Batteries International
Issue 138 Winter 2025/2026

March of the lemmings

Battery passport compliance as cliff edge comes closer

Price assault on Western battery industry continues

Hawaii H_2O: the ocean's answer to battery waste

John Pierson: battery hero for a generation gone by

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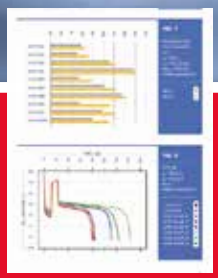
INDUSTRY NEWS

Independent GravityGuard® Testing Reveals Improved CCA & PSoC Cycling

Hammond has released a comprehensive whitepaper detailing exciting findings of new benefits of the anti-stratification additive GravityGuard.® New research shows that the BCI Innovation Award winning product also offers significant serendipitous improvements that may provide additional value to battery manufacturers and their products. Specifically, the results show GravityGuard® used in the PAM and NAM can improve CCA performance, 2C Capacity, and extend PSoC Cycle life. The paper presents notes on evaluation methods, specific comparative data, and more than a dozen charts and graphs with detailed analysis of a wide variety of test results. A PDF is available online. Just snap the QR code above to go to the publication download page.



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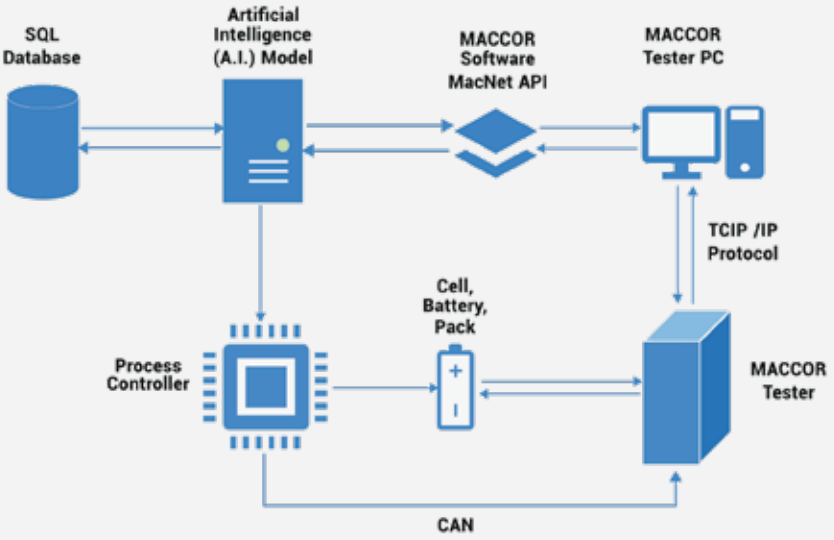

A Smarter Way to Test

As battery technology becomes more sophisticated, testing must evolve too. Hardware-in-the-Loop (HiL) testing connects real battery hardware to a simulated digital twin—allowing engineers to evaluate both hardware and software under true-to-life conditions, without the cost or risk of field trials.

How It Works

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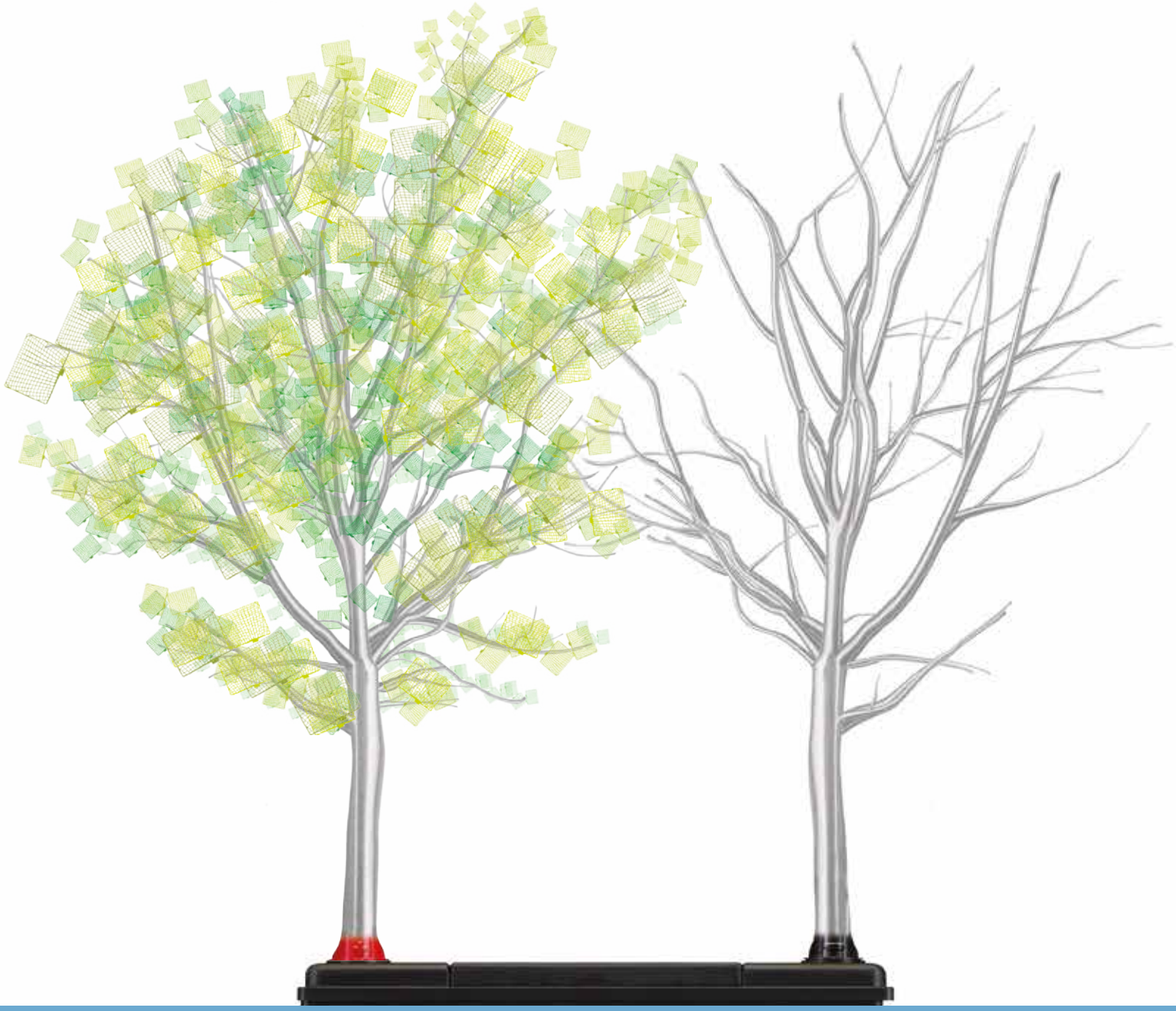

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Europe: not waving but drowning...

There's a proverb that all good things come in threes. But if we're talking about the current economic climate in Europe right now, I would strongly beg to differ.

In Germany, three out of four billionaires inherited their fortunes. In the UK, families with children haven't seen their incomes rise for 20 years, while pensioners' incomes have kept on growing. In France, the elderly now enjoy higher incomes than the working-age population, and that's a first in world history.

That's three big economies all inadvertently telling us the same concerning story. That 21st century Europe is a continent full of inequalities, unrivalled bureaucracy and with a battery industry starved by funding, regulation and innovation. A region full of promising start-ups all, seemingly, on a road to nowhere.

It's a woeful situation that no one 40 years ago could have envisaged. In the 1980s three battery manufacturers dominated the landscape: Johnson Controls, Exide and Chloride.

Yes, there was Varta, Tudor, Lucas, Century and others that were gradually assimilated or split up. But the top three were huge international players and kings of the lead acid battery.

Nowadays, European firms are bit players in the energy storage show. A few stand out — think Hoppecke or Sunlight — but although they are international, they're still standing in the wings globally.

Conversely, in the US and China, the commanding heights of the economy are in technology and industry, AI, electric cars, solar panels and batteries. Here is where the future is being shaped.

In fact, all the American giants, Alphabet, Amazon, Apple Microsoft, NVIDIA, are individually worth more than the entire German or French stock market. By contrast, Europe's top companies are dominated by big fashion. Dior, Louis Vuitton, L'Oreal, we've become a continent of handbags instead of hardware.

By the same token, look at the emergence of two battery giants from China — CATL and BYD. Dynamic. Innovative. Prepared to invest in new chemistries. New technologies too.

So where are their equivalents in Europe's battery world?

The fact is that Europe has become excellent at regulating itself. China is the world's industrial powerhouse. The US is the world's technological powerhouse and Europe now leads the world in rulemaking.

Regulate before you innovate, supervise before you create.

That seems to be the mindset right now. The European Parliament proudly announced this February its AI Act to the world — the first comprehensive legislation on artificial intelligence ever. All well and good. But slightly curious because the region has no frontier AI companies to speak of.

Is this to be Europe's legacy? The stickler, jobsworth of the modern world, constantly banging on that 'them's the rules.' The boring pedant in the office who writes KPIs for everyone to follow about 'kitchen etiquette' and washing up coffee mugs.

Europe has trained a whole new class, not of builders and creators, but of compliance officers, ESG auditors, sustainability verifiers and data protection consultants. The UK, which is where this magazine is based, has a tax code that now runs to 22,000 pages, the longest in the world.

This issue's cover story looks at the Battery Passport, a comprehensive plan devised by some of the cleverest bureaucrats in Europe for parts of the battery industry that are breaking new ground in innovation, products and route to market.

And their thinking? 'Fantastic! We're on the brink of something big here. Quick, let's write a few reports and audit the hell out of this baby. And while we're on it, any friendly consultants around? (And if there are, let's make sure we just listen to their recommendations and then promptly ignore them — just as we did for their suggestions on permitted recycling levels.)'

As Shmuel de Leon writes in his thought-provoking analysis (see following pages), European battery manufacturing projects may require five years for permitting and construction to happen while, in China, a giga factory would be up-and-running before you'd had time to say 'chopsticks'.

With Europe's battery industry already lagging under global overcapacity, price pressure from low-cost imports, rising capital costs, and growing uncertainty around supply chains and industrial policy, is the regulation machine Europe has so successfully manufactured, simply going to combust?

Things have got to get moving. The EU has clamped a ball and chain around the ankles of industry and while everyone else is running the race of their lives, Europe is barely off the blocks.

Marilyn Monroe once famously said: "If I'd observed all the rules, I'd never have got anywhere." Shame she didn't work in batteries. ■

Mike Halls, publisher

Industry veteran Shmuel de Leon gives a personal view on the present state of the battery industry – both lead and lithium. In an exclusive conversation with *Batteries International* he talks about industry turmoil, unchecked dominance of China, and why the writing is on the wall for Europe and North America.

Western battery manufacturing is in freefall ... and running out of time

"I've spent 35 years in the battery industry, and I don't think I've ever seen a crisis this severe – or one that's accelerating so quickly

I've spent 35 years in the battery industry, and I can say without hesitation that I have never seen a crisis like the one facing us now. Not in its scale, not in its speed, and not in its severity. What we are witnessing is not a cyclical downturn or a temporary market correction. It's is a structural shock that threatens the future of battery manufacturing outside China.

The roots of the problem date back to early 2023, when China entered a phase of massive overproduction.

Expectations for electric vehicle growth in Europe and North America had been extraordinarily optimistic. Chinese companies built infrastructure, production capacity, and supply chains on the assumption that EV adoption would accelerate rapidly.

They invested heavily, bought huge volumes of raw materials, and expanded factory output to levels that turned out to be far beyond actual demand.

When the growth failed to materialise, the result was brutal.

Chinese manufacturers found themselves with excess capacity and falling orders. A fierce price war followed as companies fought to defend market share. Over the past two and a half years, this has driven an average 40% reduction in material, cell, and battery pack costs.

That collapse in pricing, combined with weakening automotive markets in Europe and North America, cuts to EV subsidies, and political uncertainty, triggered the second wave of crisis. Automakers reduced their battery purchases. Prices fell further. Investors pulled back. Start-ups ran out of cash. Expansion plans were shelved. And suddenly, across Europe and North America, the battery industry began to contract.

What we are seeing now is not an isolated failure. It is systemic erosion.

High-profile companies are going bankrupt. Others are shrinking production, laying off staff, or delaying factory launches. Investors, quite rationally, are unwilling to commit capital into a market where profitability appears impossible. And all this is happening while China continues to push forward, faster and harder than ever.

On top of this, we now face tightening export controls from China. Last October the authorities ruled that critical materials and components — graphite, silicon, lithium iron phosphate, cathode materials, automation equipment, and high-energy battery packs — require export licences. This was to have become law in November but was put back a year following discussions between US president Donald Trump and China leader Xi Jinping.

For Europe and North America, which still rely heavily on Chinese supply chains, this creates another destabilising force. We are effectively building battery factories without control over the materials, machinery, or technology they depend on.

The result is a deepening crisis across the Western supply chain.

Europe, in particular, is in serious trouble. The battery industry there is shrinking, not growing. If nothing changes, China's current 75% share of global battery production will not fall — it will rise. Some analysts claim it could drop to 60–65% as Western capacity expands. I'm afraid that's nonsense. If present trends continue, China could control 85% of global battery output by 2030.

That is not healthy for any industry, and it is deeply dangerous geopolitically. Batteries are becoming the fuel of the future. Whoever controls their production controls mobility, energy storage, defence systems, and industrial resilience. Concentrating that power in one country creates enormous political and strategic risk.

What we need is a globally distributed manufacturing base. Competition across continents drives innovation, reduces costs, and strengthens supply security. But today, I see no meaningful political strategy emerging.

The US government, the European Union, and the UK all talk about energy security, but I see no long-term industrial plan capable of supporting local supply chains for the decade required to make them competitive.

> This is no longer just about cost. China is now leading in technology, speed, and industrial execution. Capital flows to opportunity, not ideology. And right now, opportunity lies overwhelmingly in China

Expecting private investors to shoulder that burden alone is unrealistic. They look at current economics and conclude — correctly — that the risk is too high. Capital flows to opportunity, not ideology. And right now, opportunity lies overwhelmingly in China.

The human cost is already severe. I estimate that roughly 20% of the European battery workforce has been laid off in the past year, alongside 10% in North America. That includes mining, materials processing, cell production, pack assembly, and even downstream integration. Expertise is bleeding out of the system. Once lost, it is extremely hard to rebuild.

This is nothing short of a catastrophe.

We need government intervention — serious, coordinated, long-term industrial policy. Not short bursts of subsidy. Not fragmented initiatives. And not political slogans. The last two decades have shown us exactly what does not work.

In the US, large funding programmes began under the Obama administration. Europe followed with its own battery alliance strategies. Yet both failed to deliver sustainable competitiveness. The fundamental problem was the absence of a realistic endgame. Companies received funding without credible pathways to independence and profitability.

Many invested in immature or unsuitable technologies. Factory construction dragged on for years, only to deliver outdated production lines by the time operations began.

In China, a 2GWh battery factory can be built in about a year. In Europe, it may take five. That time differential alone destroys competitiveness.

If we are serious, governments must provide long-term stability — guaranteed market conditions, procurement commitments, infrastructure acceleration, and regulatory reform — giving companies confidence to invest for at least a decade. Only then can Western manufacturers hope to close the cost and scale gap.

Some argue that technology leadership could rescue Europe and North America. I wish that were true. But the reality is stark: China now leads battery innovation.

Once, companies like LG, Samsung, Panasonic, and Murata drove lithium-ion development. Energy density improvements, power capability, and form factor evolution came largely from Japan and Korea. That era is over.

Today, Chinese firms dominate. In the high-volume 21700 cylindrical cell format, Chinese manufacturers deliver capacities of 6.5Ah. Their Western counterparts remain stuck at 5.5–5.8Ah. Across prismatic, pouch, LFP, sodium-ion, and solid-state research, Chinese companies lead in speed, scale, and industrialization.

This technological dominance is not accidental. It is the result of coordinated national strategy, enormous R&D spending, rapid factory iteration, and close cooperation across the supply chain. Meanwhile, Western firms struggle with regulatory barriers, fragmented funding, and risk-averse investors.

One of the most striking examples is solid-state batteries. China has invested over $1 billion across 10 major companies to accelerate development. The goal is to replace liquid electrolytes — the main source of fire risk — with solid alternatives, enabling safer designs and the use of lithium metal anodes, which dramatically increase energy density.

Chinese companies now manufacture semi-solid, quasi-solid, and even fully solid-state cells. I

> Expecting the private market to solve this alone is unrealistic. Without long-term government intervention, the Western battery industry will continue to collapse

have visited their production lines. These are not lab prototypes — they are scaling real manufacturing. Meanwhile, Western players such as QuantumScape and Solid Power remain trapped in long R&D cycles, struggling to reach commercial volumes.

This gap extends far beyond batteries. It encompasses automation, materials engineering, process control, and manufacturing know-how. China is not just cheaper. It is faster, more agile, and increasingly more advanced.

Some suggest that Europe could cooperate with Chinese companies by hosting their factories. That is happening — but let's be honest about what it means. Production may take place in Europe, but raw materials, machinery, and intellectual property remain Chinese. It reduces transport emissions and adds local jobs, but it does not create technological sovereignty.

Recycling, often presented as Europe's strategic advantage, faces equally harsh realities. Battery recycling is not profitable without subsidies. With industry margins collapsing, funding for recycling plants is drying up. Europe largely focuses on black mass processing, while refining still happens in China. Without healthy upstream manufacturing, recycling cannot stand alone.

Batteries are becoming the fuel of the future. Whoever controls their production controls mobility, energy storage, defence systems and industrial resilience

This brings us back to political leadership — or the lack of it.

Tariffs, such as those proposed by the Trump administration, will not fix this problem. Tariffs raise prices but do not create factories. LFP cathodes cost around $35 per kWh in China. There are virtually no non-Chinese suppliers. Even with tariffs, US manufacturers will still have to buy Chinese material, only now at higher cost.

Protectionism without industrial investment simply weakens domestic markets.

Tesla demonstrates the complexity of survival. The company manufactures batteries in China, sources from CATL, and sells globally. It supplements this with Panasonic cells in the US, leveraging scale and integration. But even Tesla cannot escape Chinese dominance. Most automakers lack Tesla's vertical integration and financial resilience.

Long-term, battery chemistry evolution will be gradual. NMC will remain dominant for high-performance vehicles. LFP will continue in cost-sensitive segments. Sodium-ion, while promising, remains more expensive than LFP. Without economic advantage, adoption will remain limited. Revolutionary breakthroughs are unlikely within the next decade.

What we will see instead is consolidation. Smaller firms will collapse. Mid-sized players will merge. Market share will concentrate further. Already, two Chinese companies control nearly 60% of global production. That level of concentration is unhealthy — but inevitable in the current environment.

Every week brings more bad news. Factory closures. Cancelled expansions. Workforce reductions. The political system remains largely unresponsive.

