Battery Technology: The Backbone of Modern Data Centers

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Data is central to our modern lives, whether that is in business or personally. As a result, the reliance we put on the data centers that contain this data is increasing rapidly. In fact, research firm IDC recently created a report ('Data Age 2025') that illustrates the scale of the challenge[1]. In their report they predict that by 2025 there will be 6 billion connected users, each accessing a data center almost 5,000 times per day (a factor of ten increase on 2015) and as a society we will generate 275 ZB of data annually.

In parallel, as we become more concerned about energy usage, it is important to note that data centers use around 1-1.5% of global energy[2] – and this figure will inevitably rise even though efficiency improvements mean that energy consumption is rising at a slower rate than data generation. However, managing electricity consumption is a key issue for data center operators, to meet international guidelines and to comply with their social responsibility.

Any form of downtime is a significant issue for data center operators as it reduces customer confidence and prevents data access. According to the Uptime Institute's '2020 Global Annual Data Center Survey', 78% of data center operators have had an outage in the past 3 years and 37% of these are related to power failure[3] – the most common cause.

Changes in Data Centers

In the face of this growth, it comes as no surprise that the structure of data centers is changing and this is equally applicable to the Uninterruptible Power Supplies (UPS) that they rely on to address power outages. Until recently, UPS batteries were sized to give typically 10 to 15 minutes of autonomy thereby allowing enough time for generators to be brought online, or an orderly shut-down performed. However, as modern generators can be remotely or automatically operated this time has reduced to less than 5 minutes in many cases, therefore requiring less battery capacity.

Another trend that seeks to reduce energy consumption is running data centers at elevated ambient temperatures that reduces the need for air conditioning. To achieve this, all equipment (including the servers and UPS batteries) must be capable of being reliable in these conditions.

Battery Technology

Battery technology has progressed significantly in recent years, although lead-acid remains a popular technology in data center UPS systems. In the early days, traditional flooded lead-acid batteries were used. While effective, their operation meant over time maintenance with the topping up with water was required and due to the rate of gas emissions high ventilation requirements were needed. The next generation was valve regulated lead-acid (VRLA) that immobilized the electrolyte in a gel or absorbent glass mat (AGM). This approach significantly reduced the water loss resulting in no topping up being

[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

required and a significant reduction in the ventilation requirements, thereby improving operating costs. In fact, AGM-based VRLA batteries have become very common in data centers in recent years.

AGM VRLA technology has further advanced with the advent of Thin Plate Pure Lead (TPPL) technology that adds a number of significant benefits. Here, thinner grids of very high purity are utilized to form the plates, resulting in a greater contact area between the plate and the active material / electrolyte.

Benefits of TPPL Technology

As the plates in TPPL batteries are thinner, more can be stacked in the same volume. This not only boosts power density; it also ensures that TPPL batteries are faster to charge and can deal with larger current peaks. The higher density reduces the space occupied by batteries by around 20%, freeing up additional space for servers, thereby increasing revenue for the data center operators.

Batteries are a significant part of data center expenditure and all batteries have a finite life expectancy. TPPL-based batteries have been demonstrated to have a lifespan of 8-10 years which represents a 25% increase over VRLA-type batteries. Furthermore, TPPL batteries are suited to the higher temperatures found in data centers that have reduced their air conditioning capacity to reduce energy usage. However, there is some degradation of service life due to the elevated temperatures so data center operators should consider the best trade-off between reduced energy costs and more frequent battery replacement.

Another feature of TPPL technology is its low self-discharge characteristics that mean they can be stored for longer than traditional lead acid battery types. Typically, a TPPL battery can be stored at 20°C (68°F) for up to 2 years without needing a refresh charge.

As they exhibit high charge acceptance when compared to other lead-acid technologies (AGM, VRLA or flooded), TPPL batteries can be recharged quickly, and they are ready to respond again within a very short period. This means they can deal with situations where multiple outages could occur.

EnerSys® Battery Technology for Data Centers

As an example, one currently available TPPL battery range is DataSafe® XE from EnerSys®. This TPPL battery range has been designed specifically to meet the challenging needs of modern data centers and is fully compliant with the stringent needs of IEC 60896-21/22 and IEEE-1188.

DataSafe® XE batteries offer the benefits of TPPL technology including the ability to operate at elevated temperatures and to support a longer float life, which extends the service life. They also support fast charging and have a low self-discharge which, together, ensure that they are normally ready for use when required.

The enhanced power density of the DataSafe® XE battery range provides high-rate performance of up to 1150Wpc at the 5-minute rate (1.67Vpc at 20°C / 68°F), ensuring that they can meet the rigors of life in a data center. As the pure lead plates corrode much more slowly than the plates in standard AGM VRLA batteries, the capacity of DataSafe® XE batteries remains higher for longer. When the batteries are finally ready to be decommissioned, 99% of the materials are able to be recycled giving a large, retained value that will offset the cost of replacements.

Summary

The pace of change in data centers continues to increase, fueled by the increasing amounts of data our society is generating as well as the thirst for ever more frequent access to this data. The recent pandemic will have exacerbated this situation due to increased remote working.

Coupling this with greater instability in mains power, due to a variety of factors including increased demand and it is more important than ever before that data center operators have access to reliable, high-performance battery technologies to support their UPS. TPPL batteries represent the latest generation of lead-acid batteries that have been used in backup applications for decades and this exciting new technology delivers many benefits that help data center operators meet their demanding challenges.

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.

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