

Batteries International

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APG's expanding empire The rise and rise of Atomized

**BESS insurers: the
new kings of probability**

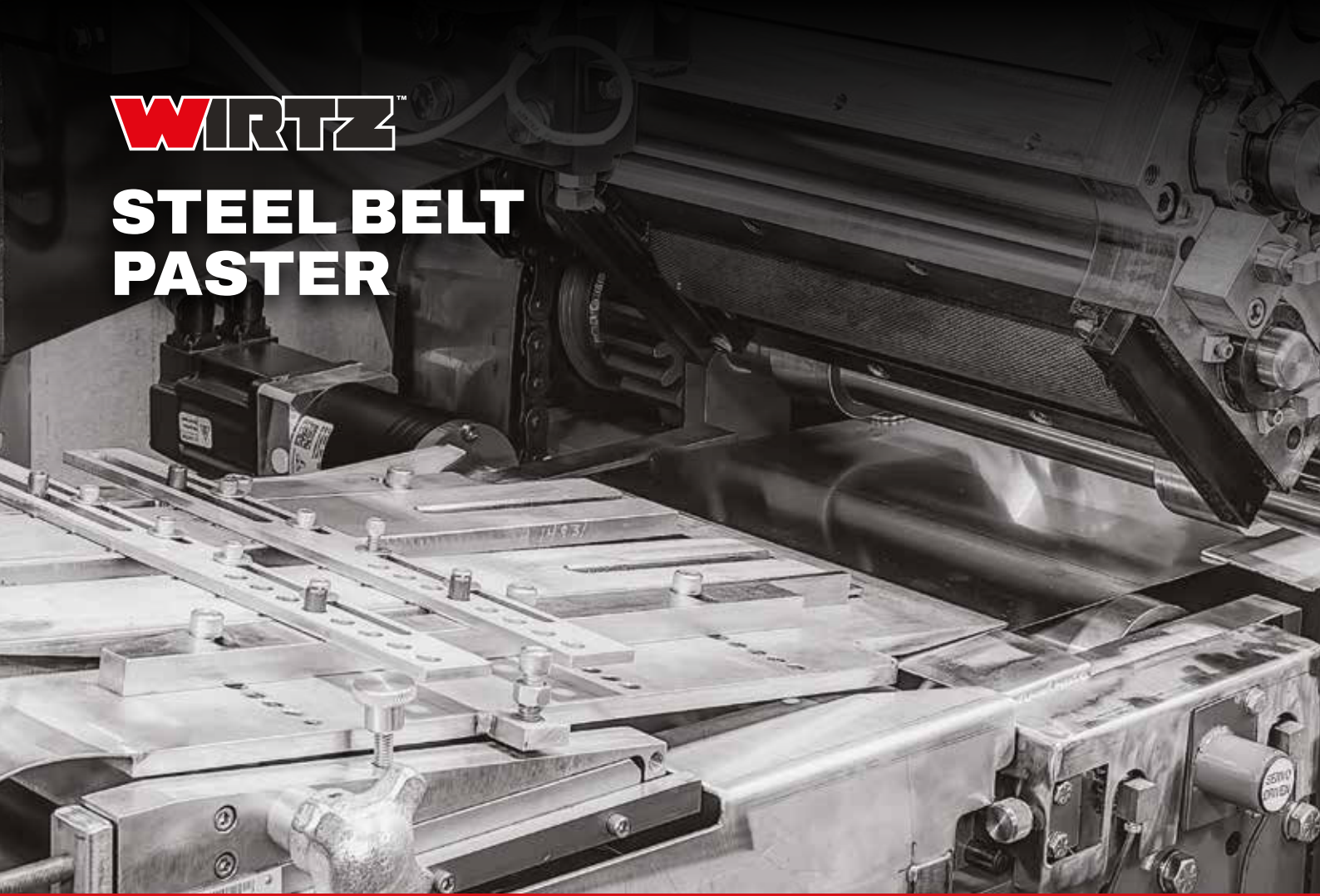
**Tales from the Beltway,
Washington, Ai and power**

**Protectionism, tariff walls,
the next barrier to innovation**

**Vehicle to grid: bidirectional
charging comes of age**

The Voice of Our Industry
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THE NEW GATEKEEPERS: HERE COME THE MONEY MEN

A large industrial machine, the Wirtz Steel Belt Paster, is shown in a black and white photograph. The machine is complex, with various rollers, belts, and structural components. It appears to be designed for high-speed production of AGM plates. The Wirtz logo is prominently displayed in the top left corner.

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Some 30 years ago, Ed and Janet Puckett gambled their family's future on an unwanted manufacturing plant. Today, their children, Lee and Steph, are steering Atomized Products Group into its next era. Shona Sibary discovers a succession story built on the understanding that while products and markets may change, the values behind the business remain constant.



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Protectionist walls do not a battery superpower make

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Protectionist walls do not a battery superpower make

History is littered with nations that believed they could wall themselves into industrial greatness.

One of the most striking examples was Spain under the dictatorship of Francisco Franco. Following the Second World War, the country pursued *autarky* — economic self-sufficiency protected by high trade barriers and state intervention.

Domestic industries that had been shielded from foreign competition, instead of becoming stronger, became inefficient, technologically stagnant and internationally uncompetitive.

When Spain abandoned *autarky* in 1959 after two decades of protectionism, it did not lose its industry — it found it.

Foreign investment poured in, exports expanded, productivity rose and Spain embarked on what became known as the *El Milagro Español* [the Spanish Miracle]. This was an extraordinary period of economic growth in Spain between 1959 and 1974.

During this time Spain transformed itself from one of Western Europe's poorest and most isolated countries into a modern industrial economy. GDP grew by around 7% a year, making Spain the second-fastest-growing major economy in the world after Japan. By the early 1970s Spain had become the ninth-largest economy in the world.

Protection can buy time, but it cannot substitute for competitiveness. That lesson deserves serious consideration as the US seeks to advance its battery industry and keep its economy as the world leader.

Batteries are strategically vital to the US economy. They underpin the emerging EV industry, grid-scale energy storage, defence applications and an increasingly electrified economy. However, China has achieved an extraordinary dominance across the battery supply chain, from critical minerals through to cathode materials, cell manufacturing and recycling.

The question is not whether America should strengthen its domestic battery industry. It absolutely should. The question is whether building a Fortress America around it is the best way to succeed.

Protectionism has obvious attractions. Tariffs create breathing space. Domestic manufacturers receive time to expand production without facing relentless price competition from overseas. Politically, it is an attractive message: protect American jobs, encourage domestic investment and reduce dependence on geopolitical rivals.

But batteries are not steel or textiles. Modern battery manufacturing is among the most globally integrated industries ever created. Raw materials may come from Australia, Chile or Indonesia. Processing typically may occur in China, but also elsewhere. Equipment may originate in Germany, Japan or South Korea. Intellectual property is developed simultaneously across laboratories in Asia, Europe and North America. Attempting to isolate one part of that ecosystem risks isolating innovation itself.

The uncomfortable reality is that the US is still trying to build a fully competitive electric vehicle ecosystem.

Tesla remains the outstanding exception rather than the rule. Traditional automakers have repeatedly scaled back EV investment, delayed model launches or postponed battery plants as consumer demand has softened and production costs have remained stubbornly high. Start-ups that promised to challenge established manufacturers have struggled to achieve commercial scale. Billions of dollars have been invested, yet the industry remains far distant from the manufacturing efficiency achieved elsewhere.

That is not simply because Chinese labour is cheaper. It is because China spent nearly two decades building an integrated industrial ecosystem where battery chemistry, manufacturing equipment, supply chains and engineering talent evolved together.

Two decades of experience

No tariff can recreate 20 years of accumulated industrial learning.

Even supporters of domestic manufacturing recognise the danger of relying solely on trade barriers. A recent report prepared for the US Congress notes that while tariffs may help protect nascent industries, economists generally regard tariffs as economically inefficient if they become permanent rather than transitional.

That distinction matters. Temporary protection accompanied by relentless investment in productivity, research and manufacturing excellence can help an industry mature.

Permanent protection can remove precisely the competitive pressure that forces companies to innovate.

The battery industry offers numerous historical examples. Japanese manufacturers dominated lead-acid batteries through manufacturing excel-

lence before facing increasingly fierce competition from South Korean producers.

Korean companies then found themselves challenged by Chinese manufacturers, who relentlessly improved quality while driving costs lower.

Competition forced innovation. Innovation drove affordability. Affordability expanded global demand. In the end consumers ultimately benefited.

LFP rules

Battery technology itself has evolved in exactly the same way. Lithium iron phosphate, once dismissed by Western manufacturers as an inferior chemistry, became commercially dominant because Chinese producers continued refining manufacturing processes while much of the West pursued higher-energy nickel chemistries.

Today even Western automakers are embracing LFP for mainstream vehicles because the economics proved impossible to ignore.

Markets have a habit of rewarding engineering more than politics.

Ted Miller, manager of battery cell research and advanced engineering at Ford, recently argued that the US ultimately needs to "innovate away from China" rather than rely indefinitely on cost protection. Analysis accompanying that assessment concluded that structural cost reductions through technological innovation would ultimately determine competitiveness as incentives fade.

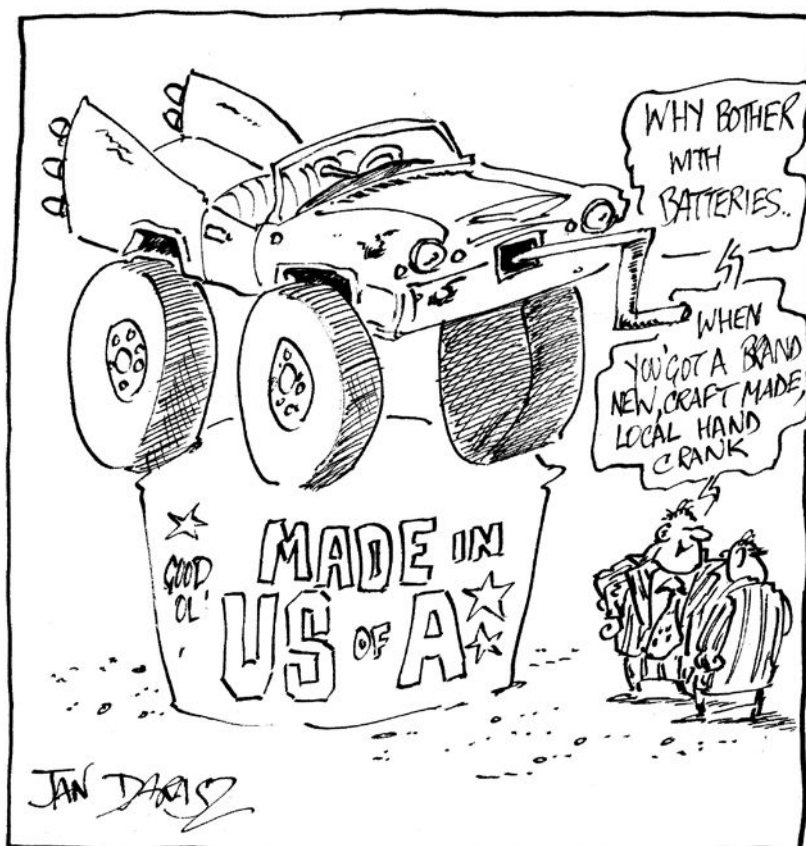
Innovation rarely flourishes behind walls. Competition is uncomfortable. It exposes weaknesses. It forces manufacturers to improve yields, reduce defects, automate production and rethink chemistry. It encourages collaboration between universities, suppliers and manufacturers. Those pressures often create stronger companies than subsidies ever can.

There is also an international dimension that should concern battery manufacturers.

Batteries are becoming a global commodity. Gigafactories are being constructed across Europe, Southeast Asia, India and the Middle East. Companies increasingly expect international supply chains, cross-border investment and global partnerships.

Excessive protectionism risks encouraging equally restrictive responses elsewhere, fragmenting supply chains precisely when scale is becoming one of the industry's greatest competitive advantages.

Even observers sympathetic to industrial policy



have warned that tariffs alone cannot solve America's battery challenge because China's lead reflects accumulated manufacturing capability rather than simply pricing.

As one recent analysis concluded, the industry's problems are "interlocked" and extend well beyond trade policy.

Competition forced innovation.
Innovation drove affordability.
Affordability expanded global demand.
Consumers ultimately benefited.

None of this suggests abandoning domestic manufacturing. Quite the opposite.

America should absolutely invest in battery research, workforce development, refining capacity, recycling infrastructure and advanced manufacturing. It should accelerate permitting for strategically important facilities. It should support next-generation chemistries where genuine technological leadership remains possible.

But there is an important distinction between helping domestic companies become globally competitive and protecting them indefinitely from global competition.

One builds champions. The other risks creating dependents. ■

Mike Halls, publisher



If AI wants the power, it should help build it

Jennifer Granholm, BYOC and the AI-energy nexus.
Our mole inside the Beltway reports.

Amid the usual Washington debate over AI supremacy, semiconductor shortages and grid reliability, former Energy Secretary Jennifer Granholm recently offered a deceptively simple proposition.

If technology companies want to build data centres that consume gigawatts of electricity, they should help build the power plants to run them. And the energy storage needed to incorporate renewables into the power mix.

The idea has acquired a shorthand label in policy circles: BYOC — Bring Your Own Clean Power. It may also prove to be one of the most consequential energy-policy concepts to emerge from the AI boom.

The concept is straightforward. Companies building large energy-hungry facilities would be expected to secure or finance the clean electricity needed to run them, rather than relying on an already stretched grid to absorb the additional demand.

The issue is becoming increasingly urgent. AI is emerging as one of the largest new sources of electricity consumption in the United States. The rapid expansion of hyperscale data centres by Microsoft, Google, Amazon and other technology giants is placing unprecedented pressure on regional power systems.

Granholm believes the coming wave of AI-related demand raises difficult questions. Who pays for the new generation and transmission infrastructure required to support it? And how can governments meet climate targets while remaining competitive in the global race for AI leadership?

Her answer challenges two widely held assumptions: that the grid, in the end, can simply absorb AI's growing appetite for power, and that environmental goals must inevitably take a back seat to technological progress.



What Granholm (above) is really describing is a broader shift in policy thinking. Energy is no longer just another sector of the economy. It is becoming the foundation of economic competitiveness, industrial strategy, climate policy and technological leadership.

Instead, she argues that major AI developers should bring new generating capacity with them.

In conversations with hyperscalers, Granholm has suggested that companies planning facilities consuming gigawatts of electricity should also invest in the power needed to support those operations. Otherwise, communities may come to see data centres not as economic assets but as a burden on local infrastructure.

The logic reflects a theme that has run through Granholm's energy policy for years. Clean energy and energy security, she argues, are not competing priorities. Nations that depend heavily on globally traded fossil fuels remain vulnerable to price shocks and geopolitical disruption.

Those that develop domestic sources of clean energy gain greater resilience and control.

BYOC applies that same thinking to AI.

Rather than becoming another vast source of demand competing for limited resources, technology companies would become active participants in building the energy system of the future. They would not simply consume power. They would help create it.

That would mark a significant shift. Historically, large industrial users have been viewed primarily as customers of the electricity system. Under Granholm's vision, hyperscalers become infrastructure partners.

Their balance sheets could help accelerate investment in advanced nuclear reactors, geothermal energy, long-duration storage and renewable generation at a pace utilities alone may struggle to achieve.

The implications extend well beyond energy policy.

Artificial intelligence is increasingly being viewed as a strategic technology on a par with railways, electrification and the internet. Countries able to provide abundant, reliable and affordable electricity are likely to enjoy a significant advantage in developing and deploying AI.

Granholm has repeatedly argued that the United States must keep AI innovation at home. If so, access to

Artificial intelligence is increasingly being viewed as a strategic technology on a par with railways, electrification and the internet. Countries able to provide abundant, reliable and affordable electricity are likely to enjoy a significant advantage in developing and deploying AI.



Granholm has repeatedly argued that the United States must keep AI innovation at home. If so, access to power may become as important as access to computing talent or capital.

power may become as important as access to computing talent or capital.

Seen this way, energy becomes the key constraint on digital growth. The debate shifts from computing power to electrical power. The question is no longer simply who builds the best models, but who can power them at scale.

Granholm does not see AI as the problem. If anything, she sees it as part of the solution. AI can improve grid operations, optimise energy systems, accelerate scientific discovery and help manage increasingly complex electricity networks.

But realising those benefits requires confronting a basic reality: AI's own energy consumption is rising rapidly.

That tension may define the next phase of the energy transition. Policymakers have spent years focusing on decarbonising transport, buildings and heavy industry. AI introduces a new category of demand. Data centres are becoming strategic infrastructure, with energy requirements increasingly comparable to those of major industrial facilities.

BYOC offers a pragmatic response.

It does not seek to slow AI development, nor does it abandon climate goals. Instead, it attempts to align incentives, ensuring that the companies benefiting most from AI's growth also contribute to the infrastructure needed to sustain it.

Critics will argue that such a model could raise costs, slow deployment or favour larger firms with deeper pockets. Those concerns are real. But the alternative—allowing vast new electricity loads to strain power systems while households and businesses absorb the consequences—may prove politically untenable.

What Granholm is really describing is a broader shift in policy thinking. Energy is no longer just another sector of the economy. It is becoming the foundation of economic

competitiveness, industrial strategy, climate policy and technological leadership.

In that sense, AI and clean energy are no longer separate stories. They are increasingly the same story.

The companies building the digital economy may also be expected to help build the physical infrastructure that powers it.

BYOC, then, is more than an energy proposal. It is the outline of a new social contract: if companies want access to unprecedented amounts of electricity, they should help create the clean energy system that makes that consumption possible.

Whether that bargain takes hold may shape not only the future of artificial intelligence, but also the pace and direction of the global energy transition. ■

Granholm does not see AI as the problem. If anything, she sees it as part of the solution. AI can improve grid operations, optimise energy systems, accelerate scientific discovery and help manage increasingly complex electricity networks.

Today, there is a new manufacturing model rewriting the rules. Forget the gigafactory. The battery industry's next manufacturing revolution may not involve building factories at all.

How Northvolt changed everything

Why battery companies need to abandon billion dollar plants

For much of the past decade, success in the battery industry seemed to depend on one thing above all else: building ever bigger factories.

The race to construct gigafactories became almost synonymous with growth. Governments offered generous incentives, investors rewarded ambitious expansion plans and manufacturers competed to announce increasingly larger production facilities.

Owning production capacity was seen as essential to establishing credibility in an increasingly competitive market.

And then the Northvolt collapse happened — the great battery hope for Europe had attracted some \$15 billion in equity, debt and public funding. Cracks in the company, founded in 2016, started to show in 2024 before its final collapse in March 2025.

Now a new business model could emerge from the ashes of Northvolt.

Instead of spending billions of dollars constructing new plants, a growing number of battery companies are choosing to manufacture their products in existing factories across Asia.

The approach — long familiar in industries such as consumer electronics — is emerging as a viable alternative for battery developers seeking to reach commercial production without exposing themselves to the financial risks of building their own facilities.

The change reflects a major shift in market conditions.

Chinese manufacturers invested heavily in production capacity during the rapid expansion of EV markets over the past five years. As EV sales growth has moderated and competition intensified, industry analysts say many Chinese battery factories are operating below capacity

following several years of rapid expansion.

Rather than leaving expensive equipment idle, a growing number of manufacturers are offering contract manufacturing services to overseas developers, according to industry reports.

For battery developers in Europe and North America, the attraction is obvious.

Constructing a modern battery factory requires investment measured in billions of dollars, together with lengthy permitting processes, specialised equipment procurement and the recruitment of skilled workforces. Even under favourable conditions, bringing a new plant into full commercial operation can take several years.

Contract manufacturing offers a far quicker route to market.

By using facilities that are already operating, companies can begin commercial production much sooner while preserving scarce capital for product development, customer acquisition and future expansion.

The model also reduces one of the industry's greatest financial risks.

Several battery start-ups have struggled under the enormous capital demands associated with constructing large manufacturing facilities before establishing profitable customer bases. The difficulties encountered by high-profile European manufacturers have highlighted the dangers of committing vast sums to production infrastructure ahead of proven commercial demand.

Using existing Asian production lines allows companies to scale output gradually while avoiding the burden of financing underutilised factories.

The approach does not mean relinquishing ownership of technology.

In most cases, developers need to retain control of cell chemistry, intellectual property and quality standards while manufacturing partners provide production expertise, equipment and trained personnel.

The relationship resembles the contract manufacturing arrangements that have become commonplace throughout the

Instead of spending billions of dollars constructing new plants, a growing number of battery companies are choosing to manufacture their products in existing factories across Asia.

electronics industry.

Asia remains particularly well placed to support this model.

China dominates global battery manufacturing capacity and possesses a highly integrated supply chain encompassing cathode materials, anodes, separators, electrolytes and cell assembly equipment. The concentration of suppliers enables rapid sourcing of materials and components while reducing production costs.

Neighbouring countries including South Korea and, increasingly, parts of south-east Asia also offer sophisticated manufacturing ecosystems capable of supporting advanced battery production.

For many young companies, accessing these established industrial clusters may prove considerably less risky than attempting to recreate entire supply chains in higher-cost markets.

Companies that are already considering this possibility are not all at the same stage of development but they include Sweden's Altris which recently confirmed it is in discussions with a Chinese manufacturer to lease an underused lithium-ion line and convert it for sodium-ion battery production.

US sodium-ion developer Unigrid has publicly described a foundry-style manufacturing model using external production partners.

Peak Energy has indicated that contract manufacturing could form part of its early commercialisation strategy before investing in large-scale domestic production. It is unclear whether it still thinks that way. Its long-term ambition remains US manufacturing, it represents the increasingly common "manufacture first, build later" philosophy.

According to recent industry reports, Ion Storage Systems has explored manufacturing partnerships in Southeast Asia.

The trend may also reshape investment priorities.

Rather than asking whether a battery company owns a factory, investors are increasingly focusing on the uniqueness of its chemistry, intellectual property, customer relationships and ability to secure manufacturing partnerships.

Rather than asking whether a battery company owns a factory, investors are increasingly focusing on the uniqueness of its chemistry, intellectual property, customer relationships and ability to secure manufacturing partnerships.

Production capacity itself is becoming less of a competitive differentiator where reliable contract manufacturing is readily available.

That does not mean gigafactories are becoming obsolete. Large-scale dedicated facilities will remain essential for companies serving major automotive customers requiring long-term, high-volume supply agreements. Government policies promoting domestic manufacturing in Europe and North America are

also likely to sustain investment in local production.

Geopolitical tensions, tariffs and concerns over supply-chain security may encourage some manufacturers to relocate production closer to end markets over time.

Industry observers believe several established Asian cell manufacturers could become important contract manufacturing partners as they seek to improve factory utilisation.

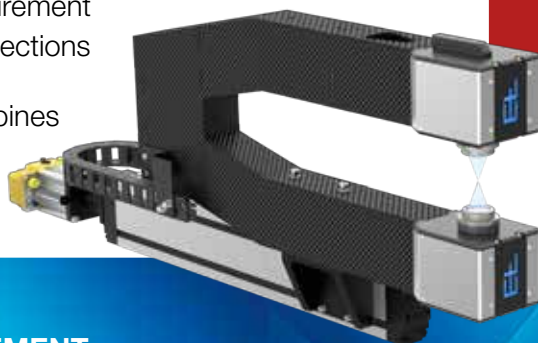
Companies frequently mentioned include CALB, EVE Energy, Farasis Energy, Gotion High-Tech, REPT Battero and Sunwoda, although none has publicly announced a broad contract-manufacturing strategy aimed at overseas battery developers. ■

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PNNL inventor accolade for energy storage 'powerhouse' Wei Wang

Laboratory Fellow and materials scientist Wei Wang has been named 2025 Pacific Northwest National Laboratory (PNNL) Inventor of the Year.

PNNL announced on July 21 that Wang had been awarded one of the lab's highest recognitions for innovation and technology commercialisation — his inventions having helped transform grid energy storage from a niche research topic into technologies that are manufactured and deployed commercially.

Presented as part of PNNL's Pathway to Excellence awards in June, the honour recognises researchers who have a significant all-time body of work and outstanding contributions to an extensive intellectual property portfolio that has led to commercial engagement and impact.

PNNL said Wang's contributions to energy storage had led him to join a select group of 21 previous recipients in the lab's history to receive the distinction.

Wang is a nationally recognised scientist who serves as the deputy director for the Energy Storage Research Alliance, is a technical lead for stationary energy storage R&D and previously directed PNNL's Energy Storage Materials Initiative from 2019 to 2024.

His pioneering contributions to redox flow batteries and electrolyte solvation chemistry have earned numerous honours from the American Chemical Society, The Electrochemical Society, the US Environmental Protection Agency, the Federal Laboratory Consortium and R&D 100.

Beyond niche

As a Battelle Distinguished Inventor, Wang holds more than 20 patents with multiple licences and has authored more than 80 scientific publications, resulting in being named a Clarivate Highly Cited Researcher.

For Wang, the recognition is especially meaningful because it reflects the growth of a field that was once considered highly niche.

He said: "I think we are in a time where energy storage has become an important, popular topic but is still an emerging technology type. To receive this award and understand that PNNL is recognising the work in



Wei Wang accepting the award from PNNL director Deb Gracio.

Photo: Eddie Pablo / PNNL

this new emerging area is exciting and encouraging."

Bill Pike, deputy director for science and technology at PNNL, said: "Wei recognised the potential of energy storage long before it became a major national priority and helped establish the capabilities, collaborations, and research directions that have made PNNL a leader in the field. His career demonstrates how scientific vision, sustained over time, can transform an emerging area of research into a strategic strength for the Laboratory and the nation."

Wang co-founded the International Coalition for Energy Storage and has encouraged early-career researchers to pursue new ideas.

"I encourage junior scientists to be really bold in their ideas and research directions," he said. "If you sense the need to start in a new research direction, don't be afraid to explore those different ideas or pathways."

ESS transformation

While pursuing his doctorate in materials science and engineering at Carnegie Mellon University (CMU), Wang connected with Daiwon Choi, a fellow CMU alumnus who had recently joined PNNL.

At the time, battery energy storage research at PNNL was limited, so Choi encouraged him to apply. PNNL hired Wang before he completed his degree, allowing him to finish his final year before joining the laboratory full time.

When Wang arrived at PNNL,

battery research received modest support from the Department of Energy's Office of Electricity. As the US grid grew more complex and electricity needs increased, reliable long-duration energy storage became increasingly important for maintaining a secure and reliable electric grid. This growing national need transformed energy storage from a specialised research topic into a strategic priority.

Although trained in lithium-ion batteries, Wang quickly expanded into multiple electrochemical energy storage technologies, laying foundation for his later work in redox flow batteries.

That work led to an R&D 100 Award for developing a nanocomposite material that greatly improves the performance of lithium ion batteries.

Redox flow potential

Christina Lomasney-Mattis, chief commercialisation officer at PNNL, said: "His inventions have generated valuable intellectual property, attracted commercial partners, and helped accelerate the deployment of technologies that support a more resilient energy future. His career is a powerful example of how sustained scientific excellence, combined with a commitment to technology transfer, can create lasting national impact."

Soon after, Wang began working on redox flow batteries, which offer promising potential for grid-scale energy storage.

Working with flow battery systems, Wang and his team tackled one of the technology's most persistent challenges: electrolyte instability at extreme temperatures. These conditions can cause solid deposits to form, reducing battery performance and lifespan.

The team discovered that carefully controlling how ions interact with surrounding solvent molecules — known as solvation chemistry — could dramatically improve electrolyte stability, preventing damaging reactions and significantly improving battery stability.

The resulting technology was licensed for commercial development, helping translate PNNL's fundamental advances in electrolyte chemistry into practical solutions for long-duration, grid-scale energy storage.

The success attracted growing support from multiple partners, allowing the programme to expand into long-duration energy storage, battery manufacturing and scale-up, materials development, diagnostics, and commercial demonstration projects. The work laid the foundation for PNNL's growth into one of the world's leading research and

development centres for grid energy storage.

Accelerating discovery

In 2017, Wang championed a new vision for energy storage materials discovery — integrating robotics, artificial intelligence, high-throughput experimentation, theory, computation, and digital twins to accelerate the discovery and development of next-generation materials.

Recognising the growing importance of energy storage, PNNL leadership asked Wang to help shape the future of the field at PNNL. Working with scientists, engineers, and researchers from multiple disciplines, he spent two years developing the Energy Storage Materials Initiative (ESMI), a five-year strategic investment to develop new scientific approaches that accelerate energy storage research and development.

From 2019 to 2024, Wang worked as ESMI's director, helping develop workflows and frameworks that combine new capabilities that use AI, automation, and robotics to evaluate materials and guide experiments more efficiently. The initiative created PNNL's Materials Innovation through

Robotics and AI Laboratory (MIRAL) as a nationally recognised capability for AI- and robotics-enabled materials discovery, located within the Grid Storage Launchpad.

Beyond building new research capabilities, Wang has also contributed to broader DOE efforts through a detailed assignment with the Advanced Materials and Manufacturing Technologies Office, helping strengthen connections between energy storage research and advanced manufacturing.

Ruozhu Feng, a seedling project leader for ESMI, said: "Through ESMI, he has created space for us to explore new ideas, develop emerging concepts, and build confidence as independent scientific leaders."

Despite his many accomplishments, Wang credits collaboration and a willingness to pursue uncertain ideas as the foundation for innovation.

He said: "Einstein asked, 'If we knew what we were doing, it wouldn't be called research, would it?' Most of the time we don't know what we're doing, but what I find rewarding is the colliding of different ideas on this team. That is the spark that leads us towards a better understanding of what we're trying to do." ■

Rich Botts and Jessica Parnell join Eagle Oxide



Rich Botts has been appointed director of operations at Eagle Oxide Services, the company announced on July 17.

The announcement came after Eagle announced on July 1 that Jessica Parnell had joined the firm as project manager.

Botts, who has more than three decades of experience in lead acid battery manufacturing and maintenance, was most recently with Hammond Lead Prod-

ucts and previously at Pratt Industries.

Eagle said his background includes extensive experience with Barton oxide systems, ball mills, red lead and litharge production, combustion systems, melt pots, hammer mills, and both mechanical and pneumatic material handling systems.

He also holds technical certifications in welding and electrical work, giving him a practical, hands-on perspec-

tive that complements his leadership experience.

Meanwhile, Jessica Parnell will help manage customer projects from planning through execution, supporting the company's commitment to quality, innovation, and on-time delivery.

Eagle said Parnell brings more than 18 years of manufacturing and project leadership experience from Honda's car production facility in Indiana.

Throughout her career, she has led project, production, and quality teams of more than 200 employees while helping oversee the successful launch of new vehicle programmes.

Parnell's experience includes managing new model vehicle weld programs and serving as technical-stage project lead for Honda's R&D team, where she played a key role

in coordinating new vehicle development.

Eagle said that her background in complex manufacturing environments and cross-functional project management is a natural fit for the company as it continues to expand its global customer base.

On Botts, Eagle CEO Eric Holtan, said: "Rich understands this industry from the ground up. His experience and technical knowledge make him an excellent addition to our leadership team, and we're excited about the value he'll bring to Eagle and our customers."