What worries me most is that time is running out. Once industrial ecosystems collapse, they are extremely difficult to rebuild. Skills disperse. Suppliers disappear. Infrastructure decays. Restarting from zero takes decades.

This is no longer just an economic issue. It is a matter of national security. Energy independence. Strategic autonomy. Industrial resilience.

We cannot allow Europe and North America to become permanently dependent on Chinese battery production. Not because China is an adversary, but because no critical industry should ever be monopolized by a single country.

The solution exists — but it requires courage. Governments must commit to long-term, industrial-scale intervention. They must support domestic manufacturing through capital, policy, and procurement guarantees. They must align education, research, and regulation behind a coherent strategy. And they must act quickly.

If not, history will look back on this moment as the point where the West quietly surrendered control of one of the most strategic industries of the 21st century.

And that would be an unforgivable failure. ■

Europe, in particular, is in serious trouble. The battery industry there is shrinking, not growing. If nothing changes, China's current 75% share of global battery production will not fall — it will rise

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Sechrist returns to EnerSys as chief people officer

EnerSys said on January 13 it was welcoming back Todd Sechrist to the US-based lead battery giant as chief people officer.

Sechrist, who has more than 25 years of experience across the firm's business operations, brings deep operational expertise and a strong record of leadership, EnerSys said.

During his career at EnerSys, he has held several senior roles including EVP and COO, president of EMEA and Americas and VP of reserve power sales and service.

After leaving EnerSys, he was appointed CEO and president of Sunlight Batteries USA, the American arm of Olympia Group battery subsidiary Systems Sunlight, in October 2021.

EnerSys said Sechrist returns ready to align our people strategy with our business priorities.

His return supports EnerGize — the firm's strategic framework plan. He will focus on attracting, developing, and retaining top talent, empowering leaders and positioning HR as a strategic partner.

Sechrist said: "Our people are the engine behind our performance. When we align talent with purpose and empower teams to lead, there's no limit to what we can achieve." ■

Stollsteimer joins Ace Green Recycling from Gopher

Ace Green Recycling has appointed former Gopher Resource executive Rick Stollsteimer as senior VP of operations, to lead development of the firm's Texas facility and its expansion of operations in North America.

Stollsteimer was formerly VP of operations at Gopher, where he oversaw a round-the-clock smelting facility producing around 160,000 tonnes of finished product annually.

Ace announced on November 18 that Stollsteimer will oversee operational readiness and scale-up of its Texas facility, where the firm will deploy its GreenLead and LFP recycling technologies.

The site is expected to start using Ace's lead acid recycling system in 2026, followed by its LFP-focused lithium ion system in 2027.

Ace claims its GreenLead technology replaces the smelting furnace, operates at room temperature, runs on electricity and has zero Scope 1 greenhouse gas emissions (direct GHG emissions such as those made while running boilers and vehicles) and reduces solid waste by more than 85%. ■

Leoch CEO Wu appointed to board as executive director

Lead battery giant Leoch has announced the appointment of group CEO Kouyue Wu as an executive director with effect from January 8.

Wu, 56, has been CEO of Leoch International Technology since December 2024. His contracted term of office as an executive director is three years.

Leoch chairman Dong Li said Wu has around 30 years of experience in production operations and supply chain management.

Wu joined Leoch in May 2014 and has successively been appointed to a number of senior management and executive posts including supply chain director, quality director, president of sales for the China region of the group and the group's chief operating officer. ■

Ex-Northvolt workers set to share in €8.5m EU payout

The European Commission has proposed a total of €8.5 million ($9.8 million) to be paid to employees dismissed after the bankruptcy of battery maker Northvolt in Sweden.

Northvolt said last March 12 it had filed for bankruptcy following an exhaustive effort to explore all available means to secure a viable financial and operational future.

The Commission announced on October 30 that the proposed payment, to support nearly 6,000 former employees, would be made from the European Globalisation Adjustment Fund for Displaced Workers, subject to approval by the European Parliament and the European Council.

Sweden applied for support from the fund in June to help those affected rejoin the labour market match their skills with emerging industries in northern Sweden.

Batteries International reported in October that California-based lithium sulfur developer Lyten had put a new management team in place in Sweden and Poland for Northvolt, in the wake of its takeover of the troubled battery firm. ■

Eternity Technologies bolsters team with new appointments

Lead battery manufacturer Eternity Technologies has announced two key appointments.

Eternity said on January 19 that Ivan Murillo Herrera had joined the company as sales director for reserve power for Mexico and Central America and Walt Beran had joined the Eternity Technologies USA team as northwest territory manager.

Murillo Herrera, a former reserve power sales director for Latin America with EnerSys, will be based in Mexico. Eternity said he brings strong expertise in reserve power and industrial applications, along with a proven track record of driving growth globally.

Beran, who was most recently regional sales manager for Flux Power, has more than 30 years' experience in the material handling industry with over seven years as an electric forklift field technician.

Last year, Eternity announced investment plans for a production hub in India on a site acquired from EnerSys as part of plans to target growing demand for electrical forklifts and energy storage in the country.

The move came after Eternity said it was joining forces with Enexa to ramp up sales of industrial batteries in Italy. ■

VP post for Witmer in Wärtsilä's ESS business

Wärtsilä, the Finland-based technology group, has appointed Luke Witmer as VP of software engineering for its energy storage business.

Wärtsilä, which announced the appointment on December 11, said Witmer had been instrumental in the group's technology evolution since 2015, before its acquisition in 2017 of Greensmith Energy.

Over the past decade, he has helped drive development of the group's GEMS digital energy platform — Wärtsilä's proprietary software for monitoring, controlling, and optimizing complex power systems — now in its 16th year of development.

GEMS manages all assets including batteries to boost uptime and efficiency, forecasting and optimizing energy dispatch with ancillary services.

Wärtsilä Energy Storage became an independent reporting unit within the group last April.

Under Witmer's leadership of the Data Science division, the platform's forecasting, optimization and analytics capabilities have advanced significantly, Wärtsilä said.

Witmer said: "Software is at the heart of today's energy transition. Energy storage is enabled by advanced software, and the renewable transition is not possible without energy storage." ■

Starita takes over as H&V chief strategy officer

Nicholas Starita, well known in the US lead battery industry for his market analysis, has been appointed chief strategy officer for battery separator manufacturer Hollingsworth & Vose.

Starita confirmed the appointment on January 26.

He was most recently H&V's VP for transformation and is a former president of the company's energy solutions division.

In his new position, Starita said he will be responsible for corporate strategic planning and execution, including advanced analytics, digitization and AI strategy.

Also part of Starita's brief will be looking at opportunities to expand the business through new technologies and services, together with partnerships, mergers, acquisitions and joint ventures. ■

AI expert Voudouris joins CRU consultancy

Research consultancy CRU said on January 12 that Vlasios Voudouris had joined the research consultancy as its new chief product officer.

Voudouris will work with CRU's product, data, commercial and customer success teams to accelerate the development of market leading analytics, enhance the rigour and relevance of CRU's price benchmarks, and scale proprietary datasets and AI driven solutions for clients across mining, metals and fertilizers.

CRU chairman Robert Perlman said Voudouris brought exactly the mix of technical depth and commercial focus needed to drive the consultancy's next phase of product innovation.

"His leadership in AI and proven ability to translate advanced analytics into tangible client value will strengthen CRU's position as the independent, trusted provider of intelligence the market relies on."

Last August, CRU and Battery Council International published a new expert study on growth rates and future trends of lead battery markets.

BCI said the report was powered by decades of metals market intelligence at CRU and the proprietary data BCI had collected on battery sales and manufacturing. ■

EnerSys praises firm's 'stringent' lead exposure policy

For the record, EnerSys has hailed the success of what it described as its own stringent blood lead monitoring policy as a key component of its newly-released sustainability strategy.

The US-based lead and lithium battery maker reported details of its internal Blood Lead Reporting & Compliance Policy (BLRC) in its sustainability report for fiscal 2025, released on October 22.

In the report, the highlights of which include how the firm is improving performance across its global operations, EnerSys said it had no violations of its blood lead level thresholds.

When lead is present, the firm said it has a stringent program to monitor employees' lead exposure levels and take immediate action if they ever exceed the internal policy — "which is much more stringent than regulatory requirements at our facilities globally".

According to EnerSys, the program involves blood lead tests for employees and is required to be updated quarterly with data reflecting the recent blood lead data for employees who were tested in the month for the quarter being audited.

This is reported globally, using individual numbers rather than employees' names, to track blood lead levels across the business. Medical staff are also employed specifically to monitor the program.

"In terms of Scope 1 emissions, these fell by 2% in fiscal 2025 compared to the previous year — amounting to a 25% reduction since fiscal 2020. This was achieved through both efficiency and electrification in the manufacturing process," EnerSys said.

"Despite the switch to electricity, our Scope 2 emissions decreased by 5% from fiscal 2024, showing a 2% fall from fiscal 2020 and a 12% decrease from fiscal 2022."

According to the report, Scope 2 emissions should continue to fall as the grid decarbonizes with support from renewables and energy storage.

On recycling, with 100% of lead battery three main components (lead, steel and plastic) being recyclable, EnerSys said its collection and recycling processes are engineered for both environmental compliance and operational efficiency.

The company also encourages participation in certified battery take-back programs.

However, EnerSys said its total water usage in fiscal 2025 increased to 952 megalitres (one megalitre equal one million litres), a moderate rise from the previous year. This was driven by higher overall production volumes and a shift in the types of batteries manufactured.

EnerSys said its facilities produced a more diverse mix of battery chemistries, each with different water intensity requirements, and changes in production ratios were a key contributor to the uptick in consumption.

Nevertheless, through expanded reuse and recycling systems at key facilities, the company said it reused and recycled over 17% more gallons of water between fiscal 2024 and fiscal 2025.

In terms of its lithium ion battery development, the report said around 1%-2% of global cobalt supplies come from artisanal and small-scale mining practices in the Democratic Republic of Congo, which pose serious human rights and environmental concerns.

To ensure EnerSys sources responsibly, the firm said it only works with suppliers committed to adopting the OECD's due diligence guidance for responsible supply chains of minerals from conflict-affected and high-risk areas.

"Our strategy to reduce supply risks to our value chain from critical minerals, like cobalt, includes investing in recycling, advancing the realization of a circular economy, and transitioning to cobalt-free chemistries," the report said.

EnerSys president and CEO Shawn O'Connell said: "My vision for EnerSys is clear: embed sustainability, resilience, and operational excellence into every part of our enterprise." ■

BCI hails 'milestone' inaugural US flow battery event

For the record, Battery Council International has hosted the inaugural Flow Batteries North America (FBNA) conference, in partnership with the Pacific Northwest National Laboratory (PNNL).

BCI said battery industry executives, researchers, and innovators gathered in Chicago from October 27-29 for the event, which was devoted exclusively to flow battery technology — and marked a major milestone in the evolution of grid-scale energy storage.

More than 150 delegates attended, including representatives from utilities and grid operators, battery manufacturers and suppliers, project developers/EPC firms, research institutions and national labs. They were joined by energy policy and regulatory experts, as well as investors and analysts.

The conference featured presentations and panel sessions covering advanced electrolyte chemistry, next-generation membranes, real-world flow battery projects, permitting and funding strategies, and commercialization.

Speakers included Doug Scott, chairman of the Illinois Commerce Commission, and Vincent Sprenkle, PNNL's strategic advisor for energy storage and co-chair of the FBNA organizing committee.

Delegates were also offered a behind-the-scenes tour of G&W Electric's CellCube facility in Illinois — one of the most advanced vanadium redox flow battery systems in the US, which combines solar power and long duration energy storage.

Scott Childers, VP of Stryten Energy's Essential Power division and chairman of BCI's Flow Battery Industry Group, said: "Decoupling power and energy delivery is at the frontier of long-duration energy storage, and no other technology can separate these functions as efficiently as flow batteries."

FBNA provided the perfect platform for the industry to discuss the latest innovations and market trends, and to look ahead to the bright future of flow battery technology, Childers said.

BCI launched its flow battery group in 2023 to maximize synergies with the lead battery industry in boosting energy security in North America.

The trade body said flow batteries are a natural fit with the association's existing member services "given several key similarities and synergies between flow battery manufacturing and incumbent battery manufacturing technologies". ■

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Indian battery veteran Mittal to lead Vikram's ESS unit

Lead and lithium battery veteran Arun Mittal has been named as CEO of VSL Powerhive, the energy storage arm of India's Vikram Solar.

Mittal, whose appointment was announced on December 3, is a former MD and CEO of Exide Energy Solutions (EESL), having worked his way up in the firm for 31 years, starting as a management trainee.

He stepped down from the lithium unit in October 2024 and also ceased to be director of the company.

Mittal is also a former automotive director at Indian lead acid battery maker Exide Industries.

He was most recently MD and CEO India at Lohum Cleantech, the lithium recycling company, a position he has held since November 2024.

Vikram chairman and MD Gyanesh Chaudhary said: "Battery energy storage is the backbone of the next phase of the global clean energy transition, and its importance in ensuring reliability and grid stability cannot be overstated."

BESS innovation will play a pivotal role in delivering resilient, efficient, and scalable energy solutions for the world, Chaudhary said.

"Arun's leadership will accelerate our ambition to create world-class battery capabilities and build a strong, future-ready energy storage ecosystem." ■

Saraf takes helm at Exide Energy Solutions as Deo resigns

Mandar Deo (above) has resigned as MD and CEO of Exide Energy Solutions (EESL) — just over a year after being appointed to the post.

EESL, the lithium-based subsidiary of India's Exide Industries (EIL), said Deo resigned on December 22, but did not disclose details.

He is succeeded by Pravin Ramchandra Saraf, previously executive director of EIL and a non-executive director of EESL. Saraf's appointment took effect on December 22.

Batteries International reported in September 2024 that Deo had been appointed to succeed Arun Mittal effective November 2024. Mittal said he was stepping down for personal reasons and would also cease to be director of the company. ■

Abrol appointed new Luminous CEO, Bajaj moves on to lead Schneider unit

Vivek Abrol has been appointed MD and CEO of India-based Luminous Power Technologies succeeding Preeti Bajaj — who is to lead the global home solutions division of Schneider Electric.

Abrol, who took over as of January 19, has more than 25 years of leadership experience across FMCG and consumer electricals.

Luminous said he will lead the firm's next phase of growth, with a mission to strengthen leadership in consumer energy solutions and accelerating solar and sustainable products. He will also drive greater innovation, digital transformation toward establishing "a high-performance, future-ready organization".

Meanwhile, the company praised Bajaj for her exceptional leadership and contribution to Luminous' growth and wished her continued success in her new role.

Bajaj has been a strong advocate for advances in lead battery technology as a way of boosting India's energy sector, promoting sustainability and strengthening the country's role as a global battery leader.

She became president of the Indian Battery Manufacturers Association in 2024, saying the following year that the organization's priorities included making the lead battery supply chain one of the most robust.

She was also recognized at the Women in Energy forum 2024, as part of India Storage Week.

During Bajaj's leadership of Luminous, the company became a member of the Consortium for Battery Innovation.

The CBI welcomed the move, praising the company for its expertise on cutting-edge solar systems, inverters and batteries.

Luminous became part of the Schneider Electric group in 2011. ■

Choudhary takes over as COO at Amara Raja

Narayan Sudhakar Choudhary has been appointed as chief operating officer of Amara Raja Energy & Mobility effective January 19.

The Indian lead and lithium battery manufacturer confirmed the appointment in an announcement to the National Stock Exchange of India.

Choudhary succeeds C Narasimhulu Naidu, who Amara Raja said is to retire and will formally step down in the next couple of months — as part of what the firm said is a planned, smooth handover of responsibilities.

Choudhary, who joins the battery firm from auto parts manufacturer Taco Punch Powertrain, has extensive experience including in management and working on large-scale manufacturing activities in industrial and automotive sectors.

Batteries International reported last November that Amara Raja had revealed its mainstay automotive lead acid business remained strong, despite a tumultuous global market.

The company said robust sales of lead batteries contributed to profit before tax of Rs666 crore ($75 million) for the half-year ended September 30. ■

BCI Foundation launches latest scholarship awards call

Battery Council International has issued a call for applications for the second round of scholarships under the BCI Foundation, which was launched in 2024.

The trade body said on November 24 the application process was open for awards of up to $5,000 for individuals studying in the 2026-2027 academic year.

The program is open to full-time undergraduate (four-year and two-year) and graduate students.

Funds provided by the Foundation will be directed to two separate scholarship awards.

The BCI Battery Chemistry and STEM Scholarship, offered in partnership with Women in the Global Battery Industry, will award $5,000 to individuals studying electrochemistry, science, technology, engineering, mathematics or a related technical discipline that will support energy storage applications.

Meanwhile, the BCI Community Scholarship will award $5,000 to an individual who is an employee or direct family member of an employee working at a BCI-member company.

The Foundation, a stand-alone charitable entity, was formed in recognition of BCI's 100th anniversary in 2024 and funded by initial donations of more than $115,000. The first class of BCI Scholars was selected in 2025, assisting three individuals in their academic pursuits.

BCI president and executive director Roger Miksad said although the trade body itself was more than 100 years old, in many ways the industry's brightest days lie ahead.

"BCI and our members are investing in the next generation of industry leaders and innovators, and the charitable efforts of the Foundation will build on that legacy to ensure a vibrant pipeline of talent."

Founding donors to the Foundation include lead battery industry giants Banner, CD Trojan, Clarios, Crown Battery, Daramic, Duncan, East Penn, ENTEK, EnerSys, GS Yuasa, Leoch Battery, Moura, Rolls Battery Engineering, Stryten Energy, Superior, and US Battery Manufacturing Company.

Additional contributions have been received from individual and anonymous donors across the industry.

Foundational scholarships are administered in partnership with the University of the Aftermarket Foundation, a group dedicated to providing funding for automotive industry education programs.

BCI Foundation scholars will be screened and selected by an independent panel of reviewers.

Applications can be made online by March 31. ■

Hoppecke certification award for training

European lead battery company Hoppecke has secured certification for its pure lead battery training programs from a key UK professional services body.

Germany-headquartered Hoppecke confirmed on October 23 that training courses for its grid | Xtreme VR batteries are now certified under continuing professional development (CPD) standards by British professional association, the Chartered Institution of Building Services Engineers.

The grid | Xtreme VR series represents the highest level of development of today's pure lead batteries in AGM technology and is trendsetting in terms of energy and power density for lead-acid storage technologies, Hoppecke said.

Engineers and building services professionals taking part in the battery maker's training courses can earn CPD points that may be used toward their professional qualifications.

Accreditation by the UK institution underscores the high practical and quality standards of the courses and their relevance for the professional development of engineers, Hoppecke said.

Other professional associations such as the Association of German Engineers and European Federation of National Engineering Associations require proof of continuous technical and professional development as confirmation of the professionalism and competence of engineers.

