The indispensable role of battery giga factories in a net zero future

By Peter Hodgkinson

5 Feb 2024

As nations and industries worldwide strive to meet net zero targets and transition to renewable energy sources, battery giga factories are emerging as a crucial player. The availability of more efficient, scalable, and environmentally sustainable battery manufacturing capabilities will expedite stakeholders in achieving these objectives.

Peter Hodgkinson, Director for Strategic Growth and Major Projects: Property & Buildings, WSP in Africa

The scramble for battery giga factories highlights the urgency for countries to swiftly acquire the necessary capabilities to preserve and enhance their capacity. Three primary markets are propelling the growth of battery manufacturing – battery energy storage solutions (BESS), electric vehicles (EVs), and consumer electronics, such as rechargeable appliances.

Race for battery supremacy

At present, there are 369 giga factories worldwide slated for completion by 2030, a significant increase from the previous figure of 115.

The global demand for batteries is projected to surge from 185GWh in 2020 to over 2,000 GWh in 2030. Moreover, the global lithium-ion battery market size is expected to exceed $193bn by 2028, reflecting a compound annual growth rate of 23.3% from 2021. This has been the driving force behind the construction of sustainable and efficient battery giga factories.

A balanced energy mix will fix crisis, not just renewables

18 Dec 2023

Research indicates that investments in battery giga factories reached $131bn in 2022, marking a 24% increase from the previous year. These investments were primarily spearheaded by China. However, North America is rapidly catching up, with its manufacturing capacity expanding by 49% in 2022, a robust comparison to China's 65% year-on-year increase.

Modifying existing facilities

From new builds to refurbing and converting previously used manufacturing facilities, or expanding existing traditional battery manufacturing facilities, to giga factories, securing these investments requires a holistic approach that encompasses construction, optimisation, power supply, site selection, feedstock sourcing, sales strategy, regulatory compliance and a sustainability lens.

Fortunately, existing facilities may be retrofitted to transform into battery giga factories through an integrated approach that looks to reuse as much of the existing buildings, services and equipment at the facility as possible, even though there might be limitations of the host building.

It should be noted, however, that the plants themselves are technically complex, requiring deep knowledge in the new generation of gigafactories, as well as specialist expertise in clean and dry room design and implementation.

Minimising risk

In managing risks for retrofitting facilities into battery giga factories, thorough studies are essential. This includes geotechnical and environmental assessments, evaluating flood risks considering climate change, and checking for ground contamination. Identifying materials such as asbestos and conducting concrete integrity testing is critical to gauge the effects of age and chemicals.

A documentation search is also vital. This should encompass existing drawings, reverse engineering, and reviewing maintenance records by consulting with on-site personnel and third-party vendors. Ensuring safety for structural and civil aspects of the construction, as well as mechanical and electrical services, is important.

Building Information Modelling (BIM) enhances upfront planning and coordination within the model space, which is fundamental in reducing risks and ensuring an efficient project timeline.

Improving energy efficiency

A fundamental question to address is how to improve the energy efficiency of an existing factory. This is where developing sustainable battery giga factories requires a combination of international experience with local insights.

Working with the permitting and local authority on establishing site boundaries and zoning rights while also maintaining compliance with national and local regulations is vital. So too are recognising the environmental conditions of where the current facility is situated. For instance, the humidity, the climate, as well as the impact of climate change.

Decision-makers must be aware that the building typically accounts for less than one-third of construction CAPEX, while services and utilities constitute the majority. They must therefore understand the cost implications of alterations, which may make Greenfield projects potentially more cost-effective than Brownfield ones.

Enabling a sustainable future

Keeping circular economy principles in mind is vital to ensuring battery manufacturing plants support the project and business' environmental, social, and governance (ESG) goals. This includes looking at solutions to, for example, design out waste and pollution while keeping products and materials at their highest possible value, and regenerating natural systems.

> *"This helps to drive clean growth, preserve natural capital and reduce waste, achieve net zero goals, reduce cost and improve industrial resilience."*

Whether it's new builds or retrofitting existing facilities to giga factories, the goal is to eliminate value leakage across the resource lifecycle, whilst creating industrial symbioses and regenerating natural capital.

Additionally, looking at the lifecycle of giga factories through a sustainability lens means targeting efficiencies not only the design and building of these facilities but also ensuring these facilities continue to operate as efficiently and sustainably as possible.

Puma Energy acquires 49% stake in MBHE Group

18 Jan 2024

Continuous monitoring and identifying opportunities to improve the lifecycle management of these factories supports these aims, and in the wake of evolving technologies and market demands.

Battery design, and therefore the design of battery giga factories, is a rapidly evolving industry. To truly drive industry growth, it's essential to embrace innovation, future-readiness and prepare for the changing landscape.

The emergence of battery giga factories will help the world embrace a more sustainable future while still meeting the demand for these precious commodities.

ABOUT THE AUTHOR

Peter Hodgkinson is director for Strategic Growth and Major Projects: Property & Buildings at WSP in Africa