Holtan said Parnell's experience leading large-scale manufacturing projects and driving collaboration across multiple teams will strengthen the firm's ability to execute projects efficiently and continue providing exceptional service to our customers. ■



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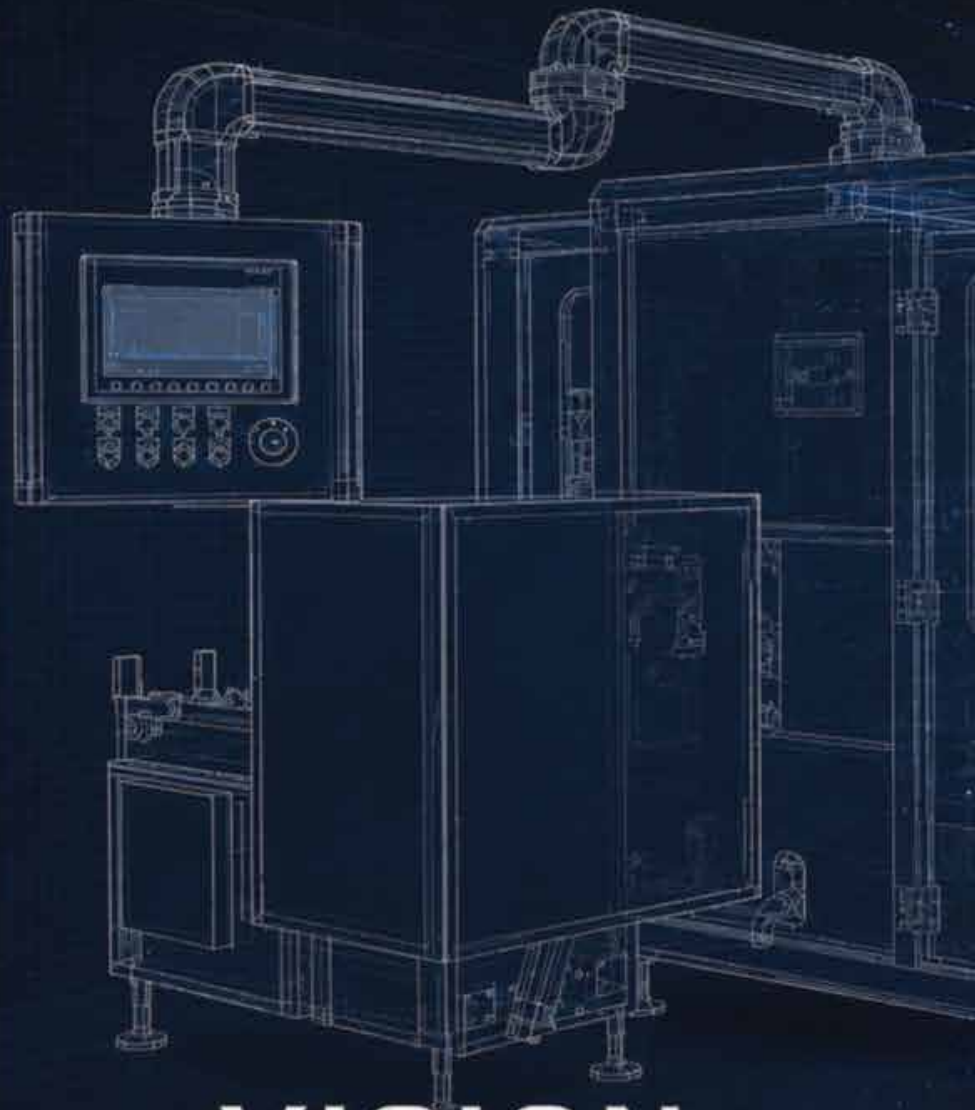
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CATL, auto giants in global sustainable battery consortium

Chinese battery giant CATL and global circular economy charity, the Ellen MacArthur Foundation, are heading up an international consortium backing initiatives for sustainability in battery design and business investment.

CATL and Ellen MacArthur announced on June 29 they had launched two new initiatives together with BMW, Renault, Volvo, Google and Chinese multinational Xiaomi.

The consortium will promote sustainable design guidelines for the entire battery lifecycle, and support

measures to accelerate policy, investment and commercial conditions needed to make circular business models the industry norm.

The initiatives were announced during London Climate Action Week as part of CATL's Global Energy Circularity Commitment — a collaborative initiative with the Ellen MacArthur Foundation.

CATL said common design standards and business models that keep materials in productive use for longer are as important as increased recycling capacity for the future of the battery

sector.

By 2040, the global battery recycling market alone is projected to exceed Rmb1.2 trillion (\$177 billion), creating more than 10 million jobs, CATL said. Meanwhile, the International Energy Agency projects demand for battery-critical minerals will increase five-fold over the same period.

In a related move, at Octopus Energy's Energy Tech Summit in London on June 22, CATL and Octopus Energy announced what they said was Europe's first battery-swapping joint venture, targeting 300,000

electric trucks and 30 hubs across Europe by 2035, with the first UK hubs scheduled to open in 2027.

Octopus Energy Group founder and CEO Greg Jackson said: "By designing batteries to be swapped, optimised, shared and reused thousands of times, we can squeeze every drop of value out of the materials we already have, rather than digging up more."

In July 2025, CATL outlined plans to "decouple" 50% of new battery production from the use of primary raw materials within 20 years. ■

Battery tech partnerships key for Europe at BATTwin meeting

Lead and lithium manufacturer the Sunlight Group has hailed technical cooperation across Europe's battery sector as key to scaling up production on the continent.

Greece-based Sunlight pledged closer partnerships with industry, research and academia after hosting the eighth consortium meeting of BATTwin — a European-funded project — at its industrial complex in Xanthi from July 2-3.

BATTwin is dedicated to supporting Europe's strategic shift toward energy sovereignty and to challenge Asian battery players' dominance of the industry.

The latest consortium meeting focused on industrial scaling up of new production lines, which Sunlight said remains volatile, with initial scrap rates frequently reaching 15% to 30%.

As manufacturing defects are typically detected only during final testing phases, following production, substantial volumes of critical raw materials are routinely wasted, compromising both the financial viability and strategic security of Europe's battery

ecosystem, Sunlight said.

BATTwin is combating this vulnerability by creating a real-time 'digital twin' of factory cell production lines in Europe.

BATTwin is developing a novel multilevel digital twin platform towards zero-defect manufacturing in battery production. Solutions include using digital twins for modelling during the critical stages of electrode manufacturing, cell assembly and conditioning.

Sunlight said the approach is being tested in Greece and at Verkor's gigafactory facilities in France.

As a key industrial anchor for the project, Sunlight said its Xanthi complex serves as a critical validation ground for technologies.

Spanning 90,000m², with an annual capacity of 9GWh, the battery firm's flagship automated facility is one of Europe's most advanced manufacturing hubs. By providing a scaled, operational ecosys-

tem, Sunlight said it offers the consortium the real-world data infrastructure required to train and validate complex predictive algorithms on a commercial scale across diverse cell geometries and chemistries.

The consortium partners were given technical tours of Sunlight's automated cell production lines to align data integration protocols between the physical machinery and the BATTwin digital platform. ■

SiliconJoule adviser Parke appointed operations director



Bipolar lead battery developer SiliconJoule has appointed Jon Parke as operations director.

Parke, who has been a strategic adviser to the company for the past two years, will now join full time to help scale battery assembly and wafer-processing operations, SiliconJoule said on June 22.

Parke's appointment comes as SiliconJoule advances commercialisation of its battery technology following the launch of its flagship GC2+ product.

The company is expanding operations, workforce, and production capabilities to meet growing demand from customers and partners worldwide.

CEO Ray Kubis said: "Having benefited from Jon's expertise as an adviser over the last two years, we are excited to welcome him to the team in this expanded capacity."

"With more than 25 years

of manufacturing and operations leadership experience at industry-leading organisations, including Johnson Controls (now Clarion), Freyr Battery, and Valence Technology, Jon brings the expertise and vision needed to accelerate our operational growth and strengthen partnerships around the world."

Gridtential Energy rebranded to Silicon Joule last March. The company also announced it was relocating its pilot operations and battery design from California to the Midwest US. ■



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Former Clarios executive Rigby named COnovate CEO

Craig Rigby, a former executive at Clarios, has been appointed president and CEO of battery materials innovator COnovate.

The company said on June 17 that Rigby, who has been a member of COnovate's board since 2022, had been appointed with immediate effect.

He succeeds Carol Hirschmugl, COnovate's co-founder and CEO since 2016, who becomes CTO to fully focus on accelerating the company's materials innovation, process development and technical roadmap.

Rigby, a seasoned engineering and business development executive, brings extensive experience in leading global teams, developing product strategies and shepherding technology-driven growth.

He held multiple executive leadership posts at Clarios (formerly Johnson Controls Power Solutions), including VP of technology.

During this time, he was pivotal in driving technology deployment, innovative



business models, strategic partnerships and government engagement, COnovate said.

While at Clarios, Rigby also served on the board of Indian lead manufacturing major Amara Raja Battery (now Amara Raja Energy & Mobility) — leading engineering for a joint venture with French battery maker Saft and served on a number of industry and academic advisory boards.

Earlier in his career, Rigby played a key role in launching the first-generation hybrid vehicle at the Ford

Motor Company.

Rigby said COnovate continued to focus on developing domestically produced next-generation anode materials that address critical performance and supply chain needs of the battery industry.

The company said its 'eCOphite' anodes provide a safer, higher-capacity alternative to graphite-based anodes in lithium ion batteries.

Derived from renewable, organic, US-sourced feedstocks, eCOphite anodes can serve as a full anode replacement or as a performance-enhancing additive alongside graphite, particularly in BESS applications using LFP cathodes, the firm claimed.

Hirschmugl said: "Craig's leadership experience in global battery manufacturing and commercialisation makes him the right person to lead COnovate through its next phase of growth."

"As CTO, I'm excited to drive our next-generation materials development and

bring high-performance, domestically sourced anode materials to market." ■

US national lab PNNL becomes latest BCI member

The Pacific Northwest National Laboratory (PNNL) has become the latest member of Battery Council International.

PNNL, a premier US Department of Energy research institution in Richland, Washington, has joined the organisation under a new public benefit membership category, BCI announced in a LinkedIn post on June 10.

The lab advances chemistry, Earth sciences, data analytics, and biology to strengthen energy resilience, enhance national security, and further scientific discovery.

Founded in 1965, PNNL is operated by Battelle and supported by the US Department of Energy Office of Science.

In 2025, PNNL won BCI's annual innovation award for its Grid Storage Launchpad (GSL). The GSL is a new US national capability for speeding up energy storage research: it brings all phases of battery development and deployment cycle under one roof, ranging from fundamental materials and device prototyping through to 100kW-400kW scale testing and validation.

Also last year, BCI announced that it had taken part in talks at PNNL focused on support for next-generation grid-scale battery storage tech. Representatives from leading energy storage companies and three national labs met at the PNNL campus on March 11 and 12. ■

Exide celebrates renewed 'gold' global rating for sustainability

Exide Technologies has hailed a renewed gold award from global business sustainability rating provider, EcoVadis, as testament to the firm's battery business.

The lead and lithium manufacturer said on June 12 the group had been re-awarded the EcoVadis Gold rating for 2026, confirming its continued commitment to strong sustainability performance.

The firm's performance was assessed across areas including the environment, labour and human rights, sustainable procurement

and ethics.

This prestigious distinction places Exide in the top 2% of over 150,000 companies assessed worldwide and in the top 1% within the battery and accumulator manufacturing industry.

Exide said the reconfirmed rating reflects ongoing progress made across all evaluated sustainability areas. Since 2025, the company has further improved its overall score, while maintaining its position among the top performers.

"Being re-awarded the

EcoVadis gold rating reflects the continued dedication of our teams and our commitment to responsible business practices," said Stefan Stübing, Exide's CEO and president.

In 2024, Exide announced it was ramping up its energy storage business in Europe with the signing of a new project deal in Italy. The firm, whose Italian operations are based in the province of Bergamo, said it had delivered its Solition Mega Three lithium BESS to a foundry. ■

Perez joins Hammond as Latin America director of sales

Hammond Group has announced the appointment of Carlos Eduardo Pikel Perez as director of sales for Latin America.

Hammond said on June 2 that Perez had joined the company and would be based in São Paulo, Brazil.

Perez will lead Hammond's commercial development drive across the Latin American market, playing a key role in the company's continued global expansion strategy.

He brings more than 20 years of global commercial leadership experience in the energy, industrial, and advanced materials sectors, Hammond said.

Most recently, Perez served as global VP of sales at Black Diamond Structures, a manufacturer of advanced carbon-based battery additives, where he managed a portfolio of 200+ strategic accounts.

Hammond said his direct experience selling into



battery manufacturers throughout Latin America and his fluency in Portuguese, English, and Spanish — gives Perez an immediate understanding of customer needs, competitive dynamics, and the technical conversations that drive purchasing decisions in the region.

Perez said his goal is to build deep, lasting partnerships with customers across the region, understand their specific technical and commercial needs, and

position Hammond as their most trusted and capable supplier.

He said: "Latin America represents a tremendous and largely untapped opportunity for Hammond Group. The region's battery industry is evolving rapidly, with growing demand for high-performance materials across automotive, industrial, and energy storage applications.

Hammond said Perez's appointment marks the latest step in the group's

expansion of its global commercial team, which in addition to Latin America spans the Asia-Pacific region and Europe, the Middle East and Africa.

VP of sales Brad Bisaillon said: "Carlos brings exactly the profile we were looking for — a proven track record driving revenue growth in complex, multi-market environments, combined with deep roots in Latin America and an exceptional ability to build strategic relationships." ■

ENEROC USA becomes BCI's first lithium-only battery member company

ENEROC USA has made history by becoming the first lithium-only battery manufacturer to join Battery Council International.

The battery firm's CEO told *Batteries International* on June 10 the move was a sign that lithium technology had matured enough to take its place within the broader conversation of power solutions driving electrification and energy transition.

BCI members have traditionally focused on lead batteries, but the association increasingly includes flow, sodium, lithium ion and other emerging chemistries and the trade body said ENEROC's membership is a natural step in that direction.

ENEROC's membership also opens the door for other lithium specialists to become part of BCI's platform of advocacy, education and industry collaboration.

According to BCI, lithium shipments from BCI members increased 31% year-over-year in 2025, even as total North American battery volumes softened.

Lithium technology has moved well beyond early-adopter status into a recognised and established segment of the industrial battery market and the organisation's membership is evolving to reflect that reality, the US trade body said.

Different applications call for different solutions, and the battery industry has always understood this. Lead batteries remain essential across automotive, stationary, and industrial applications, and BCI's member companies continue to drive innovation and sustainability in that space.

Lithium technology brings its own strengths to specific applications and BCI provides a platform for both to

collaborate on the issues that matter to the entire industry — safety, product integrity, sustainability and reliable power for the nation.

BCI president and executive director Roger Miksad said: "In over a century, we have never had a battery manufacturer join whose business was built entirely on lithium technology.

"BCI exists to represent the full breadth of the battery industry, and welcoming a lithium-only manufacturer strengthens our ability to represent the battery industry, advance safety standards, and support America's energy security."

Batteries International reported recently that BCI had held the inaugural meeting of its new sodium battery industry group, marking a significant milestone in the advancement of sodium ion battery tech in North America. ■

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Battery passports are not simply another piece of EU regulation. They are the first visible step in a digital revolution that will eventually reshape every manufactured product on the planet. Shona Sibary reports.

Beyond the QR code: why battery passports are just the beginning

If you think battery passports are simply another layer of European bureaucracy, Ken Davies CCO at DigiProd Pass believes you're looking through the wrong end of the telescope.

Yes, companies selling batteries above 2kWh into the EU will soon have to comply with incoming battery regulation. Yes, every qualifying battery will require a digital passport. And yes, manufacturers across the industry are racing to understand exactly what information those passports will need to contain.

But Davies says that focusing solely on batteries misses the significance of what is happening.

"You've got to see the battery passport as just one element of a much bigger revolution," he says. "Consumer electronics, furniture, textiles, construction materials and countless other industries are all heading in the same direction. Batteries simply happen to be first. The plan within the EU is that all of these sectors will eventually have operational digital product passports."

Data revolution

Much of the conversation surrounding battery passports has centred on regulation. Davies believes the real story is consumer empowerment.

At its heart, the digital product passport (DPP) is designed to provide transparent information throughout a product's lifetime, enabling consumers to make better-informed purchasing decisions while giving recyclers and second-life operators the information they need to recover valuable materials efficiently.

For years, sustainability has often been discussed in principle rather than practice. According to Davies, legislators are now beginning to create the legal framework that makes



Ken Davies CCO at DigiProd Pass

genuinely circular supply chains possible.

"It's really a mechanism to empower consumers with data so they can make better informed decisions about what they buy," he says. "It also provides organisations involved in recycling and second life with all the data they need to make those activities commercially viable."

The regulation may be arriving through Brussels, but Davies sees it as part of a worldwide movement rather than a uniquely European initiative.

China is already developing similar systems, while other markets are expected to introduce their own versions. Although individual regulations may differ, Davies believes the underlying structure will remain remarkably similar.

"If you want to sell something in the EU, you'll comply with the EU system. If you want to sell in another market, you'll comply with theirs. Some 95% of what companies need to do will be exactly the same."

The critical date remains February 18, 2027, when battery passports become mandatory for batteries over 2kWh placed on the EU market. Yet Davies cautions against assuming that

reaching the deadline marks the end of the journey.

Misunderstandings

One of the biggest misconceptions, he argues, is that companies only need to achieve compliance once. "It might be that the passport starts off relatively basic," he says. "Perhaps it's simply a QR code with core information. But it won't stay basic."

Instead, battery passports will evolve continuously as regulators demand increasingly detailed information.

"People mustn't think they'll reach 18 February, breathe a sigh of relief and forget about it," he says. "The expectations of the quality of the data will keep expanding."

That evolving nature says why many companies remain uncertain. The deadline itself is fixed, but some details surrounding the precise content of the passport continue to develop.

Who, for instance, will actually be responsible? Many assume it will be the battery manufacturer, but Davies is keen to clarify that this won't, necessarily, be the case.

"Responsibility will fall upon what the regulation defines as the economic operator, which is the company placing the finished product on the market," he says. "If you're Audi, you're the economic operator."

That means vehicle, truck and drone manufacturers, and countless other OEMs become responsible for ensuring compliant battery passports accompany the products they sell. And this is a distinction that matters.

But the regulation is not designed to hold OEMs responsible for every action that occurs throughout global mining supply chains. Rather, it requires transparency.

"It doesn't make Audi responsible for child labour in the Congo," Davies

says. “It makes them responsible for making sure everybody can see where everything came from.”

The emphasis shifts from assigning blame to providing visibility. When battery passports first emerged, much of the discussion focused on the visible element: the QR code attached to each battery.

Davies believes that focus is misplaced. “The QR code isn’t the challenge,” he says. “We could design that in five minutes. Instead, the real work happens behind the scenes. Information has to be collected from multiple business systems that often cannot communicate with one another.

“Manufacturing records, material data, sourcing information, carbon footprints, repair histories and operational updates all need to be integrated into a single digital record. The real challenge is coordinating the data from different systems and making sure they all work together.”

That becomes even more complicated because the passport is not static. Unlike a paper certificate, the battery passport is expected to evolve throughout the battery’s operational life.

“If a vehicle is involved in an accident and the battery is affected, the passport has to know that.”

Rather than creating a single document, companies are effectively building a living digital record that follows each battery from manufacture through use, second life and ultimately recycling.

Ironically, despite being first to adopt DPPs, Davies believes the battery industry may ultimately prove one of the easier sectors to implement them as modern battery manufacturing already generates vast quantities of production data.

“Gigafactories routinely capture detailed manufacturing information throughout production, making much of the required data readily available. The battery industry is actually very sophisticated in its data management already,” Davies says. “Compare that with textiles.

Supply chains often stretch across multiple countries, involving thousands of smaller suppliers with inconsistent digital systems and limited traceability. If you’re making a T-shirt in Bangladesh, that’s a completely different challenge.”

The principles remain identical, but the quality and accessibility of the underlying data are vastly different.

SMEs face the biggest hurdle

But while large automotive manufacturers already possess sophisticated enterprise resource planning (ERP) and manufacturing systems capable of supporting DPPs, smaller companies face a steeper climb.

Many could be forgiven for thinking a simple, low-cost solution exists, but Davies warns against knee-jerking to this assumption.

He compares DPP systems with enterprise software. Small companies rarely build their own ERP or CRM platforms from scratch. Instead, they rely on specialist providers.

“DPPs will most likely follow the same model,” Davies says. “There isn’t really going to be an easy route.”

So as the compliance deadline approaches, many SMEs are going to discover that implementation is neither quick nor inexpensive, yet remains unavoidable if they wish to continue selling qualifying products within Europe.

And despite almost all the uncertainties ahead, one striking theme remains. Battery passports will pave the way for an entirely new professional ecosystem, one in which data specialists, systems integrators, compliance experts, software providers and consultants are all likely to play increasingly important roles.

“It’s all about the data,” Davies says. “AI will undoubtedly become part of the picture, but effective data management will remain the foundation upon which future compliance is built.”

For today’s engineering graduates, entirely new careers may emerge around DPP infrastructure and lifecycle data management and the growing demand for knowledge was something that became evident during the inaugural Battery Passport Conference in Lille earlier this year.

Davies says delegates were eager not only to hear presentations but

also to compare experiences with one another.

“It was difficult getting people back into the conference room after coffee,” he says. “Everybody just wanted to keep comparing notes and talking.”

For Davies, that was perhaps the clearest indication that the industry recognises both the scale of the challenge and the value of collaboration. Rather than competing over compliance, companies were openly discussing best practice, concerns and practical solutions.

“It was an amazing networking experience,” he says. “Delegates really appreciated the opportunity to talk about this subject in isolation and in depth.”

Beyond batteries

Davies admits he only fully appreciated the scale of the DPP movement around 18 months ago while interviewing experts for his Battery Technology Podcast.

Today, he spends his time working across batteries, textiles, construction and other manufacturing sectors - a cross-industry perspective that reinforces the central message that this isn’t just about batteries. It’s everything.

For battery manufacturers, this may be the most important takeaway of all. The passport is not simply another compliance box to tick before February 2027. It is the first glimpse of a future in which every significant manufactured product carries a living digital identity, one that documents where it came from, what it contains, how it has been used and ultimately how it should be reused or recycled.

For companies still debating whether battery passports are really happening, Davies has one simple analogy. “The train has already left the station,” he says. “The sooner you get on it, the better.” ■



Stryten acquires C&D Trojan in next new phase of US consolidation

Stryten Energy agreed on July 13 to acquire C&D Technologies and Trojan Battery in one of the largest consolidations in the North American lead battery industry in recent years.

The announcement came as a complete shock to the battery industry. “I didn’t have a clue — and I normally know when something is in the air — that this was even going on,” one senior battery machinery supplier told *Batteries International*.

Financial terms have not been disclosed.

“The transaction is about far more than adding manufacturing capacity. It reflects growing demand for larger, vertically integrated battery suppliers capable of serving sectors ranging from AI data centres and telecommunications to defence, utilities and critical infrastructure,” said one observer.

In an odd way it fits in with a prophetic interview that Rick Godber, then CEO of the family firm gave in July 2013 to *Batteries International*. Trojan was then being acquired by private equity firm Charlesbank Capital Partners.

He told Mike Halls, then the editor, that the sale reflected a change in the ownership emphasis: “Our ambition is no longer to be about the future of batteries as a product — but ourselves as a solutions provider for the energy needs of the world to come.”

This deal, which should close during the third quarter of 2026 subject to regulatory approvals, also shows how private equity firms continue to reshape the battery industry through successive

rounds of acquisition and consolidation. Charlesbank sold Trojan in 2018 to C&D Technologies, itself owned by private equity firm KPS Capital which has now sold this arm on to Atlas Holdings.

The combined business will bring together two complementary companies with relatively little overlap in several key markets.

Stryten has strong positions in transportation batteries, motive power, military applications and energy storage. C&D Technologies is well known for reserve power batteries used in telecommunications, utilities and data centres.

Trojan Battery adds one of the industry’s best recognised brands in deep-cycle batteries for golf cars, floor care equipment, renewable energy and recreational vehicles.

Once completed, Stryten will operate

15 manufacturing and component facilities across the US employing around 3,700 people, together with operations in Mexico and China and commercial offices across Europe and Asia.

The company also plans to expand production of AGM batteries, reflecting increasing demand from start-stop vehicles, telecommunications infrastructure and data centres.

The acquisition strengthens Stryten’s position in markets that have become increasingly strategic. Demand for reserve power batteries has risen sharply as investment in AI data centres accelerates, while telecommunications operators, utilities and defence organisations continue to prioritise proven battery technologies supported by domestic manufacturing.

The transaction potentially reshapes the North American competitive

landscape. The enlarged Stryten will emerge as a stronger competitor to established manufacturers such as Clarion, East Penn and EnerSys. It says it will have one of the broadest product portfolios in the industry spanning automotive, industrial, reserve power, military and lithium-based energy storage technologies.

Mike Judd, chief executive officer and president of Stryten Energy, said the acquisition would broaden the company’s manufacturing footprint, strengthen its product portfolio and improve its ability to serve customers across transportation, industrial, reserve power and government markets.

Rick Heller, president and chief executive officer of C&D Trojan, said the combination would create a stronger platform capable of meeting customers’ evolving energy storage requirements. ■

Report reprieve for Leclanché as shares trading suspended

Troubled Swiss energy storage group Leclanché has secured a temporary exemption from the publication of the firm’s annual report for 2025 but said trading of shares in the firm remains suspended.

The company confirmed on June 10 it had been given until July 31 to file the report with SIX Exchange Regulation (SER), which regulates and monitors exchange participants and issuers on the Swiss Stock Exchange.

The temporary exemption for publishing the report follows a previous extension granted on April 29, which extended

the original April 30 deadline for publication of the report to May 31.

SIX said on June 1 it was temporarily suspending shares trading in Leclanché until the annual report was released.

The report extension deadline comes just weeks after Leclanché announced the appointment of Jens Emrich as chief financial officer, to succeed Hubert Angleys — who left the company last November on completion of what Leclanché said was his temporary assignment to the post.

Emrich’s appointment came just days after

Leclanché said it had concluded a financing arrangement with strategic partners in the amount of CHF 16.7 million (\$22 million) to support its near-term operational requirements.

Batteries International reported in June 2025 that Leclanché was pushing ahead with efforts “to achieve and maintain a positive equity position” and to demonstrate the firm’s ability to continue as a going concern through at least June 2026.

The company had said previously that it was in a situation of negative equity as of the end of 2024. ■

Germany's Varta files for insolvency in restructuring bid

German battery maker Varta has filed applications for insolvency as part of plans for the long-term restructuring of the troubled company.

Varta said it filed the self-administration applications in Stuttgart on July 23 and told employees the following day citing “significantly deteriorated market conditions, weaker demand and negative exchange rate effects”.

A recent decision by a key customer to end cooperation was also a contributing factor, Varta said.

In addition to the parent company (Varta AG) the operating units Varta Microbattery in Ellwangen, Varta Micro Production in Nördlingen and Varta Storage are affected.

Preliminary insolvency proceedings in self-administration have also been launched for Varta Microbattery.

The Varta Consumer Batteries business unit and its associated companies, which are legally and operationally separate and

financially independent, are expressly excluded from the applications.

Varta said its existing group structures and complex internal inter-dependencies had made it difficult to effectively implement necessary restructuring measures and require additional liquidity.

This led to a “structural financing gap” at the level of the parent company, against a background of an ongoing restructuring review, especially with regard to the further development of the company from 2027.

The Stuttgart District Court has appointed Tobias Wahl, of the German law firm Anchor, as provisional administrator — with the aim of securing the economic future of the company and the sustainable continuation of business operations.

Varta CEO Michael Ostermann said the court move was an unavoidable step.

“Varta has had to contend with major challenges in recent quarters. We on



Ostermann: court move was an unavoidable step

the board of management and the executive board are aware of the overall responsibility for employees, customers, suppliers and financiers and are working with all our might to preserve as many jobs as possible, to enable sustainable continuation and to create the best possible prospects for all stakeholders.”

Ostermann said the market for energy storage systems continues to be an industry of the future that needs strong domes-

tic suppliers and technology leaders such as Varta.

The insolvency move comes just over a year after Varta unveiled a multi-million-euro liquidity boost in the latest steps of a restructuring plan to “guarantee” battery tech production and research in Europe.

Earlier this year, Ostermann discussed his plans for Varta's future with *Batteries International* editor Shona Sibary last April.

“It's been a challenging year,” Ostermann says with a wry smile. “As you can imagine, we've been having seven-day-a-week negotiations with lenders. The very first priority for me was to get the financial situation stabilized.”

“We have become a little bit too fat in recent years. We had way too many overheads, and we are now doing some operational restructuring by making the organization and our processes slimmer. This means we will be able to make faster decisions, because this has sometimes been too slow. ■

Banner in ‘multi-million-euro’ investment to expand battery sales

Global lead battery major Banner is to invest a “significant double-digit million-euro amount” in its facilities in Austria over the next four years.

The move is part of the firm's ‘Agenda 2035’ business programme, announced on June 10, focusing on longer-term profitability, efficiency and growth beyond existing markets.

Banner said optimised processes and modern technologies are at the centre of its strategy — buoyed by news last January that the firm had secured two long-term battery supply contracts worth a total of €195 million (\$231 million)

in North American and European deals.

The company said its 2025/26 financial year was characterised by stability, strategic development and intensive transformation work. Sales, at 4.25 million units, were slightly higher than the previous year and above target.

At €311 million (\$361 million), turnover reached a similar level to the previous financial year. However, the firm said the results showed it was holding its own in the challenging market environment of the European automotive industry. The international aftermarket showed particularly dynamic

growth.

Now, the goal is to substantially expand automation and digital processes while securing the long-term competitiveness of the production site in Austria.

A key initiative is the implementation of SAP S/4HANA Public Cloud. At the same time, Banner said it is modernising machinery, infrastructure and operational processes.

Banner has also launched a new corporate design, still centred on its established bull motif, but enhanced to meet what the firm said is its ambition to give the Banner brand a clearer and modern presence as it charges ahead.

The company acknowledges that markets remain volatile and difficult to predict, but Banner's leadership said there are clear opportunities and further growth potential in the international aftermarket business, new projects, and ongoing investments.

Secured capacity utilization, high product quality, and a clear strategic direction provide a solid foundation for the company's next steps, the firm said.

CEO Werner Töpfl said: “Banner must clearly differentiate itself from the competition through quality, customer proximity, speed and decisive action.” ■

China 'on course to control some 39% of global lithium extraction'

China's ongoing march toward dominating the global battery sector is highlighted in new analysis indicating Chinese firms are set to control 39% of all lithium extracted worldwide by 2030.

Energy data analytics firm Wood Mackenzie's report, released on May 25, highlights a growing divergence between the geography of lithium production and the nationality of asset owners, noting that China's predicted grip on Li extraction is on course to rise from a third in 2020.

Australia, long the dominant force in lithium supply, accounted for 43% of global extraction in 2020 — but by 2030 that share is forecast to fall to 25%, driven not by declining investment, but by faster growth elsewhere

particularly across Africa.

Africa's share of global lithium extraction is expected to rise from near zero in 2020 to 13% by 2030, marking one of the most significant regional supply shifts in the sector.

