BATTERY ENERGY STORAGE COMPLEXITIES

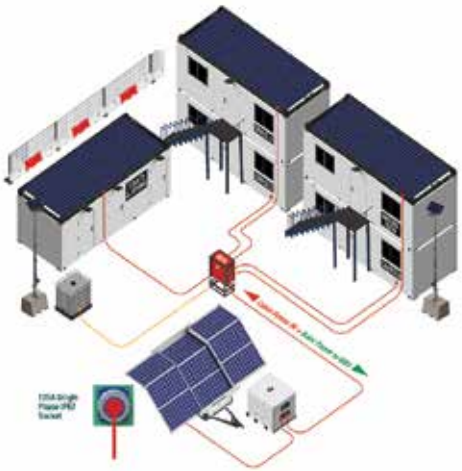
In recent years, the construction sector has begun to adopt Battery Energy Storage Systems (BESS) primarily due to massive cost savings compared to diesel powered generators, along with the reduction in CO2 emissions and - in a number of countries - the enormous cost and difficulty of having a sufficiently powerful electricity connection installed in an already overstretched National Grid.

The new systems are playing an increasingly important role in providing energy resilience and renewable energy integration. As a result, demand for such systems has mushroomed - particularly over the past year or two - with a multitude of different products and solutions now available. Those seeking an alternative to mains electricity and/or diesel generators, or interested in investing in the sector, are confronted with a confusing amount of technical information in order to find the most suitable solution.

What should you look out for? Power and energy specialist Rossa Consulting takes a look at the market and provides guidance on how to navigate product selection based on site-specific requirements.

The battery storage market is currently inundated with products from numerous manufacturers, each designed to cater for an endless variety of applications and energy needs, from small scale residential systems to large scale industrial and utility grade solutions. This diversity, while beneficial in offering choice, often leads to confusion for those tasked with selecting the optimal system for their project.

The factors which are important when choosing a storage system should not be about manufacturers and brands as they all have very similar system components and are generally all technically proficient. The main consideration



should be capacity (kWh) and the output (kW) needed on the site from the electrical requirement, the type of electrical load, and its geographical set up.

For example, where you have continuous loads such as welfare cabins and offices that may also be some distance from the site, you can calculate quite accurately the electrical requirement and therefore choose a system to suit. This may mean the system has a lower power output but a higher storage facility.

However, calculations may be further complicated by the presence of tower cranes, hoists, and mastclimbers. If you calculate the maximum of the manufacturer's recommended power consumption you might be looking at a huge demand in power and a very large battery storage unit. However, it should be remembered that the lifting equipment will never reach their maximum loads at the same time, and when in normal use, electricity demand may be very small or even zero.

Yes, they all peak in their demand on start up and when they are lifting a heavy load, but this may only be for a few seconds. Peak power can be negated first thing in the morning with the site managing the timing of each start up as necessary, ensuring the output power is sufficient to accommodate the largest kW peak requirement, and the storage capacity can be calculated accordingly. Mastclimbers, for example, move very occasionally and when they do, the power requirement is small. When stationary, they use a minimal or no power at all. Hoists are similar but this may depend on how busy the site gets. All these applications peak in their power requirement for mere seconds and then have a greatly reduced power demand.

Once the power requirement has been determined, the next issue for a site to consider is whether to buy or rent. Budget is important as the prices of battery storage systems vary significantly. Savings through reduced power requirement can be significant, but more can be saved by shopping around between brands. If purchasing, the unit that you have chosen might take three months or more to manufacture, while a rental company may have one available. However, understanding the technical specifications is critical.

CHOOSING THE RIGHT PRODUCT?

Without an understanding of key parameters such as energy capacity, input voltage, input current, power output as well as the number and capacity of circuits, navigating the optimum site solution becomes blurred, and the risk of choosing an unsuitable, or less efficient product increases. Some of the key technical specifications to understand and consider include:

INPUT CURRENT

The input current rating in amps dictates the current capacity - 16A/32A/64A etc - of the circuit and the flow of current (I) into the battery. If the voltage is three phase 400 volts (V) then we can use the calculation V x I = P where P is the charging power in Watts. If the electricity source is three phase you must also multiply the current by the square root of 3 or 1.73. For example, 400V x 64A x 1.73 = 44,288 watts or 44kW of incoming charging power.

ENERGY CAPACITY

Energy capacity is measured in kilowatt hours (kWh) and indicates the total amount of energy a particular battery energy storage system can store. A higher energy capacity usually dictates a more expensive unit, but this results in a longer duration of energy supply. If for example you have a 100kWh unit with 44kW charging power it would take approximately 2.27 hours to fully charge, although there are other small variables to consider like charging efficiency and variable charging rates.

POWER OUTPUT

Power output is measured in kilowatts (kW), or kilovolt Amps (kVA). The outgoing connectors dictate the rate at which the system can deliver continuous current. Equipment with higher peak demands depend on both the inverter and the battery management system's (BMS) ability to peak over the higher power output level. Selecting a system with adequate continuous and peak capacity power output is essential to ensure uninterrupted energy supply.

