The future of backup batteries

Olivier Amiel, marketing director for Saft's Industrial Standby Division, explains what the future has in store for backup battery technology, how the data centre market provides unique challenges for batteries and why environmental sustainability is central to the future.

Fast-changing trends in data centres mean that the market for backup power is unlike other segments. Whereas battery applications such as electric vehicles are shifting towards more energy storage capacity to provide long lasting service, data centre operators need high power to ride through short outages and overcome voltage fluctuations. We're typically seeing demand for batteries to provide five-10 minutes of backup duration, but some customers are asking for two or even one minute.

In addition, data centre operators want to build their facilities close to the businesses they serve and as a result provide faster services. This has led to development of small data centres in city-centre buildings, where rents are high, space is at a premium and floors have load bearing limits.

Today, state-of-the-art Li-ion systems can provide up to 140 kW per cabinet. This provides a small footprint and lightweight solution with no need for structural reinforcement of the floor. In turn, this offers savings in rental and structural costs that far outweigh the cost of the battery.

This is one factor that can be considered alongside Total Cost of Ownership (TCO), which is the sum of all the financial costs associated with a battery system over its life. This includes the purchase price, installation, maintenance and end-of-life costs – and operators typically find that Li-ion and nickel technology batteries offer the most favourable TCO.

Solid state for a step change in performance

Looking further ahead, there's a limit to the energy density in Li-ion. Therefore, we're now working on the next major shift in battery technology: solid state batteries. These are named for their solid electrolyte – and being solid means that they will offer high levels of safety as well as high energy density.

Solid state batteries will create a step change in our development roadmap for data centre backup and we're likely to see cabinets with a power rating of 250 or 300 kW.

Integrating Li-ion into a UPS

In the early days of Li-ion technology, we viewed the need for electronic control as an additional component that was needed to manage the battery, but that did not bring value to the customer.

However, today's customers are using it as a benefit. It enables straightforward integration into data centre control and SCADA systems. Operators can monitor their batteries remotely, identify the end of life as it's approaching and take proactive action to replace assets at the right time.

To support this, we've worked closely with Uninterruptible Power Supply (UPS) companies to support the integration of Li-ion technology with their controllers and power conversion systems. We have successfully integrated our technology with UPS manufacturers around the world such as Socomec and others including AEG, Eaton, Mitsubishi, and Piller.

A further benefit of electronic control is that the battery management system can optimise the performance and lifetime of a battery system. It achieves this by adjusting charge and discharge of individual cells to maintain constant temperature across battery strings, modules and cells. Constant temperature means that cells age at the same pace, providing consistent performance.

Nickel technology developments

Elsewhere in the data centre backup power chain, other battery types are used. For example, our SPH nickel technology batteries provide the cranking power to start up diesel gensets and ensure unbroken power in a longer outage.

We have two areas of development for nickel technology batteries. The first of these is a remote monitoring system for these nickel batteries. This digital solution will offer operators the ability to keep tabs on their fleet of batteries and take proactive action. It enables the switch from a traditional time-based maintenance to smart condition-based maintenance.

The clear benefit for customers will be OPEX savings resulting from fewer site visits. Another benefit is better planning of Capex, as real-time data will help the end-user to maximise the usage of the battery and replace it when it is needed and not before!

The second area of improvement is an adaptation of the electrochemistry to make our nickel batteries a near plug and play replacement for valve-regulated lead-acid (VRLA) batteries. This has not been possible to date as nickel technology batteries need a higher charge voltage than VRLA, typically 1.42V per cell vs 1.39 V per cell for VRLA. The consequence for the customer was the need for a DC-DC converter as part of the UPS architecture to fill the gap between 1.39 and 1.42V.

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By adapting the electrochemistry of nickel batteries, it is now possible to charge them at the same voltage as VRLA, namely 1.39V per cell. This eliminates the need for the DC-DC converter, reducing the architecture cost and making the replacement plug and play.

As a result, operators can adopt nickel technology and benefit from low TCO thanks to its long life and low maintenance requirements.

Low TCO highlights sustainability

However, TCO is not just good for the bottom line, it is also a sign of environmental sustainability. By choosing engineered products that are designed for a long life, a company can minimise its use of natural resources, transport and materials.

Li-ion and nickel batteries both provide long lifetime and high reliability. In comparison, VRLA batteries typically need extensive maintenance and offer a significantly shorter life – calling for multiple site visits, replacement batteries, transport and logistics.

Sustainability practice also continues at the end of a battery's life. We established a global network of bring back points for spent batteries 20 years ago. These ship batteries to our facility in Sweden or to fully certified recycling facilities, which ensure efficient recycling of components and materials.

Last but not least, Li-ion and nickel batteries can withstand high temperatures. This lets operators turn down the cooling, reducing both energy consumption and utility bills.