However, Africa illustrates the growing disconnect between production and ownership. While the continent is expected to account for 13% of global lithium extraction, African-headquartered companies are forecast to own just 1% of global output.

Chinese firms have built significant stakes in Australian and Argentine assets while deploying capital at scale across Africa, "filling a vacuum left by increasingly cautious Western investors".

Elsewhere, Europe's ownership share is rising

following Rio Tinto's acquisition of Arcadium Lithium in 2025 and Equinor's entry into battery materials, while North America's share has declined following the divestment of US-held assets to Rio Tinto, the report said.

Allan Pedersen, Wood Mackenzie's research director for energy transition and lithium battery materials, said: "With few exceptions, Africa's lithium growth has been financed by Chinese capital. That raises important questions around ownership, value capture and long-term supply chain influence as production continues to scale."

While production growth is becoming more geographically diverse, ownership remains concentrated among a relatively

small group of companies, mostly led by China, Pedersen said.

Wood Mackenzie's report came after Australia-based and Africa-focused Atlantic Lithium said on May 7 it had entered into a binding agreement with China's Zhejiang Huayou Cobalt for Huayou to acquire all of the issued shares in Atlantic.

Wood Mackenzie's report echoed analysis published by the International Energy Agency last March, which warned EV plants worldwide faced \$17 billion in losses for every month of a potential halt in cell exports by China.

According to the IEA, EV plants in the EU would account for over half of those losses for each month of an interruption in supply chain exports from China. ■

Graphite One secures 10,000-tonne battery materials site in Ohio

US-based Graphite One has secured a new site in Ohio for the first phase of production of 10,000 tonnes of battery materials primarily for energy storage systems and EVs.

G1 said the site in Ashtabula County marks a major step forward in its plans to launch an active anode materials (AAM) plant — including a finishing and blending facility.

Construction of the plant is scheduled for completion in the fourth quarter of 2027. The first phase is expected to involve production of 4,000 tonnes of energy storage material, 3,000 tonnes of fast-charging material and 3,000 tonnes of high-energy-density material.

These materials are intended for use in lithium ion battery applications supporting EVs, grid-scale

energy storage and emerging data centre infrastructure demand.

The site deal follows a licence of occupation agreement with Bessemer and Lake Erie Railroad Company, a subsidiary of Canadian National Railway.

G1 said the location has several strategic advantages including direct access to Lake Erie and the Great Lakes shipping corridor.

In parallel with phase one production, G1 will evaluate a second-phase expansion, with completion of construction in the third quarter of 2028 and graphitisation capacity of 25,000 tonnes per year.

The expansion will boost the firm's goal of becoming a potential domestic supplier of AAM at a time when North American supply chains continue

to seek localised sources of critical battery inputs, G1 said.

Meanwhile, the firm said it has already delivered commercial-grade anode material samples, including quantities of up to 20kg to three major EV manufacturers and three leading battery companies.

All of the companies, which were not named, are now conducting specification testing. Talks are also underway regarding potential binding offtake agreements with certain participants.

G1 said the AAM project is a key link in its development strategy, including its Graphite Creek resource in Alaska — identified by the US Geological Survey as the largest graphite deposit in the US and among the largest globally — with

downstream processing capabilities in Ohio.

Recent feasibility studies have indicated proven and probable mineral reserve tonnage at Graphite Creek is now 317% of the pre-feasibility study reserve estimate, and contained graphite is 296% of the PFS estimate.

According to the company, the US is currently 100% import-dependent for natural graphite.

CEO Anthony Huston said: "We now have a defined path from site control through development to production and customer engagement.

"Our objective is to establish a vertically integrated, US-based supply chain capable of supporting long-term North American battery demand." ■

Leoch International set for 15% half-year profit boost

Lead battery major Leoch International is set to see a profit boost of more than 15% for the first half of 2026, according to a surprise announcement.

The group revealed in a 'positive profit alert' that a preliminary assessment indicated the rise — compared to the same

period last year — was mainly due to an increase in the gross profit of its power solutions business.

The July 20 announcement came just three months after Leoch published annual results for 2025 showing the group had turned from profit to a loss of Rmb191

million (\$28 million), against a backdrop of US trade tariffs and global economic turmoil.

Trade frictions, geopolitical conflicts and exchange rate fluctuations had all contributed to operating pressure, the firm said.

In the latest announcement, Leoch founder and

chairman Dong Li said the expected profit boost is based on a preliminary assessment of unaudited consolidated management accounts of the group and other information.

However, he cautioned that the lead and lithium battery producer was still in the process of finalising results for the period and financial details had yet to be reviewed by the group's auditors.

Interim results of the group are expected to be formally released on or before August 31, 2026.

Dong Li was re-elected as an executive director of the company earlier this year following a poll of shareholders at Leoch's annual general meeting.

Batteries International revealed exclusively last April that Leoch had shelved proposals to launch a US spin-off company, with Dong Li saying the company had "decided at this time not to proceed with the project". ■

Posco and partners building Korean LFP cathode materials plant

A South Korean joint venture including battery material and chemicals group Posco Future M has broken ground for an LFP cathode materials plant in the country targeting the ESS and EV batteries market.

CNP New Material Technology, backed by Posco, secondary batteries firm Pino and battery materials producer CNGR, started building the facility "in earnest" on May 28 —

with production set to start next year.

Posco said the Pohang facility will gradually ramp up production to an annual capacity of 50,000 tonnes.

Separately, Posco is itself converting part of an existing three-element high-nickel production line at its Pohang cathode material plant into an LFP cathode material production line.

Prototype production will begin soon and mass production is planned from

the second half of this year, giving Posco an early entry into the LFP cathode material business, the group said.

While LFP batteries have lower output compared to ternary batteries such as NCM and NCA, they have an advantage in terms of low price and long lifespan, Posco said.

However, the group plans to market LFP products alongside its current main ternary products such as NCM and NCA batteries. ■

India 'set for 30-fold rise' in C&I energy storage in six years

The overall capacity of commercial and industrial (C&I) multi-chemistry energy storage systems in India is set to increase 30-fold over the next six years, according to a new study.

Cumulative ESS installations in the sector are projected to increase from less than 1GWh in 2025 to 23-31GWh by 2032, according to one scenario in the study unveiled by the India Energy Storage Alliance (IESA) and Customized Energy Solutions during the India Energy Storage Week that started on July 8 in New Delhi.

The study — *India Stationary Storage Market for C&I Applications: Insights Till 2032* — attributes the expansion to a variety of reasons

including increasing use of renewable energy systems, growing demand for cost optimisation and decarbonisation goals.

Battery technologies covered by the study include lead acid, advanced lead, lithium ion, VRFBs, sodium ion, and pumped hydro storage systems.

Analysis focuses on lithium iron phosphate, nickel manganese cobalt, vanadium redox flow, and sodium ion chemistries. LFP batteries dominate current installations, while vanadium redox flow and sodium ion chemistries are emerging for long-duration energy storage.

The study also explores the shift from backup systems to application-driven energy storage solutions tailored for open

access renewable energy projects, diesel generator replacements and rooftop solar integration.

The study details two scenarios for growth. The rapid adoption scenario anticipates C&I installations reaching 31GWh, assuming an 18% renewable energy compound annual growth rate driven by policy reforms and falling battery costs.

The business-as-usual path projects C&I storage reaching 22GWh-23GWh by 2032, assuming a 5%-6% annual load growth and a 15% renewable energy compound annual growth rate.

Debmalya Sen, IESA president, said India's energy storage market was at a moment of transition.

He said that the sector was transitioning from

backup and peak shaving to an asset for energy optimisation, resilience, and decarbonisation.

Vinayak Walimbe, MD of Customized Energy Solutions, said that with regulatory clarity, business models, and storage technologies, consumers are taking decisions that drive cost savings and boost sustainability.

The study comes just months after separate analysis published by the IESA forecast a near 10-fold increase in overall battery storage capacity in India this year.

IESA said on January 6 BESS capacity nationwide was expected to rise to 5GWh in 2026 from 507MWh in 2025, mainly due to a huge backlog of projects finally coming online. ■

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Russia plans first ESS test centre to mirror international standards

Russia's first national testing centre for ESS systems and components is to be opened next year, state-owned energy giant Rosatom has announced.

Rosatom said on June 6 the centre, which is already under development, will be capable of conducting certification of lithium ion batteries according to international standards.

The move will end the need for Russian firms to send products for testing abroad — something that has become increasingly difficult in the face of international sanctions over Russia's war

with Ukraine.

Rosatom said the establishment of a national centre of expertise would strengthen technological sovereignty in the battery and energy storage sector.

The centre is being built at 'Technopolis Moscow' — a technology hub in one of the capital's several administrative zones — at a cost of more than RUB2 billion (\$27 million).

The proposal for the project was given the green light in a government order issued last March, Rosatom said. The centre will allow domestic companies to

have products tested at costs several times cheaper than at present and accelerate the introduction of new products to the market.

According to Rosatom, the agency signed memorandum of understanding supporting the project with the Russian government during the four-day St Petersburg International Economic Forum — dubbed the country's alternative to the annual Davos World Economic Forum — which ended on June 6.

Rosatom director general Alexey Likhachev said the centre was a critical step to

support the full cycle of lithium ion battery production in Russia.

Likhachev said Russia is "localising" advanced technologies, but there was a "bottleneck in validating tech" in line with international standards.

"By combining the competencies of Rosatom, federal and national governments, we are building not just a laboratory, but a foundation of trust in the domestic energy storage industry both within the country and in foreign markets."

Rosatom's business is focused on lithium ion tech for ESS for emergency and uninterruptible power supplies, plus hybrid systems paired with renewable power generation and EV batteries.

The agency claims several gigafactory projects are being developed for cells and batteries. One such facility started operations at Kaliningrad last year (4GWh) and another is expected to start up this year in the greater Moscow area.

Rosatom said the plants will contribute to an eventual total production capacity of about 8GWh annually, which the agency said would provide batteries for about 100,000 EVs every year. ■

Yuasa, Panasonic price hikes after crude oil instability

GS Yuasa and Panasonic has increased prices of replacement lead acid batteries for cars in Japan.

Yuasa said on June 19 it was raising prices by a minimum of 20% — just weeks after announcing an increase of 10% for certain lead acid traction batteries, related parts and EV chargers sold in the Japanese market.

Yuasa said prices will be raised on all models of replacement automotive lead acid batteries for cars, motorcycles and cyclic

batteries.

Yuasa cited rising costs of raw materials, energy, logistics and labour, in addition to "ongoing uncertainty in global affairs", which the firm said suggested the high procurement costs for raw materials will likely persist.

The group said the August price increases are despite continuous efforts to streamline production and reduce costs.

"We have determined that, despite our corporate efforts, including securing

raw materials, it is difficult to maintain previous prices," Yuasa said.

Panasonic blamed its increase, announced on June 23, on persistently high component prices for automotive lead acid batteries and rising energy and logistics costs due to soaring crude oil prices.

Instability in the Middle East was also cited, with Panasonic saying prices of resins and tin had surged, making the outlook uncertain. ■

Birla Carbon shake-up looks to Asia as America, Europe demand fades

Birla Carbon has announced a global business shake-up as it focuses on expansions in Asia in the face of weakened demand in the Americas and Europe.

The carbon additives group said on May 25 it is continuing to assess its asset base in line with market trends, as it moves to a structure focused on three business units — Asia, Americas & EMEA and specialty materials.

However, the group has

yet to comment on whether any of its activities or operations in the Americas and Europe could be transferred to Asia if business does not pick up.

Batteries International also asked Birla corporate communications spokesman Roysten Dmello on June 1 what impact restructuring would have on operations supporting the global battery manufacturing sector.

As part of the shake-up

Shashank Awasthi, head of sales for Asia and business head in China becomes president of specialty materials, responsible for the division globally including specialty carbon blacks and Nanocyl — the carbon nanotube firm acquired in 2023 to strengthen Birla's presence in the lithium battery materials sector.

Awasthi will also be responsible for multi-wall carbon nanotubes serving plastics, coatings, energy

systems and non-rubber markets.

Director of technology Zachary Combs has been named global technology head with responsibility for process and product development for Birla.

Meanwhile, chief manufacturing officer Amit Kumar becomes the group's Asia president. John Davidson, chief sales and marketing officer becomes president of the Americas and EMEA. ■

Chinese battery firms added to US 'blacklist' over alleged military links

Global energy storage and EV battery majors including BYD are being added to a US 'blacklist' that alleges the firms and other tech partners have links to China's military, *Batteries International* can reveal.

BYD, Nio and Eve Energy are among those named by the Pentagon in a list seen by *Batteries International* and which was due for publication in the US government's official journal, the Federal Register, on June 10.

However, several of the companies named, including Chinese tech firm Baidu and the Alibaba Group, have already rejected claims about their operations as baseless and factually inaccurate.

The updated Section 1260H list — the official list of companies the Department of Defense has designated as Chinese military companies operating in the US — aims to highlight industry players at the heart of US-China technological competition.

Inclusion on the list does not automatically attract sanctions, but industry observers say it can lead to restrictions on future US government procurement and cause difficulties in terms of compliance in conducting business with US partners.

Firms on the list also face increased scrutiny, potential restrictions on defence contracts and reputational damage — although companies can petition to be removed from the list.

Several of the companies included on the list have already issued statements refuting the US allegations, according to the Beijing-based daily *Global Times*.

The US claims BYD is directly and indirectly affiliated with the State-Owned Assets Supervision and Administration Commission of China's State Council (SASAC) and is indirectly affiliated with the Ministry of Industry and Information Technology (MIIT).

BYD is alleged to be a military-civil fusion contributor to the Chinese defence industrial base because it is affiliated with MIIT and because it resides in or is affiliated with a military-civil fusion enterprise zone.

According to the US, EVE Energy is a military-civil fusion contributor to the Chinese defence industrial base because it knowingly received assistance from the government of

China through science, technology, research, or industrial efforts initiated, granted, or created by, or provided under, or related to, the Chinese military industrial planning apparatus, or in furtherance of Chinese military industrial planning objectives.

Baidu and Alibaba are military-civil fusion contributors to the Chinese defence industrial base because of their affiliations with MIIT, according to the US.

Baidu said on June 9: "As the company is neither a Chinese military company nor a military-civil fusion contributor to the Chinese defence industrial base, we believe there is no

justification for the company's inclusion on such a list."

Baidu said US government procurement limitations tied to the list would not impact the business of the company.

In September 2024, EVE Energy held a ceremony in California to mark the opening of its US regional headquarters.

In November 2025, BYD quoted the California Independent System Operator as confirming a newly installed 100MW /400MWh ESS it provided had been ranked No.1 in the state in terms of reliability and availability among all stand-alone energy storage projects. ■

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Banner powers into LFP market with launch of own-brand 'Traction Bull' line

Lead battery major Banner is venturing into the LFP market for the first time with the launch of the group's Traction Bull Bloc Lithium product.

Austria-headquartered Banner said the newest addition to its portfolio, to be showcased at the Frankfurt Automechanika 2026 expo in September is aimed at owners of motorhomes, travel trailers, boats, and stationary off-grid systems.

However, Banner said it remains true to its lead-powered roots and

will also feature its Running Bull AGM and Running Bull EFB batteries that have been developed specifically for vehicles with start-stop systems.

The new LFP series is being offered in five capacity levels and six battery types ranging from 50-150Ah.

Designed for deep-cycle applications, the new batteries achieve more than 3,000 cycles at an 80% DoD, Banner said. An integrated battery management system monitors cell voltages, current

flow, and temperature, and protects against overcharging, deep discharge, short circuits, and overheating.

The 80Ah, 100Ah, and 150Ah models also feature a self-heating function, allowing the battery to be charged at temperatures as low as -20°C for year-round use in outdoor.

Banner CEO Werner Töpl said the new series responds to growing demand for high-performance, long-lasting, and smart energy storage solutions.

"Automechanika offers the ideal platform to present this innovation to an international audience of industry professionals for the first time."

Batteries International reported last month that Banner was investing a "significant double-digit million-euro amount" in its facilities in Austria over the next four years.

The move is part of the firm's 'Agenda 2035' business programme, focusing on longer-term profitability, efficiency and growth beyond existing markets. ■

EnerSys revises gigafactory plan for 'defence-focused Li cells'

EnerSys has refocused plans for its \$500 million battery cell gigafactory in South Carolina for US defence needs — and is ending a tech partnership with French Li cells developer Verkor.

The US lead and lithium major has also revised the plant's construction schedule to now start work in the first half of fiscal

2028 instead of early 2025, as announced when South Carolina was selected to host the 4GWh per annum facility in 2024.

The battery maker's revised plans were confirmed on July 23. EnerSys also said it now expects to receive a revised grant of \$150 million from the Department of Energy.

Full production is now set to start around three years after construction begins.

Under the updated plans, EnerSys expects the 500,000ft² facility to have an initial production capacity of around 1GWh, using federal, state, local funding and operating cash flow to fund the facility's capital cost.

The plant will support US defence requirements for secure, foreign entity of concern compliant lithium ion cells and strengthen the country's supply chain.

Given the facility's refined defence-focused scope, EnerSys said it intends to "transition away from its technology relationship with Verkor" and does not expect the French company to serve as the project's technology partner.

Instead, EnerSys will draw on support from what it described as its decades-long, established technology partnerships within its existing aerospace and defence supply base.

President and CEO Shawn O'Connell said the revised strategy builds on the firm's role as a trusted supplier of stored energy solutions for US defence applications.

"By dedicating this facility to defence-focused lithium cell development and manufacturing, we will further strengthen a secure, resilient, domestically sourced supply chain aligned with evolving US national security requirements." ■

Semcorp deal to acquire SK's China Li separator business

South Korea's SK Innovation has agreed to sell its loss-making lithium battery separator assets in China to Yunnan Energy New Material, known as Semcorp.

Semcorp said in a Shenzhen Stock Exchange release on May 27 it planned to acquire a 100% stake in SK Battery Materials Technology from the Korean battery giant's EV battery subsidiary, SK IE Technology, for Rmb400 million (\$60 million).

Completion of the transaction is subject to the approval of China's State Administration for Market Regulation.

SK's separators unit has

good basic production equipment and a solid hardware foundation but has been suffering from weak market expansion, Semcorp said.

The impact is that the capacity utilisation rate has remained low for a long time. Low utilisation further increases unit production costs, creating a vicious cycle in operations. This cycle ultimately leads to operating losses.

Semcorp said the deal would quickly replenish the unit's existing production capacity and significantly shorten production times. The takeover will boost Semcorp's own existing Li

battery separator production capacity, allowing it to accept increase orders.

SK said its separator plant in China's eastern Jiangsu province has an annual production capacity of around 940 million m², with eight base film production lines and 10 coating production lines for active material application.

Last March, Semcorp subsidiary Semcorp Yuxi announced that it had completed all eight production lines of its phase one project in southwest China, designed with an annual output of 1.6 billion m² of Li battery separators. ■

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QuantumScape agrees R&D deal with Honda for solid-state tech development

US solid-state battery developer QuantumScape announced a joint battery research deal with auto giant Honda's R&D arm on June 18.

The next-gen solid-state Li-metal battery tech developer said the agreement aims to use the firms' combined expertise to accelerate its 'QS' battery platform.

The agreement includes a multi-year plan focused on

solid-state battery development and associated manufacturing processes.

Honda has already completed a technology evaluation agreement with QS, which included what the partners say was an in-depth, hands-on technical study of QS's solid-state tech as well as competitive benchmarking across a range of standard technical tests.

"QS technology demon-

strated compelling and unique advantages during our evaluation," said Atsushi Ogawa, COO at Honda R&D's Research Center of Excellence.

"We see potential for QS technology to add value across a range of applications, including automotive, and we are excited to move forward into the next phase of our partnership."

The agreement comes two years after Quan-

tumScape and PowerCo, the battery subsidiary of Volkswagen Group, announced a deal to industrialise QuantumScape's battery tech.

That was followed in February this year with the launch of pilot production at QuantumScape's Eagle Line in Silicon Valley.

Eagle Line forms the blueprint for the 'QS system', QuantumScape said. ■

PNNL prismatic battery line boost for energy storage innovation

South Korea's Energy Tech Solution has installed a prismatic battery assembly line at the Pacific Northwest National Laboratory in the US.

Energy Tech said on June 8 the installation of the 16-piece line, at the lab's Grid Storage Launchpad (GSL), would boost advanced battery manufacturing and help US innovators get to market faster.

Following on-site training, PNNL is now the only Department of Energy lab capable of fabricating batteries with a prismatic architecture, Energy Tech said.

GSL is a \$75 million research facility, funded by the Department of Energy's Office of Electricity, focused on creating batteries and energy storage technologies that are critical to support a reliable, affordable, secure, and resilient electrical grid.

The GSL brings all phases of the battery development and deployment cycle under one roof — ranging from fundamental materials and device prototyping to 100kW-scale testing and validation.

Energy Tech said fast prototyping and comprehensive testing of the entire energy storage development cycle are features not found anywhere else within the

national laboratory system.

The new line, which includes slurry mixing, cell assembly, electrolyte filling and quality control, will be used for both Department of Energy research projects and contract work on

behalf of industry partners.

Energy Tech, in addition to its 30 years of experience making factory equipment, recently unveiled its Made in America Cell Foundry — a collaboration with the University of Michigan.

PNNL, operated by Battelle, advances chemistry, Earth sciences, data analytics, and biology to strengthen energy resilience, enhance national security, and further scientific discovery. ■

Physical pressure key to longer lasting EV batteries, say researchers

Keeping lithium ion EV batteries under constant physical pressure could double their lifespan, according to initial findings of a study led by the University of Cambridge.

However, the researchers said in a paper released on June 30 that too much or too little pressure can cause the batteries to fail.

The pressure needs to be just right and in the 'Goldilocks zone' — referencing the British fairy-tale character who enters the home of three bears and declares the smallest bowl of porridge she tries to be "just right".

Such gains are unheard of in battery development, where tweaks to battery composition usually result in gains of 5-10%, according to Michael De Volder of the university's Department of Engineering.

De Volder co-led the research team that built a custom device to keep the

pressure on the battery in the 'Goldilocks zone', without the need for any specialised chemistry.

The device squeezes pouch cell batteries using pneumatic 'bellows' — small air-filled cushions that act like a self-adjusting clamp. The bellows maintain a continuous pressure, while a sensor monitors tiny volume changes as the battery charges and discharges.

They found that the pressure from the bellows needed to be in the 'Goldilocks zone', defined as about 12.5 bar, or roughly four times what is standard in conventional coin cell batteries. Outside this zone, the batteries failed faster. If the pressure was too high, it could cause lithium plating to form on the anode, and too little could cause the cathode to crack.

De Volder said. As the battery goes through each charge and discharge cycle,

lithium ions shuttle from the anode to cathode and back again. This causes the battery to physically expand and contract, almost like breathing.

"Batteries don't tend to like this cycle of stress and release. Much of the work on improving lithium ion batteries is done by chemists and physicists, but as a mechanical engineer, I also wanted to look into the role that mechanics play."

De Volder said researchers found that keeping the pressure on batteries relatively constant throughout each charge and discharge cycle is much better for the overall lifetime of the battery.

The technology has been tested at a laboratory scale but will need to be scaled up for commercial battery applications. A patent has been filed by Cambridge Enterprise, the university's innovation arm. ■

LDES 'needed as key pillar' for EU's clean energy future

Ten leading cleantech and energy storage organisations are calling on EU leaders to recognise long-duration energy storage (LDES) as a key asset for competitiveness, energy security and a clean industrial future.

The call came just weeks after the European Commission proposed a fresh package of support to encourage private investments in LDES projects and "novel" renewables.

However, in a recent letter sent to Commission

chiefs, LDES campaigners including Flow Batteries Europe said existing electricity markets do not adequately reward the long-term system value provided by LDES technologies — despite their potential to lower system costs, accelerate renewable integration and reduce exposure to volatile fossil fuel markets.

Signatories to the letter, sent to energy and housing commissioner Dan Jørgensen and two Commission executive

vice presidents, said LDES technologies' ability to store and dispatch electricity for eight hours or more provides much-needed flexibility to balance power systems.

In addition, LDES represents a strategic industrial opportunity for Europe — supporting innovative manufacturing and component supply chains already established across the European continent.

The EU should develop an LDES roadmap and encourage revenue certainty mechanisms for supporting technologies, the letter said.

"Europe should not build the next phase of clean-energy demand while allowing the corresponding value chains to scale elsewhere."

According to an LDES Council report released in December 2025, long duration energy storage systems are moving rapidly toward bankability, with clearer pathways for investment than ever before. ■

Nova Scotia eyes economic boost with lead battery rules change

Nova Scotia has announced regulatory changes for the lead battery sector that will open the door for new economic opportunities, the provincial government has said.

Effective from June 10, lead battery manufacturing facilities only need an industrial approval instead of also being required to hold a Class II environmental assessment — bring the province into line with the rest of Canada.

Environment and climate change minister Timothy Halman said as well as aligning regulations with the rest of Canada, the move opened the door for new economic opportunities in line with the province's focus on sustainable prosperity.

"These types of projects can be done safely and responsibly via an industrial approval, one of our most robust environmental regulatory tools, and they align with our circular economy goals."

The Nova Scotia government said it recognised the vast array of applications supported by lead acid technology, including

marine and road vehicles, energy systems and telecoms, noting the batteries' recyclability made them part of the circular economy.

Batteries International reported last January that Eternity Technologies had agreed an exclusive Canadian distribution deal with CellCare Batteries.

Details of the deal were not disclosed, but Eternity said CellCare was a trusted leader in industrial battery solutions, with strong expertise across motive and reserve batteries, as well as service, maintenance and technical support. ■

EU slaps anti-dumping duties on imports of battery raw material

The European Commission has imposed definitive anti-dumping duties on imports of 1,4-Butanediol (BDO) from China, Saudi Arabia and the US.

BDO, produced in Germany, the Netherlands and Italy, is an essential precursor for many important products including electric and hybrid vehicles and lithium batteries.

Provisional anti-dumping duties were imposed on the three countries named last February. On June 24, the Commission's Directorate-General for Trade and Economic Security announced definitive duties ranging from 105.6% to 113.7% for China, 52.4% for Saudi Arabia, and from

135.7% to 142.5% for the US.

The imposition of duties follows an investigation, launched in June 2025, which found that imports of BDO from the three countries investigated were entering the EU at dumped prices — harming the bloc's own BDO-producing nations.

According to the Commission, the investigation showed that the losses to industry in the EU were deemed so high as to represent a major threat to its existence in the short term.

In 2024, the European Union was importing BDO to the value of €140 million (\$160 million) from the three countries investigated. ■

China's Gotion secures €100m ADB loan for Morocco gigafactory

The African Development Bank Group has given the green light for a €100 million (\$114 million) loan to the North African subsidiary of China's Gotion Power for its LFP battery gigafactory project in Morocco.

The bank confirmed the loan agreement with Gotion Power Morocco on July 24 — and said it also planned to crowd in an extra €141

million from financial partners to support the eventual 100GWh capacity project in the Rabat-Salé-Kénitra Free Trade Zone.

Gotion started initial infrastructure work at the site in May 2025, saying the gigafactory will be the first in the MENA region, capable of producing 10GWh of battery cells/packs for EVs.

Total investment in the first phase of the plant is

projected at around €1.3 billion.

Bank group VP for power, energy, climate and green growth, Kevin Kariuki, said: "Battery storage is the missing link in Africa's clean energy transition."

Afreximbank president and board chairman George Elombi said Africa's economic sovereignty could only be achieved by industrialising at scale. ■

Amara Raja 'going it alone' on battery cells as China frowns on tech support

Indian battery producer Amara Raja Energy & Mobility has revealed it is now largely 'going it alone' on cells development after a flagship licensing tech partnership with a Chinese supplier came under pressure from Beijing.

Lead acid major Amara Raja agreed a deal with China-based Gotion High-Tech in 2024 for support in developing LFP cells, as part of the Indian group's 'giga-corridor' battery and R&D projects in Telangana state. The technical licensing agreement was with Gotion subsidiary GIB EnergyX Slovakia.

However, Amara Raja said in a June 2 earnings call with market and financial analysts

there are now "difficulties" over the deal in terms of technology transfers, as the Chinese government tightens its global grip on battery tech and material supplies.

Vikramadithya Gourineni, executive director of the group's lithium-based New Energy Business, said Amara Raja and Gotion had never sought approvals from their respective governments for what was a purely private deal.

Nevertheless, a number of such deals are now coming under scrutiny in Beijing and Amara Raja's product development and R&D is now being "largely driven internally".

Since 2024, you will have seen in the news that shar-

ing and licensing of technology is something largely discouraged by the Chinese government, Gourineni said.

Asked by one analyst if Amara Raja's LFP plants will now be based on home-grown Indian technology, Gourineni said: "We have a couple of products in the pipeline that we're developing. Later, we'll be able to announce that in due course, but probably sometime 2028 and later."

He said pressure from China's leaders was hitting all players and their technical tie-ups equally and the company had "taken what it could" to date in terms of cooperation and expertise.

"But largely, going

forward, whether it's NMC, LFP, or future chemistries, the efforts of product development is largely driven by teams in India."

To that end, Gourineni said Amara Raja expected initial production capacity scheduled by its New Energy Business for 2027 would focus on NMC batteries.

Amara Raja intends to pursue cell manufacturing specifically for battery storage systems in addition to container integration and pack assembly in Telangana, he said.

Analytics firm Wood Mackenzie says that Chinese firms are set to control 39% of all lithium extracted worldwide by 2030. ■

EnerSys realigns business units in bid to 'enhance focus'

Lead and lithium battery major EnerSys is realigning its previous four operating units into a three-segment operating model to boost organisational focus and better serve customers.

EnerSys said on May 28 the move would take effect in the first quarter of fiscal 2027 — which ends later this month.

The three reportable segments are network & infrastructure solutions (NIS), including the firm's previous energy systems unit, providing power solutions and services to broadband, telecoms, data centres and industrial utility customers.

Separately, industrial mobility solutions (IMS), focused on keeping essential goods and equipment moving worldwide, includes the prior 'motive power' segment with the addition of the transportation business previously reported within the 'specialty' unit.

IMS will support electric industrial forklifts and

other material handling equipment as well as transportation applications.

Meanwhile, precision power solutions (PPS), supporting defence, aerospace and the specialised products business from the prior specialty segment, will offer energy solutions in the military sector, including vehicles, advanced defence programmes and autonomous systems.

As part of the realignment, 'new ventures' will no longer be considered a separate operating segment and sales will be reported

within the segments in which those sales occur.

EnerSys president and CEO Shawn O'Connell said the changes reinforce the battery maker's position as a leading provider of end-to-end stored energy solutions for its diverse, growing and specialised end markets.

"Our updated segment structure better reflects how we serve our customers today and how we will drive the next phase of our growth. Bringing our lift truck and transportation businesses together into

one line of business creates stronger internal alignment, enables cross-selling, and allows us to deepen relationships with our warehousing and logistics customers."

The company said its guidance for the first quarter of fiscal 2027 is unchanged and not impacted by the moves.

Earlier this year, the battery maker said it was closing its lead acid manufacturing plant in Tijuana, Mexico, in the firm's latest move to focus on production in the US — and avoid the potential impact of import tariffs. ■

Battery Council International partners with CRU for second lead battery markets report

The North American lead market is expected to remain tight through 2028, despite slowing demand for lead acid batteries due to slow production, according to a new study by Battery Council International and research consultancy CRU.

