Ensure Safety and Optimized Production of Lithium Batteries

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Lithium Batteries Critical to Decarbonization Goals

Environmental sustainability strategies within the industrial, buildings and transport sectors must be addressed through operational improvement, greater energy efficiency, waste and emissions management and capture, low carbon electrification and clean fuels. The transport sector accounts for one-fifth of global carbon dioxide (CO_2) emissions, but with expected growth in demand as the population rises, this could lead to an increase in emissions. Technical innovations and a shift to lower carbon electricity sources can help offset this rise in demand. The transition from the combustion engine to electric vehicles, powered using lithium-ion batteries, is a key enabler to achieve global decarbonization objectives.

Growing Demand for Lithium-ion Batteries

The outstanding energy to weight capacity of lithium-ion batteries, due to the lightness of lithium, has made them especially well-suited to mobile applications including electric vehicles. With the five leading car manufacturers projecting annual sales of 15 million electric vehicles by 2025, this will require a significant increase in battery capacity, to around 900 GWh. To keep up with such demand, there is huge investment in lithium mining and refining, battery component manufacturing and battery cell production.

In addition to the need to increase overall battery production capacity, technological innovation is also required to improve storage capacity, reduce charging times, increase cell life, improve battery safety and reduce the cost of production.

Mining and Refining Challenges

Increased demand for lithium creates opportunities and greater investment, but in upstream lithium mining, operators are under increasing social, environmental and regulatory pressure to ensure safer and more sustainable operations, with efficient water usage and minimal environmental hazards. Mining companies must also look to minimize operating costs by improving the reliability of plant and equipment, optimizing existing operations and implementing new plant designs that capitalize on more effective modern processes and technologies.

Battery Component Manufacturing Challenges

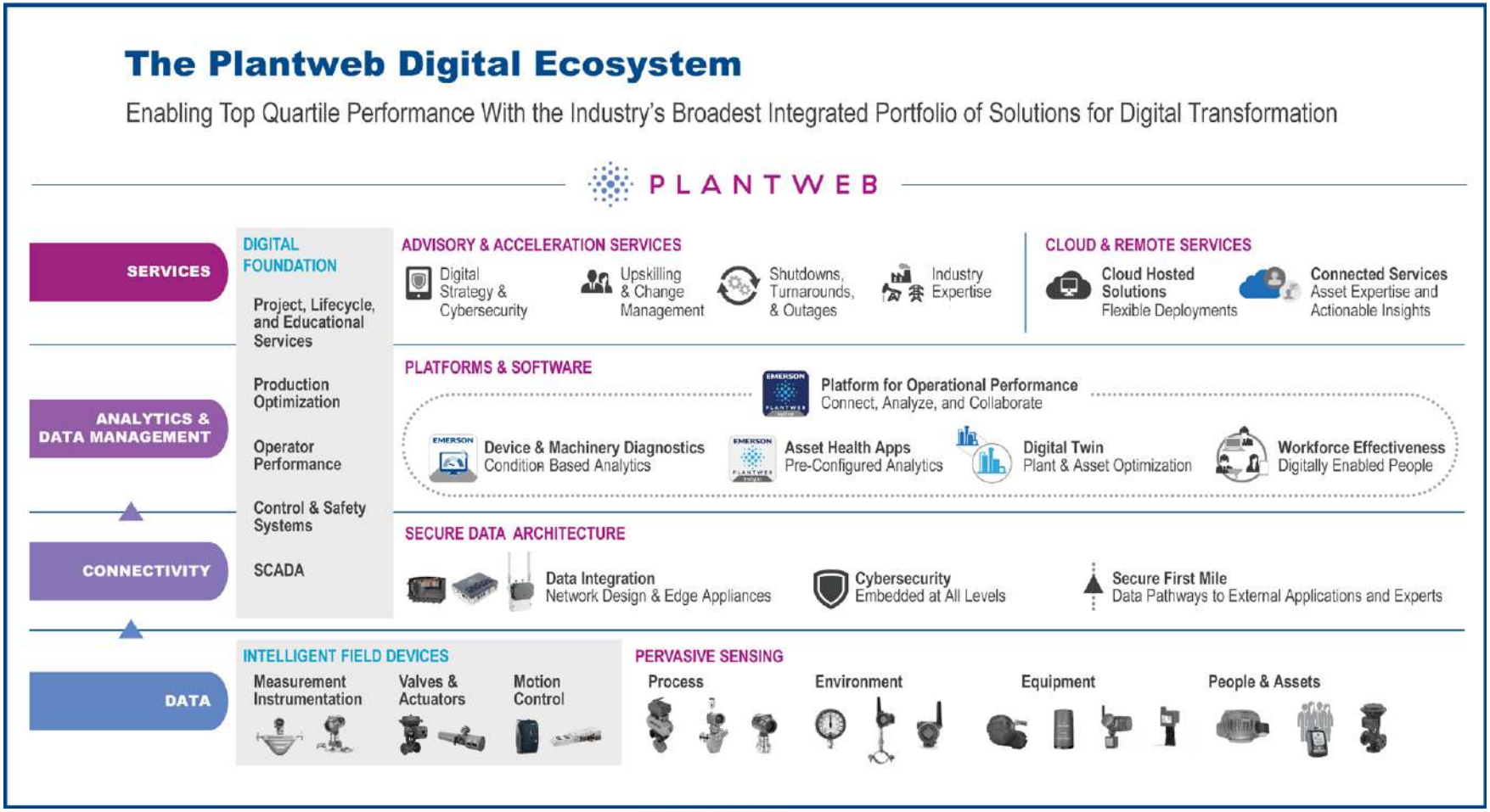
For battery component manufacturers, there is a need to bring reliable and high capacity products to market quickly, but also improve quality by ensuring consistent and optimized production from batch to batch. Within this fast-moving market, organizations need to have flexible manufacturing practices, with production equipment that enables them to change formulas and schedule runs quickly to meet changing customer demands. Meeting regulatory compliance, ensuring the safety of workers and achieving sustainability goals are all essential.