EFFICIENCY AND CYCLE LIFE

Efficiency refers to the ratio of energy output to energy input, expressed as a percentage. A higher efficiency means less energy loss during storage and retrieval. Cycle Life is the number of charge-discharge cycles a battery can undergo before its capacity significantly degrades. This is critical for long term reliability. Projects with frequent energy cycling, such as those incorporating renewable energy sources, should prioritise systems with high efficiency and extended cycle life.

BATTERY CHEMISTRY

The choice of battery chemistry - whether lithium-ion, lead-acid, flow batteries, or emerging technologies such as solid state batteries - affects performance, cost and safety. Lithium-ion batteries are popular for their high energy density and long cycle life but may require sophisticated thermal management systems which burn auxiliary energy. Lead acid batteries are more cost effective but have a shorter cycle life and lower energy density. Understanding the trade-offs between different chemical processes is vital for informed decision making.

SAFETY AND THERMAL MANAGEMENT

Safety is paramount in battery system installations. Proper thermal management prevents overheating and potential thermal runaway which can lead to fires or explosions. Advanced battery systems incorporate safety features such as fire suppression systems, temperature sensors and protective casings to mitigate these risks. Ensuring the selected system adheres to stringent safety standards is essential for protecting both the site and its occupants.

TAILORING SOLUTIONS TO SITE-SPECIFIC NEEDS

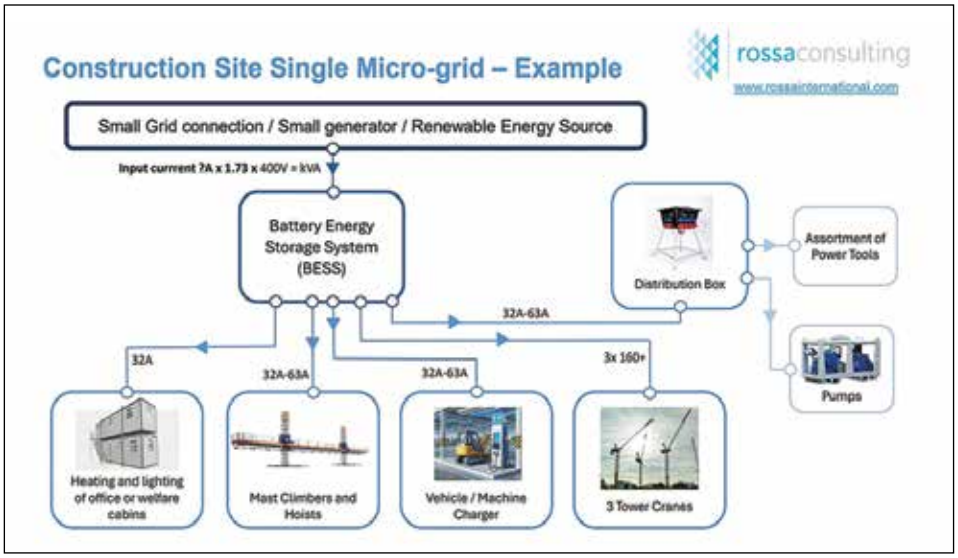
Every construction project has unique energy storage needs, influenced by factors such as the size of the site, the nature of energy consumption, and the integration of renewable energy sources. Given all these factors, together with the myriad

of battery energy system products available, a 'one size fits all' approach is impractical, and a tailored solution that supports the specific site requirements is necessary.

For example, residential installations may prioritise smaller, cost effective systems with moderate storage capacity, while larger commercial and industrial projects might require systems with higher energy density and advanced grid support capabilities. Utility scale applications, on the other hand, demand robust systems capable of handling massive energy loads and ensuring grid stability. Conducting a comprehensive energy audit to assess peak energy demands and understanding the site's renewable energy potential are critical steps in this process.

ENERGY AUDIT AND SITE ASSESSMENT

An energy audit evaluates the current and projected energy usage of the site. This includes analysing historical energy consumption data, identifying peak load periods, and estimating future energy needs. A site assessment considers factors such as available space for the installation, environmental conditions, and potential integration with the existing energy



infrastructure. These insights guide the selection of a product that meets the individual site demands.

INTEGRATION WITH RENEWABLE ENERGY

For sites incorporating renewable energy sources such as solar or wind, the system must be capable of efficiently storing and managing intermittent energy generation. This requires seamless integration with renewable energy systems, intelligent energy management software, and grid support functionalities. Selecting a battery storage product that complements the site's renewable energy profile, enhances overall energy efficiency and sustainability.

PLANNING YOUR PROJECT

Deciding how to distribute power on your site is vital to the overall cost and efficiency - in monetary and carbon efficiency terms - and of course to ensure there is sufficient energy when required. Depending on the geographical size of the site, the number of amenities requiring a power source, and technical specifications, will require analysis to decide on the quantity, the location, and capacity of the battery storage units, and who sells or rents the units to suit that requirement.