Hoppecke said this is relevant as batteries are increasingly taking on critical tasks in modern buildings, such as interim storage of renewable power, emergency power supplies and grid stabilization.

"For engineers and building services specialists, a sound knowledge of battery technologies is indispensable," the firm said. "However, university chairs dedicated solely to battery technology are rare. That is why we see it as our responsibility to pass on knowledge and share practical experience." ■

BCI names comms committee chairs

BCI has named three figures for its comms committee. Clarios's VP of public affairs and sustainability Elizabeth Tate has been appointed as vice-chair, Lisa Hartman VP and head of investor relations and corporate communications at EnerSys and EnerSys corporate communications director Karen Shaw are co-chairs on the same committee.

All three executives succeed long-time committee chair Donna Snyder, continuing strong momentum in connecting with policymakers, industry stakeholders and boosting awareness of the battery industry, BCI said.

Separately. Battery Council International has announced the appointment of Keely Anderson as director of membership and operations.

BCI has over a decade of experience in association management and member services.

She was most recently director of meetings for The Monitoring Association, the US trade association representing companies who install, service, and monitor security systems for commercial, government, and residential markets. ■

Donna Snyder retires at East Penn

Donna Snyder, the much-loved VP for marketing and advertising at East Penn Manufacturing stepped down on Wednesday after 42 years with the company. Joel Brady, also a heavyweight veteran of East Penn, will take over from her.

Donna started at the battery major in October 1983 as a graphic designer and rose through the ranks ending up as a director of marketing in the 1990s and finally becoming VP for marketing and advertising in 2006.

"I knew within the first year of working here that this was where I wanted to be," she told *Batteries International* on the eve of her retirement. "There's a family feel that I noticed almost from the beginning and that's continued to the present day.

"I would say I've had the best job in the world, from leading a team of 25 people in all aspects of our business. It's huge. From developing strategic marketing plans and campaigns, to executing them, to developing relationships with customers as well as all the other departments in the firm.

To be able to look at issues such as sustainability and the environment to make the company relevant to the future … to focus on communication efforts for government and regulatory initiatives and much more.

"I've had a fascinating career but it's also all about the people you work with and the relationships you form. I've worked with some great people and forged some great friendships which I will take with me into retirement."

Donna's profile statement says a lot about her own view of the world, a perspective shaped by her faith. She is a former church board member and Sunday School teacher, and meditation. In this she writes: "Success in life should be defined by the people you have positively affected and your contributions to creating a better world."

Pete Stanislawczyk, CEO of East Penn paid tribute to her achievements: "Under Donna's leadership, the Marketing and Advertising department grew into a dynamic team of over 25 professionals, driving initiatives in category management, research, promotions, digital strategy, and communications.

"She championed innovation, built strong supplier partnerships, and guided strategic marketing plans that positioned East Penn for continued success in a competitive global industry.

"I knew within the first year of working here that this was where I wanted to be. There's a family feel that I noticed almost from the beginning and that's continued to the present day"

Her influence extended beyond the company through active participation in industry organizations. She served as a founding member of Women in Global Battery Industry (WGBI), chaired several Battery Council International Committees, and contributed to numerous initiatives promoting education, sustainability, and collaboration."

Chris Pruitt, former CEO of East Penn who worked closely with Donna for some two decades, told *Batteries International*: "When you think of Donna you think of someone who was totally committed to the industry and East Penn. But she was much more than that.

She was thoughtful, kind, caring, creative and supportive. She never ran away from tough issues and always remained cool and calm under pressure. She was, and is, unbelievable from both a personal and professional viewpoint."

Joel Brady, who has worked with Donna for a long time and joined East Penn 28 years ago, paid tribute to her genuineness as a person and a professional. "These are big shoes I have to fill.

Donna has been a wonderful mentor to myself and others. She epitomized a style of servant leadership making her a role model to follow.

"In particular she was inspirational to women and helped create the atmosphere and culture for women to succeed," he told *Batteries International*.

Donna says that she won't be severing her ties completely with East Penn. "There is certain to be ways that I can help in the future but for the moment I want to do some more travelling with Skip [the husband she met in 1981] and seeing my family elsewhere. And, of course both of us are jazz enthusiasts so I'm already looking forward to the Berks County Jazz Fest next year."

After her four decades of service to the firm and battery industry, how does she see things changing?

"At the moment the whole battery business is changing more rapidly than ever. Covid triggered much of what we see today — the pace of technology is advancing farther all the time. It's getting more deeply embedded in our lives.

"When I started there were no computers worth speaking of, or word processors, it would take more than a decade before they became routine. The internet didn't exist but has, for the last 20 or so years, dominated the way we work.

"Ahead of us we see AI reshaping our futures too and that is going to affect everything from the way that we manufacture batteries to the way we interact with customers though some of the constants — our relationships — will remain as vital as ever."

Mike Halls, the publisher of *Batteries International* and someone who has known Donna for almost two decades said: "Along with the rest of the industry I wish you a happy retirement. It has been a pleasure and privilege to work with you, and I look forward to keeping in touch." ■

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Dan Duffield, MAC Engineering's EVP, retires

Dan Duffield, the much liked and highly regarded EVP at MAC Engineering, has retired after 41 years with the battery machine manufacturer.

Dan, just 20, and fresh from Ferris State University in Michigan with a degree in technical drafting and tool design, began his career with MAC just three weeks after graduating.

Despite an open admission of his time spent at the state college — "two years of partying but I did spend two weekends in the library" — he showed a precocious talent in terms of understanding how MAC's machines worked and were designed.

Just after a year of starting in the mechanical and engineering department his talent was recognised and he made his first visits to MAC clients, such as East Penn and Crown Battery as a field service engineer. These were to create friendships that have lasted to the present day.

These trips also allowed him to prove his worth — within a short time he knew all the intricacies of MAC's product range of COS machines, pasters, ovens and the like. By the time he was 21 he was being sent on field assignments internationally, first to Austria and later all around the world.

"Things have changed a lot since the 1980s," Dan recalls. "When I started there were around 140 to 150 different plants in the US, now we're left with a couple of dozen. It's a similar story to be found across Europe. The march of consolidation has been relentless."

A lifetime in lead batteries has also meant watching an industry change with the times...interesting times

Since that first trip to Europe, Dan reckons he has visited at least 50 different countries, some such as China, Canada and Mexico, countless times. And that's not to forget visiting 46 out of the 50 US states and all 10 Canadian provinces.

Some of his trips can only be called adventures. They include driving next to Tiananmen Square at the start of the demonstrations in 1989, open-air dining in South Africa where he was told not to worry about the lions and wild animals circling nearby, or a manic driver in China speeding around icy mountain roads with a 200 foot drop one side and cars coming at him on the other. "The train we had been taken off had been blocked by snow — I was highly dubious we would get through by car but that wasn't to do with the weather," he says. "But we did."

One of the most hair-raising was in Honduras. After being collected at the airport he found a gun under his seat in the car. "You'll need that to shoot at anyone if they come for us. Your life could depend on it," his driver said. "Do you know how to use a gun?" Dan didn't. But he immediately decided: "I'll learn how to use this helluva thing in seconds."

Dan looks back on the bulk of his travel years with real affection. "Sometimes it was the place itself that appealed. Sometimes it was the people. Many, many times it was both."

Despite such a fulfilling career, Dan, now 62, had told himself he would retire at 60 but Doug Bornas, president of the firm, asked if he would work part-time for the last year. He steps down leaving many good friends from the industry.

"There are countless people that I'll miss, so to name a couple is unfair to the others," he says. "When pressed he said, Mike Fraley from Crown, Ron Miksiewicz and all the gang at East Penn, not to mention the guys at Concorde, Surrette and Sorfin have been great to know and to work with and for. There are, of course, so many more."

There's almost an unlimited amount of anecdotes to recount in Dan's packed life. "I suppose it's funny looking back but I remember the first day for Doug (Bornas) with us as he reported to me. I was so over-worked that I took him into the conference room, pointed at some manuals and said 'I'm busy, just read them'. What an introduction to one of my best friends and future boss."

A lifetime in lead batteries has also meant watching an industry change with the times. "One of the persistent themes of the past 40 years has been the inexorable rise of automation," he says. "This has been healthy in terms of boosting productivity. But there's still a fair way to go.

"The next big thing in automation will come from AI. Artificial intelligence could well pave the way ahead for the lead battery business."

Dan will be on-hand for MAC should emergencies arise. But for now, he knows exactly what's in order. "Chilling out," he says. "Fishing, camping, the outdoor life and seeing friends around the country." ■

India honours Stevenson as lead industry's 'jewel in crown'

Mark Stevenson, one of the lead industry's most popular and best-known veterans, has been honoured with a 'Battery Ratna' by industry leaders in India.

Stevenson, the chairperson of the Asian Battery Conference & International Secondary Lead & Battery Conference, was presented with the award at the India Lead Zinc Development Association's (ILZDA) International Conference on Lead & Lead Batteries* in Delhi on December 1.

ILZDA executive director L Pugazhenthy, best known throughout the industry as Pug, told *Batteries International* 'ratna' means a 'jewel in the crown' — and said the honour was richly deserved because Stevenson is a global champion for lead batteries.

"He is also a very popular figure in India among the battery industry and his commitment and passion for lead batteries are unlimited and unparalleled. The ratna recognizes those qualities."

Stevenson said: "I am truly humbled and motivated by this recognition from ILZDA and the Indian lead battery industry."

In 2019, Stevenson was awarded the Lifetime Achievement in Lead Award at ILZDA's conference in Mumbai. That event also marked the beginning of Stevenson's 40th year in the industry.

In September 2022 Stevenson, together with Eckhard Karden, were confirmed as winners of the International Lead Award during the closing session of that year's ELBC.

Also in 2022, Stevenson was named as the 29th member of the Alpha/Beta Society, an informal group of members who have made outstanding contributions to the development of the lead acid battery industry.

At the ILZDA conference, 200 delegates from India and overseas took stock of the current situation concerning lead batteries and set out a roadmap for India to exploit new opportunities offered by emerging applications such as energy storage, electric mobility and environmental protection," said Pug.

There were more than 30 technical presentations, including some on advanced lead batteries, by Indian and overseas experts on battery technology, markets, recycling, regulations and sustainability.

The conference also agreed to form a technical committee, consisting of members from lead battery and lead recycling businesses, to ensure energy-efficient and resource-efficient environmental recycling of used lead acid batteries.

Additionally, it also supported moves for an early phase out of informal lead recycling, to be replaced by formal recycling units. This calls for firm commitment and active involvement by battery manufacturers, recyclers and consumers, the conference heard. ■

NAATBatt to honour lifetime achievement award recipients

NAATBatt International has three industry luminaries as recipients of the trade association's lifetime achievement awards for 2026.

Zhengming (John) Zhang, chief technical officer and chief scientific officer of Polypore International, is receiving his award for contributions to understanding and ensuring battery safety in high-energy lithium ion batteries.

He received the 2024 International Battery Association Technology Award for inventing a ceramic coated separator, which the IBA said has greatly improved battery safety, energy density and life.

Anna Stefanopoulou, professor of mechanical engineering at the University of Michigan and the William Clay Ford professor of manufacturing at the university, is being honoured for her outstanding contributions in academia in advanced battery technology studies.

Also recognized is Halle Cheeseman, program director of the US Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E). The ARPA-E program has led on projects including studies into ionics – novel ion conducting solids for fuel cells, flow batteries and all solid-state batteries.

NAATBatt said Cheeseman is being honoured for outstanding public service contributions in support of advanced battery technology and public understanding of its importance to the economy and human society.

As *Batteries International* went to press, all three were to be formally presented with their awards at a dinner on February 11 — during the trade body's annual meeting and conference in Arizona. ■

Zhengming (John) Zhang

Anna Stefanopoulou

Halle Cheeseman

New honour in sight for CBI-backed BESS tech breakthrough

Pioneering lead-based battery-electrolyser technology developed by a UK university has been shortlisted for the 'innovation project' category at the Hydrogen UK Awards.

Finalists will be announced on March 10 — just months after Loughborough University received an 'outstanding international impact' accolade at the separate 2025 Hydrogen Awards.

The university confirmed shortlisting for what could be another honour on January 16.

Loughborough's battery electrolyser system reimagines the lead acid battery to combine charging, power supply and hydrogen production in one recyclable unit.

The university said its system makes clean hydrogen at around 22 litres per minute and stores it safely underground, turning what used to be undesired hydrogen evolution, in lead acid batteries, into a productive feature.


Dani Strickland

Unlike conventional electrolysers, which rely on rare metals and remain idle when renewables are at low levels, Loughborough said its solution uses abundant, fully recyclable materials from the lead acid supply chain.

Over the past year, the battery electrolyser has moved rapidly from concept to real world deployment. It is backed by more than £12 million in funding and supported by over 20 partners, including leading manufacturers Monbat, Hoppecke, Hollingsworth & Vose and Ultima Forma.

The first full system was tested at Loughborough in July 2025 and has arrived in Malawi for commissioning, with another unit almost ready to be sent to Africa, the university said.

Dani Strickland, project lead, said: "Being shortlisted for the Hydrogen UK Awards is fantastic recognition for our team and partners and gives us valuable momentum as we build the next phase."

The spotlight on the technology comes three years after the Consortium for Battery Innovation said it was supporting the university's proposals to deploy lead battery technology as part of two projects to provide innovative energy storage systems for Africa. ■

Global sustainability honour for Birla Carbon

Carbon additives group Birla Carbon has been awarded an international accolade that the firm said puts it into the top 1% of companies globally assessed for sustainability performance.

Birla said on December 17 that the platinum-level rating, from business sustainability ratings firm EcoVadis, recognized the group's work in embedding sustainability across its operations, innovation and value chain.

John Loudermilk, president and CEO of Birla, said the rating reflected steady progress toward embedding sustainability at the core of Birla's business.

Loudermilk said the rating also reflected strong third-party validations, with more than 75% of operations covered under internationally recognized certifications such as ISO 14001, ISO 50001, ISO 45001, SA8000, and ISO 27001.

In 2025, Birla received an environmental award related to emissions control at its North Bend plant in the US.

Birla also said last April that it had been honoured as the judges' choice winner in the environmental impact project category at the 2025 Environment+Energy Leader Awards. ■

CATL secures Davos honour for AI-powered battery R&D

China battery giant CATL has secured a World Economic Forum award for its use of AI-driven technologies to transform battery research and development.

The WEF presented its MINDS award for 'augmented intelligence leading next-generation lithium ion battery design' to CATL at WEF's annual meeting in Davos on January 19.

CATL said its platform predicts cell behaviour and speeds up next-gen Li development, replacing manual trial-and-error methods with an AI-driven co-design.

The Chinese battery firm said its platform integrates best practice from across materials science, cell design, manufacturing processes and equipment.

The platform combines physics-based electrochemical models with machine learning to deliver what CATL said are scientifically reliable predictions that speed up key steps in cell design.

Running on a private cloud, the platform draws on more than 50 million data records. With physics-informed machine learning and 'agentic AI' — systems capable of working on projects with minimal human supervision — the platform works like a digital engineer, automatically generating, evaluating and refining design options.

According to CATL, its tech is trained on more than 100,000 battery design cases, drawing on 600 terabytes of test data and aftermarket data from a broad range of new energy vehicles. The platform can accommodate highly customised performance requirements, dynamically adjusting design priorities while achieving prediction accuracy of up to 95%, the firm claimed.

By evaluating designs against electrochemical constraints and applying AI-driven optimization, it generates design recommendations in seconds and virtual cell designs in minutes. ■

Fifth consecutive supplier award for Crown Battery

Crown Battery has won a key US industry award for the fifth consecutive year.

The company said on January 29 it had been awarded most valuable supplier award for its outstanding achievements in 2024 by industry trade association, the Material Handling Equipment Distributors Association (MHEDA).

The MVS Award is a coveted accolade within the industry, with fewer than 10% of MHEDA's member organizations earning the distinction.

To qualify for the award, Crown Battery was required to demonstrate business excellence and meet a series of criteria in a number of areas important to the companies who do business with them.

In addition the firm had to show an ongoing commitment to safety and employee training.

Nate Storey, CEO and president of Storage Solutions, and 2025 MHEDA chairman, said: "The MVS is a prestigious honour within the material handling industry, recognizing excellence across a broad range of accomplishments beyond financial performance.

"Receiving this award reflects Crown Battery's exceptional leadership, commitment to industry best practices, active community engagement, and focus on continuous improvement." ■

Innovation award for battery tech firm Dukosi

Scotland-based Dukosi has won an innovation award for its chip-on-cell technology battery systems to support EVs, ESS and other mobility applications.

Dukosi said on November 19 it had received a Top Innovator Award in the Green category at the 10th CLEPA Innovation Awards, held in Brussels.

The awards showcase innovations in green and digital technologies across the automotive supply industry.

Dukosi was among 12 Top Innovators honoured, acknowledged for its Dukosi cell monitoring system (DKCMS) with chip-on-cell technology and C-SynQ.

C-SynQ is a communications protocol for EVs, industrial transportation and stationary energy storage markets. DKCMS monitors installed on cells capture accurate measurements of voltage and temperature using C-SynQ.

CLEPA, the European Association of Automotive Suppliers based in Brussels, represents over 3,000 companies that supply components and innovative technology for safe, smart and sustainable mobility. ■

Engitec joins Association of Battery Recyclers

Italian engineering and lead recycling tech company Engitec Technologies has become the latest member of the US Association of Battery Recyclers.

The company said on November 26 that it had formally been accepted as a member of the association as of the fourth quarter of this year.

The association represents major operators in North and South America who are involved in the recycling of used lead batteries. ■

Turkish battery firms join EUROBAT

DESA Battery and ENEL Energy Electronics have become the latest members of European battery trade association EUROBAT.

EUROBAT welcomed the Turkish companies to the association on January 15.

DESA manufactures products including UPS batteries and gel batteries for a range of industrial applications and the telecoms sector at its factory in Ankara. The company supplies batteries to the European and American markets.

ENEL, which specialises in power electronics and electrical engineering, said it is also progressing toward becoming a key manufacturer in the Monoblock VRLA battery market. ■

Selwyn Mould joins Proof Energy as COO

One-time co-founder and chief operating officer of Aqua Metals, Selwyn Mould, has joined Proof Energy as COO. Mould announced the appointment on January 27.

Proof Energy is commercializing metal supported solid oxide fuel cells (M-SOFC) for use in heavy duty commercial vehicles and distributed stationary power generation.

Mould was with Aqua Metals for nearly five years from February 2014, during which he helped build the engineering and manufacturing team that created the then-lead recycler's proprietary technology, equipment and processes.

In 2018, when Steve Clarke stepped down as Aqua Metals CEO, chairman and director, he was replaced as CEO by Mould for an interim period.

In 2020, a court case against Aqua Metals and co-founders Mould, Clarke and Tom Murphy — concerning claims about the firm's recycling technology and commercialization process — was thrown out. ■

BCI 'knight' champions National Battery Day

Battery Council International introduced a new mascot and educational ambassador especially for the US National Battery Day on February 18.