Battery Cell Production Challenges

Battery technology is advancing at a rapid pace, requiring manufacturers to develop even more reliable and high capacity products that meet customer demands for safety and longevity. Batteries must be safer, more energy-dense and offer extended life, stability and charging/discharging efficiency. Implementing new production lines quickly relies on seamless integration of equipment from multiple vendors and secure data transfer to ensure efficient operations. Greater production efficiency, throughput and quality are essential to profitability.

Gaining a Competitive Advantage

In this rapidly-moving market, enhanced technology, deeper expertise and a stronger commitment to value-creating solutions guarantee a critical advantage. With automation technology at the heart of most production equipment designs, organizations across the entire lithium value chain will benefit from partnering with an expert automation technology provider who can help meet their operational challenges, achieve production efficiency and sustainability goals, and elevate their offering.



Mining Solutions

Advanced automation technology is helping to meet lithium mining challenges by providing improved process control, greater insight and actionable information. This enables mining companies extracting lithium from spodumene or brine to improve recovery, increase product quality, reduce equipment downtime, lower energy costs and ensure safer, more sustainable operations.

- Advanced sensing with neural and fuzzy control prevents transfer chute blockage and lost production.
- Model predictive control of mill speed reduces power consumption and cost, while optimizing particle size for increased lithium recovery.
- Advanced sensing with neural and fuzzy control improves hydrocyclone classification and avoids roping and plugging. Particle size is estimated in real-time.
- Enhanced flotation cell reagent control can produce a 2% increase in lithium recovery, while minimizing reagent consumption for lower costs.
- Vibration monitoring and predictive analytics can prevent unscheduled downtime of critical equipment including crushers, mills, stackers and conveyor belts.
- Valves with anti-cavitation trim increase reliability in applications where erosion and cavitation issues are caused by the process media.