According to the study, in the automotive lead battery market replacement ship-

ments fell in 2025 by 1.6%, after 2024 marked the highest growth since 2011. OE lead battery shipments dipped 3.9% in 2025.

However, the study said automotive lead battery shipments are expected to bounce back in 2026, with forecasts of a 1.9% growth rate.

Other key highlights, for

industrial truck and forklift batteries, BCI forecasts a 2.9% annual growth for LAB sales through 2028.

In stationary storage, UPS battery demand increased 21% in 2025, and future lead battery forecasts remain bullish through 2025-2028 with a compound annual growth rate of 4.5%. ■

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Ireland's Net Zero Energy in €2bn renewables-to-hydrogen ESS project

Ireland has unveiled plans for a €2 billion (\$2.3bn) long duration energy storage facility that will use excess renewable energy to generate green hydrogen and provide electricity.

Irish company Net Zero Energy (NZE) said on June 8 the 600MW facility, the Rathrush Green Energy Park, will save an estimated 180,000 tonnes of CO₂ emissions annually —

equivalent to taking around 40,000 cars off the road.

The project will use surplus renewable energy generated off-site, which NZE said is currently being lost as a result of lack of demand at certain times and inadequate grid capacity to absorb power. According to NZE, the surplus wind and solar energy will not be stored directly in batteries but converted into green

hydrogen — which will then be compressed and pumped deep underground in specially lined rock caverns. This can then be delivered into the national grid providing crucial backup when the need arises and combating the issue of renewable energy intermittency.

NZE chairman Tim Cowhig said: “By making available 600MW of renew-

able energy at the flick of a switch, this project can satisfy as much as 10% of Ireland's peak energy requirement.

“Ireland has never been in such a precarious position in terms of our energy security. We spend €10 billion annually importing fossil fuels. This project is particularly timely with widespread debate and focus on Ireland's climate change targets and the enormous, subsequent fines which would result if we fail to meet them.” ■

Qnetic announces Pulsar prototype flywheel tech milestones

US-headquartered flywheel tech developer Qnetic has begun assembly of its first full-scale 200kWh ‘Pulsar’ prototype and has started building a test facility in China.

Qnetic said on July 16 its test technology centre in Shanghai represents a million-dollar-plus investment that will serve as the company's primary site for validating the performance of its next-generation flywheel systems.

Significant excavation and foundation work is taking place, with installation of the Pulsar prototype planned on completion of the facility, followed by technical validation.

The milestones are major steps toward commercial deployment of Qnetic's technology — which the company claims is designed to provide long-duration energy storage without the degradation, fire risk or dependence on critical minerals associated with conventional lithium ion batteries.

Pulsar is being developed for applications including data centres, renewable energy time-shifting, grid balancing, microgrids, and industrial power resilience.

Qnetic is working with an undisclosed partner specialised in spin-test technologies to deliver a system the

firm said will offer grid and commercial operators a durable, lower-lifetime-cost alternative for multi-hour energy storage. Qnetic's flywheel systems can complement or replace lithium ion batteries in applications where long

asset life, unlimited cycling, sustainability and predictable lifetime economics are critical, the company said.

Pulsar operates at extreme speeds and in vacuum conditions, “pushing conventional motor design to its limits”.

Qnetic announced this March it had raised \$7.1 million over the past year to accelerate commercialisation, including \$5 million to launch manufacturing in the US and deploy its first flywheel systems. ■

China tax freeze to boost new battery tech

China is introducing a temporary exemption of selected new-technology batteries from the nation's consumption tax for the next two years in a phased move to promote development of the sector.

Sodium ion and solid state are among a range of technologies that will be free from consumption tax from September this year

to December 2028, under new rules issued by customs and tax authorities and the finance ministry.

The ruling, confirmed by state news agency Xinhua on July 17, takes effect on September 1 and is designed to promote sustainability and stimulate technological advancement.

Lithium ion, nickel-metal hydride and all vanadium

redox flow batteries will be taxed at 2% from September and at 4% from September 2027. PV cells will face a 2% tax from April 2027, rising to 4% from April 2028.

China currently levies a 4% consumption tax on batteries, a policy in place since February 2015, with seven categories including lithium ion and solar cells exempted, Xinhua said. ■

CATL, Alfen plan 5GWh sodium ion BESS parc across Europe

Plans to deploy 5GWh of sodium ion BESS systems in Europe have been unveiled by Chinese battery major CATL and Netherlands-based energy infrastructure specialist Alfen.

The companies said on July 16 the move marked the next step forward in a long-standing partnership that includes a battery supply deal agreed in 2023.

Initially focused on lithium ion energy storage

projects, the supply partnership was extended in 2024 to support Alfen's growing demand for ESS developments in Europe.

CATL said the joint deployment of sodium ion projects will allow it to gain experience in European grid applications for sodium batteries, optimising products for adaptation to European grid codes and accelerating the battery maker's push to deploy its technology globally.

The partners did not give costings or timelines for their plans, but Alfen CEO Michael Colijn said: “Sodium ion is the next step in how we think about energy storage — more diversified, resilient, and built for where the market is heading.”

Last February, CATL and Chinese auto firm Changan unveiled what they said is the first mass-production car equipped with sodium ion batteries. ■

Chinese integrators hold 76% of global BESS market: analysis

Eight of the top 10 integrators worldwide are now headquartered in China as the country continues its dominance of the international battery storage market, latest analysis has revealed.

Firms with roots in the Asian battery tiger nation captured 76% of global market share in 2025, according to energy data analytics firm Wood Mackenzie.

“China has expanded its global BESS footprint at remarkable speed,” Wood Mackenzie said in its 2026 ‘Global energy storage system integrator market share’ report, released on June 29.

Tesla and Sungrow retained the top two positions for the third consecutive year, while China’s BYD advanced five places to claim third.

Jiayue Zheng, senior research analyst, said: “The combined share of the top three integrators fell from 36% in 2024 to 30% in 2025, but this reflects rapid overall market growth and the rise of mid-tier vendors rather than any weakening at the top.”

Tesla retained its lead-

ership in North America, supported by its lithium-based Megapack hardware platform, Auto-bidder software, and US-based manufacturing.

NextEra Energy entered the top three for the first time, benefiting from its position as a vertically integrated self-integrator insulated from tariff disruption.

Looking ahead, the US ‘One Big Beautiful Bill Act’ introduces Foreign Entity of Concern (FEOC) compliance thresholds for projects seeking to take advantage of the country’s 48E Investment Tax Credit, with provisions taking effect from this year.

Non-FEOC sourcing requirements start at 55% of project costs in 2026, rising to 75% by 2030, a trajectory that will significantly constrain the ability of Chinese manufacturers to supply into the US market, Wood Mackenzie said.

Meanwhile, Sungrow retained first place in Europe while BYD closed the gap from fifth to second and Huawei entered the top three.

Chinese vendors now occupy all three leading positions. The market

is expanding beyond the UK, Germany, and Italy, with Bulgaria, Romania, Belgium, Spain, the Netherlands, and Greece forming a distinct second tier of growth markets.

China-based CRRC topped the regional ranking for the third consecutive year, followed by HyperStrong and Envision and China accounted for roughly 85% of the APAC market.

“China has expanded its global BESS footprint at remarkable speed”
Wood Mackenzie

However, Wood Mackenzie said Southeast Asia emerged as a “meaningful growth frontier”, with the Philippines, Vietnam, Indonesia, Thailand and Malaysia advancing regulatory and procurement frameworks. Australia remained the region’s most accessible market for non-Chinese integrators, given its stringent technical standards and lender preferences.

Chinese integrators have also extended their reach across the Middle East and Latin America.

The United Arab Emirates announced a 5.2GW solar project paired with 19GWh of storage, and Saudi Arabia’s two BESS tender rounds covered a combined 5GW/20GWh.

BYD and Sungrow together captured 87% of the regional market. In Latin America, Chile led with the most mature regulatory framework, as BYD’s total contracted volume with Grenergy reached 6.5GWh across all phases of the Oasis de Atacama project.

Zheng said competition in the global BESS integrator market is shifting from scale alone to a multi-dimensional set of capabilities. Policy compliance, grid-forming technology, software-driven revenue optimisation, and financing support are becoming decisive competitive variables.

“Integrators that can meet these demands across diverse regulatory environments will build the most durable market positions through the remainder of the decade.” ■

Eni-Fib deal to ramp up LFP stationary storage project in Italy

Italian energy group Eni has agreed a deal to expand its joint development of LFP batteries for the BESS and electric mobility sectors with energy storage firm Fib — the Seri Industrial Group.

The partners said on May 29 the deal is expected to be completed by June 3 and ramp up operations at a stationary lithium batteries operation they launched in Italy last year.

The initiative aims to create a fully integrated industrial platform that

includes the production of lithium iron phosphate battery cells and modules, the assembly of systems for stationary storage applications and for industrial and commercial electric mobility.

Future activities are set to include materials recycling and recovery and the production of active cathode material.

The project involves Fib’s development of the existing LFP hub at Teverola-Brindisi. Eni Storage System, a jointly controlled company

of Eni Industrial Evolution and Fib, will complete the assembly line for utility-scale BESS systems at the hub by the first half of 2027.

A second facility, to produce cells and modules with an output of more than 8GWh/year, is planned by 2029.

As part of the deal, Eni Industrial Evolution is acquiring a 30% stake in a newly established company established by Fib, of which Fib will retain a 70% stake.

The new company will be

dedicated to the project’s commercial development and procurement and engineering activities. The consideration for the stake includes a fixed component of €55 million (\$64 million), plus any price adjustment mechanisms.

Umberto Carrara, CEO of Eni Industrial Evolution, said the project provides another piece of the puzzle required to complete the European supply chain from critical materials to the production of energy storage. ■

Eku Energy enters German market with 1.6GWh project

UK-headquartered Eku Energy has entered the German energy storage market by acquiring a 1.6GWh BESS under development in Lower Saxony.

Eku said on June 30 the Dion BESS will provide black start capability through a direct connection to the transmission grid, boosting energy security in the region by support-

ing faster and more reliable grid recovery during outages.

Dion's commissioning is planned for the end of 2029. The project's developer, NION, will remain responsible for further project development up to the ready-to-build stage, while Eku will have strategic leadership across development, design and technology.

Eku will also work with Fluence, a long-standing LiFePO₄ supply partner, through the project's development.

Looking ahead, Eku said it plans to build a long-term project pipeline in Germany with the opening of an office in the country next year.

Eku is jointly owned by the British Columbia Investment Manage-

ment Corporation, one of Canada's largest institutional investors, and a fund managed by Macquarie Asset Management, one of the world's leading asset managers with A\$722 billion (\$500 billion) in assets under management.

The company already has more than 25GWh of projects in delivery across Australia, Japan, New Zealand, the UK and Italy. ■

ZOE Energy Storage agrees Saudi 18GWh joint venture

China-based ZOE Energy Storage has signed a joint-venture agreement with an undisclosed Saudi Arabian partner to develop and build an 18GWh BESS in the kingdom.

The first phase will develop an annual production capacity of 6GWh. This should start operations in Q1 2027.

Once operational, the BESS will contribute to the

kingdom meeting its 'Saudi Vision 2030' clean energy targets, including 48GWh of energy storage and 130GW of renewables.

Financial details of the deal were not disclosed. ZOE deploys liquid cooled containerised LFP cells in existing BESS systems.

According to ZOE, the 150-acre Saudi facility will meet "top European manu-

facturing standards" and earn 'made-in-Saudi' certification. A green energy academy will also be set up on site.

Saudi becomes ZOE's second overseas production hub following a similar operation in Hungary.

ZOE said it shipped over 1,000 units of its commercial and industrial energy storage cabinets of varying capaci-

ties to the global market in 2025, including its flagship Z BOX-C.

Saudi Arabia has been at the centre of increasing commercial interest in developing energy storage and associated projects. Other Chinese companies with interest in the region include BYD, which is developing 12.5 GWh of new Saudi BESS projects. ■

NatPower, Tesla set sights on 100GWh+ deal for Europe

Energy projects developer NatPower and Tesla have agreed a multi-year deal targeting the potential construction of more than 100GWh of BESS systems across European markets.

An initial five projects under the deal are planned for Italy and the UK — covering more than 25GWh of capacity — to be owned and operated by NatPower.

Tesla will provide its Megapack battery tech in addition to other services, including financial, engineering, procurement and construction, under the terms of the agreement announced on June 23.

Aggregate construction value across the full scope of the agreement is estimated at \$4-5 billion and revenues expected from projects is set to exceed \$15 billion over 20 years.

The partners said BESS systems will be delivered and allocated through a

coordinated system that directly links production, financing and execution on a multi-country basis — claimed to be the first time at this scale — "moving beyond an opportunistic and local approach".

Key areas of focus include manufacturing capacity reservation, grid access and connection, permitting and regulatory compli-

ance, financial structure and execution scheduling and timeline management

"The agreement goes beyond the supply of technology alone, establishing an integrated structure combining electrical infrastructure, industrial capacity and advanced energy trading models, which provide the flexibility and certainty required to finance and

deliver projects of NatPower's scale."

NatPower manages its operations from five main offices across Asia, Europe and the US. CEO Fabrizio Zago said his company and Tesla had established an ecosystem that enables alignment between capital and execution, and that can be replicated across multiple markets. ■

Delta launches Sungrow BESS in boost for Nordic power sector

Delta Capacity has announced commercial operation of a 70 MWh / 160 MWh Sungrow PowerTitan 2 BESS in Sweden — which the partners say marks the launch of the largest individual such project in the Nordics to date.

Swiss-based Delta said on July 20 the Ånge BESS will contribute to balancing Sweden's power

system while offering rapid response capabilities and capacity for both frequency regulation and arbitrage across the volatile Nordic power market.

Ånge is owned by a joint venture between Delta and sustainable investment fund WOOD & Company Renewables Sub-Fund — which has led the project from design to completion.

The project was acquired

from Renewable Energy Systems in February 2025 and has taken 15 months from procurement through to commercial operation. Financial details were not disclosed.

Sweden and Finland together installed more than 1GWh of new battery capacity last year, according to Solar Power Europe's EU Battery Storage Market Review 2025. ■

Battery projects 'driving Australian power market'

A record 9GW of new Australian generation and battery storage capacity reached full output in the last financial year, according to latest data.

Battery projects continued to dominate the connections pipeline, accounting for 52% of total capacity, and were also the fastest mover through the applications process, the Australian Energy Market Operator (AEMO) said in its latest quarterly 'scorecard' released on July 20.

The 9.1GW total was more than double the result achieved in 2025 for power generation and storage projects connecting to the National Electricity Market.

While AEMO's scorecard reported new generation and storage projects from initial application through to full output for the quarter ending in June, it also marked the end of fiscal 2026, providing a snapshot of annual outcomes across the connections pipeline.

Solar and battery hybrid projects are an increasingly significant component of the development pipeline with 4.3GW of applications received during fiscal 2026.

In addition, 2.4GW of solar projects started or completed the process of adding a BESS, reflecting the industry's growing interest in combining low-cost renewable generation with flexible storage, said AEMO group manager for onboarding and connections Margarida Pimentel.

The overall picture demonstrated strong end-to-end performance across the pipeline, including a new record of 5.2GW for wind project applications.

However, Pimentel said the scorecard highlighted growing challenges in the delivery pipeline, with only 6.4GW making it through to delivery.

"Design changes and equipment substitutions can require additional assessment and re-work, while the sale of projects, extended financing and commercial readiness activities are also contributing factors."

Nevertheless, Pimentel said battery and solar technologies will play an important role in delivering the diverse mix of resources needed to support Australia's energy transition.

Batteries International reported in March 2026 that Australia's battery materials recovery sector had the potential to be worth around A\$7 billion (\$5 billion) to the national economy by 2050.

The sector, which currently contributes more than A\$2 billion, could also support more than 32,000 jobs from the then 19,450, based on modelling in a national industry profile report commissioned by the Association for the Battery Recycling Industry.

In May, RWE Renewables Australia received official sign-off from AEMO and Transmission Network Service Provider Transgrid to operate Australia's first eight-hour BESS at full capacity in New South Wales.

Kinterra Capital enters European market with Poland pCAM project deal

Canada-based investment firm Kinterra Capital has acquired the core assets of a planned lithium carbonate and precursor cathode active material manufacturing project in Poland.

Kinterra, which has around \$1.5 billion in assets under management following closure of a second fund last February, told *Batteries International* on July 8 the Polish deal marks its first investment in Europe.

The private equity firm has acquired the Polish portfolio for an undisclosed sum from battery materials company Ascend Elements — which filed for Chapter 11 bankruptcy in the US last April as part of a restructuring process.

Kinterra said the acquisition was completed on May 26 through a special purpose vehicle and previous investors in Ascend retain minority stakes in the Polish portfolio.

The deal included intellectual property and an option to buy around 45 hectares of industrial land in the Wałbrzych special economic zone in southwest Poland. Kinterra said it will take up the option to underscore its commitment to the project.

Poland's government has pledged grant aid equivalent to \$340 million and Kinterra plans to crowd in additional project financing and offtake deals.

The project will focus on recycling materials to produce pCAM used to make lithium batteries and lithium carbonate.

Proposed production details were not announced, but *Batteries International* reported in 2024 that the economic zone site had the capacity to process 12,000 tonnes of used Li ion batteries each year — or about 28,000 EV battery packs annually.

Kinterra's project execution global head Graeme Weeks said: "Europe's critical minerals ambitions will ultimately be measured by projects that

can be permitted, financed, built and operated at industrial scale.

"This project has the core attributes we look for: strategic location, infrastructure access, government support and a strong regional industrial base. Our task is to translate those advantages into a technically robust and executable development plan."

Eni backs EnergyX Li project in Chile with \$225m investment

Italian energy giant Eni has made a \$225 million investment for a minority stake in Chile's Project Black Giant — one of the world's largest lithium projects, extraction and refining tech company Energy Exploration Technologies (EnergyX) has announced.

EnergyX said on July 6 the project, with planned capacity to produce up to 52,500 tonnes of lithium carbonate annually across the first two phases, is set to make it one of the largest lithium producers globally, as well as a world-leading direct lithium extraction technology manufacturing company.

Eni will receive rights up to around 25% of future Li production from the project. EnergyX has also secured further strategic offtake agreements supporting future production from the project.

Total expenditure for the project is estimated at almost \$1 billion, including financing costs, and the project is set to generate about \$1.3 billion in annual gross revenue once the first two phases are fully operational.

Eni's new investment builds on their corporate venture capital arm Eni Next's participation in EnergyX's \$50 million series B financing from December 2022. The Italian multinational joins other strategic partners backing EnergyX including General Motors and South Korea-based POSCO.

The Chile investment boost came after EnergyX was selected to develop and operate a lithium processing facility on a US army base, in a first for a military installation in the country.

EnergyX confirmed on June 25 it had been given a conditional long-term lease to process domestic lithium into battery-grade lithium hydroxide, lithium carbonate and lithium metal and nuclear-grade lithium isotopes at the Red River Army Depot in Texas.

Development is slated to begin as early as 2027 with initial operating capability targeted by or ahead of 2028, although EnergyX did not disclose details about production capacity.

The company said all the materials will energise next-generation military power

systems and the broader clean energy transition — in line with the Trump administration's push for greater energy security and the domestic mining and processing of critical minerals.

EnergyX was one of four companies selected through the army's strategic capital initiatives and the only partner awarded for lithium.

The company, founded in 2018 by CEO Teague Egan, is an innovator in sustainable direct lithium extraction and refining technologies.

Egan said: "Processing lithium on American soil, at a US army installation no less, is exactly the kind of bold step this country needs to secure its energy and defence supply chains."

The award builds upon EnergyX's presence in the US Smackover formation — a geological area that extends across parts of Texas and several other states known for its high lithium concentrations in brine, making it a significant resource for battery production, particularly for EVs.

EnergyX controls around 50,000 acres in the Smackover formation and is building a commercial lithium hydroxide plant.

ABTC wins appeal to reinstate grant for \$115m Nevada Li plant

The US Department of Energy has reinstated a grant to support building a \$115 million lithium refinery project in Nevada after an appeal by the American Battery Technology Company (ABTC).

The grant to ABTC was terminated last October — along with more than 200 projects that the Trump administration said then would save taxpayers more than \$7 billion.

However, the US government has since ramped up support to boost supply chains and domestic production of critical minerals and materials processing, along with derivative battery manufacturing and recycling.

ABTC said on June 8 it had won its appeal for reinstatement of its competitive five-year grant toward construction of the first phase of its commercial scale critical mineral lithium refinery, as part of its Tonopah Flats Lithium Project (TFLP).

The company received an initial grant from the DoE in January 2021 to fund the demonstration and scaling of its extraction technologies. An additional grant was awarded in the amount of \$57 million to design, construct, commission and operate the commercial scale facility, with an initial capacity of 5,000 tonnes of

battery-grade lithium hydroxide per year.

Before the termination, ABTC had successfully completed the first two years of the contracted grant and had been selected for fast-tracked federal permitting.

TFLP encompasses one of the largest known measured, indicated, and inferred lithium claystone resource deposits in the US.

A pre-feasibility study of TFLP, published in October 2025, indicated that the project had a highly competitive cost of production of \$4,307 per tonne of lithium hydroxide monohydrate.

ABTC's CEO Ryan Melsert praised the firm's long-standing partnership with the DoE and the department's "rigorous due diligence" in concluding the critical mineral lithium refinery project had achieved all of its contracted technical and commercial milestones to date, and that continued federal support was warranted.

"Of the hundreds of DoE grants terminated last fall, very few have been able to successfully appeal the decisions and have their contracts reinstated," he said.

Closing of the transaction is expected in the third quarter of 2026 subject to various regulatory approvals and arrangement of a financing package.

Schneider Electric launches multi-chemistry battery UPS

French multinational Schneider Electric has unveiled a next-generation UPS system that runs on VRLA or lithium ion batteries — and is designed to also support future battery chemistries.

Schneider announced the launch of its APC Smart-UPS on August 10 as the industry's "first monolithic multi-chemistry UPS" for distributed IT and edge environments.

The UPS allows the use of VRLA batteries today as a cost-effective option, while customers can move to longer-lasting Li ion when ready — and can then adapt to new battery chemistries as Schneider introduces compatible battery packs.

This latest model offers up to 3x the base runtime, up to 1.4x more power density and up to 57% more outlets, while helping reduce power loss by up to 40%, Schneider claims.

The platform supports up to 10 external battery packs for extended runtime. Genuine APC batteries maximise the performance and lifespan of the UPS.

All have been tested for compatibility and are backed by warranty cover-

age — in addition to being shipped "factory fresh", with validated runtime data and support for authorised recycling programmes.

The latest APC debuts with the 'SRTD On-Line' 2.2kVA and 3kVA series, designed for servers and networking equipment in medical, light industrial, and IT white space applications. Additional capacity models will follow.

"Customers shouldn't have to choose between investing in backup power today and being ready for what comes next," said Manish Kumar, EVP for secure power and data centres.

Last January, Vivek Abrol was appointed MD and CEO of Schneider's India-based subsidiary, Luminous Power Technologies, succeeding Preeti Bajaj — who moved to lead the global home solutions division of Schneider.

CIP energy projects fund tops \$3bn as latest BESS comes online

Copenhagen Infrastructure Partners has closed its Growth Markets Fund II at \$3 billion, on the heels of starting up its latest BESS facility in the UK.

CIP announced the closing of GMF II on August 14. The fund targets large-scale energy infrastructure projects in 15 markets across Eastern Europe, Asia and Latin America.

GMF II is nearly triple the size of the first vintage and has already committed around \$1.6 billion across nine investments including commissioning of a standalone battery project in Chile and starting construction on Mexico's first large-scale solar and BESS projects.

Niels Holst, partner and co-head of growth markets funds at CIP, said the company had been successful in attracting a diverse group including sovereign wealth funds and pension funds.

Meanwhile, on August 12, CIP announced the start of commercial operations of Coalburn 1 in Scotland — a 500MW, two-hour duration BESS, which the company said is currently the largest operational battery in Europe.

CIP said the lithium ion BESS will play an important role in strengthening the flexibility and resilience of the UK power system and supporting the continued integration of renewable energy generation.

Coalburn 1 is part of CIP's expanding portfolio of UK energy infrastructure investments. It is one of three transmission-connected BESS assets developed by CIP in Scotland. Together, Coalburn 1, Coalburn 2 and Devilla will provide 1.5GW of power capacity and 3GWh of energy storage. ■

Innovation over imitation: that's how to win the global battery race with China writes Mathias Ingvarsson, CEO of Holyvolt Group.

Looking for breakthrough chemistries vs China

China did not invent the Li-ion battery, nor was it first to commercialise the technology, but it was quick to understand that dominating supply was of strategic importance and took less than 20 years to get there. For the West to compete the focus must be on discovering breakthrough chemistries and accelerating the progression from lab to volume production.

Like any commodity market, the global lithium-ion battery sector is defined by massive numbers and a scale that is truly astonishing: in 2025 the market was worth more than \$150 billion and the total output was 1,600GWh of capacity. But sourcing is decidedly one-sided. More than 80% of batteries that year were manufactured in China. Of those made elsewhere, the majority relied on materials supplied by China.

This dependency has long been recognised but most attempts to compete have so far ended in failure. So how can the rest of the world catch-up? Not through scale alone, and certainly not by trying to replicate what China has already achieved.

As an industry we must focus on innovation because where we can lead is by developing next-generation chemistries, not ramping-up production of the last ones. Bloomberg reports that European and North American battery packs cost 56% and 44% more respectively than those from China, and expects the next wave of cost reduction to come from new cathode materials and cell designs.

Wildcat's High Throughput Platform (HTP) is a key enabler for this. (Wildcat Discovery Technologies was acquired by Holyvolt earlier this year.) Based on techniques first developed in the pharmaceutical industry to accelerate synthesis, testing, and commercialisation of new drugs, Wildcat was first to apply them to

battery chemistry discovery more than 18 years ago and has optimised the method ever since. Where existing R&D processes can evaluate several potential new chemistries in a year, Wildcat's can screen several thousands in a week.

The value of this unrivalled speed is compounded by the data it creates because the results of every single experiment performed to date have been recorded. These two assets when integrated with AI will deliver a data-led step-change in capability by creating an intelligent discovery engine that can find the next breakthrough first, accurately predict their key performance attributes, then validate them.

This dependency has long been recognised but most attempts to compete have so far ended in failure. So how can the rest of the world catch-up?

The value of this is far greater than just enabling better batteries. With materials accounting for more than 82% of cell production costs, focusing development efforts here will have a strong influence on competitiveness with China — and moving away from critical minerals such as cobalt and nickel.

In parallel, Holyvolt's screen-printing process and high solid content, water-based technology for electrode manufacturing offers a cost-effective, sustainable, and scalable route to production that does not suffer the same investment risks as conventional gigafactories. Designed for lower CAPEX spend than the dominant slot-die process, screen printing at gigawatt scale cuts electrode coating costs by at least half for a given line speed and production capacity.

Further CAPEX savings come

from smaller drying ovens — those used for NMP solvent-based slurries are as long as a football pitch — and smaller dry rooms. This in turn enables factory footprint to be smaller, and with every square metre costing several thousand dollars, any reduction in size is worthwhile.

Downsizing plants and equipment also reduces OPEX. Drying ovens for existing wet coating processes draw megawatts of power and need complex solvent recovery systems to capture and purify toxic and highly flammable NMP vapours. This stage of manufacturing and the dry room are the most energy-intensive of all, accounting for more than 75% of the total. Screen printing eliminates NMP altogether, making it an inherently cleaner technology, and we believe we can reduce that energy consumption by half.

This combination of next-generation cell chemistries, cutting-edge manufacturing techniques, and streamlined plants provides Western cell companies a viable, cost-efficient, scalable route into high volume production without the inherent risk of the current gigafactory model.

These qualities are also becoming increasingly attractive due to burgeoning regulatory requirements for sustainability, and growing demand from governments and industry for sovereign capability.

The ability to compress timescales from discovery to pilot production and robust, efficient, cost-effective scale-up is fundamental to removing the bottleneck that acts as a brake on the pace of innovation in Europe and the US. The technical solutions exist, and collaborative development will enable successful industrialisation.

To win we must stop looking back at what China has achieved and redouble our efforts to find the chemistries we need for the future. Otherwise, we will still be playing catch-up rather than taking the lead in a race we cannot afford to lose. ■



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As the number of BESS projects reaches a critical mass, Matthew Ling, business development director at Leep Utilities, explains the realities of delivering these complex solutions in a fast-moving sector.

From pilot to pipeline: what a growing BESS market needs

It's not long ago that battery energy storage systems were a niche technology pursued by a handful of early movers. But all that has changed fast: BESS solutions are now a mainstream part of the UK energy conversation, with projects increasing in number and scale. We're seeing far greater commercial interest, and the policy environment is pointing broadly in the right direction.

But growth in this sector also brings risks. The pace at which BESS is expanding is, in some respects, outrunning the industry's collective understanding of how to deliver these projects well.

The mistakes being made are not always technical, they are often a failure in process, or procurement, or engagement with suppliers in the wider ecosystem. But many of these issues are entirely avoidable, and almost without exception they are far cheaper to prevent than to fix.

Modern BESS projects are not straightforward undertakings. They operate under complex frameworks such as the Bilateral Embedded Generation Agreement (BEGA) or Bilateral Embedded Licence Exemptible Large Generator Agreement (BELLA). They must align with net zero objectives, and are frequently expected to serve a network reinforcement function at the same time as generating commercial returns.

A recent project of Leep's — a 33kV-connected BESS — required a complex discharge profile across multiple daily peaks, including morning and early evening demand, alongside a later evening surge driven by public sector shift changes, providing a reliable 2.5 discharge cycles per day.

That level of operation needs more than good equipment: it requires expertise across engineering, legal, regulatory and commercial disciplines, all working together from day one.

The range of participants entering the market adds another layer of complexity. Some are long-term asset owners looking to operate and retain a battery for 20 years or more.

Others are developers whose model

is to get planning, secure a grid connection, then sell the project on to the open market — with the independent distribution network operator (IDNO) already contracted in as part of the package. Others still are battery owners focused purely on grid export revenues.

Each model requires a different approach, and the industry does not always make that distinction clearly enough.

One of the most consistent findings from the BESS projects we work on is that the IDNO is consistently brought into the project far too late.

By the time a scheme is reviewed by the IDNO, the asset owner may already have board sign-off, a contracted independent connection provider (ICP), and a full cost plan — often based on a specification that the IDNO can't adopt.

This creates a painful situation. The client has made commitments based on figures that do not reflect the full picture. When the IDNO flags that the proposed equipment is not adoptable — perhaps because it doesn't meet G81 standard, or because the transformer specification is non-standard — it offloads additional cost and timeline slippage onto the client.

It's not necessarily the ICP's fault. Their job is to win and deliver the construction works. Long-term adoptability is not their primary concern, and it is unrealistic to expect it to be. But unfortunately, the organisation that does have long-term adoptability as a primary concern — namely the IDNO — is not in the room at the time those decisions are made.

A further challenge for BESS projects is that they operate in a relatively new area of regulation and legislation, which can make compliance and approvals feel like moving targets.