BCI says 'Sir Chargewell', has a mission of sharing how batteries power the world.

With his super electrifying personality, Sir Chargewell embodies BCI's commitment to making battery education engaging and accessible, the US lead battery trade body said.

"He demystifies energy storage technology, highlights batteries' critical economic role, and champions industry innovation.

"On National Battery Day, we celebrate both where we've been and where we're going."

BCI celebrates National Battery Day every year, showcasing batteries as a key component in the global economy and the role its member companies and organizations play in supporting critical applications including cars and trucks, data-centers and grid-scale energy storage.

"Our industry's foundation is built on over a century of lead battery innovation. BCI has provided 100+ years of leadership, and some members have manufactured lead batteries even longer." ■

Batteries International meets the new guru of the green transition — and his bold plan to prove Mount Fuji can help solve the global energy crisis.

Mind over magma

A conference room on the 22nd floor of Osaka's Marriott hotel is perhaps an inauspicious space to be witnessing groundbreaking methods to deliver innovative solutions to the current energy predicament.

But Andy Shih, is a man on a mission to prove to everyone that he has discovered one of the cleanest, renewable energy sources in modern times.

Since 2021, his Taiwanese company — LumiFusion Green Energy — has been developing a revolutionary technology which experiments with ways to connect solar energy with advanced gravity using a technique to activate and collide particles in volcanic rock.

Sounds improbable? We thought so too. But Andy, who is head of research, is nothing if not passionate about something that, if he is to be believed, could be a global game-changer.

He invited us along to this second world exclusive press conference in Japan (the first was held last June in Tokyo) to demonstrate that heat released from connecting advanced solar energy and what he describes as 'advanced gravity' with the collision of 'thermos' and gravitation, causes the movement of charged particles, thus generating an electromagnetic field which, once stabilised, produces electricity.

"We have conducted numerous experiments and found that different materials have different particle properties," he says. "The particles of Mount Fuji's volcanic rock are the most stable and efficient. We have proved, in our experiments, that the technique of generating energy from Mount Fuji rock is entirely different from the current principle of energy extraction to generate electricity.

"Our methodology is a non-intrusive extraction of material energy on Earth, resulting in zero pollution, low costs, no accidents and energy independence."

It's important to mention Shih's experiments are still at a proof-of-concept stage. What this means is that what we witnessed still requires evidence that demonstrates a design

concept is repeatable, feasible and practical.

But Shih, a former regional CEO of SVA NEC Liquid Crystal Display Co, said his research team could prove that the power of the mind — he called this "consciousness particles" (generated by consciousness) — "could directly change the trajectory and structure of material particles".

The theory behind this may, admittedly, be a little out of the box but Shih's thinking fits into a larger, more modern tradition that is still trying to find a place somewhere in our understanding of the world.

Nobel Laureate Brian Josephson whose theories on superconductors are now standard, has spent much of his life proving that consciousness (the power of thought from the brain) can have a direct impact on the physical world.

Josephson has for decades argued that mainstream science is too restrictive and that it prematurely dismisses phenomena such as telepathy, psychokinesis, and consciousness-related effects. He has cited parapsychology experiments (for example, ganzfeld telepathy studies) as evidence that anomalous information transfer occurs at rates above chance.

Similarly too, much of modern science — in particular our understanding of the wave/mass/energy issue posed by quantum mechanics — is still changing, as is our understanding of the forces that shape the universe. Atomic forces, such as Gluons (strong force), Bosons (weak force) are relatively new and Higgs bosons, although postulated in the 1960s, were not evidenced till 2012.

Dark matter, which only became widely accepted in the late 20th century, has never been detected directly and its existence is inferred from gravitational effects only. And gravitational waves, although postulated by Einstein in 1916, were only directly detected in 2015.

With this in mind, Shih's explanation of a measurable phenomenon — "combining high-level solar energy and high-level geocentric gravitational force with advanced technology, to show it is possible to generate electricity by releasing charged particles from within the volcanic rocks of Mount Fuji" — opens the door for further development.

His demonstration consisted of two stands, displaying Mount Fuji volcanic rock intertwined with copper wiring. Members of the 40 plus assembled audience — including press and potential investors — were invited to step up to the stands and place their fingers on the copper wire.

Once energy was released, a tingling effect through the wire could be felt. Approximately 90% of those present confirmed that they had, indeed, experienced this sensory difference.

Shih later confirmed that he had secured interested investors for plans to construct receptors on Mount Fuji to harness these increases in energy.

"It a theory that starts with the idea of modern physics being based on particle wave theory — gravity being a prime example —much of which is still unknown," he admitted.

Here at *Batteries International*, we acknowledge that Andy's efforts are, for most, a leap of faith. But still, given the many unexplainable particle-related phenomena could there not be something in it? And wouldn't it be great if there were? We wait to see. Because, however cynical you might be, it's hard not to rally behind someone so committed to the future of the planet's energy. ■

Batteries International spoke to Alma Feldpausch, the newly appointed director of health science at the International Lead Association about her role and her priorities for the year ahead.

Why health science — not just air limits — will shape future lead regulation

Tell us about your professional life before ILA?

I joined ILA last September, following the retirement of my predecessor Cris Williams. It followed a career spanning more than 25 years working in environmental consulting where I supported the mining, smelting, and other industrial sectors.

Most recently, I led Ramboll Americas' Risk Assessment & Community Health Department and performed health risk assessments under contaminated sites clean-up and permitting processes and led community health and biomonitoring studies for clients throughout the Americas.

My educational training is in environmental science and toxicology, and I earned my diplomate from the American Board of Toxicology in 2015.

Explain what your job involves?

At ILA, I focus on health sciences that inform regulations and practices relevant to our members, and my work compliments my colleague Jasim Chowdhury who specializes in environmental sciences.

I'm responsible for monitoring and anticipating scientific and regulatory trends, communicating emerging scientific issues to members, and when needed, sponsoring research that addresses issues of concern to our members and then disseminating the results in scientific, regulatory, and public forums to ensure that maximum benefit is realized.

Our members also may reach out to me for technical assistance, as I serve as a resource for information on lead health impacts.

Inhaling lead in air is not the primary exposure route influencing worker blood lead levels and so continuing to reduce the permissible exposure limit for lead in air, currently set at 50 ug/m3 in the US, is unlikely to result in a meaningful decrease in worker blood lead levels

What are your top three priorities this year?

In recent years, ILA has focused on representing our members through engagement with the US Environmental Protection Agency (EPA) on review and revision of the National Ambient Air Quality Standard for Lead; however, that action appears to be a lower priority for the current US administration and so we are focusing on other activities in the interim.

We anticipate multiple actions at the federal and state levels in the near future that are driving our top three priorities in the US.

One, we have several US state, and possibly federal, OSHA (Occupational Safety and Health Administration) actions to revise lead worker standards. This means states, such as Minnesota, Oregon, and Washington, may revise the permissible exposure limit for lead in air and change medical monitoring procedures. ILA is working closely with Battery Council International (BCI) to represent our members and engage with regulators on the science underlying proposed regulations.

Two, because US EPA has identified lead as a priority for risk evaluation under the TSCA (Toxic Substances Control Act) regulations, we are assessing potential information needs

and gaps in this process and then will work to address these.

In addition to proactively anticipating issues related to Pb assessment under TSCA, we are working with the North American Metals Council (NAMC) to engage with US EPA on improving the metals risk evaluation methodology under TSCA.

Three, ILA is leading a study in partnership with BCI and the ABR (Association of Battery Recyclers) that will assess the significance of non-inhalation exposure pathways for lead in occupational settings. This will include identifying potential interventions aimed at reducing worker exposures and blood lead levels.

The results of this study will fill an information gap for regulatory agencies that have historically over-emphasized the importance of the inhalation pathway in explaining worker blood lead levels.

Our objective is to encourage regulators to manage worker blood lead levels, as opposed to over-regulating air lead, particularly considering our members have clearly demonstrated a willingness and ability to effectively reduce worker blood lead levels, annually, in the absence of a more stringent permissible exposure limit.

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What are other examples of ILA health science research and how does this benefit your members?

The non-inhalation exposure study that I mentioned kicking off this year with BCI and ABR is a follow-on to a study published just last year, which found that the relationship between air lead and worker blood lead in modern battery recycling facilities is very weak.

What this means is that inhaling lead in air is not the primary exposure route influencing worker blood lead levels and so continuing to reduce the permissible exposure limit for lead in air, currently set at 50 ug/m3 in the US, is unlikely to result in a meaningful decrease in worker blood lead levels.

With this knowledge, it does not make sense to focus singularly on regulating air lead. This is exactly the type of work ILA is working to highlight with regulatory authorities, to inform science-based and protective regulations.

We do not yet know what the results will be; however, experience tells us that facilities effectively managing air lead may be more likely to see improvements in worker blood lead levels by focusing on worker hygiene practices that address the incidental ingestion exposure route.

We look forward to learning more from the research team that leads this study!

ILA also sponsored a longitudinal study in which new lead facility workers were tracked from baseline to a period of over two years, monitoring multiple health endpoints to assess relationships between blood lead levels and potential cardiovascular, neurological, and renal effects.

Over two dozen publications came from this program, called Study for the Promotion of Health in Recycling Lead (called SPHERL) which as a whole demonstrated that current regulations are effective in protecting worker health.

I encourage readers to contact me if they would like copies of the SPHERL publications or more recent publications assessing the relationship between air and blood lead in battery facility workers.

What do you see as the most challenging part of your job?

There are many challenges I face in my new position, with the top challenge of anticipating regulatory actions within agencies that have had a high turnover in leadership and staff, budget reductions, and changing priorities.

I'm grateful to our partnership with Battery Council International and the Association of Battery Recyclers, and involvement with NAMC, to tackle this challenge together as we collaborate and advocate on behalf of our collective members.

What so you see as the biggest opportunities for lead and lead batteries in the future?

Lead and lead batteries are of course integral to so many products and applications that underpin society and our economic infrastructure. In the US lead is now identified as a critical raw material, underscoring its importance now and to economic growth and electrification in the future.

My colleagues at the Consortium for Battery Innovation are also pursuing cutting-edge research taking lead batteries to the next level of performance and durability. And I think next generation lead batteries will be essential across a wide range of industries, from back-up power in data centres to automotive and energy storage.

It's important that the health science continues to inform worker health and safety as demand for our industry's products continues to grow.

What will be key to your and the industry's success?

Key to success for myself, the ILA, and the industry is continued diligence and collaboration in advancing the science to support the safe use of lead, particularly as it is now designated as a critical mineral in the US and is essential to powering the transition to diversified energy sources.

Additionally, we need to work together to address lead health and environmental issues in low and middle-income countries, which are lagging behind in regulatory support. We want to continue to raise the bar across the global supply chain.

This is in part why ILA developed the LeadBattery360 program and is working to gain traction in these areas.

And what do you do when you are not being a health scientist?

I'm a parent of two active, school-age boys so outside of work I stay busy volunteering with school sports (cross country, track, and orienteering). I also enjoy hiking, biking, and camping with my family when our Pacific NW weather permits and cooking, reading, and knitting the rest of the time.

I'm always open to suggestions for wild game recipes and new books — both non-fiction and novels. ■

Breaking barriers and building labs: a woman's path to industry leadership

The Women in the Global Battery Industry (WGBI), met Gwenn Barker, global laboratory operations manager at Clarios, whose career journey — from lab technician to global leader — exemplifies the power of perseverance, innovation, and influence. This is a redacted interview of a larger article.

What is your current job at Clarios, and how does your work support the broader battery industry?

I've been with Clarios for 14.5 years and my focus is on standardizing and improving our global laboratories that test both lithium-ion and lead-acid batteries. One of our key initiatives is implementing a Laboratory Information Management System (LIMS).

This system provides a consistent platform for global teams to request testing and upload results, which supports uniform reporting and enables us to compare performance across labs and products. For instance, if two plants are manufacturing the same battery, we should see similar test results.

If we don't, that prompts a deeper dive into processes and opportunities for improvement. This standardization also fosters greater collaboration across our global lab network.

Can you walk us through your professional journey — your education and career path — and what led you to your current role at Clarios?

I began studying biochemistry at UW–Oshkosh, then moved to the West Coast and continued my education in Spokane, Washington. I eventually returned to Wisconsin when my father was terminally ill and completed my degree at UW–Milwaukee. I worked full-time throughout college to avoid student loans.

My career has taken me through a variety of lab-based roles. I've worked as an industrial chemical lab technician, handled hazardous waste recycling, conducted food chemistry analysis, performed R&D in pharmaceuticals, and even managed analytical testing for printing ink chemistry.

When I joined Clarios (then Johnson Controls), I was hired to establish and run R&D laboratories on the UW–Milwaukee campus. The idea was to have our chemists working side by side with UWM students and professors to advance lithium-ion battery technologies.

I was responsible for building out the labs and overseeing testing, even though the students and employees reported to other managers. It was an incredible opportunity that merged science, education, and innovation.

What initially drew you to the battery industry, and what continues to motivate you in your work today?

At the time, Johnson Controls was pioneering its collaboration with UW–Milwaukee, and I was excited by the opportunity to be a part of that innovation.

Having attended UWM myself, I knew how meaningful the academic environment could be — and it was inspiring to return in a professional capacity to help shape the future of energy storage. I was also ready to step into a leadership role, and this job offered the chance to build labs from the ground up.

We started with empty rooms and turned them into cutting-edge research spaces. I was able to apply my experience in safety protocols, scientific procedures, ergonomics, and project management while mentoring students and collaborating with professors.

It truly was a dream role, combining everything I loved about science, leadership, and community engagement.

What have been some pivotal moments or lessons in your career that shaped your approach to leadership or innovation?

One of the most meaningful experiences was building the labs at UWM — some of which were the first of their kind in the world. We constructed a dry room that enabled students and employees to build lithium-ion cells completely from scratch. The work we were doing, and the team I was part of, impressed and inspired me every day.

When the economy shifted and we transitioned those labs to UWM, it was a tough but valuable lesson. I had poured so much into creating and managing them — they felt like my babies — but I had to let go and pivot.

That experience helped me realize I could take everything I'd learned and apply it to a broader, global context. I began supporting the standardization of our existing global labs, using my experience to drive improvements.

A key challenge was that I had no direct authority over these labs. I had to lead by influence — building relationships, establishing trust, and showing the value of collaboration. It was a humbling and powerful lesson in leadership.

Another major lesson came from visiting our labs around the world. While we're all part of the same company, each country has its own culture, and I learned quickly that a one-size-fits-all approach doesn't work. To be effective, I had to adapt

my communication style to fit the cultural norms of each location.

What are some key challenges professionals in the battery industry face today, and how do organizations like WGBI help address them?

There are still challenges with diversity and inclusion across the industry. Additionally, the political landscape in the US is increasingly polarized, and that has implications for global manufacturers like Clarios.

While the government is encouraging more domestic manufacturing, we also need to maintain a global footprint. It's unclear how policy will shape the future of our industry, and organizations like WGBI can help us navigate those complexities with broader perspectives and shared strategies.

How does Clarios foster a culture of diversity, collaboration, and inclusion? Are there any programs or initiatives that stand out to you?

Honestly, I've felt that since Clarios became an independent company, the focus has largely been on stabilizing operations and achieving profitability. While that's understandable, I do think we've lost some momentum when it comes to diversity, collaboration, and inclusion. I don't see as much diversity in leadership as I'd like to, and I hope Clarios recommits to these values in a more meaningful way.

Being part of WGBI helps me feel more connected to a supportive network, but I believe there's still significant opportunity for growth at Clarios in this area. ■

Top tip for starters: Don't go it alone

What advice would you offer to someone just starting out in the battery sector — regardless of their background?

When I started, there weren't formal mentors, but I had one incredible person I could go to for anything — from navigating systems like setting up work travel to understanding technical tasks like using a Bitrode for charge/discharge testing.

That person was Linda Grus, and she made a huge difference. If she didn't know the answer, she always helped me find someone who did. That helped me build a network of resources.

My advice: Don't go it alone. Find someone who can help guide you, ask questions, seek answers, and then be that resource for others when you can. Get involved — participate in work activities and community events that nourish your soul.

Clarios does a lot of outreach and volunteer work, and that's just as important (in my opinion) as your day-to-day job. Engage with your workplace in ways that make it a community you're proud to be part of. ■

From cultural curiosity to global leadership

Eugenia Montes, a global business leader whose passion for cultural connection and international collaboration has shaped her successful career at Moura Batteries and helped advance the visibility of women in Latin America's battery sector.

Eugenia's introduction to the battery industry began in 2006 as a college intern in Grupo Moura's Export Department. What initially drew her in was her passion for interacting with different cultures. That curiosity quickly evolved into a deep, lasting commitment to global business and commercial development.

Now, with nearly two decades of experience, Eugenia serves as international business/exports manager, leading export sales and supporting Moura's international growth. Her global outlook aligns with her personal mission: "supplying energy and meeting the needs of our market"—a role that lets her blend business expertise with her love for connecting with people.

Eugenia's leadership approach is rooted in trust, values, and collaboration. "I've learned to approach challenges with a focus on people and values," she explains. "Building trust and respectful relationships with colleagues, partners, and customers is key to achieving meaningful results."

She sees the battery industry as a platform for driving clean energy, mobility, and sustainability—work that gives her a strong sense of purpose. "What motivates me most is contributing to the transformation of the industry — bringing fresh ideas, challenging the status quo, and helping build a more innovative, inclusive, and sustainable future."

Believing that diversity drives better outcomes, Eugenia actively fosters inclusive, high-performing teams and encourages open dialogue as a means of problem-solving.

Eugenia joined WGBI to expand her global network and help uplift women across the industry. "WGBI provides a great environment for women to build important connections within the industry on a global scale," she says. As part of the Latin America Chapter, she's excited about the growing space for women professionals in the region.

Her favourite WGBI experience so far? The Mentorship Program. "It has been the cherry on top." Eugenia was impressed by how thoughtfully the program was structured — matching participants based on specific areas for development and growth. "I feel very lucky and grateful to be a mentee of such an inspiring professional and person. This experience has had a real and lasting impact on my growth, both personally and professionally."

Eugenia encourages women in the battery industry to get involved with WGBI: "This community provides a valuable opportunity to connect with inspiring women who are making meaningful contributions to the industry." She advises full engagement: "It has had a positive impact on my work and career, and I truly believe it can do the same for you." ■

Allen Byrne (1944–2025)

It is with sadness *Batteries International* reports that Allen Byrne, 81, a stalwart of the lead battery industry for almost half a century, passed away in Connecticut on December 28.

A popular, well-liked and extremely knowledgeable engineer he was known for his expertise in lead battery applications; his support for the industry and also for being one of the founders of Battcon, the long-standing conference on stationary power.