DATA CAPTURE

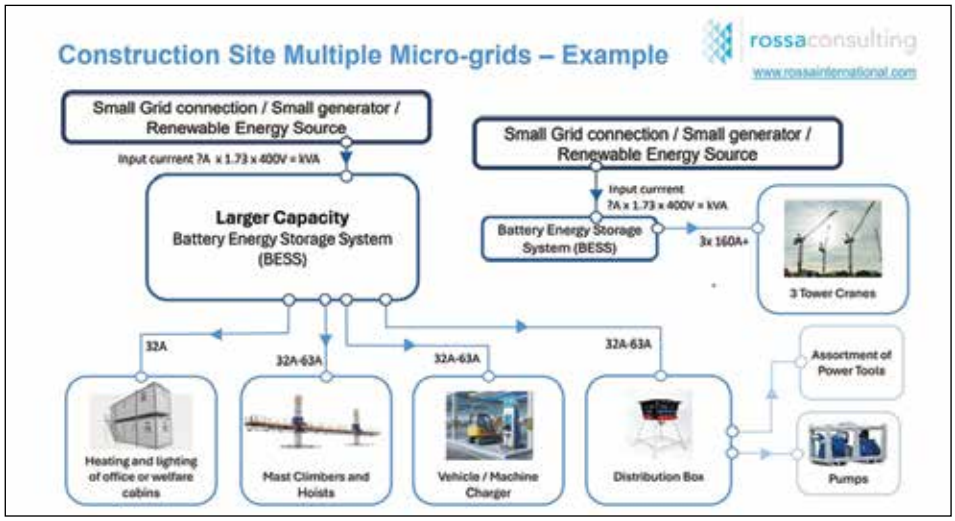
Software is available to automate the timings of the power source and record and store all the data from that appliance. Storing and analysing all data is imperative for several reasons, for example, allowing real time analysis of each power usage to provide product specific data. Analysis of the data means the planning of future projects and selecting the required size of system moving forward - together with additional relevant products - can be semi-automated.

STAYING CURRENT

"The complexity of the battery energy storage market poses challenges for the construction industry, but it also offers opportunities for optimising energy storage solutions," says Sean O'Sullivan of Rossa Consulting. "By understanding the diverse range of products and carefully analysing technical specifications, guidance is available to continuously update stakeholders to make informed decisions that align with their site's specific needs. Tailored system solutions not only enhance energy resilience and cost effectiveness but also contribute to the broader goal of sustainable development in the construction sector. As the market continues to evolve, staying abreast of technological advancements and emerging trends will be key to navigating this dynamic landscape successfully."

"Offering the consulting services required to navigate the complexity of battery energy storage solutions, and having gained valuable experience in this sector, we can support with coordinating site analysis, planning and providing strategic solutions going forward." ■


Sean O'Sullivan



BIG POWER FROM SMALL BATTERIES

At the end of last year UK based Dumarey Green Power launched its new Revolution Battery, an industrial battery energy storage system (BESS) which claims to break the link between energy storage and output power. The system incorporates a battery pack which can deliver high amounts of power from a comparatively small amount of energy storage resulting in a smaller battery with fewer battery cells, higher efficiency and lower embedded emissions.

Typical battery systems require large amounts of stored energy to generate high peak power. However, while many applications require high power, it is usually required for just a few seconds, a minute or two at most, with comparatively little energy used during normal operations. Once the power spike has passed, the required energy can often be supplied by a modest mains connection or a small, generator set. As a result, storing large amounts of energy in a battery system is not needed.

Jon Drakeley, product director at Dumarey Green Power says: "The new Revolution Battery allows even the heaviest tower cranes in the country to be powered from just a 32 amp mains supply."

The first unit went to launch customer UK based Falcon Tower Cranes which supplied a Bowmer + Kirkland construction site in Nottingham, where the system has been powering Jaso J118PA and Jaso J138A tower cranes. Traditionally these cranes would have been

powered from a 200kVA diesel generator resulting in significant CO2 and other local emissions. Instead, the Revolution Battery allows them to be powered from a 32 amp connection. As a result, Dumarey expects the system will save around 800 litres of fuel and over two tonnes of CO2 a week.

Falcon associate service director Rupert Cook said: "Battery Energy Storage Systems have been making rapid inroads into the tower crane market. Our new fleet of Revolution Batteries allows us to power large cranes from a smaller power supply. Early testing has shown we can run three cranes from a single system which is smaller than one of our regular generators and the installation can be done in moments, making it ideal for busy sites where space and time are at a premium."

Dumarey Green Power - previously known as Punch Flybrid - is part of the Dumarey group and produces the Revolution Battery at its facilities in Silverstone, Northamptonshire, UK, utilising

local labour and suppliers. It is part of a product range that focuses on power or energy to provide savings that general products cannot achieve. The company has already deployed around 250 of its flywheel energy storage systems which it claims have saved in excess of 6.5 million litres of fuel and more than 20,000 tonnes of CO2.

For applications that need a lot of energy, Dumarey uses its second life battery products, which utilise energy dense battery modules previously used on buses or trucks before becoming part of its PowerSkid and EnergySkid products. ■