If your team can't adapt at this speed, either because you don't have the knowledge and resources in-house, or you don't have easy access to an experienced external team, you put your projects at risk of failing.

The same applies to engineering scope. As BESS projects scale up and connect at higher voltages, unexpected

findings become more likely, not less. For a recent BESS project we worked on, detailed engineering work revealed anomalies in the wider network that required reinforcement across multiple circuits.

With our in-house legal team, we were able to work alongside local specialists and government bodies to navigate this through to final sign-off. It was time consuming, but the solution ended up ultimately benefiting residential and commercial properties in the surrounding area.

As project size increases, so does the importance of choosing the right IDNO partner. Asset values, different customer charge mechanisms, grid export revenues and project-flip structures all operate differently and suit different types of infrastructure owner.

Choosing an IDNO shouldn't just be on who can meet safety levels and standards. An IDNO whose commercial offer aligns with your model — not just one that can connect you to the grid — matters more than it once did. If you focus purely on minimising upfront costs and accelerating timelines, then you are potentially missing out on longer term value — and almost certainly creating liabilities you haven't fully accounted for.

Lessons to be learned

Grid-scale battery storage is a relatively new industry, but it's based on proven technology and comes with strong commercial and environmental cases for further growth.

But the industry's ability to realise the full potential of BESS depends on applying the lessons that are already available — from projects that have been through the complexity and come out the other side.

Done well, BESS solutions deliver real and lasting value: to asset owners, to the networks that adopt them, and to the communities they serve. Getting there requires the right partners, engaged at the right time, with the depth of capability that these projects genuinely demand. ■

For more information about Leep Utilities and BESS visit: <https://www.leeputilities.co.uk/elw/>

How LFP technology made electric forklifts the only logical choice. By Max Khabur, marketing director ENEROC USA.

Has lithium turned the corner on lead traction batteries?

Ask anyone in material handling why electric forklifts are taking the market share from propane and diesel-powered machines, and you'll probably get these answers: E-commerce and narrow aisles in warehouses; emissions regulations and fuel cost.

They're not wrong but it's not the complete picture. The shift toward electric industrial trucks has been underway for more than two decades. What changed recently, and what most industry commentaries overlook, is the rapid decline of lithium iron phosphate battery prices.

That turned lithium from a premium upgrade for the most demanding applications into the most cost-rational choice in the market. That is what is driving the acceleration.

And it deserves a closer look.

By 2020, electric forklifts already outnumbered internal combustion engine-powered (ICE) shipments globally. In 2024, they accounted for 71% of North American retail orders according to the Industrial Truck Association, with Europe exceeding 70%.

Electric trucks were always the rational indoor default; lead-acid batteries powered them reliably for generations. The trend line was never in doubt.

The question is not whether electric is winning. It is why the pace accelerated so sharply, and why ICE holdouts that resisted for two decades are now converting.

The rise of Class II and Class III

The conventional narrative focuses on the material industry structural shifts, and these are real. The explosion of e-commerce fulfilment has changed what warehouses look like: taller, denser, and more automated.

This market trend has driven strong growth in Class II and Class III trucks; narrow-aisle reach trucks are the fastest-growing electric segment. At MODEX 2026 in Atlanta, one of the panellists of the session hosted by the Advanced Energy Council of MHI, addressed this directly: "We have seen a significant jump in Class II and Class III orders over the last few years. The combination of tighter aisle configurations and operators

who simply will not consider anything that produces emissions indoors has made lithium-powered electrical products the default spec for every new fulfilment project we quote."

More modern warehouses mean more specialized and efficient electric lift trucks. It does not explain why Class IV and V ICE users, who resisted electrification for decades, are now converting. Nor does it explain why lithium is displacing lead-acid within the electric segment at a rate that is rewriting the battery market.

For that, we need to look at what happened to the price of LFP cells.

LFP is not a new battery chemistry, discovered in the 1980s. But what has happened to its cost over the past five years is without precedent in the battery industry.

According to BloombergNEF, lithium-ion battery pack prices averaged \$137/kWh in 2020, following a long decline from almost \$1000 in the early 2000s as manufacturing volumes grew.

In 2022, prices briefly spiked to \$151/kWh, the first-ever annual rise so far, driven by a spike in demand for lithium carbonate. Then the floor gave way. By 2024, pack prices had fallen to \$115/kWh globally, the largest single-year drop since 2017, down 20%, and as low as \$84/kWh in China. By 2025, the global average reached \$108 per kilowatt-hour and is still falling.

This was a structural repricing event, driven by massive battery manufacturing (over)capacity and intense competition among the leaders: CATL, BYD, LG, Gotion, and CALB, the world's dominant lithium battery cell producers.

The market responded immediately: lithium-ion forklift models expanded 41% as cell prices crossed below \$90/kWh hour. In 2024 alone, the Li-ion forklift segment grew more than 10% while ICE variants declined 1% and lead-acid-powered models fell 7%.

Interact Analysis projects lithium will surpass lead-acid in market share within the electric segment around 2026, and that 81% of all new

More modern warehouses mean more specialized and efficient electric lift trucks. It does not explain why Class IV and V ICE users, who resisted electrification for decades, are now converting.



electric forklifts shipped globally will carry lithium batteries by 2034. The technology had long since proven its thermal stability, cycle life, and safety credentials.

What was missing was the price. And now the price objection is over.

For years, the counter-argument to lithium adoption was simple: the upfront cost, typically two to three times that of a conventional lead-acid battery, was a hard stop for capital budgets, regardless of the lower total cost of ownership over a few years. That has changed.

“LFP lithium batteries are nearly at price parity with traditional lead acid in the retail market,” says Mark D’Amato, vice president of sales at ENEROC USA. “When a fleet manager is comparing one of our lithium battery against a traditional lead-acid battery, the upfront numbers are now very close.

“Add in that LFP delivers higher performance from day one, offers a much longer useful life per battery, and a longer warranty...the conversation has completely changed. We are still lowering the TCO overall, but now the acquisition price is much lower too.”

An LFP battery is about 40% lower in total cost of ownership than lead-acid in multi-shift power-hungry operations, with positive ROI typically within 36 months and documented fleet savings exceeding \$120,000 per 10-truck fleet over five years.

In the context of today’s market prices, this new price parity can be illustrated with an example of a popular forklift battery. Based on a recent price survey, a 48V, 1000Ah capacity model made by a top manufacturer using lead-acid chemistry would cost around \$12,000 (retail), while its lithium LFP counterpart with similar specifications would sell for \$14,000-\$15,000. (Note a similar NMC lithium battery can be three times more expensive than a lead-acid battery, and is likely to stay a niche product.)

As recently as the 2000s, lead-acid batteries couldn’t seriously challenge ICE in the heaviest applications. The lift truck electrical systems were inferior as compared to today’s models, and they suffered limitations based on the lead battery technology: strict charging limits, memory effect and voltage drops during discharge, especially at low or freezing temperatures.

Li-ion technology solved these problems. Its flat discharge curve means a truck at 80% depth of discharge (DOD) lifts and moves as fast as one at 20% DOD, resulting in less truck component wear.

Lithium batteries have much higher energy density and can pack much more power into the same-sized battery compartment. Starting in 2024, one after the other, forklift manufacturers introduced heavy electric forklifts with lifting capacity exceeding 20,000 pounds, describing them as “lithium-first” to underline the new generation of electric motive power, replacing propane and diesel for good.

Calling forklift electrification a ‘trend’ is now outdated. Lead-acid has powered electric forklifts for over a century. But for the past decade, lithium has been the best technology at a premium price. And for these last two years, it has been the best technology at a competitive price.

When a fleet manager is comparing one of our lithium battery against a traditional lead-acid battery, the upfront numbers are now very close... We are still lowering the TCO overall, but now the acquisition price is much lower too.”

That is the definition of a new default.

The battery revolution in material handling did not begin with a regulation or an e-commerce boom. It began when the most competitive manufacturers in the global battery industry drove LFP prices below the threshold where any other answer stopped making economic sense. ■



Starting in 2024, one after the other, forklift manufacturers introduced heavy electric forklifts with lifting capacity exceeding 20,000 pounds, describing them as “lithium-first” to underline the new generation of electric motive power, replacing propane and diesel for good.

Some 30 years ago, Ed and Janet Puckett gambled their family's future on an unwanted manufacturing plant. Today, their children, Lee and Steph, are steering Atomized Products Group into its next era. Shona Sibary discovers a succession story built on the understanding that while products and markets may change, the values behind the business remain constant.

Founded on a leap of faith, driven by the next generation



It's clear from the moment I start interviewing the brother-sister duo running APG, that this is a company with a no-nonsense approach.

Stephanie Puckett joins on Zoom from Virginia, where she is VP and general manager of the firm's Chesapeake plant. She has chosen not to blur or put a fake background on her screen, and so behind her head I have a bird's eye view of a cluttered bulletin board — the kind seen in every home in America — and it is absolutely crammed with pinned childhood drawings, reminders and all the domestic admin needed to keep a busy family functioning.

One picture stands out. It's an artist's impression of two hands side by side — as it happens, the hands of her 13 year old twin daughters, Fiona and Devon — but it could just as easily be those of the two siblings I'm

about to interview, and it strikes me as a fitting symbolic visual of the trust and closeness they so clearly share.

A rocky start

When you know the background, it's hardly surprising. Steph was 14, and Lee, 12, when their parents first began the firm.

Until that point, Ed's senior job at Gould National Battery had involved extensive travel, often taking him away from the family for weeks at a time. Then, almost overnight, he stopped travelling and was home a lot more. Their mother, Lee remembers, initially appeared less than delighted by the new arrangement.

"We noticed she was suddenly in a really bad mood most of the time," he jokes.

Lee and Steph did not fully understand it yet but, behind the

scenes, their parents had taken an extraordinary financial and professional gamble.

Ed, then VP of GNB's recycling division, had learned the company intended to close a manufacturing facility in Garland, Texas. The plant made lead powder, primarily for the oil and gas industry, and it no longer fitted the company's future plans.

As there was already a looming question mark over his future at the business, he suggested something audacious. Rather than closing the plant, Gould could sell it to him instead.

"Dad turned to his boss and said, 'You don't have to let me go. I'll quit. But you need to sell me this facility you're going to shut down anyway,'" says Lee.

There was one substantial problem. Ed and Janet could not raise the bank financing to complete the purchase. Ed therefore persuaded his former employer not only to sell him the operation, but to finance the acquisition over an eight-year term.

It wasn't just a huge leap of faith, but a bold, entrepreneurial move leaving little margin for error.

The family remained where they lived in Georgia so Lee and Steph could finish high school, while Ed's long-time friend and colleague, Bill Greenwood, managed the Garland operation.

Bankruptcy fears

With Ed focussed on selling the plant's products, Janet was made president and handed day-to-day responsibility for running the business.

Certified as a Women's Business Enterprise

Something Steph is perhaps most proud of, is this APG credential, awarded in 2016. But she's keen to point out that it represents far more than a diversity ticking box for customers.

"We truly put it into practice," she says.

In addition to Janet as CEO, Steph has Jen Michoski and her sister-in-law, Liz Puckett, as her counterparts. Jen is the VP and general manager at the Texas location and Liz is the VP of administration for both locations.

"In Chesapeake, the operations and logistics manager is also a

woman," says Steph. "So is the quality control and laboratory technician and the plant foreman. And her sister is the second-shift lead."

Several of these employees began in entry-level positions and have progressed through the organization.

"They've proven themselves," says Steph. "They have been seen, heard and brought up in the same way any man would have been."

This matters in an environment where APG's negative expander products involve carbon black, barium and lignin — materials that make manufacturing physically

demanding and frequently messy.

"It's a lot of men in a blue-collar situation out there," Steph says. "To hold your own and have them respect you in that leadership role speaks volumes."

She believes female leadership has also influenced the company's culture as employees may sometimes feel more comfortable discussing family problems, illness or childcare needs with a woman than with a conventional male supervisor.

"There's a lot more communication," she says. "Whether we love it or hate it on certain days, we all feel like a big family out there."

'Dad couldn't afford to hire anybody else,' remembers Lee. 'He basically said: "Hey Janet. You might need to help me out a bit with this." Mom hadn't ever run a company before and she had to learn the financial, administrative and operational sides of the organization almost from scratch.'

Their gamble became even more precarious within the company's first year when oil prices collapsed, drilling activity slowed sharply and demand disappeared for the lead powder on which their fledgling business depended.

"Suddenly, maybe a year in, there were concerns that we were going to have to go bankrupt and close the business," Lee says. "We didn't have customers or sales."

Ed and Janet largely, but not quite, managed to conceal the seriousness of the situation from their children.

"They did an incredible job of making us feel safe," Steph says. "We never really knew how precarious the situation was. But we were observant. We read the atmosphere."

In fact, they developed what became known in the Puckett household as the 'Mom Meter.'

"We would have a day where it was like: 'How's Mom doing today?' Lee remembers. "If she was a seven or an eight, we could ask her for stuff. If she was a two, we left her alone."

Steph remembers the siblings passing each other in the hallway and silently holding up a number to indicate the prevailing maternal stress level.

But the humour of this memory





sits alongside a much more serious reality. Ed and Janet had put the family's future on the line.

"They had no safety net," Lee says. "They either made this work or the whole business was up in the air and they would have had to start over."

Without knowing it, Lee and Steph were absorbing lessons that would shape their own professional path decades later. Through witnessing their parents working relentlessly, adapting to a difficult commercial landscape while holding their nerve, they were already learning how to be the leaders they are today.

Big shoes to fill

Neither Lee nor Steph were pushed into the family business. "To our parents' credit, they never said, 'We expect you to come and run APG'" says Lee. "It was always just there as an option."

But by the time he reached university, however, it was becoming an option he was beginning look at a bit more closely.

"Many of the people in the Garland office were already in their 50s and 60s. I could see that the business would eventually require a younger generation of leadership and during my third year of undergraduate study I decided I wanted to learn what that might involve," he explains.

He initially took a summer internship, working the second shift on the plant floor, and performing the same physical jobs as APG's operators.

"There I was, the owner's kid, out there busting his butt at midnight with them," Lee says. "I hoped that would help ingratiate me with the guys."

In addition, as most of the operators at the Texas plant spoke Spanish, Lee added this as a language minor to his economics degree. It gave him the ability to translate between employees and management and, crucially, demonstrated a willingness to meet the workforce on its own terms.

"I realised pretty quickly that working for Ed and Janet Puckett was actually far better than working for most other people. I mean, it could have gone really badly because they were my parents. But they are very hardworking people, and they put that ethos into Lee and me without even realising they were doing it."

See-a-need, fill-a-need

Steph, on the other hand, followed a different route, spending 20 years at the beginning of her career in another of the family's enterprises — a vineyard and wine business. Her responsibilities there ranged from working in the vines and tasting room to distribution, events and regulatory compliance.

Then, in 2020, the Covid pandemic closed tasting rooms and created enormous uncertainty throughout the wine and hospitality sectors. At the same time, two major frosts caused a complete crop loss at the vineyard.

Steph was raising two young children and attempting to homeschool them while also confronting the physical and emotional exhaustion that followed two decades in agriculture.

"We were hitting our end game mentally, physically and emotionally with the vineyard," she recalls. We had to decide whether to continue pushing forward or redirecting our energy elsewhere."

Initially, APG was not part of her plan. But the company was looking to move beyond its existing ISO certification and secure an IATF one — the more demanding automotive quality management standard.

This International Automotive Task Force framework involves exhaustive documentation, audits and quality controls specific to the automotive supply chain.

At the time, APG had people

capable of running its facilities, but nobody with sufficient time and organisational capacity to lead the certification project across both the Garland and Chesapeake sites.

Lee knew where his own strengths lay — and where they didn't. "I think I'm a pretty good salesman," he says. "And I'm pretty good at running an operation. But fully documenting everything and providing all the justification an auditor needs is not my strength."

Conversely, Steph, after years dealing with alcohol regulation, distribution, compliance and administration, possessed precisely the skills APG needed and the company achieved its IATF certification on its first attempt — a milestone Steph still counts among her proudest professional moments.

"I had no intention necessarily of working for APG," she recalls. "It was more of a see-a-need, fill-a-need idea."

At just this time, Lee and his wife, Liz — who had moved to Virginia in 2014 to establish APG's Chesapeake operation — decided to return to Texas, where they had met, to raise their young family.

The management structure left behind in Chesapeake struggled under the additional pressures of Covid, workplace safety requirements and employee compliance. So what had begun as a focused certification assignment increasingly drew Steph into the operational life of the Virginia facility.

"I hadn't ever wanted to come in just because I was the daughter and should be given a role," she says. "But the position grew because the need grew."

"Some of the other individual roles within the company evolved in the same way. Liz came to work in the Garland TX plant in 2013 in an operations role. In the true fashion of a small company she wore many hats and her role has grown and evolved over the years to be the VP of administration."

"We were hitting our end game mentally, physically and emotionally with the vineyard," she recalls. We had to decide whether to continue pushing forward or redirecting our energy elsewhere."

“Having trusted family members as integral parts of the daily operation and company structure is a big part of APGs strengths.

“But also, nobody just works here because they are family...they work here because they have proven themselves, are willing to roll their sleeves up to get the job done and also have the flexibility to adapt as the needs and demands of the company change.”

At the helm together...

Today, Lee works as president and COO, having formally taken on the position in 2022. Liz oversees much of the group's financial, human resources and back-office operation. Also based in Texas, sister-in-law, Jen Michoski, is Steph's counterpart as vice president and general manager of the Garland plant.

It's a second-generation leadership structure that has evolved around individual strengths rather than family hierarchy.

Even Steph's position as Lee's older sister did not change the reporting line.

“When she came on board, I did have to say, ‘You understand you're going to be working for your baby brother for quite a while?’” he jokes. Her response was simple: “That's perfectly fine.”

Their relationship works partly because their abilities are so different. Asked who would struggle more if they exchanged jobs, Steph

immediately nominates herself.

“Lee has previously run a manufacturing plant, and he totally underestimates how much technical knowledge he has accumulated,” she says. “It's far above what he gives himself credit for. Also, I have no desire to take on prolonged sales cycles and the kind of relationship-building involved in winning major industrial customers.”

Lee is equally complimentary about his sister.

“I'm type B and she is definitely type A,” he says. He points to her organisation, her willingness to listen to employees and her instinct to join people on the production floor when problems arise. “She leads by example way more than I ever did.”

Handing over the reins

Founders Ed and Janet remain involved, though both have largely stepped back from daily operations. Janet serves as APG's CEO and majority owner, while Ed acts as treasurer and holds a minority stake.

But their business mindset clearly continues to endure.

In perhaps the greatest compliment a child can pay their parents, Steph says: “I realised pretty quickly that working for Ed and Janet Puckett was actually far better than working for most other people. I mean, it could have gone really badly because they were my parents. But they are very hardworking people, and they put that ethos into Lee and me without

even realising they were doing it.”

Both are still available as advisers and sounding boards, even if family proximity can sometimes blur the boundary between home and work.

Steph lives approximately a third of a mile from her parents.

“You can never just leave work at work,” she says. “Work comes home because they want to know how things are going, what happened today, who you hired or who you fired.”

Their continued presence is also an enormous source of support. When Steph has an idea, a concern or fears she may fail, her parents can draw on their own 30 years of experience.

They often point out that they faced something similar — or considerably worse — 20 years earlier. They also understand when she has had enough. “If I tell them, ‘It's been a day and I don't want to talk about it,’ they give me space,” she says.

APG 2.0 on a global stage

Preserving the values of their family firm while adapting it to a very different world is a challenge Steph and Lee don't underestimate.

Both see the new chapter as being shaped by three central questions. Where will future growth come from? How will APG operate in an increasingly complex international marketplace? And what role can a company rooted in the lead battery industry play as energy technologies diversify?

An ethos to be proud of

Both believe that their pervading family culture does not mean avoiding difficult management decisions, but finding a way to approach them differently.

Obviously modern employment law and an increased risk of litigation necessitates a more cautious approach.

APG also holds monthly employee meetings over lunch, giving people across the business the opportunity to raise production problems, equipment concerns or ideas for doing things differently. The meetings create an open forum in which an operator can mention a recurring issue and discover others are experiencing the same thing.

Nobody is left wondering whether

management cares or whether it is safe to speak.

“If you're not actively listening to the people who are out there grinding themselves down every day and working really hard, you're setting yourself up to fail,” says Lee.

“They have to deal with the gritty day-to-day machinery. If you want it to continue showing up at the customer's location in good condition, you need to listen to them.”

Employees who feel invested in the company respond differently when problems occur. If a delivery arrives unexpectedly at 7am on a Sunday, people turn up to unload it. If equipment fails, they take responsibility for getting production running again.

“It becomes their baby as much as

it is ours,” says Lee.

This approach has created extraordinary loyalty. Several employees at Garland have worked at the plant for close to 30 years. They have raised families, put children through college and sent earnings to relatives in Mexico and Central America.

One of Lee's most enduring memories is when, at Chesapeake, his plant supervisor, Eric, thanked him, saying that APG had made it possible for him to marry his wife and buy a home.

“I never would have been able to do this if you guys hadn't given me this opportunity,” Eric told him.

For Lee and Steph, it is these relationships that rank amongst their proudest achievements.



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BATEK MAKINA AS



Lee views mature lead battery markets in North America and Europe as relatively stable, although unlikely to deliver dramatic long-term growth.

"In some applications and regions, lead demand may continue to trend gradually down as lithium, sodium and other technologies become more established, but lead batteries are not disappearing," he says. "They still have a role to play."

Alongside conventional automotive applications, Lee also predicts continued opportunity in absorbent glass mat and enhanced flooded batteries, auxiliary power for increasingly electronics-heavy vehicles, backup power, data centres and stationary energy storage.

But it's the developing markets, including Brazil and India, that are pushing APG towards a stronger international strategy. Demand continues to grow in these markets, yet they do not possess the infrastructure needed for a wholesale shift into newer technologies and remain heavily dependent on the reliability, affordability and established recycling systems surrounding lead batteries.

APG now works with sales agents in India, South Korea and Brazil, some of whom also cover neighbouring regions.

"We need boots on the ground providing a more regionally focused sales and distribution network," says Lee. "It's that personal, local presence that is increasingly important in a world where free trade is less straightforward than it was when my parents established the business."

What's next?

"Of course, geopolitical tensions, trade barriers and government policy



are making international commerce more difficult. We are therefore also exploring whether APG may eventually need manufacturing, warehousing or supply networks in additional locations."

Lee is acutely aware that the future of APG may well depend on diversification. "We started with lead powder before moving into negative expanders where we are now a big player in the market. How do we retain that? But also does our next step involve lithium, another battery technology or even a market outside batteries and automotive altogether?"

"If we're going to continue growing and developing, what's next?" he asks.

The answer requires APG to keep its ear close to developments across energy. Everyone in the industry knows that global demand for energy resources will continue to rise. The technologies used to meet that demand will evolve and Lee does not

pretend to know which chemistry will dominate future energy markets.

Indeed, he is doubtful that any one technology can. The future, as he sees it, is not about defending lead against every other chemistry. It's about recognising the different strengths each technology can bring.

"We're still going to need a mix," he says. "It can't just be sodium. It can't just be lead acid. We're going to need a blend of all of it."

What keeps him awake at night is not whether APG can manufacture a good product or serve its customers.

It is, instead, the growing number of forces outside the company's control.

Since 2020, like all other businesses, APG has had to navigate Covid, tariffs, inflation, escalating raw material and freight costs and severe disruption to ocean transport.

"The things that keep getting in the way haven't been that we made a bad product, didn't get an order out or failed our customers," Lee says. "They've been outside influences."

Government decisions, trade policy and geopolitical events can all derail growth plans that have taken years to build. My biggest worry is not knowing what might be next."

When asked what he and Steph hope their parents think about how APG is being steered, Lee reveals that the judgement has already been delivered. A year ago, Ed told them both: "You guys have done this better than I ever could."

It is difficult to imagine a more meaningful endorsement from a parent and founder.

As the company celebrates its thirtieth 30th this year they've come a long way from an unwanted plant, seller financing, and children quietly calculating their mother's stress levels in the hallway.

The business remains privately owned, hands-on and intensely personal. The products may have changed and the markets expanded. Compliance requirements, technical partnerships and global ambitions bear little resemblance to those of 1996.

But the beating heart of APG remains strong. Ed and Janet Puckett started their company against all the odds. The generation following them is not simply preserving that legacy. It is proving what can happen when founders have the courage to let go. And their children earn the right to pick up their baton. ■

Biggest lesson learnt

Lee describes one of the most important lessons of leadership as recognising that almost nothing is entirely positive or entirely negative.

"A substantial new order sounds like good news," he says. "But it also creates immediate demands for raw materials, labour, overtime, machine capacity, production scheduling and warehousing. The customer may overstock and reduce orders later. A highly profitable year brings a larger tax burden."

Similarly, a difficult event may contain a silver lining or force them to improve.

"Every piece of news that comes through APG, we have to sit there and pro-and-con it," Lee says. "Is this actually a good thing? What do we need to do to prepare for the bad version?"

Our parents learned those lessons when the survival of their company and family finances were inseparable.

Insurers, brokers and specialist engineering firms are playing a growing role in determining which BESS projects secure finance, how they are designed and the level of risk investors are prepared to accept.

Here come the moneymen...



Enter stage right: the new custodians of the energy storage business. But they're no longer the bankers. Nor is it the lawyers that hold the bankers in such sway.

It's the insurers.

In a previous lifetime of writing about capital markets, M&A, corporate and structured finance, subordinated debt, derivatives trading strategies and the like it is strange to see the pendulum swing away from the giants of the trading floor, the alchemists of the derivative markets and the hard-nosed whizz-kids of project finance.

The new Masters of the Universe — yes bankers often describe themselves as that — are to be found with the back-room boys of the insurance world.

Although they would have always insisted that they were the only real arbiter of risk, their work was unglamorous. Bean counter stuff: where calculators and probabilities were the only real measure of success.

But history has proved that perception wrong. For much of the past decade, the

battery industry has been preoccupied with a familiar set of challenges. Could lithium supplies keep pace with demand? Which cell chemistry would dominate the market? How quickly would costs fall? Would governments provide the regulatory certainty needed to encourage investment?

As battery energy storage systems (BESS) moved from demonstration projects to critical infrastructure, these questions shaped conference agendas, investment decisions and public policy.

Another question, however, has steadily moved to the forefront. It rarely appears in press releases announcing new projects, yet it is now routine in meetings between developers, banks, brokers and investors long before construction begins.

So who is prepared to insure the project?

There is also a more subtle one: who is prepared to insure the insurers of these BESS?

The final bill for the Moss Landing fire in January 2025 could well be over \$1.5 billion if large-scale personal injury, property value or environmental lawsuits succeed. Typically all insurers tend to sell off part of their book to the reinsurance giants such as Swiss Re or Munich Re. Otherwise single insurers would have been brought to their financial knees.

The importance of both questions has increased because battery storage has changed. Early installations were comparatively small and often financed by companies willing to accept a greater degree of technical uncertainty.

Today's projects are different. Grid-scale battery systems commonly represent investments of \$100 million

Insurance is becoming part of project development rather than simply one of its supporting services

or more and, increasingly, form part of a critical national infrastructure.

Their investors include commercial banks, pension funds, infrastructure funds and institutional investors whose priorities extend well beyond technological innovation.

They require predictable long-term returns, robust engineering and confidence that unexpected failures will not jeopardise the value of their investment.

Insurance has therefore assumed a role that extends far beyond financial protection. Increasingly, it provides lenders with independent reassurance that a project's engineering, operational procedures and risk management have survived detailed scrutiny.

A recognised insurance programme is no guarantee of success, but it has become an important indicator that experienced underwriters and engineers are prepared to commit their own

capital alongside that of the developer.

This represents a significant change in the commercial structure of the battery industry. Insurance was once regarded largely as a procurement exercise.

Brokers used to assembled cover towards the end of project development, policies were negotiated and construction proceeded and when engineering decisions had already been taken. Today, insurers and their technical advisers are becoming

A market maturing faster than its data: the new kings of probability



Insurance is fundamentally a business of probabilities. Underwriters attempt to estimate the likelihood that an event will occur, the financial consequences if it does and the premium required to compensate for that uncertainty.

The process depends heavily upon historical evidence. Commercial aviation, commercial property and petrochemical industries have generated decades of operational data, enabling insurers to develop increasingly sophisticated models of future losses.

Battery storage presents a different challenge.

Modern lithium-ion BESS has expanded from a niche technology into a major infrastructure sector in little more than a decade. During that period, almost every aspect of the technology has evolved.

Battery chemistries have changed, software has become more sophisticated, energy densities have increased and project sizes have expanded dramatically. Facilities exceeding one gigawatt-hour are no longer exceptional, while developers are already planning installations substantially larger still.

The pace of technological development has outstripped the accumulation of actuarial evidence.

For insurers, this creates an unusual situation. They are being asked to

support an industry whose commercial importance is increasing rapidly, while the historical claims data normally used to assess long-term risk remain comparatively limited. That does not mean battery storage is uninsurable. Rather, it means insurers rely more heavily upon engineering judgement than they would in more mature industries.

Engineering has therefore assumed a central role in the underwriting process. Before agreeing terms, insurers routinely examine battery chemistry, thermal management systems, fire detection, suppression technologies, battery management software, emergency response procedures, maintenance strategies and site layouts

Insurers rely more heavily upon engineering judgement than they would in more mature industries.

Increasing attention is also given to cybersecurity, recognising that battery systems are becoming highly digital assets whose operational resilience depends as much upon software as hardware.

This technical scrutiny sometimes surprises developers unfamiliar with

the insurance market. From the insurer's perspective, however, it reflects a simple commercial reality. Insurance companies allocate capital in much the same way as banks.

Every project accepted on to their books consumes underwriting capacity that could otherwise support another investment. Decisions are therefore shaped not only by engineering considerations but also by the efficient deployment of capital.

That discipline has become more pronounced across the insurance industry during recent years. A succession of costly natural catastrophes, combined with inflation in construction costs and higher reinsurance prices, has encouraged insurers to focus on technical profitability rather than premium growth. Battery storage has entered the market at precisely the moment underwriters have become more selective in how they deploy their capital.

For developers, this has important consequences. The quality of engineering presented to insurers increasingly influences the availability of cover, the amount of capacity offered, policy conditions and, ultimately, the confidence with which lenders approach a project. Insurance is no longer merely responding to engineering decisions. It is helping shape them. ■



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involved much earlier. Developers increasingly seek their views during design, recognising that changes requested late in the process may prove expensive or delay financial close.

The consequence is that insurance is becoming part of project development rather than simply one of its supporting services. CalifoUnderwriters are no longer assessing completed designs in isolation. They are influencing the design process itself.

That evolution has occurred quietly, yet its implications extend throughout the battery supply chain. Engineering consultants, manufacturers, contractors and developers are all adapting to a market in which insurability has become a commercial advantage rather than merely a contractual requirement.

The insurance market's approach to battery storage has been influenced by a series of high-profile incidents that exposed weaknesses in engineering practice while accelerating improvements across the industry.

Lessons written in smoke

Among the most influential was the explosion at the McMicken Energy Storage Facility in Arizona in 2019. Investigators concluded that thermal runaway within a lithium-ion cell led to the release of flammable gases inside a battery container. When emergency responders entered the enclosure, those gases ignited, seriously injuring several firefighters.