Allen was born in 1944 in Coleraine, County Antrim, Northern Ireland. After attending St. Patrick's College in Armagh, Allen joined Britain's Royal Air Force where he served on NATO missions and alongside US armed forces. He left the service in June 1974 with a degree in electronic engineering. Among his many international postings probably the most prestigious was his time working at NATO Communications Headquarters in England.

Allen then began an international civilian career in power systems engineering. From the late 1970s he worked for Systems Engineering International in the Middle East, initially as an international operations manager but then as VP for marketing, operations and engineering. While working in Riyadh, Saudi Arabia, he met his wife, Maura, a nurse at King Faisal Hospital. In 1979, the couple moved to the US, ultimately settling in Frederick, Maryland. They were married for 46 years.

In the 1990s Allen became recognized internationally and in 1994 he became a co-founder of PowerConsult Inc. Until his retirement in September 2016, he worked for three well recognised industry names — American Power Conversion, Douglas Battery and most latterly Interstate Power-Care (part of Interstate Batteries). He continued to act for Interstate through his consultancy firm, Brass Tacks Power System Advisors, and in one of his most enjoyable jobs, with Eagle Eye Power Solutions.

Allen was also a senior member of the IEEE, a well-regarded speaker at a variety of events and for many years a contributing editor for Power Quality Assurance magazine.

Allen will be particularly remembered for the huge contribution he made for stationary battery professionals in helping set up Battcon.

Speaking to *Batteries International* in 2016 he talked about how Battcon evolved. "We first started talking about a conference dedicated to battery performance in 1994 but it took a couple of years for it to develop. The need for something dealing with the VRLA battery industry was evident. Especially so, given customers' anger, regarding the VRLA product and the battery industry in general.

"In response to this I wrote, in June 1996, what could be best described as a call-to-action and distributed it to senior figures in the industry and most importantly Glenn Albér. It was called 'Bothered by Batteries … Is there an Answer?' In it I addressed the same concerns that I had about VRLA batteries in general and called for some form of a battery users group. In that same issue, Glenn Alber and Marco Migliaro wrote 'Guaranteeing Battery System Performance. Part 1 — Understanding Failures.'

"The scene was set. Less than a year later Glenn founded Battcon and Marco was the first moderator. Unfortunately, Marco was unable to moderate the second Battcon and I was press ganged, literally the day before the conference."

Allen, who was an original member of the Battcon Technical Committee, went on to chair the conference for 17 years and was inducted into the Battcon Battery Hall of Fame in 2011.

"Allen was the technical genius on battery performance and safety, as well as the comic relief as the Battcon moderator. I was lucky enough to have attended most of the Battcon conferences, and Allen was the guy everyone would seek out to shake his hand and enjoy his humor," said industry colleague Don Lenz.

"Allen was a great mentor and friend. I had the privilege of working with him in the IEEE Stationary Battery Committee and Battcon. He was a unique individual and will be sorely missed."

Allen was deeply committed to the Frederick community where he lived for some three decades. As a practising Christian, he belonged to St John's Catholic Church, and was active in many levels of charitable service to his home town. He served on the Frederick County Economic and Community Development Commission and with the Kiwanis Club of Frederick, including a term as chapter president of its work for the needed and disadvantaged and its involvement with the Mission of Mercy and the Salvation Army.

Allen had a wide array of interests — these included time as state historian for the Ancient Order of Hibernians of Maryland and president of the local rugby club. His friends said he had an encyclopaedic knowledge of Irish history and music. He was adventurous too, driving the entire 2,450 mile length of Route 66 solo in 2017.

"He was a man of intelligence, wit, candour, and quiet resolve, who deeply loved his family. He will be greatly missed by all who knew him," said one friend. "He was a mentor to many."

Writing many years ago about what he hoped his legacy might be, Allen said: "Depending upon the point in their career path, I would want anyone that I mentored to know more than I did when I was in their shoes. I want them to be so competent that they can rise in the ranks. I hope that I have made their job easier and more rewarding."

Allen is survived by his wife, Maura Byrne; his five children and six grandchildren. He is also survived by his brother, Arthur Byrne. He was predeceased by his parents and his brother, Martin Byrne. ■

Rombat's Ioan Repede: 1954-2025

It is with sadness that *Batteries International* reports the death of Ioan Repede, the legendary CEO of Rombat, the Romanian battery manufacturer. He led the firm for more than a quarter of a century and was instrumental in its fortunes for some 42 years.

Ioan, who died on November 5, was the head of Rombat's lead acid manufacturing business from 1995 to 2021 and was the key figure in the negotiations that led to Rombat's acquisition by South Africa-based Metair Investments, in 2012.

A man who was as much admired for his humanity and Christian faith as well as his business acumen, he is also remembered as the driving force in making Rombat a respected national and international brand.

Ioan, who was born in July 1954, showed exceptional promise in his high school years and made a name for himself with, according to his friends, "outstanding academic results" while at the faculty of industrial chemistry at the Politehnica University of Timişoara.

Founded in 1920 the Politehnica is still one of the largest technical universities in central and eastern Europe. Ioan later said that Timişoara held a special position in his heart for his years there and how his Christian faith developed during that time.

After graduation he moved to Bistriţa, some 400km from Timişoara, where he started working for a battery manufacturing business which became the predecessor of Acumulatorul Bistriţa, which later went on to become a state-owned battery company in 1980. His rise within the firm was meteoric.

In 1985 he married and the couple's 40 year marriage, resulted in three children and seven grandchildren.

In 1991, with the opening up of Eastern Europe to Western market influences, Rombat became a joint-stock company.

In 1996 Ioan was the key driver in the privatization of Rombat when effectively the company was sold to its employees. Rombat was then, and is now, the main manufacturer of 12V car batteries in the country.

A man who was as much admired for his humanity and Christian faith as well as his business acumen, he is also remembered as the driving force in making Rombat a respected national and international brand.

On his retirement in February 2021, Repede was succeeded by Alin Ioaneş.

In a celebration of 45 years of business, held last May, Rombat acknowledged the role Ioan had played in turning the firm into "the national leader in car battery production" and an important exporter to European markets.

In a special awards ceremony in 2023, Alin Ioanes, said: "The 41 years he spent at the helm of the Rombat factory reflect the effort, dedication, vision and discipline with which he developed a successful business — one that has been iconic for Romania, and also has had a significant impact for the local community."

He was credited by the local press for turning Rombat into a competitive company on the European market "without departing from its Christian principles and community spirit".

Graeme Fraser-Bell, vice president for lithium sales at ENTEK said at the time of that ceremony: "I had the pleasure of working with Mr Repede over many years and was always impressed with his servant leadership approach and his utter professionalism."

Rombat described him as a special man and leader with vision and passion. He was also pastor of the Holy Trinity Pentecostal Church, where he was much loved and admired, and honorary citizen of the city of Bistriţa, Transylvania, where he lived.

A tribute to Repede published on November 7 by regional daily newspaper, BZI, credited him for turning Rombat into a competitive company on the European market "without departing from its Christian principles and community spirit".

The obituary noted Repede was awarded the title of honorary citizen of Bistriţa in 2014 and also of Bistriţa-Năsăud county in 2018 — "in recognition of his contribution to the economic and moral development of the community". ■

VARTA pays tribute to CTO Rainer Hald

VARTA AG has led tributes to its chief technical officer, Rainer Hald, who the company said died unexpectedly on November 23. He was 56.

The German battery brand extended its condolences to Hald's family and loved ones in a LinkedIn announcement on November 26.

Hald, who was also a member of the executive board, completed his training at VARTA in Ellwangen in 1989, then rejoined the group in 2000.

He went on to play a decisive role in shaping the technological development of the group for more than two decades, VARTA said.

As CTO, he was responsible for key areas of innovation and future development, providing strategic impetus and making a significant contribution to strengthening the firm's position as a technologically leading group.

Hald's professional foresight, integrity and high standards of quality and cooperation were of particular importance to VARTA, both internally and externally, the group said.

"With his passing, we have lost a personality who played an extraordinary role in shaping VARTA. His work will continue to be visible long after his tenure. We will honour his memory with respect and gratitude."

Battery industry veteran Mike Dunckley joined online tributes to

Hald, saying he was deeply sorry to hear the news: "I had the pleasure of meeting Rainer a few times and know that he was a great asset to VARTA."

Bernhard Wolf, VARTA's head of investor relations, said he would remember Hald for his positivity and how he always inspired colleagues in their work: "It was a pleasure to have worked with him. It's great loss and an even greater loss for his family and loved ones."

In an interview published last July by German technical organization, VDE, Hald said when he started his career, his main goal had been constant, professional development and to "really make a difference.

"Those were always my personal motivations and I could not have dreamed 20-25 years ago that I would have the chance to define the technology strategy of VARTA."

Hald said he was proud that, as well as small rechargeable lithium ion cells, VARTA was the only manufacturer in the world that has six electrochemical systems in mass production.

Last year, Hald praised the research activities of VARTA and partners toward the European Union-funded ECO2LIB project.

A key result of ECO2LIB is the development of battery cells in the 21700 format, which are primarily used in electromobility and home energy storage.

"The project has made great progress in the development of lithium ion batteries, which we did not consider realistic just four years ago," Hald said. "It's an important step towards a clean energy supply. And we at VARTA are proud that we have been able to make an important contribution here." ■

PENOX announces death of former CEO

Germany's PENOX Group has paid tribute to former CEO Giso von Steinau-Steinrück, who has died aged 65.

The lead oxides and additives company announced the death on January 20.

Von Steinau-Steinrück died in Paris last November and a memorial service was held in Germany earlier this month. He spent the last 17 years working as an independent consultant and most particularly working in Brazil, India, Mexico and South Africa. In addition to offering business development strategies he was involved in recycling projects.

Giso will be remembered as he played an essential role in the creation and development of PENOX, formerly the Penarroya Oxide Group, the firm said.

"Over more than two decades, his commitment and contribution left a lasting mark on the company and on all those who had the privilege to work with him.

"Giso's vision, drive and leadership were instrumental to the future success of the firm, which was created by the merger of the lead oxide activities of Heubach & Lindgens and Metaleurop in October 1994."

The merger brought together lead oxide production and experience in the fields of red lead, litharge, battery oxide as well as plant engineering.

"From the mid-1980s until the early 2000s, Giso dedicated his energy and passion to this industry to build a unique group that continues to supply high-quality lead oxide to customers around the world."

Today, PENOX is one of the world's largest producers of lead oxides, with operations in Germany, Spain, Mexico and South Korea.

In addition to lead oxides, the company said it has increasing sales in activities such as battery additives and R&D on behalf of clients. ■

As CAM exclusively reveal plans for a new division dedicated to lithium recycling, we talk to Francesco Marfisi – part engineer, part YouTube sales star – about his mission to continue evolving a traditional family firm into an industry leading global player.

The Opex vs Capex debate

It could cost you millions...

"The silence of a stopped production line is the most expensive sound an entrepreneur can hear," says Francesco. For a battery manufacturer, that silence isn't just a technical break, it's a financial haemorrhage draining margins, destroying planning, and eroding market competitiveness.

Every hour lead doesn't flow and oxide isn't produced, your capital evaporates under the weight of fixed costs that never sleep. Many convince themselves that success starts with saving on the initial purchase (CAPEX), but operational reality punishes this short-sightedness with mathematical violence.

The true enemy of your profit isn't a high initial investment, but the deceptive promise of "low-cost" solutions, often of low construction quality. Sellers of these plants bet everything on the immediate gratification of a lower price tag, leading you to believe a lead oxide production plant is a simple commodity. It is not."

Francesco Marfisi, nephew of the founder of CAM, an Italian manufacturer of industrial equipment for the lead acid battery industry, is, by his own admission, a bit of a Jekyll and Hyde.

With one hat on, he is clearly a gifted engineer, a graduate in electrical engineering who, in his own words, was 'born' into the company, working on the production line as a summer job in his teens.

Fast forward over two decades and he has now successfully carved himself a niche as a lead battery communications guru with his own YouTube channel where he describes his goal to bridge engineering and business.

On this channel he takes viewers on a kind of behind-the-scenes of his professional life, as the self-billed 'Engineering Salesman.' For readers he will even engage with his own magazine (cover shown here).

It's all quite avant-garde for the dry world of lead oxide mills and curing chambers, but Francesco is a man on a mission to show the world that engineering isn't just about theories and formulas, but 'endless opportunities'.

"I try my best to share our knowledge because I am the face of the company," he says. "It's important today, in 2026, to share not only the product and service we have because that's only the tip of the iceberg.

"There is so much more to learn about, cost, new technology and the market. Sometimes this market is known as an old industry but it's crucial to improve, move with new technology, new ways to save money and cut energy. There are a lot of things to do."

The company was founded in 1967 by Armando Marfisi, who was later

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joined by his brothers Bruno and Fernando. Today, Fernando is the CEO, but it is the younger Marfisi's, Francesco and his brother, Matteo, who are driving the firm's sales and innovation.

"Matteo is the technical director," says Francesco. "He's a mechanical engineer and he's the one who developed our patented lead shaver."

It is this lead shaver that is undoubtedly the star of CAM's product portfolio. A mechanical device with a cutting tool and a rotating shaft, it shaves perfect cylindrical flakes off a lead ingot, eliminating the need for a traditional, (energy consuming) melting process.

For such a game-changer in the oxide manufacturing world, Francesco explains that, perhaps predictably, the original light-bulb moment happened over a bowl of pasta.

"My uncles were on a business trip and had pulled over, tired, to have some lunch," he says. "Fernando watched as a waiter grated a generous portion of Grana Padano cheese into his bowl. And at that moment a spark ignited in his mind.

"'Why can't we grate lead ingots just like that?' he asked his brother. Armando, ever the pragmatist, listened intently, and together they began to sketch out a revolutionary new machine."

Even before the lead shaver, CAM had, for decades, been at the forefront of lead battery technology, modernizing the industry with their innovative ball mills and curing chambers.

"The advantage of the ball mill is to have real stability of the oxide," he says. "The oxide and the plates are the heart of the battery. If you have a great plate, you will have a guaranteed battery. If you don't have good oxide and good plates, you won't have a good battery."

Marfisi is understandably buoyant about CAM's position in the market but it's clear his real passion lies in communicating the company's mantra of 'built to last a lifetime'.

"Our approach is to focus on the TCO (total cost of ownership) and not just on the Capex," (capital expenditure) he says. "TCO is a topic a lot of managers don't understand very well, because they are so often focused on the break-even point in six months to one year, and they want a very short payback.

"But what I keep telling purchasing managers is that those who sell you on low price are hiding the TCO. They count on your distraction regarding maintenance costs, spare parts availability, and long-term reliability. They sell you a machine that works during tests but reveals itself as an 'Achilles' heel as soon as it's subjected to the stress of continuous 24/7 production.

"Chasing initial savings is, in fact, signing up for a 10-year subscription to sudden breakdowns and uncontrolled production scrap." ■

The physics of profit: the CAM method and TCO engineering

"At CAM, we don't design machines to be cheap; we design them to generate constant wealth," he says. "Let's analyze the real data for a plant with a production capacity of around 24,000kg/day (~1 tonne/hour) optimized for the European market.

With a conservative contribution margin of €0.50/kg, the value of lost production is €12,000 per day. This is where the technical difference between a CAM plant and a cheap one becomes a matter of corporate survival.

Reliability and downtime: A cheap plant suffers an average of 18 days of downtime per year, compared to only five days for a high-quality CAM system.

The impact of failure: Over 10 years, this gap translates into a staggering production loss of €2,160,000for the cheap machine versus €600,000 for CAM.

Quality and scrap: CAM's engineering precision keeps scrap costs to ~€100,000 over a decade, while the approximate tolerances of "cheap" competitors quadruple this figure to €400,000.

Maintenance drain: A low-cost system requires continuous intervention, pushing maintenance and spare parts costs to €700,000 over 10 years, whereas CAM stays at €600,000.

The math is hit-you-in-the-gut simple: the cheap machine saves you (apparently) €475,000 on the purchase price.

However, it presents a final bill of €1,485,000 more than a CAM plant over a decade. Investing in CAM means eliminating the risk of losing over 1.5 million euros in lost production alone.

Francesco acknowledges that the most common objection he comes across is that a CAM plant costs significantly more upfront. "Yes. But this is a technically correct statement that is economically irrelevant. Those who reason only in terms of Capex ignore the brutal reality of Opex," he insists.

"Claiming a quality plant costs too much is like saying a quality parachute costs too much: the price is irrelevant if it fails to perform when needed. A plant that costs less but stops three times as often is not an investment, it is a financial liability.

"The stability of the oxide production process is the heart of your battery; compromising that heart to save a fraction of the total budget is a mistake your industrial accounting will never forgive."

It's a message that's hard to ignore. Another is the revelation from Francesco that, over the next year, CAM has big plans to expand into the lithium recycling market with a new division to be called TITANAX.

"I will be developing the marketing and strategy of the new company, which will still come under the CAM umbrella, and we are currently in the study and development phase," he says.

What he does reveal is that the name, TITANAX, sprung from the very same company motto: 'To last a lifetime' that has always underscored their success in lead battery manufacturing.

"Titanium is a very strong metal, and "ax' because the machine will be for axial rotation."

We can only wait with bated breath to see what this next stage in CAM's journey will bring. If Francesco has anything to do with it, we'll be regularly updated via billboards in Times Square, Ted Talks and, quite probably, a blockbuster movie about black mass.

After all, as the champion of communication for the battery manufacturing industry — why on earth would he stop at YouTube? ■

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As the global electric vehicle fleet approaches 40 million vehicles, a critical question emerges: are we truly on the path to building a sustainable transportation future, and where should we focus our efforts to improve? The answer lies in how quickly we can move from today's linear EV battery value chain into a truly circular system argue Violeta Vargas and Jose Daniel Cruz, researchers at Eurecat.

From EV cradle to grave: the European perspective

The EU-funded RECIRCULATE project has taken a life-cycle view of EV batteries and examined a baseline plug-in hybrid (PHEV) NMC622 battery pack with a nominal capacity of 13.6kWh across its entire life cycle, from raw material extraction to End of Life management, highlighting where the biggest environmental impacts occur and how circular strategies can change the picture.

When the battery's journey is examined from beginning to end (cradle-to-grave), one conclusion stands out: the main environmental burden is generated before the battery reaches the vehicle. Material extraction and processing, mainly for cathode and anode production, as well as assembling the battery cells into modules and packs are all energy intensive steps that dominate the overall footprint. Key findings show that battery manufacturing consistently drives the largest share of environmental impacts, representing 62% of the total Global Warming Potential (GWP).

