CyberSecure Battery Storage System for Industrial Application in Australia

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The Australian climate and geography pose difficult challenges to direct-import battery energy storage systems from other markets, which do not consider the local conditions here. In Australia, the climate conditions require robust and long-lasting battery performance at higher temperatures; the tough deployment environments at customer sites in the outback, e.g., dairy farms, call for system sturdiness. Further, the sparse distribution of customers means technical support is preferably provided remotely over the internet. Given the fast-growing cyber-security threats Australia faces, the internet connectivity necessary for remote support in turn needs to be cyber secure. We present a complete battery system design to address these requirements, which is shown in Figure 1.

At the cell level, high-capacity lithium-iron-phosphate (LFP) prismatic cells are selected because of their balanced performance at high temperatures, which is common in Australia. The capacity of each cell is 100 Ah, meaning there will be fewer electrical connections to be made during assembly.

Based on the Battery Management System (BMS) technology developed in CSIRO, and working closely with Energy Renaissance, who has in-depth market intelligence, we tailed the BMS configurations specifically for the safe operation of the battery system in hot climates, the dominant challenge in Australia. The thermal management configuration is guided by a finite element model (FEM). The FEM takes into account the high ambient temperatures possible in Australia and the heat from cycling the battery cells to assess the cooling effects of the various cooling related parameters such as the number and power of the cooling fan, and the channels for airflow. This helps ensure that the battery cells do not overheat and suffer from excessive capacity degradation due to heat.

The Power Conditioning System (PCS), which is typically an inverter, is the interface to the power grid. It also acts as a communication relay between the battery system and the Energy Management System (EMS) to coordinate the power distribution. Data related to battery system diagnostics, system audit, and especially firmware updates (installer package and authentications) are regarded as highly sensitive and, if compromised, pose great risks to the safety (e.g., fire hazard), business operation (e.g., power outage) and reputation (e.g., negative publicity). Such data is only communicated to/from the servers via a Secure Access System (SAS) with enhanced cyber-security features. As an example, the SAS separates the communication channels for downloading firmware update packages and package integrity authentication to reduce the risk of man-in-the-middle attacks.

We present a battery system that employs proven technologies with minimal technical risks whilst still providing robust performance in a harsh environment. The battery system is modularized, meaning it can be both expanded and continuously upgraded remotely for both greater energy storage and improved performance in the future, respectively.

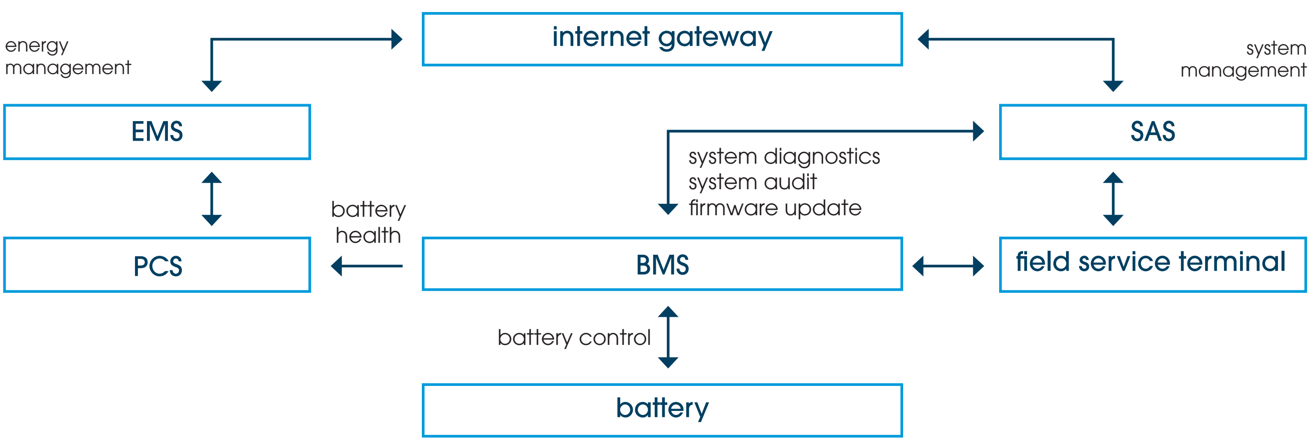

Figure 1. Battery System Structure