The incident demonstrated that understanding thermal runaway alone was insufficient. Equal attention had to be paid to the behaviour of gases released during such events, prompting

Battery safety was shown to depend not simply upon chemistry but upon the way systems were integrated, monitored and maintained throughout their operational life

renewed emphasis on ventilation, gas detection and emergency response procedures.

A different set of lessons emerged from the succession of battery fires experienced in South Korea. Although investigations identified multiple contributing factors rather than a single universal cause, they highlighted the importance of installation quality, commissioning practices and operational management.

Battery safety was shown to depend not simply upon chemistry but upon the way systems were integrated, monitored and maintained throughout their operational life.

More recent incidents at Moss Landing in California have continued that process of learning. They have reinforced the importance of fire propagation studies, containment strategies and practical emergency planning for very large battery installations.

For insurers, these events have not undermined confidence in battery storage as a technology. Instead, they have broadened the range of questions asked before cover is offered.

Insurance capacity has not withdrawn from the battery market. It has become more discriminating. Projects supported by recognised engineering standards, experienced contractors and comprehensive risk management continue to attract

competitive underwriting. Those unable to demonstrate comparable levels of preparation face a more demanding market.

In many respects, battery storage is following a pattern already observed in other emerging infrastructure sectors. Offshore wind, liquefied natural gas and large-scale petrochemical facilities all experienced periods during which insurers relied heavily upon engineering expertise while operational data accumulated. Battery storage is progressing through the same process, although at a considerably faster pace because the technology is expanding more rapidly than many earlier infrastructure industries.

The result is that engineering and insurance are becoming increasingly intertwined. Every major incident generates new technical understanding. That understanding influences underwriting practice.

Developers respond by changing project design, manufacturers refine their products and engineering standards evolve. Through this cycle, the insurance market is helping disseminate best practice across the industry.

It is an influence that remains largely invisible outside specialist circles. Yet it is already reshaping how battery projects are conceived, financed and delivered.

At first sight, the insurance of a battery energy storage project appears to be little different from that of any other industrial facility. A developer appoints a broker, technical information is submitted to insurers, premiums are negotiated and policies are issued before construction begins or commercial operations commence.

However, a modern utility-scale BESS project may involve half a dozen insurers, one or more reinsurers, several engineering consultancies, specialist lawyers, loss-control engineers and a broker acting as technical adviser as well as intermediary.

By the time the insurance programme reaches financial close, hundreds of pages of technical documentation may have been reviewed, engineering reports commissioned and site-specific risks analysed in detail.

The complexity reflects the scale of the investment rather than any lack



California's most expensive BESS insurance loss: Moss Landing fire by night

PHOTO: Guy Churchward

of confidence in battery technology. A project valued at say \$150 million represents an exposure that few insurers would wish to retain entirely on their own balance sheet.

Instead, responsibility is shared across a panel of insurers. One company acts as the lead underwriter, negotiating policy wording, pricing and technical conditions, while other insurers subscribe to proportions of the overall risk. Behind them sit reinsurers, providing another layer of financial support by accepting part of the insurers' own exposure.

This layered structure is common in large infrastructure projects, but it has particular significance for battery storage because it introduces multiple technical opinions into the underwriting process.

A developer is no longer satisfying a single insurer. It is presenting its project to a market whose participants may have different engineering philosophies, different appetites for risk and different views on acceptable levels of protection. Reaching consensus can therefore become almost as important as negotiating price.

It also explains why experienced brokers have become central figures in the battery industry.

Actuarial engineering

The growing importance of engineering consultancies follows naturally from the growing role of brokers in putting insurance together.

Companies including DNV, Jensen Hughes, UL Solutions, FM, CSA Group and Kiwa are not insurers, yet their influence within the battery industry has increased markedly because they provide the independent technical analysis upon which underwriters increasingly rely.

Their work extends well beyond confirming compliance with recognised standards.

A modern engineering review may examine battery chemistry, thermal propagation testing, battery management systems, container ventilation, suppression technologies, emergency access, maintenance procedures, operational monitoring and cybersecurity. Environmental risks, including flooding, wildfire exposure, seismic activity and severe weather, may also be incorporated into site-specific assessments.

For insurers, these studies perform an essential function.

Historical claims data remain limited. Engineering therefore provides

After the explosion at the McMicken Energy Storage Facility in Arizona in 2019. Investigators concluded that thermal runaway within a lithium-ion cell led to the release of flammable gases inside a battery container. When emergency responders entered the enclosure, those gases ignited, seriously injuring several firefighters.



evidence that actuarial models cannot yet supply. Independent technical assessments reduce uncertainty and allow underwriters to differentiate between projects rather than treating battery storage as a single category of risk.

This represents one of the most important developments within the insurance market over recent years.

Only a short time ago many battery projects were assessed through a relatively cautious lens because operational experience remained limited.

As engineering knowledge has improved, insurers have become more capable of distinguishing between well-designed installations and those presenting elevated risks. The market is therefore becoming more selective rather than simply more conservative.

That distinction is frequently overlooked. Selective underwriting rewards good engineering. Conservative underwriting discourages investment.

This greater technical scrutiny is

extending throughout the supply chain.

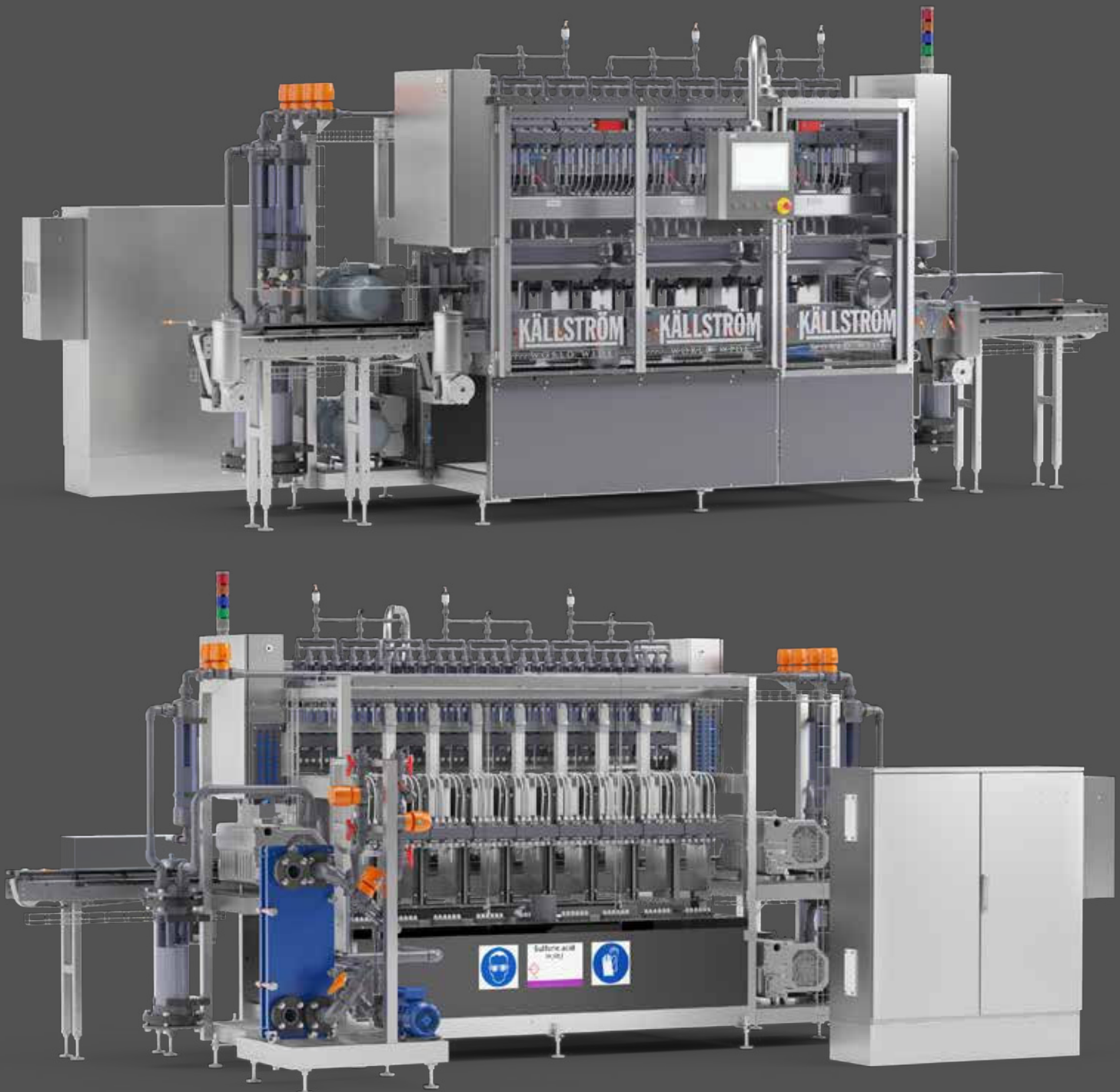
Manufacturers once competed primarily on energy density, price, warranty terms and production capacity. Those factors remain important, but insurers and developers are now examining additional aspects of manufacturing performance that were rarely discussed publicly only a few years ago.

Quality assurance systems have assumed greater importance. Traceability of individual cells and components is receiving increased attention. Manufacturing consistency, factory audits, production testing, warranty reserves and evidence of long-term field performance all contribute to insurer confidence.

Some underwriters now consider whether manufacturers have established processes for investigating failures, analysing returned products and implementing corrective actions across production facilities. Others pay close attention to the transparency with which suppliers share operational information and engineering data.

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SF4-8T syringe is an automatic vacuum filling machine with three filling stations for filling small AGM batteries with a specific volume. The filling is done by vacuum, and the volume is measured by seal-less ceramic syringe pumps. The machine can be supplied with 1–10 filling stations.

These requirements are not intended to replace technical standards such as UL 9540 or UL 9540A. Rather, they complement them by providing reassurance that manufacturing quality remains consistent long after certification has been obtained.

The commercial implications are significant. Insurance is becoming an indirect assessment of manufacturing quality.

Developers selecting between technically similar products increasingly recognise that a supplier with a strong operational reputation may simplify discussions with insurers and lenders alike.

Conversely, repeated quality concerns associated with a particular manufacturer may continue to influence underwriting long after engineering improvements have been introduced.

Insurance is therefore shaping procurement decisions in ways that are not immediately visible.

An informal regulator

The battery industry is frequently described as being shaped by regulation, technological innovation and market competition. Increasingly, however, there is a fourth influence operating alongside those more familiar forces.

Insurance.

Unlike governments, insurers cannot prohibit technologies or mandate engineering standards. Their influence

derives from commercial rather than legislative authority. They determine the terms on which they are prepared to commit capital, and those decisions influence the behaviour of developers, manufacturers and investors.

The mechanism is straightforward. If insurers conclude that a particular engineering approach presents unacceptable risk, they may increase premiums, reduce available capacity or require additional risk mitigation before providing cover. Developers seeking project finance generally respond because lenders expect comprehensive insurance programmes to be in place before funds are released.

Manufacturers respond because equipment that is easier to insure is often easier to sell. Engineering consultancies incorporate those evolving expectations into future project reviews, allowing revised practices to spread throughout the market.

In effect, underwriting decisions can influence engineering standards without any formal regulatory intervention.

This process frequently operates more quickly than legislation. Revising national regulations often requires consultation, technical review and political approval, a process that may take several years.

Insurance markets respond according to commercial experience. Following a significant incident, underwriters

may revise engineering expectations during the next renewal cycle, while brokers and engineering consultants communicate those changes across international markets. Lessons learned from one project can therefore influence underwriting decisions for subsequent projects long before regulatory frameworks are updated.

That does not diminish the importance of technical standards or government oversight. Organisations responsible for developing recognised engineering standards continue to provide the foundation upon which insurers make many of their decisions. Nor should insurance be viewed as a substitute for regulation. Rather, it has become an additional mechanism through which engineering practice evolves.

The distinction is important because it reflects the maturity of the industry itself. Emerging technologies typically depend upon innovators prepared to accept uncertainty.

Mature industries depend upon institutions capable of managing that uncertainty consistently. Battery storage is beginning to make that transition.

The next phase

Much attention continues to focus on manufacturing capacity, battery costs and the deployment of increasingly larger storage systems. Those trends will remain important. However, they represent only one aspect of the industry's development.

The institutional framework surrounding battery storage is also becoming more sophisticated. Independent engineering consultancies have assumed greater prominence. Testing organisations have expanded their influence. Specialist brokers provide technical advice alongside insurance placement. Reinsurers have developed expertise in battery risks.

The battery industry has spent much of the past decade proving that energy storage can be deployed at scale. The next phase of its development will be defined not only by larger projects and lower costs but by the confidence of investors prepared to finance them over the long term.

That confidence will depend upon engineering, operational performance and commercial discipline working together. Insurance has become one of the points at which those three considerations meet, making it an increasingly important, if often overlooked, component of the industry's continued growth. ■

The broker as engineering adviser

The traditional view of an insurance broker as someone who simply obtains quotations no longer reflects the reality of the energy storage market.

Major international brokers now employ engineers, fire specialists, former utility executives and catastrophe analysts whose work often begins long before insurers are formally approached. Their role is to identify issues that may concern underwriters, recommend practical solutions and ensure that projects are presented in a manner that reflects current market expectations.

Increasingly, developers involve brokers during the earliest stages of project design rather than after engineering decisions have been finalised. That allows concerns about container spacing, fire suppression, emergency access or natural catastrophe exposure to be addressed before they

become expensive design changes.

This evolution has altered the relationship between developers and insurers. Instead of viewing insurance as an obstacle appearing late in the development process, experienced companies increasingly treat it as another engineering discipline. The objective is not simply to purchase cover but to build a project that the market regards as insurable from the outset.

Several brokers have observed that early engagement frequently produces commercial benefits extending beyond insurance itself. Engineering improvements requested during underwriting often strengthen lender confidence, reduce financing uncertainty and simplify due diligence. Insurance therefore becomes part of a broader process of project optimisation rather than an isolated financial transaction. ■

Premiums: how insurers calculate what liabilities a project will have

Premiums are among the least understood aspects of battery insurance.

Outside the insurance industry there is often an assumption that premiums are determined primarily by replacement value or the likelihood of fire. In practice, pricing reflects a much broader assessment of project quality.

Battery chemistry remains an important consideration, with many insurers viewing lithium iron phosphate systems more favourably than nickel manganese cobalt because of their different thermal characteristics. Chemistry alone, however, rarely determines the outcome.

Location is equally important. A battery installation situated within a flood plain, exposed to hurricanes or located in areas of increasing wildfire activity presents different challenges from one occupying a comparatively benign environment.

Engineering quality also influences pricing. Thermal management systems, fire suppression, container spacing, gas detection, cybersecurity, emergency planning and operational monitoring all contribute to the insurer's assessment of expected losses.

The experience of the engineering contractor may also be relevant. Developers employing contractors with established records in utility-scale battery projects often benefit from greater insurer confidence than those relying upon organisations with limited operational experience.

This explains why two projects of similar size can attract markedly different premiums.

Insurance reflects risk. Risk reflects engineering. Engineering reflects management.

By the time an underwriter proposes terms, the premium has become a commercial summary of hundreds of technical judgements rather than a simple calculation based upon asset value.

That process reinforces a broader trend emerging across the battery industry. Insurance is no longer simply responding to technological development. It is influencing which technologies, engineering practices and management systems become commercially successful.

The growing influence of insurers extends beyond individual projects. It

is also beginning to shape the way the battery industry develops new technologies, adopts engineering practices and allocates investment. That influence is unlikely to diminish as battery storage becomes a larger component of electricity infrastructure and the technologies used within the sector continue to diversify.

During the next decade, insurers will be asked to assess commercial risks associated with technologies that remain at different stages of maturity.

Other technologies

Lithium iron phosphate has become the dominant chemistry for many stationary storage applications, but sodium-ion batteries are moving steadily towards commercial deployment and several manufacturers are investing heavily in solid-state cells. Flow batteries continue to attract attention in long-duration storage, while second-life electric vehicle batteries are beginning to establish a niche in lower-cost stationary applications.

Each technology offers different technical characteristics, operating profiles and failure modes, requiring insurers to develop new underwriting assumptions as experience accumulates.

This presents a challenge familiar to every industrial sector built upon technological innovation. Underwriters cannot rely entirely on historical claims data when those technologies have relatively short operating histories. Instead, they must combine the evidence that is available with engineering assessments, laboratory testing, operational experience and independent technical advice. Over time, as more projects enter service and performance data accumulate, underwriting becomes increasingly data-driven. Until then, engineering judgement inevitably plays a larger role.

Battery storage is not unique in this respect. Offshore wind experienced a similar period during its commercial expansion, as did the liquefied natural gas sector and, before that, the commercial aviation industry.

In each case, insurers gradually refined their understanding of risk as operating experience expanded. What distinguishes battery storage is the speed with which this process is occurring. Technologies are evolving while deployment is accelerating, leaving

insurers to assess an industry that is changing even as it matures.

For developers, the implications are increasingly commercial rather than merely technical. Better engineering does more than reduce the probability of failure; it improves the quality of information available to insurers and lenders.

Detailed operational data, transparent maintenance records, validated fire testing and well-documented quality assurance processes reduce uncertainty, making projects easier to assess and, ultimately, easier to finance. Several brokers note that insurers are placing greater value on demonstrable operational discipline than they did only a few years ago, reflecting a market that is becoming more sophisticated in its assessment of battery risks.

The relationship is self-reinforcing. Better engineering generates stronger operational performance. Stronger performance provides more reliable data. Improved data increases insurer confidence, encouraging additional underwriting capacity and more competitive pricing. Lower financing costs, in turn, support further investment in battery deployment.

The cost of capital

The opposite dynamic can also occur. A succession of significant losses may reduce underwriting appetite, increase premiums and restrict available capacity until confidence is restored through improved engineering or operational experience.

Understanding this relationship is becoming increasingly important because insurance influences far more than the cost of a policy. It affects the overall cost of capital.

Infrastructure investors evaluate projects according to risk-adjusted returns. Insurance forms part of that calculation because it influences the resilience of future cash flows. A project that secures comprehensive insurance on competitive terms is generally perceived as presenting fewer uncertainties than one requiring extensive exclusions, high deductibles or limited underwriting participation. Although insurance is rarely the deciding factor in an investment decision, it increasingly contributes to the broader assessment of project quality ■

Russell Woolley from law firm Carpmaels & Ransford offers practical insights for battery innovators navigating a patent-dense landscape and explains why patent strategy is a competitive necessity.

Why creating an IP strategy is important for the battery sector



In the battery sector, intellectual property is not just a legal consideration. It is a core element of competitive strategy. Put simply, if you are not taking patents seriously, your competitors almost certainly are. In a field as patent-dense and fast-moving as battery technology, that can quickly leave you at a disadvantage.

A brief historical perspective illustrates why. One of the foundational inventions in lithium-ion battery technology, the lithium cobalt oxide cathode, emerged from the work of John Goodenough's team at Oxford in the late 1970s.

That invention was protected by patents in Europe, the US, and Japan (incidentally, at the time, China was not viewed as a key filing territory, which would be unthinkable today and highlights how the battery landscape has evolved).

The patent was filed in 1980, yet commercialisation of lithium-ion batteries did not occur until about a decade later. This delay arose because an enabling anode material had yet to be identified, a breakthrough ultimately made in Japan. Despite this gap, Goodenough's original patent remained in force and became highly valuable once the technology was commercialised.

This example demonstrates a central feature of the patent system. Early protection of a foundational idea can deliver long-term commercial

leverage, even if the route to market is indirect or delayed.

Today, the scale is vastly different.

The relatively sparse patent landscape of the 1980s has evolved into one characterised by many thousands of active patents.

A recent example is Tulip Energy, a non-practising entity that has acquired around 5,000 battery patents from LG and Panasonic. These patents are now monetised through licensing and enforcement, including actions against companies that do not take licences.

Against this backdrop, filing patent applications should be seen as fundamental. Whether you are developing next-generation chemistries or incremental improvements, patents help you secure a position in a crowded and contested field. If you do not claim that space, others will.

There is also a defensive aspect.

The patent system operates on a first-to-file basis. The first party to file a patent application gains priority, regardless of who conceived the invention first. Once your application is published, typically after 18 months, it becomes prior art which can make it harder for competitors to patent similar developments.

In this way, your filings do not just create assets; they also shape the patent landscape and help protect your freedom to operate.

Finally, investors increasingly expect to see a coherent IP strategy. In funding rounds, a strong patent position is often viewed as evidence of technical differentiation and barriers to entry. In many cases, it is a prerequisite for serious investment.

Patent value

The value of a patent in the battery sector varies significantly depending on the nature and maturity of the technology it protects.

For emerging technologies, a relatively small number of patents can be extraordinarily valuable. A single, well-positioned patent may protect a foundational concept that underpins an entire new class of batteries or materials. Goodenough's lithium cobalt oxide patent is a clear example. One patent protected the now ubiquitous cathode chemistry.

In contrast, in more mature areas of technology, foundational patents may have expired, and innovation proceeds through incremental improvements, typically protected by many narrowly scoped patents. Individually, such patents may have limited value, but collectively they can form a powerful portfolio.

The Tulip Energy portfolio illustrates this second category. While any individual patent within that portfolio may be relatively narrow, the aggregation of thousands creates significant leverage in licensing and enforcement.

This leads to a two-tier value structure:

High-value, foundational patents, associated with emerging battery technologies, which can confer broad competitive advantage

One takeaway is that the patent process is slow. It is not unusual for five years or more to elapse before a patent is granted. However, this timeline can be advantageous.

Lower-value, incremental patents, more common in mature technologies, which derive strength from volume and collective coverage

A further point that is particularly relevant in the battery sector is the complexity of the supply chain. From active materials through to electrode formulations, cell design, module integration and pack architecture, there are opportunities for patent protection at multiple levels.

The value of a patent therefore depends not only on the invention itself, but also on where it sits within that broader supply chain.

For example, a materials innovation may be valuable because it can be adopted across different cell formats and manufacturers. Companies should therefore consider where their innovation sits, and how broadly it can be deployed. This is where thoughtful patent drafting becomes important. It is often possible to design a portfolio that protects not only the immediate point of innovation, but also adjacent aspects of the supply chain.

For companies in the battery sector, the implication is clear. Those working at the cutting edge should focus on securing protection around foundational innovations. Those operating in more established areas should build portfolios that reflect their position in the supply chain and provide meaningful negotiating power.

So what to know: how patent protection is secured and used strategically

Although the patent system can seem complex, its basic structure is relatively consistent across jurisdictions.

Protection begins with a first filing, referred to as a priority application. Within 12 months, this is followed by a further filing, commonly an international ('PCT') application. Approximately 18 months later, the applicant selects countries or regions in which to pursue protection through national phase applications. These applications are then examined over several years before grant or refusal.

One takeaway is that the patent process is slow. It is not unusual for five years or more to elapse before a patent is granted. However, this timeline can be advantageous. It allows costs to be deferred and provides time to assess commercial viability before committing to jurisdictions.

That said, speed can matter. Companies may wish to secure granted patents quickly to support funding

Common patent pitfalls and how to avoid them

There are several recurring pitfalls that can undermine otherwise strong innovation programmes.

One of the most common is a failure to generate the comparative data needed to support patentability. To obtain a patent, it is generally necessary to demonstrate that an invention involves an inventive step over existing technology.

In the battery field, this often requires experimental evidence showing improved performance. Generating this evidence typically requires benchmarking against prior art systems. However, R&D teams are naturally focused on advancing their own work and may be reluctant to devote time to reproducing earlier technologies. From a patent perspective, this can be a costly omission. Without robust comparative data, it becomes much harder to build a convincing case for patentability.

A second pitfall is failing to consider

freedom to operate early enough. The volume of patent activity in the battery sector means that new applications are published constantly, some of which may pose risks if granted.

Establishing a patent monitoring system helps spot potential issues early. Where problematic applications are identified, it is often possible to act before grant, for example by submitting observations to the patent office. These steps can often be taken without revealing your identity, allowing you to defend your position without alerting competitors.

Finally, companies should recognise that not all granted patents are robust.

Weak patents can enter the system and may create uncertainty or barriers to entry. A proactive strategy that combines monitoring, analysis and, where appropriate, challenge, can help mitigate these risks. ■

Strategically, it is rarely optimal to adopt a “file everything” approach. While it may be tempting to seek protection for all outputs from R&D, this can create significant budget pressure as deferred costs mature.

discussions, deter competitors, or enable licensing. Mechanisms exist to accelerate examination, particularly for technologies aligned with energy transition goals.

Engaging with a patent attorney at an early stage can help identify and use these options effectively.

Strategically, it is rarely optimal to adopt a “file everything” approach. While it may be tempting to seek protection for all outputs from R&D, this can create significant budget pressure as deferred costs mature. Poorly drafted applications can also lead to prolonged and costly examination. A more effective approach is often to focus on a smaller number of high-quality filings that capture the core inventive contributions.

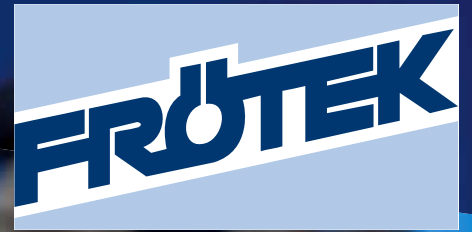
Well-prepared applications, supported by a clear understanding of the technology and relevant prior art, are more likely to result in robust and enforceable patents.

It is also important to recognise that patents are not always the best option. In some cases, trade secrets may offer more appropriate protection,

particularly where innovations are difficult to reverse-engineer. Process conditions, material formulations or manufacturing know-how may be better protected through confidentiality than disclosure. A sophisticated strategy will combine patents and trade secrets. ■



Russell Woolley is a partner at Carpmaels & Ransford, a European intellectual property law firm, where he advises battery innovators on global patent strategy across materials, manufacturing, and downstream applications.



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The latest modelling for asset allocation in battery storage projects has a new iteration: V8. This develops the idea of a technology transition cliff — a rapid market shift — to embrace the importance of non-disruptive events as well as disruptive ones. Sang Bong Song outlines the thinking.



Capital allocation for next-gen energy storage

It was the last item on the agenda, and the room had thinned out. A capex committee at a mid-sized European industrial group — the kind that owns both a small high-nickel cathode pilot line and a portfolio of telecom backup contracts in Africa — was working through its 2027 plan.

Two proposals sat side by side on the projector.

The first was a roughly \$500 million expansion of a high-nickel NMC line tied to a multi-year automotive supply contract, complete with the usual gated qualification milestones.

The second was a similarly sized program to refresh thousands of lead-acid telecom backup strings across a regulated network, with annual recompetition and a gradient of incremental AGM (absorbent glass mat) and lead-carbon upgrades behind it.

The finance director put it plainly: “We are running the same Gantt chart on both. Are we sure that’s right?”

That question — whether the same

financial planning architecture applies to a cliff-shaped chemistry transition and a gradient-shaped retrofit — is one a new piece of public-disclosure analysis lets us answer more honestly than before.

The asymmetry of published findings

Industry analysis has a publication-bias problem. Reports detail the so-called “cliffs” they find — the point where, the inflection points they identify and the transitions they call — but very rarely publish the chemistries where their model came up empty.

That is convenient for headlines but corrosive for capital allocation, because the negative result — the regime where no cliff can be identified — is exactly the information a finance committee needs to choose between a step-change playbook and an incremental ladder.

The independent IDP V8 framework, released on Zenodo on May 21, 2026, is one of the first public-disclosure tools to put negative findings on equal footing with positive ones.

In one sentence: V8 supplies a verdict on whether a technology trajectory is cliff-shaped, and it

The investment committees that will look disciplined in 2030 are the ones who, in 2026, separated their cliff-shaped capex from their gradient-shaped capex on the record — not the ones who ran a single Gantt chart across both and discovered the difference the hard way.

reports as a first-class output the trajectories where no cliff can be identified — including memory semiconductors, the Bondalti chlor-alkali membrane series, and several perovskite photovoltaic trajectories.

That four-tier rubric (S/A/B/C/D), with Tier D explicitly defined as “framework-boundary negative findings,” is the V8 contribution this piece is built around.

Not every battery transition is a cliff

V8 finds clean cliff signatures in three battery families. NMC cell-level specific energy is a Tier A cliff with the framework’s discrete-step verdict pinned at the upper bound, consistent with the qualification-gate behaviour the automotive supply chain has been planning around for several years. LFP cell-level specific energy is also a Tier A cliff, with a cliff location estimated around 2021 and a wide confidence band.

Solid-state battery (SSB) trajectories sit in the framework’s “compatible architecture, awaiting mass-production sample” position — cliff-shape strongly suggested, full Tier A activation pending real production data.

Three further battery regimes that any senior executive in this readership knows well share the structural features V8 associates with Tier D clusters, even though V8 has not yet fit them directly.

For vanadium redox flow specifically, V8’s framework-boundary verdict on the chemistry side is mirrored on the capital side by a structural problem that capex committees know well: Western project finance time horizons do not stretch to where redox flow scale-up curves bend, and the only project finance that does — Chinese state-anchored long-duration storage finance — sits inside a procurement architecture that most Western capex committees cannot reach.

• **Lead-acid stationary BESS.** This is a mature, gradient-improvement regime. The global stationary lead-acid storage market sat at \$9.4 billion in 2025, with EnerSys, Exide, East Penn, C&D Technologies, GS Yuasa, Narada and Crown Battery the entrenched players.

The technology roadmap is incremental: thin-plate pure lead, carbon-enhanced AGM, lead-carbon hybrid, bipolar lead-acid. No single step-change qualification gate organises the procurement cycle.

• **Redox flow battery scale-up.** This is configuration-driven rather than chemistry-driven. Rongke Power has now commissioned the world’s first GWh-scale vanadium flow project at Jimusaer (200MW/1,000MWh) alongside its 175MW/700MWh Xinhua Power Generation Wushi system, and Invinity has won UK approval for a 20.7MWh deployment.

IDTechEx forecasts the redox flow battery market reaching \$9.2

billion by 2036 at a 27% CAGR. The bottlenecks are pump architecture, membrane cost, electrolyte hedging and tank geometry — variables that scale continuously, not via a discrete chemistry cliff.

Sodium-ion entry-tier commercialization. This is still in the “insufficient mass-production sample” zone V8 would today flag as Tier D for identifiability reasons. CATL’s Naxtra

Same dollar amount. Different decision rule. V8’s Tier-D-as-output structure is what lets a committee tell them apart on the record rather than after the fact.

Three actions for senior battery industry decision-makers

One — tag every active capex line as cliff-regime or gradient-regime, and budget the planning cycle accordingly.

Where V8 (or a comparable public-disclosure cliff test) returns a Tier A verdict, run a step-gate Gantt with multi-year qualification windows.

Where it returns Tier D or sits in structurally Tier-D-shaped territory, compress the planning cycle to annual or semi-annual reviews.

Quantitative effect: cliff-regime programs gain six to 12 months of advance positioning around qualification windows; gradient-regime programs shave one to two quarters off internal scenario-planning cycles by dropping unwarranted multi-year locks.

Qualitative effect: ends the failure mode where a single Gantt chart is run across structurally different capex lines.

Two — reallocate roughly 10%–20% of the screening-stage capex pool from “single play-book” to “tier-aware” assessment.