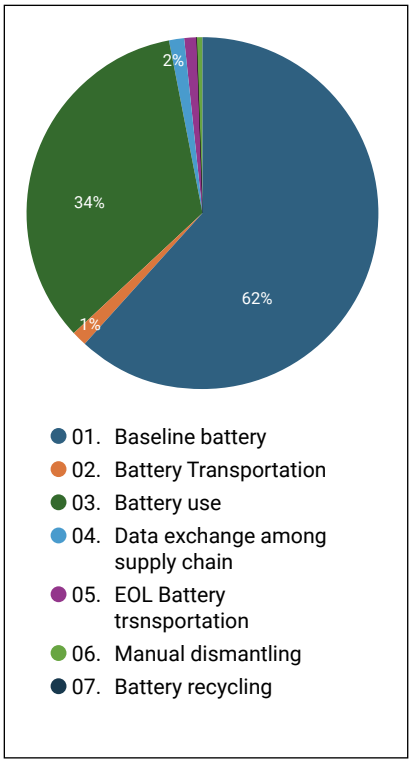

Figure 1: GWP, distribution of the baseline PHEV battery

Overall, GWP of the baseline battery is 0,016 kg CO_2 eq per kWh delivered during its lifetime, or 175 kg CO_2 per kWh capacity

The 03 stage (use) also plays an important role, accounting for 34% of the total GWP. Strongly influenced by the electricity mix used to charge the vehicle, is the second most important contributor.

The 05, 06, 07 stages (End of Life), including transportation, dismantling, and recycling, contribute only marginally, typically below 1-5% of total impacts, confirming that the manufacturing and use phases dominate the life cycle profile. Yet End of Life activities are crucial for enabling circularity. Without robust logistics, safe handling, and efficient recycling technologies, it is impossible to keep valuable materials in the loop or extend the useful life of batteries beyond their first automotive application.

The fact that battery materials and manufacturing processes dominate the overall life-cycle impacts highlights the key limitations of the current linear model, in which batteries are discarded only after eight to 10 years of use, along with its embodied energy and resources, while new virgin materials must be extracted to produce replacements.

This extract-produce-dispose model significantly increases the per-kWh environmental burden compared with a circular model that enables second-life applications and material recovery. Incorporating second-life use scenarios can markedly lower the climate-change impact per delivered kWh by increasing the total energy each battery provides over its lifetime, while reducing demand for virgin materials.

Upcoming life-cycle inventory (LCI) data from the RECIRCULATE project will enable an accurate quantification of the benefits of second-life pathways designed to maximize battery use and minimize virgin materials demand.

Today, the battery value chain still behaves largely as a linear system: resources are extracted, batteries are manufactured, used in vehicles for a number of years, and then removed from service when they no longer meet vehicle performance requirements.

From a life-cycle perspective, this means that a significant amount of embedded energy and materials is "locked" into a single use. Circular strategies change this equation by increasing the useful lifetime and therefore the total useful energy

From a life-cycle perspective, this means that a significant amount of embedded energy and materials is "locked" into a single use. Circular strategies change this equation by increasing the useful lifetime and therefore the total useful energy delivered by each battery and by recovering high-value materials at the end

Putting this all together — the implications

A key aspect for reducing the environmental footprint of lithium-ion batteries is to maximize the functional value obtained from each unit produced. RECIRCULATE is developing circular systems that enable second-life battery applications alongside advanced recycling and material recovery processes.

By extending the productive use of each battery and efficiently returning recovered materials or components into new battery packs, these approaches can reduce the frequency of replacement cycles, minimize waste generation, and lower the demand for virgin raw material extraction. Although the direct contributions of end of life stages such as transportation, dismantling, and recycling are comparatively modest relative to manufacturing in the baseline LCA, they remain critical enablers of circularity and thus of an overall impact reduction.

On the industrial side, OEMs and battery manufacturers need to design batteries for disassembly from the outset, incorporating modular architectures that facilitate repair, refurbishment, and material recovery. Battery manufacturers play a key role in ensuring transparent material traceability through digital product passports and supporting documentation systems.

Recyclers can contribute by investing in automation for a more efficient dismantling and high recovery rates, making circular pathways economically viable at scale. Energy storage operators will play an important role in deploying second-life applications that help amortize manufacturing impacts.

Policymakers, in turn, must create coherent regulatory frameworks that mandate or incentivize circular design, support data transparency, and remove regulatory barriers to reuse. ■

delivered by each battery and by recovering high-value materials at the end.

Even when a battery is no longer suitable for use in a vehicle, it often retains a substantial amount of its capacity. This residual performance can be harnessed in less demanding applications, such as stationary energy storage, backup power, or grid services. Giving batteries a second life can allow the same product to deliver considerably more energy over its existence. In environmental terms, the impacts of production are spread over a larger "service" life, which lowers the impact per unit of energy delivered.

The second lever is high-quality material and component recovery. Once further use is no longer technically or economically viable, efficient handling processes can recover critical materials/components that would otherwise be lost. Returning these materials or components to the battery supply chain helps to reduce the need for virgin raw materials, with benefits not only for climate-related indicators but also for resource depletion and supply risks.

Validating the circular advantage

The work completed so far offers a baseline view of how a representative electric vehicle battery performs in a largely linear scenario. The next phase of RECIRCULATE will integrate primary data covering automated dismantling, battery testing and grading, and repurposing for second-life applications.

This will allow the project team to quantify, under realistic operating conditions, how much different circular strategies can reduce environmental impacts, and under which circumstances they deliver the greatest benefits. The forthcoming analysis will focus specifically on the stages after the battery no longer serves its original automotive purpose, capturing both the additional energy and material requirements of circular processes (transport, dismantling, reassembly, recycling) and the avoided impacts of virgin material extraction and new battery manufacturing in the baseline linear pathway. ■

The battery value chain still behaves largely as a linear system: resources are extracted, batteries are manufactured, used in vehicles for a number of years, and then removed from service when they no longer meet vehicle performance requirements

Full comparative results incorporating primary RECIRCULATE process data are to be published by the second half of 2026 providing the battery industry with concrete guidance on how to optimize circular pathways and maximize environmental benefits.

The RECIRCULATE project is funded by the European Union's Horizon Europe program and SERI, Swiss agency for Research and Innovation (Grant No. 101103972) and brings together partners across the battery value chain to develop and validate circular economy solutions for EV batteries.

Violeta Vargas, advanced researcher, Eurecat

José Daniel Cruz, advanced researcher, Eurecat

Germany's BESS market is clearly moving from early-stage enthusiasm toward a more disciplined, finance-driven phase. But it's back to basics — bankability is about structure, risk allocation, and credibility — say four experts at a recent EES panel discussion.

Germany — it's not how BESS operate, but how capital thinks

Standardization, portfolio thinking, and early involvement of financiers will likely define the next wave of projects. Batteries may be the backbone of flexibility, but it is commercial sophistication — not technology alone — that will determine who succeeds.

As Germany continues to push renewables at scale, the winners in BESS will be those who understand not just how batteries operate, but how capital thinks.

Germany's energy transition is no longer just about adding renewables. It is about managing volatility. As wind and solar scale rapidly, flexibility has become the system's new currency — and battery energy storage systems are increasingly central to how that currency is traded.

By balancing intermittent generation and enabling round-the-clock renewable supply, BESS is emerging as a cornerstone of Germany's power market.

But as development accelerates, complexity is rising just as fast. New regulatory frameworks, a more cautious capital market, and diverging views on long-term revenues are forcing investors to ask harder questions. Are battery projects truly bankable? Which commercial models actually work? And how much risk are financiers really prepared to carry?

These questions took centre stage at the ees Europe conference session Commercial Models for Utility-Scale BESS – How Investor Appetite Is Shaping the Development Process in Germany. Moderated by Christopher Bryan, director at Apricum – The Cleantech Advisory, the discussion brought together senior voices from Engie, EnBW, terralayr, and Deutsche Kreditbank to unpack what is driving investment decisions in Germany's fast-growing battery market.

Why is Germany such a hotspot for BESS investors right now?

Mikko Preuss, chief commercial officer, terralayr: Germany is simply moving faster than most other countries. Last year alone, around 20 gigawatts of renewables were added. That kind of pace creates an immediate system-level need for flexibility to keep supply and demand in balance.

At the same time, market signals are becoming much stronger. Day-ahead price spreads have increased by almost 300% over the past five years. For investors who understand how to operate flexible assets properly, batteries can generate attractive returns. But it's not automatic — it requires sophisticated optimization and risk management.

With only around 2GW of utility-scale BESS currently operating, are we heading into a bubble?

Martin Daronnat, head of flexibility & structured origination, Engie: I do think expectations are overheated — particularly when it comes to revenues. The last few years were exceptional. COVID-19 and the war in Ukraine created extreme price volatility that should not be used as a baseline for future forecasts.

Investors need to be disciplined. That means challenging assumptions, speaking directly to traders, requesting forward quotes, and grounding projections in data rather than recent history. If you don't do that, you risk building a business case on conditions that are unlikely to persist.

Marcel Schepers, product manager flexibility marketing, EnBW: I would be careful with the word "bubble." We've seen grid connection requests totalling nearly 400GW, but that figure is misleading. A lot of those requests are duplicates — developers applying to multiple DSOs for the same project.

The real issue is the gap between renewable generation and flexible capacity. That gap is still very real. High volatility is the market telling us something: flexibility is missing, and batteries are one of the key ways to provide it.

Thomas Osburg, sales manager new energies, Deutsche Kreditbank: If anything, my concern is not today but five years from now. The pipeline is enormous, but our ability to actually build, finance, and offtake all those projects is limited.

So while the numbers look explosive on paper, delivery constraints — from financing capacity to construction

"The last few years were exceptional. Investors should not build long-term revenue models on conditions created by COVID and the war in Ukraine" — Martin Daronnat, Engie

and grid integration — will likely slow things down. That may ultimately prevent a true bubble from forming.

How much revenue certainty is needed before a final investment decision?

Osburg: Interestingly, the specific revenue model isn't what decides whether a project is financeable. We can structure financing around different strategies. What really matters is that there is a clear revenue approach from the outset.

Are you fully merchant, which is high risk? Are you using a floor model with some downside protection? Or are you pursuing a tolling agreement with contracted revenues? That choice defines how we assess and price risk.

Best practice is to work with specialised energy advisors who can provide project-specific forecasts under different scenarios. We always run downside cases as well. Even if financing isn't finalised, the revenue framework must be clear enough to assess bankability.

How do you weigh tolling agreements versus merchant exposure as an investor? And are you concerned about merchant revenue saturation?

Daronnat: At Engie, we're targeting 10 gigawatts of BESS globally by 2030. As a utility, we have decades of experience managing market risk, and that shapes our approach.

We believe strongly in the long-term value of flexibility, but we approach risk in a very structured way. Our Supply and Energy Management teams are built specifically to manage trading, structuring, portfolio optimization, and origination. That capability allows us to take risk — but only because we know how to manage it.

Revenues will almost certainly decline. We've had several years of extremely high prices, and ancillary services in Germany account for up to two-thirds of BESS revenues. That won't last forever.

That said, I'm not overly concerned about saturation of trading revenues. We hedge actively. Risk management is fundamental to how we operate. Very few energy suppliers in Europe can secure flexibility at scale, and those who don't expose themselves to risks that can severely limit growth.

By 2030, Germany will need several gigawatts of flexibility just to support renewable portfolios and deliver 24/7 green power to customers. Without hedging, the market risk would become unmanageable.

> "I would be careful with the word "bubble." We've seen grid connection requests totalling nearly 400GW, but that figure is misleading. A lot of those requests are duplicates, developers applying to multiple DSOs for the same project"
>
> — Marcel Schepers, EnBW

Is there a project size where one revenue model clearly works better?

Schepers: There's no hard threshold, but from our experience it tends to be around 40MW to 50MW. Below that, merchant or hybrid models often make more sense because investors are chasing upside.

As projects get larger, the investor profile changes. Infrastructure funds and large equity players prioritise risk mitigation, which usually means contracted revenues. When we closed our first tolling deal in 2022 for a 7MW project, negotiations took six months. What the market really needs now is standardization.

Preuss: I'd argue it's less about individual asset size and more about portfolio structure. Most of our assets are between 10MW and 30MW, but we aggregate them.

By pooling projects, we can offer, say, 50MW to an offtaker with a balanced mix of contracted and merchant exposure. We've recently closed deals like that. Thinking in terms of total megawatts under management — rather than single assets — is where the market is heading.

Osburg: Market access is key. The PPA market in solar is a good analogy. PPAs are usually reserved for large projects because the legal and administrative effort has to make economic sense.

The same applies to BESS. Large assets can absorb those costs; smaller ones often can't. Without standardized frameworks to aggregate and contract smaller projects efficiently, many will remain stuck with merchant exposure.

What makes a BESS tolling agreement successful?

Daronnat: First, absolute clarity. Structured deals are complex, and even small misunderstandings in terminology can cause major delays.

Second, trust. Every deal encounters surprises — delays, missing details, changing assumptions. Trust is what keeps negotiations moving. Strong legal, trading, and structuring teams are essential, because you must fully understand the risks you're taking on.

And finally, don't sign a toll just because it looks good. Sign it because it fits your strategy and risk profile.

Preuss: From an investor perspective, start with your own strategy. What is your risk appetite? Are you equity-constrained? Are you optimising for long-term cash flow or IRR?

Then run a competitive process. With no market standards yet, benchmarking is critical. And understand your counterparty's value drivers. Structuring a toll as a virtual, capacity-based agreement rather than tying it directly to an asset can keep it off balance sheet and materially improve economics.

Osburg: And don't forget the bank. We often provide up to 70% of the capital. That means we need visibility on availability guarantees, penalties, reporting rights, and commercial risks.

If the bank is involved too late, the entire agreement may need to be reopened — which nobody wants.

Schepers: Risk allocation is crucial. Who is responsible for monitoring? For warranty compliance? A deal can look attractive until you realise all the risk sits with the asset owner — and that can quickly become a financing problem.

Fairness and clarity matter just as much as price. ■

Lead industry urged to push for share of €1.8bn EU battery aid

All battery technologies could be eligible for a share of a €1.8 billion ($2 billion) financial lifeline to Europe's struggling manufacturers, according to the European Commission which confirmed on December 16 it planned to push ahead with its new 'battery booster' scheme — first reported by this publication in September — with €1.5 billion of the total to be made available through interest-free loans for European battery producers.

One veteran lead battery industry insider told this publication that producers and trade bodies must now seize the opportunity to demand financial support is on offer for all chemistries — and not let Brussels return to "business-as-usual funding for anything but lead".

Asked by *Batteries International* whether all EU-made batteries — such as lead, lithium and other technologies — could benefit from the support, a European Commission spokesperson said on December 17: "The eligibility and selection criteria for support are yet to be established."

According to the commission, "additional targeted policy measures will support investments", to create a European battery value chain and foster innovation and coordination across EU member states.

These measures aim to enhance the cost competitiveness of the sector, secure upstream supply chains and support sustainable and resilient production in the EU, contributing to the derisking from dominant global market players, the commission said.

The battery booster confirmation came at the same time as the commission proposed scrapping the EU's effective ban on new combustion-engine cars from 2035. A new 'automotive package' would allow continued sales of some non-electric vehicles.

"The European battery industry, like the EV sector, is facing challenges in sustaining itself amid aggressive low-price competition. Therefore, urgent EU action is needed to level the playing fiel." — Ilka von Dalwigk, RECHARGE

Currently, the EU requires new cars and vans from 2035 to have zero emissions. However, under the new proposal, that clean energy transition target would instead change to a 90% cut in CO2 emissions from 2021 levels, instead of 100%.

RECHARGE, which represents the European battery industry, said on December 17 it welcomed recognition of the strategic significance of the sector, but more was needed for the struggling European car industry and the nascent battery value chain.

Director general Ilka von Dalwigk said the battery booster was a "first step".

"The European battery industry, like the EV sector, is facing challenges in sustaining itself amid aggressive low-price competition. Therefore, urgent EU action is needed to level the playing field."

She said to future-proof the strategic autonomy and technology leadership of the EU's automotive industry, the bloc needs a resilient and sustainable homegrown battery value chain.

Commission president Ursula von der Leyen said of the latest proposals that innovation, clean mobility and competitiveness had been the EU's top priorities in "intense dialogues" with the auto sector and other bodies.

"As technology rapidly transforms mobility and geopolitics reshapes global competition, Europe remains at the forefront of the global clean transition."

However, as evidenced by recent reporting and analysis by *Batteries International*, EU leaders are desperately scrambling to shore up the battery sector in the face of overwhelming global competition, from predominantly Asian players.

Last September, EU leaders were urged to act urgently to support European battery manufacturers — after being warned the industry faced costs that are some 20% higher that Asian competitors.

The call came at what was termed a high-level ministerial meeting of the European Battery Alliance (EBA) and the European Solar Industry Alliance in Brussels, including representatives of EU member states, the European Commission and the European Investment Bank.

Earlier, in an open letter to the European Commission, the CEOs of the Automotive Cells Company, battery maker Verkor, and Volkswagen's PowerCo battery tech firm called for immediate, targeted measures to support a rapid ramping up of battery production across the continent.

The letter, titled Who Will Make Our Batteries? Europe's Moment of Truth, was released by the EBA on September 5.

In terms of support specific to the lead battery sector, a senior member of the European Parliament said last year that the industry could breathe a sigh of relief and help energize Europe's clean energy transition now one of the industry's bogeymen — former EU Green Deal supremo Frans Timmermans — was out of office.

German Christian Democrat MEP Peter Liese, speaking in Brussels, said: "We should not go back to the Timmermans years."

Liese diplomatically described Timmermans' time as former European Commission executive vice president in charge of the Green Deal as "problematic".

"Since Timmermans has left we've had a different focus," he said. ■

European Commission fines lead battery firms and EUROBAT, over price-fixing

The European Commission has fined lead battery majors Exide, FET (including its predecessor Elettra) and Rombat — along with trade association EUROBAT — a total of around €72 million ($85 million) for breaching EU antitrust rules.

The Commission said on December 15 that the fine related to participation in a "long-running cartel" in respect of automotive starter batteries and also involved Clarios (formerly JC Autobatterie).

However, Clarios was not fined because it received full immunity for revealing the existence of the cartel.

The Commission said it had also closed proceedings against lead manufacturing giant Banner and EUROBAT service provider Kellen.

The largest fine of €30 million was handed down to Exide. Rombat was fined €20.2 million (of which €11.5 million jointly and severally with Metair), while Elettra, FET's predecessor, was fined €15.6 million.

FET was fined €6.1 million (of which €5.3 million was jointly and severally with Resonac) and EUROBAT was fined €125,000.

Batteries International reported in December 2023 that the Commission had formally launched proceedings under its price-fixing probe, which the Commission said had begun in September 2017.

Now the Commission has revealed that, for more than 12 years, manufacturers, Clarios, Exide, FET and Rombat (owned by Metair Investments), together with EUROBAT, entered into "anticompetitive agreements and engaged in concerted practices related to the sale of automotive starter batteries to automotive original equipment manufacturers (OEMs) in the European Economic Area".

As lead is the most important input material and cost factor for the batteries concerned, battery producers pay a premium to suppliers to procure lead with the necessary quality, the Commission said.

"This cartel restricted competition and may have led to higher prices for the manufacturing of cars and trucks in Europe."