Refining Solutions

Within lithium refining, automation is helping to increase production efficiency by optimizing existing and new plant processes through greater automated data collection. Equipment reliability and availability is increased by implementing predictive maintenance strategies supported by machinery condition monitoring. Refinery sustainability goals are supported with environmental protection systems and efficiency monitoring solutions that help reduce energy and emissions.

- Model predictive control improves kiln combustion efficiency and reduces fuel consumption, SOx and NOx emissions and off-spec product.
- Wireless vibration and other sensors together with analytics software helps to extend the life of critical assets including pumps, heat exchangers and conveyor belts, reducing maintenance costs and unscheduled downtime.
- Capacity management with digital twin technology allows comparison of modeled and actual plant data to identify underperforming process stages, leading to increased throughput.
- Continuous monitoring ensures sequential process steps run smoothly for greater throughput/reduced fuel and chemical consumption.
- Diagnostic features provide insight to control valves that allow reliable and optimal process operation.

Battery Component Manufacturing Solutions

Within cathode, anode and electrolyte manufacturing, automation helps to lower production costs and ensure quality and safety. Product quality is achieved using batch control system software, advanced measurement technology and analytics software that provides site-wide production visibility insight that increases yield, reduces variation, minimizes the need for rework and ensures customer schedules are met. Scalable control solutions reduce automation complexity and accommodate change, providing manufacturers with the agility to meet market demands. Real-time monitoring solutions identify leaks and issues before they impact safety and environmental targets.

Batch automation reduces manual operations, cycle times and transition times, creating an optimized and more flexible production process capable of adapting to frequent formula changes.

Real-time viscosity and mass flow measurement improves reactor control, batch consistency and final product quality.

Digital control valves built for corrosive and erosive applications ensure smooth operations that allow processes to run closer to specification limits for higher efficiency and right-first-time production.

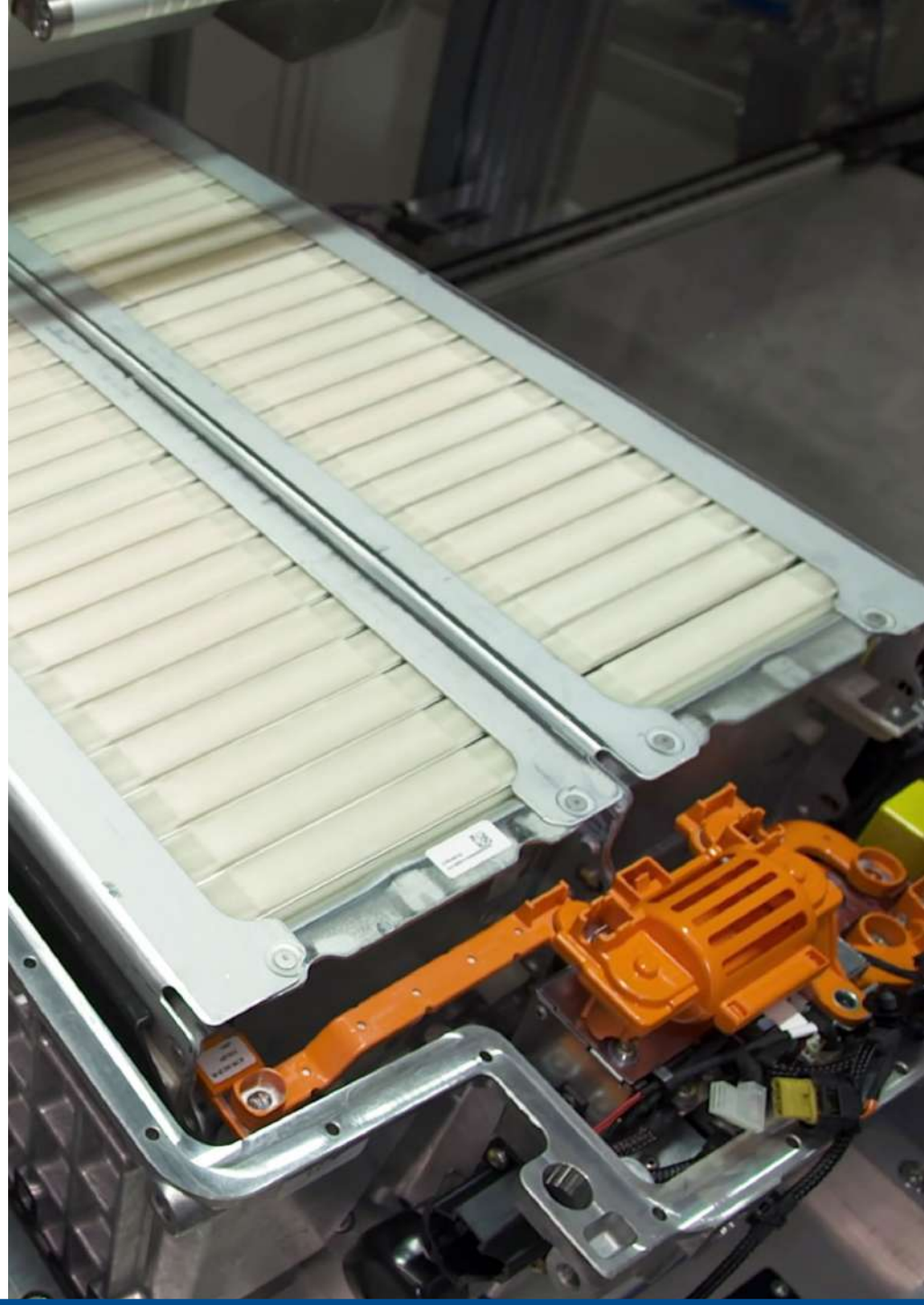
Wireless corrosion and erosion monitoring reduces the risk of chemical leaks.

