many cases.

A significant portion of a data center's energy consumption is for cooling supplied by air conditioners. Cooling keeps the electronic equipment like servers and UPS batteries in an acceptable operating range. However, advances in technology allow the batteries to operate at elevated ambient temperatures.

Changes in UPS Battery Technology

Flooded lead-acid batteries were commonly used in the early days of data centers. The technology did, however, have some drawbacks. For instance, the batteries needed significant maintenance including regular topping up with water. It also means that relatively high levels of gas are generated, which require ventilation.

The introduction of VRLA (Valve-regulated lead-acid) batteries achieved benefits over flooded technology by immobilizing the electrolyte in a gel or absorbent glass mat (AGM) material. This eliminated the need

[1] https://www.import.io/wp-content/uploads/2017/04/Seagate-WP-DataAge2025-March-2017.pdf
[2] Digitalization and Energy Report, International Energy Agency, November 2018.
[3] https://uptimeinstitute.com/2020-data-center-industry-survey-results

for topping-up with water and reduced the gas emissions. AGM-based VRLA batteries are now common in data centers because of the lower maintenance and reduced ventilation requirements.

Thin Plate Pure Lead (TPPL) technology offers further advances compared to standard AGM VLRA batteries. The plates are formed from very high purity thinner grids, which results in a greater contact area between the plate and the electrolyte.

The Advantages of TPPL Battery Technology

TPPL batteries have a higher power density than AGM VLRA batteries. The effect comes from stacking more of the thinner plates into the same volume. As a result, TPPL batteries take up less space, normally being at least 20% smaller than their standard VRLA equivalents. This is a significant advantage for data centers as it frees up space for additional servers.

High power density also helps TPPL batteries to charge quickly. They can deal with larger current peaks and have a higher charge acceptance than other lead-acid technologies. A short charging time means that batteries are ready to respond to the next disturbance quickly and can, therefore, handle multiple outages in succession. TPPL batteries also have low self-discharge characteristics. They can be stored at 20°C (68°F) for up to 2 years without needing a refresh charge.

Battery life is a significant contributor to the total cost of ownership (TCO) of UPS solutions for data centers. Every battery has a finite life, after which it must be replaced. However, TPPL batteries have a proven lifespan of 8-10+ years, which is typically 25% longer than VRLA batteries. In addition, TPPL technology is robust in terms of tolerating higher ambient temperatures, allowing data centers to reduce cooling and save on energy. Higher temperatures reduce battery life, so lowering energy costs should be weighed against the cost of more frequent battery replacement.

EnerSys® Battery Solutions for Data Centers

The DataSafe® XE TPPL battery range from EnerSys® is designed to meet the challenging demands of data centers. These batteries are compliant with IEC 60896-21/22 and IEEE-1188.

This range offers all the benefits of TPPL technology. Importantly, they support fast charging ensuring that they are ready for use when needed. What's more, DataSafe® XE batteries can operate at elevated temperatures, therefore extending their service life.

DataSafe® XE batteries provide a high-rate performance of up to 1150Wpc at the 5-minute rate (1.67 Vpc at 20°C / 68°F). Furthermore, their pure lead plates corrode much slower than plates in AGM VLRA batteries, providing a longer service life. A bonus is that 99% of materials from the DataSafe® XE battery range can be recycled after decommissioning. The retained value at the end of their life can offset the cost of replacements.

Summary

Data centers are playing a more vital role in the global community due to the high volume of data we generate as well as the need for continuous access to this data. Recent increases in remote work due to the pandemic also contribute to this trend towards data center growth[4].

Power grid instability is a serious threat to data center online time but increases in power demand only add to the pressure on the grid. It is crucial for data centers to have reliable backup power in the form of a UPS complemented with high-performance battery technology. Lead-acid batteries have supported backup applications in data centers for decades, and TPPL technology builds on that foundation. This advanced battery technology delivers improved performance for the demanding environment of data centers.

For more information about data center UPS batteries, please visit www.enersys.com.

ABOUT ENERSYS®

EnerSys®, the global leader in stored energy solutions for industrial applications, manufactures and distributes energy systems solutions and motive power batteries, specialty batteries, battery chargers, power equipment, battery accessories and outdoor equipment enclosure solutions to customers worldwide. Energy Systems, which combine enclosures, power conversion, power distribution and energy storage, are used in the telecommunication, broadband and utility industries, uninterruptible power supplies, and numerous applications. Motive power batteries and chargers are utilized in electric forklift trucks and other industrial electric powered vehicles requiring stored energy solutions. Specialty batteries are used in aerospace and defense applications, large over-the-road trucks, premium automotive, medical and security systems applications. EnerSys® also provides aftermarket and customer support services to its customers in over 100 countries through its sales and manufacturing locations around the world. With the recent NorthStar® acquisition, EnerSys® has solidified its position as the market leader for premium Thin Plate Pure Lead batteries which are sold across all three lines of business. More information regarding EnerSys® can be found at www.enersys.com.

[4] https://www.idc.com/getdoc.jsp?containerId=prUS46286020

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