The Commission found that the four manufacturers, helped by EUROBAT, agreed to create and publish premiums calculated based on their purchasing price of lead (the so-called EUROBAT premiums) in the industry publication Metal Bulletin.

They also agreed to use such premiums in the price negotiations with their respective OEM customers, such as manufacturers of cars and trucks, to ensure that the resulting surcharge was kept at a level higher than it would have been without such agreement.

In general, a surcharge is a legitimate tool suppliers use to reflect changes in raw material costs in product prices, allowing them to transfer this cost risk to the customers.

However, the Commission said it was "clearly illegal for suppliers to secretly coordinate to introduce and use such a surcharge as an industry-wide standard".

Teresa Ribera, the EU's executive VP for clean, just and competitive transition, said: "We have zero tolerance for price fixing or any type of cartel. It is our duty to ensure that our citizens and businesses, including European auto manufacturers, can depend on suppliers that play fair and respect competition rules.

"With this decision, we also remind trade associations that they should not use their position as representatives of the industry to facilitate collusion among their members."

In response to the Commission's announcement, Metair Investments said on December 15 the fine was likely to have serious financial implications on Rombat's business operations. Metair's and Rombat's boards are considering the Commission's findings — including an assessment of all legal options and the extent to which the fine may be enforceable against Metair.

Metair said it refuted the legal presumption that it exercised decisive influence over Rombat in this matter.

Key decisions regarding the implementation of the EUROBAT premium had already been firmly established by the time Metair acquired Rombat in 2012 and were not identified during the due diligence process carried out by external advisers, Metair said. ■

Monbat €9m deal for full ownership of Tunisia's Nour

European lead acid major Monbat has signed a contract that will give it full ownership of Tunisian battery manufacturer Nour.

Monbat said on December 22 it was acquiring the remaining 40% of capital in Nour — nearly four years after the Bulgaria-based business acquired a majority 60% stake in the North African lead acid firm.

The total cost of the latest transaction amounts to €9 million ($10.6 million), which is payable in three instalments, the first €4 million tranche of which is due on completion of the deal.

The acquisition is expected to be finalized in the first quarter of 2026, subject to approval from the Central Bank of Tunisia.

Monbat said the remaining tranches, amounting to €2.5 million each, will become due at the end of 2026 and end of 2027 respectively, together with applicable interest for the deferred payment.

Monbat said previously that taking control of Nour was part of plans to expand its market share across North Africa and the Middle East.

Nour, founded in 1956, claimed to be the first Tunisian company to specialize in the production or batteries, which it supplies to sectors including cars, public transport vehicles and maritime vessels.

Batteries International reported in 2023 that Nour was preparing to start operations of a new lead battery breaker plant supplied by Italian engineering company STC.

STC said a year earlier that it had been awarded a $5 million contract to supply a lead battery recycling plant to Nour, featuring STC's novel 'U4Lead' paste desulfurization tech.w source of grid flexibility." ■

Clarios and partners plan sodium ion production 'in Europe or US'

Clarios has revealed plans to launch serial production of low-voltage sodium ion batteries before the end of the decade, after announcing an extended partnership with Swedish battery tech developer Altris.

Clarios said on January 7 serial production would be at a dedicated European or US facility equipped for scalable manufacturing, although the lead and lithium battery giant did not give details.

The US-based company said it has now "deepened" its investment in Altris, to speed-up battery development, but did not disclose financial details.

The partners are also working with Slovak manufacturer InoBat to prepare for assembly of initial sodium ion test cells for automotive applications. Prototype batteries at InoBat's facility in Slovakia will be based on test cells produced at InoBat's pilot plant, using Altris' advanced sodium ion technology.

Clarios claimed these cells demonstrate strong cold-start capability down to -25°C (-13 °F) low internal resistance, and high power density – features that ensure reliable winter operation and efficient energy delivery for modern vehicles.

All performance validation and testing is being conducted at Clarios' R&D laboratories in Hanover to ensure compliance with OEM requirements.

Cooperation with Altris was launched in 2024, when Clarios said the aim was to develop a sodium ion battery with a potential of up to 60V to support automotive applications in new vehicles and for aftermarket replacements that can also complement a multi-battery low-voltage system configuration.

The partners are working to a joint development agreement focused on what they describe as a power sodium platform.

Validation and testing are conducted in Clarios' R&D laboratories in Hannover to ensure compliance with OEM requirements.

By planning for localized production in Europe and keeping the option for US capacity, Clarios said it is building a resilient supply chain anchored in Western markets to mitigate global sourcing risks and ensure long-term sustainability.

InoBat's facility was commissioned in 2024. The site includes R&D labs, quality testing, and a pilot line capable of producing up to 50,000 cells annually. It is running customer qualification programs and serves as a key enabler for future serial production. ■

Supercap firm Maxwell Technologies acquired

For the record, Clarios acquired Maxwell Technologies from California-based UCAP Power for an undisclosed sum in November.

Maxwell, a manufacturer of supercapacitor cells and modules used in grid and onsite power applications, including data-centers, will operate as an independent, US-based business, within Clarios.

Clarios said the deal strengthens its position in high-performance, short-duration energy storage solutions. The lead and lithium battery giant said supercapacitors are perfect for storing excess energy and supporting systems during sudden spikes in peak demand.

Key benefits for Clarios include bolstering its supply chain of supercapacitors — which can deliver up to one million cycles, operate across extreme temperatures and require no maintenance or fire-risk mitigation — to support US and global original equipment customers, the firm said.

Maxwell has decades of innovation in supercapacitor systems, with more than 85 million supercapacitor cells shipped and applications spanning US energy generation, grid stabilization, automotive, transportation, and industrial automation, Clarios said.

CEO Mark Wallace said: "Maxwell's supercapacitors are designed to provide customers with high-power energy storage solutions that emphasize reliability, safety, and long life."

Wallace said the acquisition boosted opportunities for the battery maker to expand its presence in non-automotive sectors.

"Maxwell's existing customer relationships in data-centers, grid, military and industrial applications will be maintained and actively developed under Clarios' leadership."

Maxwell was formerly owned by Tesla, which finalized its purchase of the firm in 2019. Tesla sold Maxwell to UCAP two years later.

In March 2025, Clarios unveiled a 10-year, $6 billion plan to expand battery manufacturing and help boost US energy and critical minerals independence.

The company said its strategy, through to 2035, included increasing production of additional cutting-edge energy storage technologies. ■

Skeleton pushes graphene tech with latest European launch

Skeleton Technologies has formally opened its latest European 'SuperFactory' site, in Germany, at a cost of around €220 million ($258 million).

The Leipzig facility manufactures the firm's graphene-based supercapacitors and follows the opening of a plant in Finland, as revealed by *Batteries International* in November..

Skeleton announced the Leipzig opening on December 1, saying the site already supplies Siemens, General Electric and Hitachi Energy, serving European electrical grids and "major US hyperscalers" for AI infrastructure.

Supercapacitors from Skeleton use no lithium, cobalt, manganese, or other critical raw materials, and are based on its proprietary 'curved graphene' tech.

Skeleton said its high performance GrapheneGPU system has the ability to reduce data-centers' AI energy consumption by up to 45% — tackling a key challenge for expansion of AI systems.

Leipzig is designed for an annual output of up to 12 million cells.

CEO Taavi Madiberk said: "Skeleton's systems are already used by German transmission operators as a last line of defence, a real safety belt for a grid increasingly powered by renewables." ■

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Lead acid 'regeneration' tech firm seeks partners

South Korean company Repowertek is seeking joint venture partners and investors to expand deployment of its innovative lead battery regeneration technology in global markets.

Repowertek says its 'PRIME Series' solution is the first to feature technology capable of regenerating lead-acid batteries without internal overheating.

A proprietary high-frequency pulse algorithm ensures stable battery performance for up to 10 years while preventing overheating or degradation, according to the company.

A spokesperson said PRIME, inspired by automotive maintenance practices, incorporates scheduled restoration cycles.

"After initial regeneration at roughly two-thirds of a battery's service life, follow-up treatments every 12-18 months restore capacity, reduce total ownership costs, and maintain fire-free operation over the battery's extended lifespan."

With regular maintenance and the use of a regenerator, lead acid batteries can achieve up to three times the lifespan of typical use, the spokesperson said.

The proprietary technology also offers a safer, more economical alternative to lithium based energy storage systems and combats what Repowertek said are growing global concerns over Li battery fires and "lithium fire phobia".

"Amid intensifying global competition in energy storage, lithium ion batteries are increasingly considered ticking time bombs, prone to fire, thermal runaway, and toxic gas emissions."

Repowertek said after more than a decade of R&D and several product generations to date, it has already exported PRIME to over 70 countries.

The system safely and repeatedly restores industrial lead acid batteries for ESS, UPS, and traction applications across sectors such as telecoms, datacenters, hospitals, shipping, railways and defence.

The system integrates battery subscription and leasing models, PRIME maintenance services, equipment rental, lead recycling, and strategic partnerships with manufacturers, creating recurring revenue streams and a fully circular, sustainable closed-loop ecosystem. ■

BCI urges new investment to support 'foundational role of lead'

Battery Council International has issued a rallying call for "long-overdue investment" in US supply chains for critical battery materials, saying North America's economic future and national security depend on it.

BCI said on December 22 that, on balance, 2025 had been a year of progress for the North American energy storage industry, highlighting the recent US designation of lead as a critical mineral for the first time.

The trade body said this was an overdue recognition of lead's foundational role in the American economy as the primary raw material in batteries that power nearly all cars and trucks on US roadways, among many other important applications.

BCI noted there had not been a new battery recycling center built in the US since 2009 — "in large part to permitting red tape and misconceptions about local impacts".

At the same time, primary lead smelters as well as secondary lead recyclers have both declined, with a total of nine facility closures between 1990 and 2021.

However, BCI praised existing recyclers for doing their best to expand, despite current constraints and highlighted a recently-issued 10-year permit renewal for Ecobat's City of Industry facility in California.

Additionally, Clarios has unveiled comprehensive supply chains upgrades that includes $6 billion in total US investments to increase domestic battery production and critical minerals recycling and processing.

"Increased capacity is in everyone's interest," BCI said, pointing to the trade body's own data showing that the need for lead in battery production continues to increase at a 2% projected growth rate through 2027.

What's more, AI and data center growth and the need for backup power will create exponential demand in the long term, building demand on top of the current projections.

"It all adds up to a battery materials supply chain under stress at a time of peak demand, and therefore an urgent need for investment and regulatory support." ■

Amara Raja says lead battery sales robust as lithium rises

Amara Raja Energy & Mobility said in its first half figures its mainstay automotive lead acid business remains strong, despite a tumultuous global market.

Chairman and MD Jayadev Galla said robust sales of lead batteries contributed to profit before tax of Rs666 crore ($75 million) for the half-year ended September 30.

"Even though it has been a tumultuous quarter with tariffs and global uncertainties, our performance has been solid, and we look forward to making better gains."

Executive director for automotive and industrial, Harshavardhana Gourineni, said continued growth in the original equipment manufacturer segment underscored the firm's unwavering commitment to quality and reliability.

However, Gourineni said the company was seeing a decline in lead acid tech in the telecoms sector, while lithium batteries from the firm's developing new energy business were gaining traction.

Meanwhile, the company is confident that its customer qualification plant for domestic lithium cell manufacturing will be operational by the fourth quarter of this financial year — which in India ends next March.

In September, the company said it had already sold nearly 100MW in lithium battery cell packs to the telecom sector. However, the EV battery side of the business had slowed in the first quarter of this year because of lower demand from OEMs, although the firm expected this to rise in future. ■

Morrow upbeat on gigafactory but seeks investors, partners

Norway's Morrow Batteries is entering the final phase towards full-scale series production — but the firm said its priorities include conserving cash, as it closes an office in Oslo.

Production lines for the eventual 1GWh LFP battery factory in Arendal are running and commercial deliveries are starting, Morrow said on January 9.

However, Morrow highlighted the "demanding reality" it faces, against the backdrop of a European battery industry dealing with global overcapacity, price pressure from low-cost imports, rising capital costs, and growing uncertainty around supply chains and industrial policy.

The announcement came after the firm said on December 19 Lars Christian Bacher was stepping down as CEO, with Jon Fold von Bülow taking over as acting CEO.

The battery maker said it is now pursuing a "partnership-first" strategy, seeking long-term investments and strategic alliances to accelerate technology validation and win offtake agreements.

"Industrial alliances are the way forward for Morrow," said von Bulow, one of the firm's founders.

"We aim to work with strategic players to accelerate technology validation and secure offtake agreements."

Executive chair Ann Christin Andersen said: "This is an important milestone and a unique achievement for us as an independent cell manufacturer in Europe, but we still have a lot of work ahead.

"To build on this momentum, we have therefore set clear priorities to preserve cash and focus resources. The company will consolidate all operations at the factory in Arendal and in Grimstad and plans to close the Oslo office.

As the company centralises in Arendal, CFO Steffen Føreid and co-founder and EVP Pål Brun have decided to pursue new opportunities, the battery maker revealed: "Both played central roles in bringing Morrow to its current stage and will continue to support the leadership with key strategic deliverables during a transition period."

Batteries International reported in January 2025 that Morrow had secured a loan facility equivalent to more than $13 million to help scale-up its battery manufacturing plans in the country.

The NOK1.5 billion facility from Innovation Norway boosted Morrow's business plan for starting up its first 1GWh LFP battery factory in Arendal.

Last July, Morrow said it would work with the Swedish Electric Transport Laboratory on speeding up development of LNMO battery cells. ■

Battery 'likely cause' of UK cargo vessel blaze

Batteries are suspected of being the cause of a major fire on a cargo ship docked in the UK earlier this year, investigators have concluded.

The blaze broke out on the Marshall Islands-registered bulk carrier Altay on the morning of June 27, while scrap metal was being loaded into the vessel's aft cargo hold at Albert Dock in Hull.

A preliminary assessment of the incident, published by the Maritime Accident Investigation Branch (MAIB) on November 27, said an undischarged battery or other ignition source likely caused a spark that ignited combustible material in the scrap cargo.

The cargo had been classified as group 'C' scrap metal under the International Maritime Solid Bulk Cargoes Code, which did not require the shipper to declare hazard identification and cargo composition. However, the scrap contained hazardous impurities, including batteries, oil drums, and oily residues, which posed a fire risk, MAIB said.

The fire was not distinguished until the early hours of the next day and, although there were no injuries, smoke and continuously evaporating water created a noxious cloud that drifted over the local area.

MAIB said the scrap cargo was later removed and analyzed. An inspection of the Altay on July 14 found significant heat damage to structural steelwork in the aft cargo hold. The vessel, owned by Beyaz Denizcilik Ltd Şti, was allowed to leave port on July 27 for drydock repairs in Turkey.

Beyaz Denizcilik has since stressed the importance of cargo loading monitoring and pre-loading inspection to its crews, MAIB said. Meanwhile, the owner of the cargo loading facility involved, The Griffiths Group, has ceased trading.

The UK incident came just weeks after customs chiefs in the Dutch port of Rotterdam launched an investigation into the discovery of an illegal shipment of hazardous old and discarded lead batteries, suspected to be on route for processing in India's unregulated sector.

There was no appropriate permit and the cargo was incorrectly labelled as comprising non-hazardous plastic waste and metal residues.■

Volvo parks NOVO battery venture until tech partner found

Volvo Cars has announced an "operational pause" for its battery start-up, NOVO Energy, halting operations while it continues the search for a technology partner.

Volvo said on January 13 its long-term ambition continued to be the production of NOVO batteries for its electric cars in Sweden.

However, a year-long search for an external technology partner continues. This means NOVO cannot proceed with operations at this stage. As a result, NOVO has announced layoffs.

"This decision has not been taken lightly but is necessary considering the current situation," Volvo said.

NOVO was originally established as a joint venture with Swedish battery maker Northvolt and was fully acquired by Volvo in January 2025. In March 2025, Northvolt confirmed it had filed for bankruptcy in Sweden.

Last March, Volvo's venture capital arm became a key investor in Swedish sodium ion battery developer Altris.

The undisclosed investment by Volvo Cars Tech Fund was made in Altris' B1 funding round. Volvo Cars will also collaborate on product development for potential new battery energy storage systems. ■

Ecobat Battery relaunches 'energized' as Veloris

UK and European automotive battery business Ecobat Battery has been relaunched as Veloris — six months after being acquired by private equity firm Endless.

UK-based Endless said in June it had bought the battery distributor from the US Ecobat group for an undisclosed sum — the latest in the group's piecemeal sell-off of business units worldwide.

Veloris inherits a network of 23 distribution hubs in the UK, Ireland, France, Netherlands, Belgium and Spain.

The firm said the relaunch follows a comprehensive review of the business's position in, and value to, the market.

CEO Russell McBurnie, who was previously MD of Ecobat Battery, said: "After separating from an industrial group, we are now free to pursue our own priorities.

"By regaining our independence, we are re-energized and able to use the skill, knowledge and experience embedded in the business, to drive growth and fulfil our potential."

McBurnie said: "As battery technology has developed and the legal requirements have increased and become more complex, it is now more important than ever to have a battery supply partner that understands the details, whatever the sector."

Batteries International reported in October that private equity investor Splitstone Capital was acquiring Ecobat Resources UK's (ERUK) lead battery recycling business, while further sales of Ecobat's assets in the US were under discussion. ■

Samsung SDI in partnership for next-gen EV battery tech

Korean battery maker Samsung SDI is partnering with national automaker KG Mobility (KGM) to develop and commercialize next-generation EV battery pack technologies.

The companies said on December 23 they had signed a memorandum of understanding focused on Samsung's 46-series cylindrical battery cells and expanding collaboration on advanced technologies.

Samsung said its 46-series already features high capacity high-nickel NCA cathodes and its proprietary silicon carbon nanocomposite anodes, which the firm claims, reduce swelling while extending battery lifespan.

The technology also incorporates a tabless design that reduces internal resistance and optimizes current flow, enhancing high-power output and fast-charging performance, together with enhanced thermal management.

Joint R&D into advanced technologies aims to manufacture products targeting the domestic and international EV markets, the partners said.

The partnership comes against a backdrop of increased state support for the country's faltering battery sector, with an initial cash infusion worth close to $15 billion unveiled early in 2025, in response to a global slump in EV sales.

Meanwhile, Samsung is set to push ahead with mass production of all solid-state batteries (ASBs) in 2027, under plans outlined in 2024. President and CEO Yoon-ho Choi made the commitment to expand the firm's products portfolio at the annual general meeting of shareholders in Seoul.

A pilot line for ASBs was set up at Samsung's Korea R&D center in December 2023. ■

SK On 'ending battery joint venture' with Ford

South Korean battery manufacturer SK On said on December 11 it was ending its joint venture with Ford Motor for battery factories in the US.

SK, a subsidiary of SK Innovation, said it was "reorganizing" the structure of BlueOval SK, the 50:50 joint venture, but would continue "strategic cooperation" with Ford.