A program manager weighing an NMC expansion against a lead-acid retrofit, a vanadium flow scale-up or a sodium-ion BESS pilot should be required to attach a regime tag — cliff or gradient — to each proposal, with a one-page V8-style rationale.

Quantitative effect: the IRR delta between correctly-classified and mis-classified projects in 2024–2026

vintages is typically 200–400 basis points; the due-diligence cost of adding a tier tag per target is trivial by comparison.

Qualitative effect: lifts the screening-stage signal-to-noise ratio without lengthening the cycle.

Three — require negative-finding disclosure in supplier and partner technology roadmaps.

This is where a vendor claims a cliff that V8-style analysis cannot identify, treat that as a yellow flag — not because the vendor is wrong, but because the underlying disclosed data does not yet support the claim.

Batteries International readers commissioning RFPs for stationary BESS, flow systems, sodium-ion pilots and bipolar lead-acid can specify “Tier D-equivalent honest reporting” as a procurement requirement at near-zero cost.

Quantitative effect: no upfront cost; reduces post-award rework where vendor claims fail to materialize.

Qualitative effect: builds counter-pressure against the publication-bias asymmetry that currently favours over-confident vendor narratives.

The investment committees that will look disciplined in 2030 are the ones who, in 2026, separated their cliff-shaped capex from their gradient-shaped capex on the record — not the ones who ran a single Gantt chart across both and discovered the difference the hard way.

How V8 was built — and what the tier A–D rubric does

V8 is the eighth iteration of a framework I have been developing since 2024 for tracking industrial defectivity and yield trajectories during mass-production scale-up.

The early versions, V5 and V6, used a two-layer reduced-form model — a smooth saturation kernel layered with an identifiable cliff transition — fitted to a single industry at a time, typically batteries.

V6 added real-data validation against the published battery technology census across NMC, LFP, and solid-state.

V7 extended the model across domains and added the structural-identifiability tests that are now standard in the framework.

V8, published May 21, 2026 on Zenodo (under the Creative Commons Attribution 4.0 International licence, fits the same six-parameter cliff-detection model to 13 mass-production process clus-

ters — 19 sub-cluster fits in total — spanning batteries, semiconductors (EUV node transitions), and biopharmaceuticals (FDA-approved monoclonal antibody fill-finish).

The same statistical machinery returns identifiable cliffs in all three regimes. V8 also introduces the Tier A–D rubric, which reports the diagnostic outcome at each cluster:

Tier S — strongest cliff evidence. Pharmaceutical monoclonal antibody fill-finish is the only Tier S cluster in V8.

Tier A — cliff statistically identified. Battery NMC, LFP, and solid-state.

Tier B — cliff moderately identified. Semiconductor EUV node transitions.

Tier C — cliff weakly suggested, more data needed before a structural verdict.

Tier D — no cliff identifiable at present sample size. Mature lead-

acid, emerging sodium-ion, iron-air, vanadium redox flow, zinc-bromide, nickel-hydrogen.

Reported as a first-class output, not a model failure.

The point of separating Tier D from the others is editorial as much as statistical. An emerging chemistry whose trajectory is not yet structurally legible should not be evaluated on the same matrix as a Tier A chemistry whose cliff position is statistically pinned.

They warrant different capex commitment structures, different milestone gates, and different hedging discipline. Treating them on the same matrix is the single most common capex-evaluation error in the battery industry.

V8 is open-access. The full validation table, all 12 statistical tests, and reproducible code are archived at doi.org/10.5281/zenodo.20321477.

is moving to GWh-scale industrialization in 2026 at up to 175Wh/kg, with the Changan Nevo A06 — the world's first mass-production passenger vehicle equipped with sodium-ion batteries — set to reach the market by mid-2026, and the first 300+ Ah sodium-ion BESS cells coming off Envision's line in March 2026.

The chemistry will likely fit a cliff in three or four years but today there are not enough disclosed data points to identify one.

For a Batteries International reader, the implication is direct: these three regimes need a planning architecture that looks nothing like the NMC qualification-gate playbook, and pretending otherwise is the failure mode V8's Tier D output is built to surface.

The discrimination matters for capital allocation

A model that finds cliffs everywhere is suspect. A model that finds cliffs in NMC and LFP, suggests one in SSB, and explicitly returns “no identifiable cliff” in memory semiconductors and

the Bondalti chlor-alkali membrane series is doing real discrimination. That discrimination is what makes the verdict investible.

The 2027 capex committee in the opening scene was facing exactly this choice. A \$500 million high-nickel NMC expansion lives in cliff territory: discrete qualification windows, OEM nomination cycles tied to vehicle platforms, EU Battery Regulation deadlines that hard-gate market access (carbon-footprint declarations for industrial batteries above 2 kWh from February 18, 2026, digital battery passports from February 18, 2027), and procurement contracts that bake in three-to-five-year exclusivity.

The right planning architecture is step-gate, multi-year, and locked.

A \$500 million lead-acid telecom refresh lives in gradient territory: annual recompetition, incremental AGM and lead-carbon upgrades, replacement cycles every 8–10 years across a deployed base, and a supplier set that competes on service network and recycling logistics rather than discrete chemistry cliffs.

The right planning architecture is rolling, scenario-based, and recompute-friendly.

Same dollar amount. Different decision rule. V8's Tier-D-as-output structure is what lets a committee tell them apart on the record rather than after the fact. ■



Sang Bong Song is principal analyst at Song Industry Research, Seoul. He authored the open-access IDP V8 framework (Zenodo, 2026); earlier work appeared in SemiWiki and Battery Power Online. sang-bong908@gmail.com

V8 supplies a verdict on whether a technology trajectory is cliff-shaped, and it reports as a first-class output the trajectories where no cliff can be identified



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Bidirectional charging is coming of age as V2G readies move from trial technology to vital grid asset

The latest signal that vehicle-to-grid is moving out of the demonstration phase came on June 24, when Valeo and Nissan signed a contract to commercialise Valeo's bidirectional charging stations in Europe, supporting Nissan's V2G roadmap beginning in the UK.

Under the deal, Valeo will provide two types of charging equipment: a smart unidirectional, or V1G, AC charging station compliant with the UK's EV smart charging point standard, and a bidirectional AC charging station compatible with V2G. The companies aim to expand their presence in the EV market through the partnership.

V1G charging allows charging to be managed in response to grid signals and electricity prices. V2G technology enables power stored in an EV battery to be sent back to the grid when demand is high, helping reduce energy costs, balance electricity systems and broaden the role of EVs as energy assets.

That deal matters because the market has been waiting for three pieces to arrive together: vehicles designed for bidirectional operation,

certified chargers, and a commercial route for the owner of the battery to be paid.

For years, vehicle-to-grid has been one of those technologies that looked inevitable in system studies but awkward in practice.

The physics was straightforward. An electric vehicle contains a large battery, typically far larger than a household stationary battery, and it spends most of its life parked.

The commercial reality was harder: who controls the battery, who guarantees mobility, who pays for battery wear, and how does the distribution network know that a thousand cars will not export at the wrong time?

That is now changing. The International Energy Agency's 2026 analysis says smart and bidirectional charging can cut charging costs and create revenue streams for EV

owners, while helping reduce peak demand and limit grid investment.

But it also warns that V2G still needs compatible vehicles and chargers, interoperable communications, testing regimes, regulation and incentives.

The most advanced use cases are emerging where vehicle behaviour is predictable. That is why school buses, municipal fleets, depot-based vans, car-sharing fleets and some company cars are the first serious markets. Private passenger cars will follow, but only once the customer proposition is almost invisible: plug in, set a minimum state of charge, and let the optimiser trade the remaining capacity.

In the US, the most credible V2G activity is centred on fleets, especially electric school buses. These vehicles have large batteries, fixed routes and long idle periods, including during summer peaks.

EV batteries are becoming part of the storage stack. They will not replace stationary batteries, but they will compete with them for some flexibility services and complement them in constrained distribution networks.

The World Resources Institute's Electric School Bus Initiative notes that V2G can work under different ownership and utility models, but successful programmes need to be designed for V2G from the start, with clear local grid objectives and robust financial incentives.

Retrofitting V2G on to an electrification project after the buses have been bought, the chargers selected and the interconnection agreement signed is expensive and slow. The charger must be bidirectional.

The vehicle must support the export of the power. The utility must approve the interconnection. The metering has to distinguish import from export. The software must know the transport schedule. The battery warranty has to tolerate cycling for grid services.

The US policy backdrop is improving, though not uniformly. FERC Order 2222 is important because it opens wholesale electricity markets to aggregated distributed energy resources, including electric vehicles and charging equipment.

FERC's own explainer says small distributed resources often need to be bundled by an aggregator to meet market-participation requirements, and that aggregations can be as small as 100kW under the reforms.

That creates a possible route for V2G fleets to sell capacity, energy or ancillary services. But implementation is uneven. FERC notes that each regional grid operator has had to develop its own tariff and systems, and some timelines stretch years into the future. MISO, for example, is working toward phased implementation, with Phase 1 due by June 2027 and Phase 2 by June 2029.

California remains one of the most active US markets, but it also shows the complexity of scaling. PG&E's Vehicle-to-Everything microgrid pilot was granted an extension to June 30, 2026, for Phase I demonstration and data collection, while Phase II was modified into a hybrid support model rather than a simple expansion.

That is a useful reality check. V2G works technically. The question is whether it works administratively, commercially and repeatedly across thousands of sites.

The US market is therefore adopting V2G in layers. The first layer is vehicle-to-home and vehicle-to-building backup, where the value is resilience rather than market revenue.

Ford's F-150 Lightning, GM's bidirectional charging plans and similar systems have familiarised consumers with the idea that an EV is a mobile power source. Reuters reported in March that more than 630,000 EVs in the US were already equipped for bidirectional charging, while manufacturers including GM and Hyundai were moving toward broader bidirectional capability.

The second layer is managed charging, or V1G.

Utilities can delay or accelerate charging to reduce peaks, absorb solar output or avoid local constraints. For many networks, smart charging will deliver most of the near-term value with less complexity than V2G.

The third layer is true V2G. This is where energy flows back from the vehicle to the grid. It is the highest-value but hardest use case. It requires tighter controls, better forecasting and stronger rules on compensation. Battery degradation is not a show-stopper, but it must be priced. A fleet operator will not cycle a \$100,000 bus battery for free.

A European perspective

Internationally, Europe is ahead in commercialising passenger-car V2G. The Netherlands is the most striking example.

In June 2025, Reuters reported that Dutch car-sharing company MyWheels would deploy 500 grid-connectable Renault EVs in Utrecht, using bidirectional chargers from We Drive Solar. The project was described as Europe's largest V2G car-sharing scheme, with a development cost of about €100 million.

The Dutch case is technically important because car-sharing changes the utilisation model. A privately owned car may or may not be plugged in when the grid needs it. A managed shared fleet is easier to aggregate, schedule and monetise. The operator can reserve vehicles for mobility while exposing spare capacity to the energy market.

The UK is also becoming a key test bed. Nissan has said it will launch affordable bidirectional charging on selected EVs from 2026, beginning in the UK and then other European markets. Motability Operations and Nissan announced in March 2026 that they would explore V2G using the British-built Nissan LEAF to help reduce EV running costs for drivers.

That points to a second commercial route: affordability. If V2G can reduce

monthly motoring costs, it becomes easier to sell than if it is presented as an abstract grid service.

The customer does not need to care about frequency response, local congestion or wholesale price arbitrage. The customer needs to know that the car will be ready in the morning and that the energy bill is lower.

Japan has a longer V2G and vehicle-to-home history, largely because resilience has been a major driver since the Fukushima earthquake and tsunami in 2011. Nissan's early LEAF programmes made bidirectional capability visible years before most western markets were ready to commercialise it.

More recently, Reuters reported that Nissan had supplied V2G-enabled LEAF and Ariya models to France and Spain, showing how Japanese OEM experience is being exported into European grid markets.

China is harder to summarise because its V2G direction sits inside a much larger EV, battery and charging

The US policy backdrop is improving, though not uniformly. FERC Order 2222 is important because it opens wholesale electricity markets to aggregated distributed energy resources, including electric vehicles and charging equipment.





Japan has a longer V2G and vehicle-to-home history, largely because resilience has been a major driver since the Fukushima era. Nissan's early LEAF programmes made bidirectional capability visible years before most western markets were ready to commercialise it.

infrastructure strategy. The country has the vehicle scale, the battery manufacturing base and the grid-planning capacity to move quickly if policy requires it. The likely Chinese model is not thousands of individual household export contracts. It is depot, fleet, charging-station and city-level aggregation, tied into broader demand response and renewables integration.

Australia is another logical market because rooftop solar penetration is high and distribution networks are already dealing with midday export and evening peak problems. V2G can, in principle, soak up solar during the day and export during evening demand peaks. But the same barriers apply: standards, network approvals, tariffs and consumer trust.

Technically, the strongest case for V2G is not bulk energy storage. A car battery is not a cheap replacement for a grid-scale LFP battery container sitting at a substation. Its real value is distributed flexibility. It is already connected near load. It can respond quickly. It can reduce local peaks. It can support voltage and frequency. It can provide resilience where stationary storage has not been installed.

The weakness is availability. A

stationary battery is where the grid operator expects it to be. A vehicle is mobile, privately controlled and emotionally important to its owner. That means V2G systems must be conservative. They must protect mobility first. They must avoid deep cycling unless properly compensated. They must forecast not only electricity prices but human behaviour.

The market is therefore moving toward aggregation platforms. Automakers, utilities, charger companies and software firms all want to control the interface between the battery and the grid. This is where the money sits. Hardware margins may compress; orchestration, market access and customer relationship may be more valuable.

V2G works technically but that is not enough. The question is whether it works administratively, commercially and repeatedly across thousands of sites.

The next stage will be defined by standards. ISO 15118, charger interoperability, utility interconnection rules and cybersecurity requirements will decide whether V2G scales or remains a series of bespoke pilots. Madeleine Brolly, a senior associate at BloombergNEF warns that standardisation across manufacturers will be a key challenge for adoption at scale.

The conclusion is that V2G has crossed an important threshold. It is no longer an elegant laboratory idea. It is entering commercial deployment through fleets, car-sharing schemes, school buses and selected passenger-car programmes. But the market should not be overhyped. V2G adoption will be uneven, local and regulation-led.

EV batteries are becoming part of the storage stack. They will not replace stationary batteries, but they will compete with them for some flexibility services and complement them in constrained distribution networks. The winners will be companies that understand both battery electrochemistry and electricity-market rules.

V2G is not simply about putting energy back into the grid. It is about turning transport electrification from a grid burden into a controllable distributed resource.

The latest news from Nissan, Valeo, Dutch car-sharing operators and US school-bus programmes matters. The market is beginning to move from promise to architecture. ■

China plans dumping crackdown as levels of used EV battery level soars

China is set for a crackdown on the illegal disposal of EV batteries as the country braces for a wave of power battery 'retirements' in the sector.

As power batteries from earlier new energy vehicles (NEVs) reach the end of their service life due to capacity degradation, the volume of retired batteries is growing significantly, according to China's Ministry of Industry and Information Technology (MIIT).

Now MIIT is calling for tough new regulations to ensure protection of the environment by stopping dumping and controlling recycling, state media

reported on May 28.

The move is understood to underpin a digital battery passport-style scheme focused on the NEV sector, as reported by *Batteries International* earlier this year.

Unlike the EU battery passport scheme coming into force — which critics say has fundamental reporting difficulties in its cradle to grave approach — the Chinese scheme is less focused on the initial stages of sourcing before the battery is manufactured.

According to the Xinhua news agency, MIIT has demanded strict investigation and punishment of ille-

gal activities, including the unauthorised disposal of retired batteries.

A special MIIT meeting on recycling also called for measures to stamp out manufacturing of substandard products using retired batteries, tackle failures to fulfil information tracing responsibilities, and halting illegal dismantling causing environmental pollution and unlicensed operations.

The number of retired power batteries in China is estimated to exceed one million tonnes annually by 2030, according to MIIT.

Ministry chiefs reportedly highlighted the urgent need to accelerate the estab-

lishment of a sound battery recycling system.

New measures are expected to include the use of digital technologies to better monitor battery flows and ensure all operators involved in the battery industrial chain fulfil their responsibilities.

MIIT also urged deeper collaboration among industry associations, key companies and research institutions to accelerate the development and application of advanced technologies and equipment, explore new business models, and build a solid foundation for high-quality development of the industry. ■

Wärtsilä unit to become part of new energy storage joint venture

Wärtsilä, the Finland-based technology group, is to establish a 50-50 joint venture with German engineering firm RCT Solutions for its global energy storage business.

Wärtsilä confirmed the deal on June 15, saying that new investors may join the joint venture at a later stage, which could reduce the ownership of the initial shareholders.

The new enterprise will include the Wärtsilä Energy Storage business, which is currently reported as a separate segment. The unit has been the smallest segment within Wärtsilä, with about 480 employees globally, net sales of €694 million (\$796 million) and a profitability of 3.3% in 2025.

Wärtsilä said it will transfer net assets representing less than 5% of its total net assets into the joint venture.

RCT Solutions is a German engineering company, founded in 2012, with international expertise in solar and BESS. The company has led the

engineering and establishment of several battery and solar manufacturing facilities worldwide, while one of the RCT companies has supported Wärtsilä Energy Storage as a key supplier for several years.

"This transaction offers an excellent opportunity for the Wärtsilä Energy Storage business to strengthen its competitive-

ness," said Håkan Agnevall, president and CEO of Wärtsilä.

Peter Fath, CEO of RCT Solutions, who will become CEO of the joint venture, said: "By combining Wärtsilä's proven technology, customer base and project expertise with RCT's engineering capabilities, vertical integration knowhow and existing

manufacturing initiative in the US, we are creating a foundation to succeed in the rapidly evolving energy storage market.

"Our focus will be on strengthening competitiveness, accelerating profitable growth, and positioning the joint venture as a leading player in battery energy storage worldwide." ■

CATL, auto giants in sustainable battery consortium

Chinese battery giant CATL and global circular economy charity, the Ellen MacArthur Foundation, are heading up an international consortium backing initiatives for sustainability in battery design and business investment.

CATL and Ellen MacArthur announced on June 29 they had launched two new initiatives together with BMW, Renault, Volvo, Google and Chinese multinational Xiaomi.

The consortium will promote sustainable design guidelines for the entire battery lifecycle, and support measures to accelerate policy,

investment and commercial conditions needed to make circular business models the industry norm.

CATL said common design standards and business models that keep materials in productive use for longer are as important as increased recycling capacity for the future of the battery sector.

By 2040, the global battery recycling market alone is projected to exceed Rmb1.2 trillion (\$177 billion), creating more than 10 million jobs, CATL said. Meanwhile, the International Energy Agency projects demand for battery-critical

minerals will increase five-fold over the same period.

In a related move, at Octopus Energy's Energy Tech Summit in London on June 22, CATL and Octopus Energy announced what they said was Europe's first battery-swapping joint venture, targeting 300,000 electric trucks and 30 hubs across Europe by 2035, with the first UK hubs scheduled to open in 2027.

Octopus Energy Group CEO Greg Jackson said: "By designing batteries to be swapped, optimised, shared and reused thousands of times, we can squeeze every drop of value." ■



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Malaysian firms' LAB collection deal to boost recycling chain

A new lead battery collection scheme has been launched in a bid to strengthen Malaysia's recycling chain.

Battery collection company BateriHub said on July 1 it had signed a memorandum of understanding (MOU) with MNA Metal Resources to boost responsible collection, documentation and recycling of used automotive batteries.

BateriHub, operated by Battery4U and Global Energy Battery, is Malaysia's largest direct-owned automotive battery retailer and licensed by the Department of the Environment (DOE).

The MOU names MNA, a licensed lead-acid battery recycler and smelter, as

the preferred used battery collector — either directly or through transporters appointed by MNA — for scrap batteries collected through BateriHub and Global Energy Battery's operations.

The arrangement is designed to ensure that used batteries are channelled through proper, licensed and documented collection and recycling processes, BateriHub said.

General manager Stanly Ng said the arrangement would ensure used batteries do not "disappear into an unknown chain".

The partnership comes as Malaysia's automotive sector continues to expand. According to the Malaysian Automotive Association, Malaysia recorded

820,752 new vehicle sales in 2025, its second consecutive record year.

While this MoU focuses on used lead-acid automotive batteries, it also comes amid wider national attention on battery waste management, with growing attention on the importance of regulated recycling and disposal of batteries as Malaysia's vehicle ecosystem evolves.

BateriHub customers can hand over old batteries when buying replacements at the firm's branches or during deliveries.

Global Energy Battery, which focuses on battery wholesale, supply and distribution, also collects batteries through its wider network.

Together, BateriHub

and Global Energy Battery have channelled approximately 280,000 used batteries through to formal disposal and recycling over the past three years.

MNA is already licensed by the DOE for its operations including the collection, movement and processing of waste.

Global Energy Battery's COO, Sandy Yap, said: "As a company involved in the supply and distribution of batteries, we recognise that responsibility does not end at the point of sale.

"A sustainable battery industry requires proper collection, proper documentation and proper recycling. This partnership allows us to support that responsibility across our business network." ■

Hong Kong to launch first 'large-scale' EV battery recycling plant

Hong Kong's first large-scale recycling facility for decommissioned EV batteries was formally started production in June.

The government of the Hong Kong Special Administrative Region said on June 3 the new facility is expected to help generate an annual economic added value for the territory of around HK\$66 million (\$8.5 million).

Acting environment and ecology secretary, Diane Wong, said the Tuen Mun EcoPark facility will process waste power batteries into black mass for onward shipment to the Chinese mainland and neighbouring region.

Retired EV batteries that still have a high reusable value will be repurposed into second-life products such as stationary energy storage systems.

There are currently five licensed chemical waste disposal facilities across the

territory that capable of handling retired EV batteries, Wong said.

Between 2023 and 2025, about 130 tonnes of retired lithium EV batteries were preliminarily treated across the five facilities for transport overseas to authorised treatment facilities for recycling.

An updated EV policy roadmap issued by the territory's government last February showed EVs in Hong Kong had increased more than fourfold from around 28,000 in 2021 to around 149,000 by the end of 2025.

It is estimated that the number of electric private cars could surpass 290,000 by 2030 and approach nearly 500,000 by 2035.

According to Wong, the lifespan of EV batteries is generally five to 10 years. She said a rough estimate by the Environmental Protection Department (EPD) indicated the volume

of retired EV batteries over the next five years is projected to increase gradually from around 1,300 tonnes in 2026 to nearly 7,000 tonnes in 2030.

However, Wong said the actual lifespan of each EV battery was affected by various factors, including whether the battery had been repaired, the owner's charging habits and the battery's chemical composition. In addition, as some batteries may be replaced or recycled before reaching their service life, the actual quantity of retired EV batteries may differ from the estimate.

In a related move, Wong said the EPD plans to require suppliers who distribute EV batteries in Hong Kong to register with the department before distribution, and to submit information regarding the batteries, such as battery identification numbers, weight and quantities

distributed, on a regular basis.

The EPD is also consulting the sector on a producer responsibility scheme for EV batteries, including how to improve the traceability mechanism for EV batteries to enhance the effectiveness of battery life-cycle management.

According to a study released by European clean transport campaign group Transport & Environment (T&E) in December 2024, the estimated recovery of 105,000 tonnes of lithium carbonate equivalent, nickel, cobalt and manganese from recycling in Europe by 2030 could enable the production of 1.3 to 2.4 million battery electric cars (or 14% to 25% of the projected battery electric cars sales) — assuming a medium sized electric car with a battery capacity of 74kWh and the average car chemistry mix in that year. ■

China smelters under pressure over sluggish lead battery demand

Some refined lead and alloy smelters in China have cut or halted production as domestic secondary lead smelters face increasing cost pressures, according to analysis published on June 30.

Lead acid battery end use consumption remains sluggish, with weak purchasing demand for lead ingots and lead alloys, according to data published by the Shanghai Metals Market

(SMM) said.

SMM said secondary refined lead production rose slightly by 2.23% month-on-month but dropped sharply by over 31% from the 2026 peak of 282,000 tonnes in January.

The industry's production centre shifted lower continuously in the second quarter and SMM said its weekly operating rate for secondary lead across four provinces hovered in the

range of 28.4%–29.7% throughout the month, staying well below the normal reasonable range for a prolonged period.

SMM warned in June 2025 that secondary lead smelters in China were in “dire straits” following a fall in raw material stocks and operating activities.

The situation comes despite the commissioning of new secondary smelting capacity in the country in

2025, as reported earlier this year by the Lisbon-based International Lead and Zinc Study Group (ILZSG).

ILZSG also said Chinese net imports of lead contained in lead concentrates increased by just over 14% to 1,243kt in 2025, while net imports of refined lead metal amounted to 52kt compared to 126kt in 2024. ■

Exide Technologies hails ‘ambition into action’ sustainability report

Lead and lithium battery producer Exide Technologies has hailed key milestones achieved in emissions reduction and recycling in its newly released sustainability report.

The European battery major unveiled its ESG Report for 2026 on July 20 — just weeks after the company was re-awarded a gold award from global business sustainability rating provider, EcoVadis.

Part of the report showed an increase in the share of recycled or recovered materials used in production from 74% to 77%, plus further investments in renewable energy projects.

The company's automotive division develops and manufactures advanced 12V battery solutions for internal combustion engines, hybrid vehicles and EVs. The portfolio includes advanced lead acid technologies such as EFB, AGM, and Gel, as well as lithium ion batteries supporting applications ranging from cars and commercial vehicles to motorcycles and boats.

Exide has three advanced lead acid recycling facil-

ities in Europe, with valuable raw materials remaining in continuous use, significantly reducing the demand for virgin resources, the firm said.

All of Exide's lead acid battery and recycling plants operate in compliance with legal limits for lead emissions into air and water. While not all facil-

ities are currently subject to regulatory limits for sulfate emissions into water bodies, the company said it recognises the environmental significance of both lead and sulfate emissions.

Energy consumption has increased over the reporting period, which Exide said has been driven by

operational factors including a 2% increase in technical lead output and expanded recycling activities — particularly higher throughput in breaker operations.

Further electrification of selected lead pots in certain plants also led to increased electricity consumption. ■

Gravita consolidates recycling with Kathua plant closure

Gravita India is to close a lead recycling subsidiary in the north of the country on August 1 as part of a group consolidation plan.

The company announced the closure of its Gravita Metal Kathua unit on July 27, saying the same line of business is already underway at the group's Jaipur manufacturing facility.

Kathua, in the northernmost part of India, provides integrated recycling facilities with battery dismantling, smelting and refining operations.

The facility has a total installed capacity of 6,000 tonnes and produces high-quality lead ingots and lead alloys by recycling

lead ore, lead concentrate, and lead battery scrap to meet specific requirements of original equipment manufacturers.

Kathua has also benefited from financial incentives provided by the regional government of Jammu and Kashmir, which Gravita said enables the production of competitive products that exceed industry standards.

However, Jaipur offers greater operational and cost efficiencies, Gravita said in documents filed with the National Stock Exchange of India.

The decision is not expected to have any material impact on the group's

financial position.

Batteries International reported in May 2026 that Gravita had posted adjusted consolidated EBITDA of Rs 452 crore (\$47 million) for the fiscal year ended in March 2026 — aided by a slight growth in lead sales.

The lead recycler reported a 7% increase in sales in the lead segment of its business, amounting to 49,000 tonnes per annum in fiscal 2026.

That came after Gravita announced the overall lead battery recycling capacity of its Mundra plant has increased to more than 145,000 tonnes per annum following an expansion project. ■

Birmingham puts the battery ecosystem under one roof

Battery Cells & Systems Expo returned to Birmingham's NEC in July alongside three complementary exhibitions. The result was a compact but revealing snapshot of the technologies, materials and manufacturing processes increasingly shaping the battery business.

Putting Battery Cells & Systems Expo alongside the Vehicle Electrification Expo, Advanced Materials Show and Advanced Ceramics Show continues to make increasing sense. The boundaries between these industries are becoming harder to define — and the 2026 gathering at Birmingham's NEC demonstrated why.

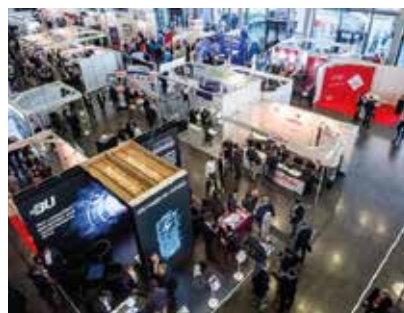
Held on July 8-9, the four co-located exhibitions brought together more than 200 exhibitors, with organisers expecting upwards of 4,000 visitors from industry, research and academia.

For battery industry visitors, the attraction was the breadth of technology on display. Battery Cells & Systems Expo covered considerably more than cells and packs. Battery and power management systems sat alongside manufacturing and automation equipment, testing and measurement, laboratory equipment, thermal management, fire protection and insulation technologies.

Perhaps the greatest strength of the Birmingham event, however, is what lies beyond the battery exhibition itself. A walk into the neighbouring materials and ceramics halls demonstrates how much battery development now depends on advances elsewhere. Coatings, composites, polymers, nanomaterials and high-performance ceramics increasingly have direct applications in batteries, power electronics, thermal management and electric vehicles.

That crossover gave the show a distinctly technical character. This was less about gleaming finished EVs and more about what goes inside them — materials, components, manufacturing processes, testing equipment and the engineering needed to turn promising chemistry into commercially viable products.

The conference programme reinforced the point. Five theatres operated across the four exhibitions, with



discussions ranging from battery design and electrification to materials science and manufacturing. Rockfort Engineering's Angus Lyon discussed rapid battery design and the integration of solid-state technologies, while other sessions examined subjects including thermally conductive polymers.

For the traditional battery industry there was another message. Although much of the exhibition inevitably reflected the continuing expansion of lithium-ion and EV technology, the emphasis was increasingly on the wider battery ecosystem rather than cell chemistry alone.

Safety, testing, manufacturing efficiency, recycling, materials and system integration are common challenges across almost every part of the energy storage industry.

The NEC event remains modest compared with the enormous battery exhibitions staged in China and some of the rapidly expanding shows elsewhere in Europe. That may be part of its attraction. Birmingham offers a manageable, technically focused meeting place where useful conversations can still be held without being overwhelmed by the sheer scale of the exhibition.

Most importantly, the four-show format works. Batteries no longer exist in an industrial silo. Their future will be determined as much by developments in materials, ceramics, electronics and manufacturing as by electrochemistry itself. Birmingham provides a useful window on all of them — and a reminder that the next important advance in batteries may come from well beyond the cell. ■

7th Oslo Battery Days Conference

August 24-25 | Oslo, Norway

The 7th OBD Battery Conference will meet to discuss and provide a platform for technological innovations and business opportunities with the latest updates in that field in Norway and abroad.

Contact

www.oslobatterydays.com
E-mail: post@oslobatterydays.com
Phone: +47 90 73 91 59

RE+ Florida 2026

**August 25 - 26
Tampa, Florida, United States**

RE+ Florida is an in-person regional clean energy conference focused on the Florida renewable energy market. It covers solar, storage and associated clean energy technologies, making it suitable for battery storage suppliers, project developers, installers, investors and renewable energy professionals looking to understand market activity and partnership opportunities in the Sunshine State.