Personnel location awareness digitally transforms facility safety, reducing response times to incidents and providing a safer work environment.

Battery Cell Production Solutions

Leveraging modern open standard and scalable technologies helps to reduce system complexity, enable seamless transmission of critical data and allow rapid configuration for new production requirements. Automation can also deliver significant improvements in production quality, with advanced ultrasonic welding solutions enabling high quality joining of layered cells, which helps to produce more energy-dense EV and ESS batteries.

- Integrated system control prevents islands of automation and enables site-wide visibility that delivers significant improvements in quality, efficiency and throughput.
- Ultrasonic welding solutions remove welding bottlenecks, ensure high-quality joins of multi-layered cells that help create higher energy density products, and enhance worker safety.
- Automated process and machine safety systems, offering fast response, protect employee safety and the environment, with minimal impact on operations.
- Ultrasonic, point and open path gas leak detectors increase detection efficiency and reduce the consequences of a pressurized gas escape, helping protect people and the environment.



Choosing a Technology Partner

In an expanding, but increasingly competitive market, relationships with experts and reliable partners become critical for your success. When selecting an automation technology partner, a key consideration is whether they have technologies designed for your demanding applications and are able to provide the necessary business performance improvements needed. Does the company have the necessary experience and understanding of the specific challenges of mining and processing lithium, or production of lithium-ion battery manufacturers? Can they provide the product and application support globally in line with your expected growth?

The right partner will offer:

- Product suitability and reliability
- A comprehensive portfolio to reduce complexity
- Solutions that increase and optimize operational performance and safety
- Collaborative design engineering capability
- Project execution capability
- Global scale and responsive local support

Lithium Value Chain Automation Expertise

By delivering advanced control, increased process visibility and actionable information for improved decision-making, Emerson's advanced automation technologies are helping lithium mining and lithium-ion battery manufacturers to optimize their operations to achieve greater safety, quality and throughput. Our Project Certainty methodology and technologies, combined with extensive industry expertise, available globally, reduces project risk and helps to ensure completion of projects, on time and within budget.

With the lithium-ion battery industry evolving rapidly, we continue to develop innovative automation solutions to meet the challenges of expanding operations, including the need for more sustainable and efficient production processes and enhanced battery performance and safety.

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