The event gives useful coverage of solar and storage and renewable

energy, making it relevant for storage developers, investors and financiers, technology suppliers and solar and renewable energy professionals.

Contact

Email: customerservice@re-plus.com
Phone: +1 703-738-9460
Website: <https://re-plus.events/florida/>

NET ZERO MEA Solar & Energy Storage Summit

**August 31 - September 1
Dubai, United Arab Emirates**

NET ZERO MEA Solar & Energy Storage Summit is a leadership-focused event for solar, energy storage and renewable energy decision-makers across the Middle East and Africa. The summit targets developers, IPPs, financiers, EPCs, technology providers, manufacturers and policy stakeholders. It is especially relevant for companies interested in utility-scale solar, storage deployment, project finance, supply chains and partnerships in high-growth MENA energy transition markets.

Contact

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<https://netzerosolaramea.metal.com/>



The smarter E South America Intersolar South America – ees South America

August 25 - 27 | Sao Paulo, Brazil

The smarter E South America is Latin America's large alliance of energy industry exhibitions, bringing together Intersolar South America, ees South America, Power2Drive South America and Eletrotec+EM-Power. ees South America, recognized as Latin America's leading event dedicated to batteries and energy storage systems, is hosted at the Expo Center Norte in São Paulo,

Brazil. The conference emphasizes advanced storage solutions that reinforce energy systems with a rising share of renewable resources, while facilitating the integration of prosumers and electric vehicles

Contact

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www.thesmartere.com.br/home

Intersolar & Energy Storage North America Texas 2026

**September 1 - 2
Dallas, Texas, United States**

IESNA Texas is a solar and storage conference for the Texas market. Bringing together developers, EPCs, manufacturers, executives and suppliers working across solar, battery energy storage, EV infrastructure and clean energy manufacturing. Useful for companies targeting the Texas solar-plus-storage market and for organisations seeking partnerships with renewable energy and storage decision-makers.

Contact

Email: sales@iesna.com
Phone: +1 207-842-5621
Website: <https://www.iesna.com/texas/>

Energy Storage Summit Middle East

**September 1 - 3
Dubai, United Arab Emirates**

ESSME is a focused BESS and energy storage conference co-located with Middle East Energy. It is designed for developers, IPPs, investors, manufacturers, EPCs, software providers, consultants and policymakers working in the Middle East storage market. The event focuses on battery deployment, investment, procurement, project economics, policy development and the role of storage in supporting large renewable energy targets across the region.

Contact

Email: sm.energystorage@informa.com
Website: <https://storagemiddleeast.solarenergyevents.com/>

Intersolar Middle East

**September 1 - 3
Dubai, United Arab Emirates**

Intersolar Middle East is held as part of Middle East Energy and focuses on photovoltaics, solar production technologies and energy storage systems. It is relevant for solar developers, equipment manufacturers, battery storage companies, project integrators, EPCs, utilities and investors targeting the MENA solar and storage market. Provides access to regional decision-makers and technology suppliers involved in solar-plus-storage deployment.

Contact

Email: mee.customerservice@informa.com
Phone: +971 4 408 2888
Website: <https://www.intersolar.ae/home>

Middle East Energy

September 1 - 3
Dubai, United Arab Emirates

Middle East Energy is one of the region's largest energy exhibitions and conferences. It is broader than a battery-only event, but includes renewable energy, energy storage, solar, clean power technologies and commercial energy solutions. The event attracts manufacturers, suppliers, project developers, utilities, consultants, government buyers and regional energy professionals, making it useful for companies looking to build relationships in the Middle East, Africa and wider international energy market.

Contact

Email: mee.customerservice@informa.com
Phone: +971 4 408 2888
Website: <https://www.middleeast-energy.com/en/home.html>

Intersolar Mexico 2026

September 1-3
Mexico City, Mexico

Intersolar Mexico 2026 is an international trade fair and conference dedicated to the solar energy sector. Held at the Centro Citibanamex in Mexico City, the event highlights the latest innovations and trends in photovoltaics, solar thermal technologies, and energy storage.

It also provides a vital networking and business hub for manufacturers, distributors, investors, and industry professionals engaged in Mexico's growing renewable energy market and the wider region.

Contact

www.intersolar.mx/home

The Battery Show Indonesia 2026

September 2-5
Jakarta, Indonesia

The second edition of The Battery Show Indonesia will take place alongside the renowned Electric & Power Indonesia and Data Center Asia – Indonesia events, fostering an exciting synergy across the energy and engineering sectors.

Scheduled for September 2–5, the event will cover the full battery industry value chain, from upstream research and development to downstream applications. As part of the

International Congress for Battery Recycling ICBR 2026



September 8-9
Berlin, Germany

ICBR 2026 is the international platform for reviewing the challenges faced by the battery recycling industry on a global basis.

For 31 consecutive years, ICBR has brought together the international community of experts and decision makers of the entire

battery recycling value chain, including battery recyclers and manufacturers, collection organizations, OEMs, policy makers, materials and services providers, and many more.

Contact

Email: info@icm.ch
Phone: +41 62 785 10 00
www.icm.ch

globally recognized Battery Show series, it offers an exceptional platform for the Indonesian energy market to showcase its innovations and opportunities. The Battery Show Indonesia aims to spotlight the entire spectrum of battery technology, delivering valuable insights and business opportunities for stakeholders across the energy sector.

Contact

www.thebatteryshowindonesia.com/
E-mail: budi@pamerindo.com

Battery Tech Europe 2026

September 8-9
Barcelona, Spain

Battery Tech Europe 2026 is a must-attend event for professionals involved in developing new stationary and industrial battery applications, bringing together thousands of experts from high-value battery sectors.

Contact

E-mail: david.reeks@104-media.com
Phone: +44 1283 381 719
<https://batterytechexpo.europa.com/>

Argentina Energy Week Summit & Exhibition

September 8 - 10
Buenos Aires, Argentina

Argentina Energy Week Summit & Exhibition brings together senior energy leaders, project owners, investors, government representatives and suppliers across Argentina's energy sector. It is broader than a renewables-only event but includes renewables, storage, electrification and BESS as named themes. The summit is relevant for companies tracking renewable project development, storage opportunities, energy investment and strategic partnerships in Argentina and the wider Southern Cone market.

Contact

www.netzerocircle.org/event/argentina-energy-week-summit-exhibition





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www.TheSmarterE.in
- **JUNE 8–10, 2027, MUNICH, GERMANY**
www.ees-europe.com
- **AUGUST 24–26, 2027, SÃO PAULO, BRAZIL**
www.ees-southamerica.com

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BATTERY JAPAN [Autumn] - International Rechargeable Battery Expo

September 9 - 11
Chiba / Tokyo area, Japan

The autumn edition of BATTERY JAPAN forms part of Smart Energy Week and focuses on rechargeable battery technologies, materials and production. It is relevant for battery manufacturers, materials suppliers, renewable energy companies, equipment providers and storage developers. The exhibition covers battery components, battery management, manufacturing equipment, testing, recycling and applications linked to clean energy and mobility.

Contact

Email: wsew.jp@rxglobal.com
Phone: +81-3-6739-4119
www.wsew.jp/hub/en-gb/about/bj

K-Battery Show

September 9 - 11
Goyang, South Korea

K-Battery Show is a Korean exhibition focused on secondary battery materials, components and equipment. The show covers cathode and anode materials, separators, electrolytes, battery protection circuits, manufacturing equipment, battery management systems, testing, charging systems and recycling. It is relevant for manufacturers, equipment suppliers, materials companies and buyers working across the battery supply chain.

Contact

Email: ex@eandex.co.kr
Phone: +82-2-551-0102
Website: <https://kbatteryshow.com/en>

RE+ Centroamerica 2026

September 9 - 10
Panama City, Panama

RE+ Centroamerica is an in-person clean energy event for Central America. It focuses on solar, energy storage, green hydrogen, wind and renewable energy business development. The event brings together regional and international companies through an expo hall, educational sessions and networking opportunities, making it useful for storage, solar and renewable energy suppliers targeting Central American markets.

The event gives useful coverage of solar and storage, wind and stor-

age and renewable energy, making it relevant for technology suppliers and solar and renewable energy professionals.

Contact

Email: customerservice@re-plus.com
Phone: +1 703-738-9460
Website: <https://re-plus.events/centroamerica/>

RE+ Midwest 2026

September 9 - 10
Schaumburg, Illinois, United States

RE+ Midwest is a regional renewable energy event for professionals working in solar, energy storage, wind and related clean energy sectors. The event is designed for networking, policy discussion, business development and technology discovery across the Midwest market. It is suitable for battery storage suppliers, renewable developers, installers, equipment providers, investors and organisations exploring solar-plus-storage opportunities.

Contact

Email: customerservice@re-plus.com
Phone: +1 703-738-9460
Website: <https://re-plus.events/midwest/>

Fastmarkets European Battery Raw Materials 2026

September 15 - 17
Budapest, Hungary

A battery raw materials conference covering the supply chain behind Europe's battery build-out. Topics include lithium, graphite, cathode materials, recycling, pricing, OEM procurement, project finance, gigafactories and energy storage market demand. It attracts senior decision-makers from materials, processing, cell manufacturing and end-use sectors.

Contact

Email: conferences@fastmarkets.com
Website: <https://globalevents.fastmarkets.com/european-battery-raw-materials>

World Battery & Energy Storage Industry Expo (WBE)

September 16 - 18
Guangzhou, China

WBE is a large battery and energy storage exhibition in Guangzhou. It covers battery cells and packs, lithium batteries, lead-acid batteries, flow batteries, energy storage systems,



ELBC 2026

September 15-18
Vienna, Austria

ELBC 2026 is the leading conference for lead battery innovation, uniting experts, researchers, companies, and suppliers from around the world. Its technical program highlights the latest advances in electrochemical research and technological developments, spanning applications from energy storage to automotive lead batteries.

The conference's technical programme showcases cutting-edge advances in electrochemical

research and technical improvements, covering key applications from energy storage to automotive lead batteries.

ELBC typically attracts more than 1,000 attendees who are actively engaged in lead battery innovation. The event is organized jointly by the International Lead Association and the Consortium for Battery Innovation.

Contact

E-mail: elbcexpo@ila-lead.org
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www.elbcexpo.org



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battery materials, manufacturing equipment, testing devices, recycling and renewable energy integration. The event is suitable for manufacturers, distributors, buyers, installers, developers and companies involved in solar, storage and broader battery technologies.

Contact

Email: wbelinda@yeah.net
Phone: +86 18565152028
Website: <https://en.battery-expo.com/>

BATTERY KOREA

September 21 | Seoul, South Korea

BATTERY KOREA is a battery materials, components, equipment and recycling conference. It focuses on next-generation battery R&D, market trends, recycling, high-performance battery commercialisation, manufacturing innovation, safety, battery management systems and investment strategy. The event is relevant for battery manufacturers, research organisations, technology suppliers, investors and companies following Korea's battery sector.

Contact

Email: battery@infothe.com
Phone: +82-2-719-6933
www.batterykorea.org/2026/eng/

ACP RECHARGE: Energy Storage Conference 2026

**September 22 - 24
Aurora, Colorado, United States**

ACP RECHARGE is a dedicated energy storage conference from the American Clean Power Association. It features expert-led sessions, poster presentations, business networking and an exhibition focused on the technologies and commercial issues shaping the energy storage industry. It is relevant for BESS, long-duration storage, battery manufacturing, project development, finance, safety and clean energy storage policy.

Contact

Email: conference@cleanpower.org
Phone: +1 202-383-2500
Website: <https://cleanpower.org/recharge/>

Energy Storage Canada Conference 2026

**September 22 - 23
Toronto, Ontario, Canada**

The Energy Storage Canada Conference is Canada's national conference and trade show dedicated to energy storage. It brings together storage developers, utilities, regulators, financiers, manufacturers and technology providers for two days of industry insight, networking and exhibition activity. The event is highly relevant for battery storage, long-duration storage, project finance and Canada-focused storage market development.

Contact

Email: info@energystoragecanada.org
Website: <https://events.canplaninc.ca/esc2026/save-the-date>

Solar & Storage Live UK 2026

**September 22 - 24
Birmingham, United Kingdom**

The UK's largest solar and energy storage trade show, bringing together solar and battery storage professionals, installers, developers, EPCs, suppliers and clean energy buyers. The event includes exhibitors, conference content and networking around solar PV, battery storage, inverters, mounting systems and renewable energy deployment.

Contact

www.terrapinn.com/exhibition/solar-storage-live/index.stm

Future Energy Summit Peru

September 28 | Lima, Peru

Future Energy Summit Peru is part of the Future Energy Summit tour for Latin American energy leaders. It focuses on renewable energy, storage, solar, wind, green hydrogen, distributed generation, financing and utility-scale project development. The summit is suited to senior executives, developers, investors, manufacturers, energy ministries, project financiers and clean energy suppliers looking to understand opportunities and form partnerships in Peru's energy transition market.

Contact

Email: info@futureenergysummit.com
Website: <https://futureenergysummit.com/home/>

Energy Tech Summit Asia

September 29 - 30 | Kuala Lumpur, Malaysia

Energy Tech Summit Asia is a climate and energy innovation event covering energy transition technologies, investment, green infrastructure and climate hardware. It is broader than a battery-only conference, but relevant for renewable energy, storage, energy software, investment and clean technology companies seeking APAC partnerships. It attracts investors, founders, corporates, policymakers and technology leaders.

Contact

Phone: +60175051203
www.asia.energytechsummit.com

SunRise Arabia Clean Energy Conference

**September 30
Riyadh, Saudi Arabia**

SunRise Arabia Clean Energy Conference is an in-person clean energy conference co-organised by pv magazine and Solarabic. It focuses on Saudi Arabia's solar and clean energy market, with discussion of renewable deployment, project development, investment and technology opportunities. It is relevant for solar companies, storage providers, EPCs, investors, manufacturers and policy-focused stakeholders interested in Saudi Arabia's rapidly growing clean energy sector.

Contact

Email: info@pv-magazine.com
Website: <https://shop.pv-magazine.com/pv-magazine-events/sunrise-arabia-clean-energy-conference-2026/>

Future Energy Summit Colombia

October 1 | Bogota, Colombia

Future Energy Summit Colombia is a high-level renewable energy and energy transition summit for the Colombian market. It covers solar, storage, wind, green hydrogen, distributed generation, financing and utility-scale renewable development. The event is relevant for project developers, generators, investors, manufacturers, large energy users, government representatives and technology suppliers seeking networking and market insight across Colombia and the Andean region.

Contact

Email: info@futureenergysummit.com
www.futureenergysummit.com/home

The Battery Show North America 2026



October 12-15 | Detroit, USA

Last year the Battery Show & EV Tech Expo 2025 brought Detroit to life with four days of innovation, exploration, and industry collaboration, celebrating 15 years of growth and progress.

Thousands of engineers, executives, and innovators came together to discover the latest breakthroughs from over 1,300 exhibitors driving the future of electrification.

With engaging conference sessions, exciting product launches, and vibrant networking opportunities, the 2025 event set a new standard for innovation and industry connection.

Each conference day kicks off with a notable keynote address followed by a roundtable panel of top industry leaders discussing the most important market disruptors.

Gain insights from 150+ thought leaders as they discuss the latest developments in battery chemistry, manufacturing scalability, EV integration, sustainability, and beyond.

There are five reasons to attend the conference

Focused conference tracks — gain clarity on critical issues like battery safety, recycling, and policy shifts, with strategies to tackle them head-on.

Keynotes from industry leaders — hear how executives are navigating disruptions in EV adoption, supply chain volatility, and investment uncertainty.

Actionable insights — leave with solutions to address your organization's challenges—whether it's cost reduction, scaling production, or regulatory compliance.

Interactive learning formats — participate in workshops and Q&As to get tailored advice on problems you're facing right now.

Collaborative networking — build relationships with OEMs, suppliers, and policymakers who can help you overcome obstacles and accelerate growth.

Held on day one of the event, six 3-hour workshops explore topics in great depth and breadth, offering a detailed and interactive learning experience on core subject matters in battery and EV tech.

In all there will be 136 hours of education and some 21,000 attendees are expected to visit.

Contact
<https://www.thebatteryshow.com>

Electricity Transformation Canada 2026

October 19 - 21
Toronto, Ontario, Canada

Electricity Transformation Canada is a major Canadian renewable energy event covering wind, solar, energy storage and clean electricity technologies. It brings together energy professionals, project developers, suppliers, policymakers and investors to discuss Canada's clean energy transition.

Contact
Email: info@renewablesassociation.ca
Phone: +1 613-234-8716
www.electricity-transformation.ca

Flow Batteries North America 2026

October 19 - 22
Phoenix, Arizona, United States

Flow Batteries North America is a specialist in-person event focused on flow battery technologies and their role in stationary and long-duration energy storage. It brings together manufacturers, project developers, researchers, investors and end users interested in vanadium, zinc, iron and other flow battery chemistries. The event is highly relevant for companies targeting LDES and non-lithium storage markets.

Contact
Email: info@batteryCouncil.org
Website: <https://batteryCouncil.org/flow-batteries-north-america/>

Solar & Storage Live Cape Town

October 20 - 21
Cape Town, South Africa

Solar & Storage Live Cape Town is a focused solar and battery storage event for South Africa's Western Cape and wider regional market. It covers residential, C&I and utility-scale solar and storage projects, bringing together installers, EPCs, developers, storage providers, technology suppliers, investors and commercial energy users. The event is relevant for companies seeking exposure to South Africa's solar-plus-storage and distributed energy sector.

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Phone: +27 0 10 346 1640 / +971 4440 2500
www.terrapinn.com/exhibition/solar-storage-live-cape-town/index.stm



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WETEX & Dubai Solar Show

October 20 - 22

Dubai, United Arab Emirates

WETEX & Dubai Solar Show is a major sustainability, water, energy, technology and solar exhibition organised by Dubai Electricity and Water Authority. For this directory, its relevance is its solar, renewable energy, green mobility and sustainability technology content. It is useful for solar companies, battery and storage suppliers, clean energy technology providers, public-sector buyers, investors and firms seeking exposure to the UAE and wider Gulf sustainability market.

Contact

Email: contracts@dewa.gov.ae /

payments@wetex.ae

Phone: +971 4 3244444 / +971 4 515 1431

Website: <https://www.wetex.ae/>

Energy Storage India

October 22 - 24

Greater Noida / Delhi NCR, India

Energy Storage India is a focused storage event co-located with Renewable Energy India Expo and The Battery Show India. It is aimed at the Indian energy storage market, including BESS, policy, tenders, finance, deployment and storage technologies. It is relevant for developers, battery suppliers, system integrators, investors, consultants, utilities and clean energy companies active in India.

Contact

Website: [https://storageindia.](https://storageindia.solarenergyevents.com/)

[solarenergyevents.com/](https://storageindia.solarenergyevents.com/)

Renewable Energy India Expo (REI Expo)

October 22 - 24

Greater Noida / Delhi NCR, India

Renewable Energy India Expo is a major Indian clean energy trade fair covering solar, wind, bioenergy, energy storage, green hydrogen and e-mobility. It is relevant for manufacturers, developers, EPCs, distributors, investors, policy-makers and clean energy buyers. Storage is a significant part of the event, making it useful for companies involved in solar-plus-storage, battery systems and renewable project development.

Contact

Email: feedback-india@informa.com

Phone: +91 8591287266

www.renewableenergyindiaexpo.com/

The Battery Show India

October 22 - 24

Greater Noida / Delhi NCR, India

The Battery Show India is an advanced battery and energy storage exhibition focused on India's growing battery ecosystem. It brings together engineers, business leaders, manufacturers, technology suppliers and buyers. The event is relevant for lithium batteries, EV batteries, energy storage systems, raw materials, battery recycling, thermal management, battery manufacturing and industrial supply chains.

Contact

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Website: [https://www.](https://www.thebatteryshowindia.com/)

[thebatteryshowindia.com/](https://www.thebatteryshowindia.com/)

Energy Storage Summit Latin America

October 27 - 28 | Santiago, Chile

Energy Storage Summit Latin America is a dedicated energy storage event for the Latin American market. It brings together governments, IPPs, developers, investors, banks, manufacturers, EPCs, consultants and software providers to discuss storage deployment, policy, finance, hybrid renewable projects and market growth. The summit is especially relevant for companies working in BESS, utility-scale storage, solar-plus-storage and renewable integration across Chile, Brazil, Colombia, Peru and the wider region.

Contact

Email: [sm.energystorage@informa.](mailto:sm.energystorage@informa.com)

[com](mailto:sm.energystorage@informa.com) Website: [https://storagelatam.](https://storagelatam.solarenergyevents.com/)

[solarenergyevents.com/](https://storagelatam.solarenergyevents.com/)



10th International Secondary Lead Conference

October 26-27, 2026

Cinnamon Life at City of Dreams, Colombo, Sri Lanka

The International Secondary Lead Conference returns for its 10th edition this October, bringing the global lead recycling community to Colombo for one of the sector's most important international gatherings.

First held in Macau in 2009, the conference is dedicated to the secondary lead industry, which now accounts for more than 70% of global lead metal production. Delegates will include recyclers, smelters, battery manufacturers, equipment and technology suppliers, traders, technical specialists and policymakers.

The programme will examine the forces reshaping lead recycling,

including developments in secondary smelting and refining, environmental controls, responsible sourcing, sustainability, regulation and changing global supply and demand.

The conference is followed from the afternoon of October 27 by the Lead Training Academy's Learning Lead Course, continuing through October 28. The course will provide practical instruction across the lead value chain, from used lead battery recycling and refining through to health, safety and environmental best practice.

Contact

CW3 Events & Studio

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Nigeria Energy

October 27 - 29 | Lagos, Nigeria

Nigeria Energy is West Africa's leading energy event, covering energy generation, clean power, renewables, electrical infrastructure and commercial energy solutions. It is broader than battery storage alone, but useful for companies working in solar, storage, renewable energy technology, project development and industrial power solutions. The event attracts regional energy professionals, government stakeholders, manufacturers, distributors, developers and investors.

Contact

Email: nigeriaenergy@informa.com
Website: <https://www.nigeria-energy.com/en/home.html>

All Energy Australia

**October 28 - 29
Melbourne, Australia**

All Energy Australia is one of Australia's largest clean energy events and is held in partnership with the Clean Energy Council. It covers solar, storage, wind, clean energy technology, project development, policy and commercial opportunities. It is relevant for renewable developers, installers, battery storage companies, investors, technology suppliers and energy professionals working across the Australian clean energy market.

Contact

Email: info@all-energy.com.au
Phone: 1800 571 960
www.all-energy.com.au/



Battery Recycling Expo 2026 (North America)

**October 28-29
Atlanta, Georgia, USA**

Battery Recycling Expo is North America's premier trade show and conference focused on battery recycling, reuse, and sustainability. This technology-driven event brings together manufacturers, recyclers, material processors, and industry innovators dedicated to advancing the circular battery economy and supporting a sustainable future for electric vehicles, energy storage, and consumer electronics.

Discover cutting-edge recycling technologies, recovery solutions, and circular supply chain strategies that are reshaping the industry. Join thousands of professionals at this free, two-day expo and conference to connect with battery recycling experts, technology leaders, and policymakers driving the future of battery sustainability in North America.

Contact

E-mail: info@trans-worldevents.com
Phone: +1 404 737 8307
<https://criticalmineralsxpona.com/battery-recycling-expo-north-america>

Future Energy Summit Chile

**October 28 - 29
Santiago de Chile, Chile**

Future Energy Summit Chile is part of the Future Energy Summit international tour and focuses on renewable energy opportunities in Chile. Topics include solar, storage, wind,

green hydrogen, distributed generation, financing and utility-scale renewable projects. The audience typically includes developers, generators, investors, manufacturers, policymakers, energy buyers and specialist suppliers interested in Chile's mature renewable and storage market.

Contact

Email: info@futureenergysummit.com
Website: <https://futureenergysummit.com/home/>

Solar Asia Expo / Battery Asia Show

**October 28 - 30
Goyang / Seoul area, South Korea**

Solar Asia Expo and the co-located Battery Asia Show focus on solar energy, battery storage and distributed energy solutions. The event is positioned for solar, ESS and VPP-related businesses in Asia, including manufacturers, project companies, equipment suppliers, installers and renewable energy service providers. It is suitable for companies targeting integrated solar and storage markets in South Korea and nearby Asian markets.

Contact

www.solarasia.co.kr

Bharat Renewable Energy Summit & Expo

November 2 - 5 | New Delhi, India

Bharat Renewable Energy Summit & Expo is a Government of India renewable energy event focused on investment, innovation and clean energy deployment. It includes renewable energy technologies and associated global events, making it relevant for companies interested in solar, green hydrogen, energy storage and clean energy partnerships in India. It is most useful for government, investors, developers, manufacturers and technology providers.

Contact

Website: <https://mnre.gov.in/en/demore/>



Future Energy Summit Brazil

November 3 | Sao Paulo, Brazil

Future Energy Summit Brazil is a renewable energy and energy transition networking summit focused on Brazil's market. It covers solar, storage, wind, green hydrogen, distributed generation, financing and utility-scale project development. The event is relevant for developers, investors, energy generators, manufacturers, public-sector stakeholders and technology providers exploring Brazil's fast-growing renewable and battery storage opportunity.

Contact

Email: info@futureenergysummit.com
www.futureenergysummit.com/home/

Energyyear Mexico

November 4 - 5 | Mexico City, Mexico

Energyyear Mexico is a senior-level renewable energy networking conference for the Mexican market. The Energyyear format is aimed at executives, investors, project developers, manufacturers, public bodies and service providers active in energy transition. It is relevant for solar, wind, storage, financing, utility-scale projects and clean energy partnerships in Mexico, particularly for companies seeking commercial introductions and regional market insight.

Contact

Email: info@energyyear.com
 Phone: +34 923 156 904
www.energyyear.com/en/mexico

Battery Innovation Days 2026

**November 10 - 12
 Stockholm, Sweden**

A European battery research and innovation event covering the battery lifecycle, from research and materials through applications, recycling and sustainability. It brings together research organisations, industry, policymakers and end-users to discuss European battery innovation priorities and market development.

Contact

Email: info@batteryinnovationdays.eu
 Website: <https://www.accelevents.com/e/battery-innovation-days-2026>

Powerelec Kenya

**November 10 - 12
 Nairobi, Kenya**

Powerelec Kenya is a solar, renewable energy, energy storage, power, EV and electrical exhibition for East Africa. It is relevant for battery and storage companies, solar suppliers, EPC contractors, project developers, installers, manufacturers, government bodies and investors. The event positions itself as a platform for clean energy and electrical technology providers looking to develop partnerships and distribution opportunities in Kenya and the wider East African market.

Contact

Email: info@powereleckenya.com
 Phone: +971 50 704 8024
 Website: <https://powereleckenya.com/>

Batteries Event 2026

**November 16 - 18
 Lyon, France**

An international battery conference and exhibition covering the battery value chain, including battery production, materials, recycling, second-life uses, innovation and energy storage systems.

It brings together industrial leaders, researchers, manufacturers, suppliers and decision-makers from across the battery sector.

Contact

Email: contact@batteriesevent.com
 Phone: +33 06 80 62 37 69
 Website: <https://batteriesevent.com/>

RE+ 2026

**November 16 - 19
 Las Vegas, Nevada, United States**

RE+ is North America's largest clean energy event, representing solar, energy storage, hydrogen, wind, microgrids and EV infrastructure. It combines a major exhibition with conference education and business networking.

The event is useful for battery energy storage suppliers, renewable energy developers, investors, installers, manufacturers and companies working in solar-plus-storage and broader renewable energy markets.

Contact

Email: customerservice@re-plus.com
 Phone: +1 703-738-9460
 Website: www.re-plus.com





BATTERY JAPAN - OSAKA International Rechargeable Battery Expo

November 18 - 20 | Osaka, Japan

BATTERY JAPAN Osaka is part of Smart Energy Week and focuses on rechargeable batteries, battery materials, manufacturing equipment, components, testing systems and recycling. It is relevant for manufacturers, energy storage companies, materials suppliers, clean energy firms and technical buyers looking for battery technologies connected to renewable energy and electric mobility.

Contact

Email: wsew.jp@rxglobal.com
Phone: +81-3-6739-4119
www.wsew.jp/hub/en-gb/about/bj.html

Solar & Storage Live Riyadh

**November 23 - 25
Riyadh, Saudi Arabia**

Solar & Storage Live Riyadh is Saudi Arabia's major exhibition for solar, storage and energy technologies. It focuses on residential, C&I and utility-scale solar and storage projects, with an exhibition and conference aimed at decision-makers from utilities, industry, finance and government. The event is useful for battery storage suppliers, solar companies, EPCs, manufacturers, integrators and investors targeting Saudi Arabia's Vision 2030 clean energy market.

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Phone: +971 4440 2500
www.terrapinn.com/exhibition/solar-storage-live-riyadh/index.stm

Future Battery Forum 2026

**November 24 - 25
Berlin, Germany**

A leading European battery technology and energy storage forum focused on the battery value chain, including manufacturing, supply chain, sustainability, recycling, innovation, gigafactories and future battery markets. It brings together decision-makers from industry, policy, research and technology companies.

Contact

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Phone: +49 0511 473147-90
Website: <https://en.futurebattery.eu/>

The Battery Symposium in Japan

**November 24 - 26
Yokohama, Japan**

The Battery Symposium in Japan is an academic and technical battery conference organised by the Committee of Battery Technology of the Electrochemical Society of Japan. It focuses on battery science, materials, electrochemistry, performance, safety and applications. It is most relevant for researchers, engineers, battery manufacturers, materials specialists and organisations tracking advanced battery research in Japan.

Contact

www.67denchi.com

SUSTAIN 2026 - Sustainable Energy and Industry Conference

**November 29 - December 2
Dhahran, Saudi Arabia**

SUSTAIN 2026 is a clean energy

and sustainable industry conference hosted by KFUPM. It covers renewable energy technologies, solar, wind, energy storage, fuel cells, microgrids, power electronics, hydrogen, industrial electrification and sustainable manufacturing. The event is useful for researchers, engineers, technology providers, policymakers, investors and companies interested in Saudi Arabia's clean energy innovation ecosystem.

Contact

Email: KIKX.Logistics@kfupm.edu.sa
Website: <https://sarece.com/en>

Advanced Automotive Battery Conference North America 2026

**December 7 - 10
San Diego, California, USA**

AABC North America is a technical and business conference for advanced battery technologies. Although it is strongly connected to vehicle electrification, the programme includes battery chemistry, large-scale energy storage, recycling, battery manufacturing, materials and AI for energy storage. It is relevant for battery scientists, OEMs, cell manufacturers, materials companies, pack integrators and stationary storage innovators.

Contact

Email: ce@cambridgeenergetech.com
Phone: +1 781-972-5400
www.advancedautobat.com/us

Battery Asset Management Summit Europe

December 2026 | Rome, Italy

The second edition of the Battery Asset Management Summit Europe was a remarkable success, receiving an outstanding response from the community. Europe experienced unprecedented growth in energy storage last year, installing a record 12GW, with Battery Energy Storage Systems (BESS) at the forefront of this expansion.

The 2025 Summit arrived at a pivotal moment for the industry. Building on the momentum of previous years, it focused on the evolving challenges faced by developers, operators, and investors in managing operational assets across the continent.

Contact

<https://batteryeurope.solarenergyevents.com/>
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