Ford issued a brief statement on December 12 saying only that it was aware of the announcement and had no further comment.

According to SK, a Ford subsidiary will take full ownership of battery plants in Kentucky, while SK will assume full ownership and operate the Tennessee plant. The Tennessee plant is in 'BlueOval City', Ford's electrified vehicle and parts complex.

This decision is a strategic choice to respond more effectively to changing market and customer needs by improving productivity, operational flexibility, and response speed through selection and focus, SK said.

According to SK On, the new arrangements are expected to be finalized by the end of the first quarter of 2026, subject to various regulatory and other approvals.

A spokesperson for the battery maker said: "We will focus on profitability-oriented internalization in the North American market by supplying batteries and ESS for electric vehicles for various customers such as Ford."

Last year, Ford's EV business reported that losses soared in its first quarter to $1.32 billion, or $65,272 for every electric vehicle sold in the first three months of 2024, according to analysis by industry commentator Robert Bryce.

The Detroit-based auto giant lost more money in its EV segment than it made in net profit over its entire business. ■

CATL readies Hungary battery cell plant for production

China battery giant CATL says it is set to launch its new cell factory in Hungary as a springboard to strengthen long-term European operations. CATL told China's state Xinhua news agency on December 4 that production from the plant in Debrecen, with an initial annual capacity of 40 GWh, is already "fully booked" by clients.

Cell production starts in early 2026 after construction and installation of equipment is completed. CATL said it expects to employ 1,500 on site by the first quarter of 2026.

"Our Debrecen investment is a major step towards strengthening CATL's European presence," said Matt Shen, managing director of CATL Germany and Hungary. The plant aims to achieve carbon-neutral certification within two years of launch. ■

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Sunlight starts up logistics hub to power battery supply chain

For the record, Greece-based battery manufacturer the Sunlight Group has launched operations at its €21 million ($24 million) logistics center in Xanthi to underpin its expanding operations in European and international markets.

Sunlight said on November 3 the move underscored the importance of the 16,000m2 site, in north-eastern Greece, where the firm announced a €50 million expansion of its lead and lithium battery manufacturing units in 2021.

At the heart of the site's operations are a myriad of advanced technologies in automation, robotics, warehouse management systems and AI, which Sunlight said are powering its global supply chain.

Antonis Theologitis, Sunlight's group operations director, said: "It is an investment that establishes Greece's role as a central operational hub for the group's international activities, offering greater flexibility to our fully integrated supply chain."

Separately, Sunlight confirmed on October 2 that the firm had successfully completed its first group ISO certification audit, marking a key milestone in the company's commitment to operational excellence and sustainability.

Batteries International reported in 2023 that Sunlight was spinning off its lead recycling operations into a new subsidiary, Sunlight Recycling, to guarantee raw material supplies for lead battery production.

Sunlight CEO Lampros Bisalas said then the move would create one of the largest secondary lead producers in the world, help to expand the Greece-based firm's collection of used batteries in Europe and America and make its lead battery production operations more competitive. ■

Asahi Kasei set to launch UHP cell with EAS Batteries

For the record, Japan's Asahi Kasei said in November it was licensing its novel electrolyte technology to Germany-based EAS Batteries for the launch of an ultra-high-power battery cell.

The acetonitrile-containing electrolyte tech will be used by EAS, which is owned by European lead battery major Monbat, to develop novel ultra-high-power lithium ion cells using LFP cathodes.

Asahi said the electrolyte's high ionic conductivity contributes to reduced internal cell resistance and enhanced rate capability, even under demanding temperature conditions.

The market launch of EAS' new cell utilizing this technology is in line with Asahi's commercialization plans, with the product scheduled to be released by March 2026.

The development of the new cylindrical, ultra-high-power cell, UHP601300 LFP 22, is receiving undisclosed financial backing from Germany's Federal Ministry of Research, Technology, and Space.

Asahi said the tech is designed to target demanding applications in marine, railway, and construction machinery.

In 2010, Asahi began developing high ionic conductive electrolyte with Akira Yoshino, focusing on acetonitrile as a promising ingredient in lithium ion battery electrolytes.

Yoshino is credited with inventing a new combination of carbon for the negative electrode and lithium cobalt oxide for the positive electrode. He also developed the fundamental lithium battery technology, and fabricated the first battery cell.

In June 2024, Asahi announced the successful proof of concept for lithium ion batteries using its proprietary high ionic conductive electrolyte containing acetonitrile. This technological breakthrough enables increased power output at low temperatures and improved durability at high temperatures, the company said.

The new cell, with a capacity of 22Ah, demonstrates a specific power of 2,550 W/kg under continuous discharge conditions. Asahi said this is about 60% higher than that of cells using conventional electrolytes. It also delivers 3,760 W/kg under a two-second pulse discharge, representing a 10% improvement.

In addition, the cell is said to show a cycle life of 2,400 cycles at 5C/5C — it can be charged or discharged at a rate that is five times its rated capacity — (100% DoD) at room temperature before reaching 80% of its initial capacity.

This was demonstrated by testing with the charge and discharge current set at 110A, which corresponds to a fast full charge and discharge cycle completed in just 24 minutes.

The reduced internal resistance of the new cell also results in lower heat generation during cycling and improved energy efficiency compared to cells using conventional electrolytes.

Asahi and EAS have agreed to sub-license their combined technologies to global OEMs and battery manufacturers, aiming to expand into mobility applications.

Osamu Matsuzaki, senior executive officer of Asahi and head of corporate R&D and IP, said: "By combining our technology with the expertise of EAS, we achieved an advanced cell design with unprecedented performance.■

Nano One cash boost for LFP cells project

Amara Raja Energy & Nano One has been awarded C$5 ($3.6 million) from Natural Resources Canada to scale production of the firm's proprietary One-Pot process for LFP cathode active materials process and accelerate commercialization.

Canada's energy and natural resources minister Tim Hodgson said the funding would support Nano One's ongoing work at its Candiac, Québec and Burnaby facilities through to March 31, 2027.

The non-repayable contribution covers eligible operating and capital expenditures for scale-up, product development, and commercialization activities at both facilities.

The funding supports the next phase of Nano One's scale-up at its Candiac facility from 200 tonnes per annum to a minimum of 800 tpa with the flexibility to reach more than 1,000 tpa to meet customer demand.

Hodgson said the non-repayable aid will enable the company to continue developing different product grades of One-Pot LFP to meet performance requirements across energy storage systems, defence, electric vehicles and other applications.

Sumitomo Metal Mining is a project partner under the award and will contribute technical expertise as in-kind support. ■

CATL claims EV first for sodium ion as UNIGRID begins first sales from US

CATL and Chinese auto firm Changan have unveiled what the partners said is the first mass-production car equipped with sodium ion batteries. This is a huge leap forward for the chemistry which, despite initial higher manufacturing costs than lithium ion battery packs, has the potential to disrupt the EV market by eventually bringing in yet cheaper EVs. Meanwhile, UNIGRID, a US manufacturer of sodium ion cells announced that it was making its first international sales in scale.

"The big leap forward for CATL is in its energy density," one observer told *Batteries International* at a conference in early February. "This is still lower than lithium ion but it's the start of a trend where we can only see performance going up while costs come down. It may be early to say that this will replace LFP in regular EV packs but it could make lithium redundant as the industry standard in as little as 10 years."

In April last year Naxtra was revealed along with two other EV battery types. According to CATL, Naxtra achieves an energy density of up to 175Wh/kg, setting the current benchmark for mass production.

Changan said the vehicle was rolled out in Inner Mongolia on February 5 and the model is set for market release by the middle of this year — marking the move of sodium ion tech from pilot applications to large-scale commercial passenger use.

The launch represents a major step in the industry's transition toward a dual-chemistry ecosystem, where sodium ion and lithium ion batteries complement each other to meet diverse customer needs, Changan said.

CATL, as Changan's exclusive battery partner for sodium ion, is supplying its Naxtra brand across the auto firm's range.

Its cell-to-pack system and intelligent BMS enable a pure-electric range exceeding 400 km, the Chinese battery giant claimed.

As the sodium-ion supply chain advances, ranges are projected to reach 500-600 km for pure-electric variants and 300-400 km for range-extended/hybrid configurations — covering over 50% of the range requirements in the new energy vehicle market.

CATL said Naxtra operates reliably even under extreme cold, delivering nearly triple the discharge power of equivalent LFP batteries at -30°C, while maintaining over 90% capacity retention at -40°C and stable power delivery at temperatures as low as -50 °C.

Additionally, the battery maker said testing conditions including crushing and drilling has shown the battery "stays smoke and fire free and continues to provide power, setting a new standard for safety and reliability".

Batteries International reported CATL's launch of its second-generation sodium battery last November.

Speaking at the World Young Scientists Summit on November 18, CATL chief scientist Wu Kai said the launch marked a significant leap forward in battery technology, especially for colder regions where traditional lithium ion batteries struggle.

Meanwhile, UNIGRID, a sodium-ion battery company, announced mid-January, that it had begun commercial-volume international shipments of its proprietary NCO sodium-ion cells. "This milestone positions US-based UNIGRID as the first battery company outside of China to export sodium-ion at scale, enabled by critical transport certifications and its cost-efficient foundry manufacturing model," said a spokesperson for the firm.

"Scaling new battery chemistries is typically constrained by the high costs and long timelines of building dedicated gigafactories, which slows commercialization and limits access to emerging technologies.

UNIGRID scales its sodium-ion cell chemistry through manufacturing partners rather than building capital-intensive gigafactories. This enables rapid global scale-up, with Grade A cells shipped directly from foundries to customers in 40-foot ocean containers.

"Commercialization accelerated earlier last year following UNIGRID's successful attainment of UN38.3 transport certification for its sodium-ion cells. By the end of 2025, the company had progressed rapidly from pilot-scale production to commercial export volumes.

Darren Tan, CEO and co-founder of UNIGRID said: "Through collaboration with our foundry partners, we've proven that advanced battery chemistries can be commercialized without massive capital buildouts." ■

LG Chem-Sinopec agree sodium ion partnership

South Korea's LG Chem is teaming up with China's Sinopec to develop materials for sodium ion batteries targeting ESS and EV applications in Chinese and global markets.

Under a joint development agreement, announced last year, Sinopec (China Petroleum & Chemical Corporation) said the partnership aims to accelerate the commercialization of sodium ion battery technologies, establish new business models, and extend cooperation into broader new energy and high-value materials sectors.

The partners said they had selected sodium ion because of the advantages the chemistry offered over lithium ion in terms of resource accessibility and cost efficiency. Enhanced safety and faster charging performance were also a key benefit.

Sodium ion batteries also maintain better capacity retention under low-temperature conditions, outperforming lithium iron phosphate batteries and demonstrating strong commercial potential.

The partners cited latest, unspecified industry research, indicating that China's sodium ion battery market is expected to grow from 10GWh in 2025 to 292GWh by 2034, representing an average annual growth rate of around 45%.

By 2030, China is projected to account for over 90% of global sodium ion battery production.

As *Batteries International* reported last year, all the major lead and lithium battery manufacturers are exploring sodium ion technology.

Clarios, for example, teamed up with Natron Energy to formulate a manufacturing process for them. Natron, however, ceased operations last September. ■

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Long duration storage costs to fall by 2030

Costs of long duration energy storage (LDES) projects are on track for meaningful reductions within the next four years, according to a new study. (A fuller review is available elsewhere in this issue.)

Advances in technologies and increased manufacturing scale will drive costs down, said the study — '*Cost Benchmarking for Long Duration Energy Storage Solutions*' — by the LDES Council and US-based non-profit Electric Power Research Institute (EPRI).

LDES, launched in 2021 by energy firms and developers such as Ambri, Highview Power, ESS and CellCube, said the study draws on real world data provided by its technology developers and reviewed by EPRI.

Key findings suggest cost estimates are becoming more consistent in several categories, reflecting a growing maturity across the LDES landscape.

At longer durations, some LDES technologies can scale more efficiently than short duration storage, depending on system design and application, the study said.

The study is intended to support utilities, system operators, energy modellers and others planning future power systems with increasingly high shares of renewables in the energy generating mix.

Data from a range of intraday electrochemical technologies, that provide energy storage over periods of 24-100 hours, are among those included in the study. The types of technologies in this category include sodium-sulfur, vanadium redox flow batteries and iron-salt flow batteries.

For the intraday electrochemical, intraday compressed gas, and thermal energy storage categories, data was aggregated for contract years 2025 and 2030.

However, the names of individual technology developers were not disclosed.

Justin Raade, EPRI program manager for bulk energy storage said: "Policy and investment choices depend on how costs are represented.

"By aligning cost benchmarks for LDES assets, we help system planning and policy to be grounded in consistent, actionable data. ■

LDES in fast lane toward bankability, report says

Long duration energy storage systems are moving rapidly toward bankability, with clearer pathways for investment than ever before, according to a new report.

The LDES council report *Accelerating LDES bankability*, published on December 9, followed two workshops with investors and technology providers this year — one in London and the other in New York City.

The council, launched in 2021 by energy firms and developers such as Ambri, Highview Power, ESS and CellCube, held the workshops in collaboration with global CEO advisory group Teneo.

Several recent major financial raises supporting LDES technology are highlighted in the report, including that of Form Energy, a developer of iron-air battery tech up to 100 hours duration, which raised around $1.4 billion in its latest round in 2024.

Gravity-based LDES and BESS tech developer, Energy Vault, had raised a total of almost $800 million as of this year, according to the report.

Key findings arising from the workshops include a need for long-term procurement or market mechanisms with guaranteed revenues to de-risk investment.

Combining sovereign guarantees with multilateral finance and local co-investment to partially support LDES projects, particularly in emerging markets, can also reduce political and credit risk while enabling rapid development.

Meanwhile, the report urged policymakers to introduce public funding programmes that can play catalytic roles, by reducing risks and the levels of finance needed by investors.

Investors should consider becoming part of consortia, the report said, noting that while co-investment can complicate projects and relations among businesses involved, LDES technologies often provide opportunities for a variety of strategic players that seek exposure to different types of risk.

Anna Siefken, lead on the report and North America policy and markets lead at the LDES council, said: "Long duration energy storage is advancing rapidly toward bankability, with clearer pathways for investment than ever before.

"The sector now has a defined roadmap, supported by detailed analysis of the remaining barriers spanning technology performance, revenue certainty, and risk allocation. Each part of the ecosystem has a specific role to play in unlocking LDES at scale, and we hope this paper helps instil the confidence and clarity needed to make a fully bankable LDES market a reality."

Batteries International reported in August that Google had made an undisclosed investment in Italian energy tech firm Energy Dome and had signed a commercial arrangement to use the technology to help power its operations.

Energy Dome claims its CO2 Battery is capable of continuously dispatching energy for periods of eight to 24 hours to meet both the baseload and flexibility requirements of large energy users. ■

Kodiaq in £850k boost to spur electrolyte pilots

University of Cambridge spin-out Kodiaq Technologies said in December it had completed a £850,000 ($1.1 million) funding round to scale UK-developed organic electrolytes for metal-free LDES flow battery storage.

Kodiaq, which said it is backed by more than 20 high-net-worth investors across the climate tech and deep tech sectors, claims its technology has the potential to provide a scalable, cost-effective alternative to lithium and vanadium-based systems.

Using organic chemistry rather that mined metals also offers environmental and supply-chain benefits for the energy storage industry, Kodiaq said.

The firm claims its electrolytes enhance energy density in storage and long-duration performance in flow batteries, improving system economics by delivering more energy from the same hardware and significantly reducing the investment per unit of storage capacity. ■

Alert for battery sector over Li supply shortages

Existing global lithium supplies will only meet just over a third of predicted 2035 demand, according to new analysis.

Lithium supply will need to more than double by 2035, according to the white paper From Minerals to Megawatts: Building Resilience for EVs, Data Centres and the Electricity Grid, published in December 2025 by global consultancy Kearney, in partnership with the World Economic Forum.

By 2035, EVs are projected to account for 86% of total lithium demand, 55% of cobalt and one-third of global rare-earth consumption, placing their supply chains at the centre of future mineral balances.

Sectors with a large share of global demand — such as EVs for lithium, and grids for copper and vanadium — can shape market signals, steer investment and accelerate innovation, but are also mutually exposed to vulnerabilities faced by producers that, in turn, rely on their bankable demand to scale capacity, the paper said.

Recycling can help the situation but cannot close these gaps alone. The paper said contributions from recycling can be meaningful for copper and aluminium, citing International Energy Agency estimates.

However, recycling of lithium and rare earths remains nascent due to low end-of-life volumes and insufficient collection and mechanical separation capacity. Recoverable battery volumes are expected only after 2030, as vehicles sold in the early 2020s reach 'retirement age'.

Additionally, for speciality materials such as graphite, lithium, cobalt, nickel and manganese, the top three mining and refining countries hold more than 75% of the market share, the paper said.

"This heightens exposure to single-point disruptions such as operational outages or export controls, which can trigger global price or schedule shocks — even when aggregate supply appears adequate."

Early warning signs are already apparent, with new capacity for critical minerals still awaiting permits or funding while demand continues to outpace upstream investment, the paper said.

And as battery chemistries and semiconductor designs evolve faster than capacity can respond, this in turn creates mismatches between innovation cycles and supply resilience. ■

Refined lead supply exceeds demand at start of 2026

Global supply of refined lead metal exceeded demand by 20kt during the first 10 months of 2025, according to the Lisbon-based International Lead and Zinc Study Group. ILZSG gave the update on December 17 based on provisional data reported from its member countries. Total inventories fell by 22kt during the year.

The data is line with forecasts made by the group last October — when it reported that demand for refined lead metal would continue building on its near 2% increase in 2025, to just over 13 million tonnes.

Refined lead metal usage in 2025 grew by 1.5%, mainly as a result of rises in Brazil, Taiwan, the US and Vietnam. Demand in Europe also increased, which the ILZSG said was influenced by increases in France, Germany, Poland and the UK — but partially offset by declines in Italy and Spain.

Usage in India and Mexico was lower than during the same period of 2024.

Increases in lead mine production in China, India, Peru, Turkey and Europe were largely offset by reductions in Australia, Kazakhstan and the US, which the ILZSG said led to a negligible overall increase of 0.1%.

A 1.7% rise in global lead metal production was mainly a result of higher output in Canada, China, India, South Korea, Mexico, Sweden and Brazil, where new secondary capacity was recently commissioned.

However, these increases were partially offset by reductions in Japan, Kazakhstan and the UK.

Meanwhile, Chinese imports of lead contained in lead concentrates increased by 8.5% to 981kt. Net imports of refined lead metal totalled 24kt, a decline of 95kt compared to the first 10 months of 2024.

The battery sector will again underpin usage of lead through 2026, according to a flurry of business activity in the industry, as reported by *Batteries International* in recent months.

Last September, Exide Industries said it intended to boost the percentage of secondary lead purchased internally and externally to 85% over the next five years.

In October, GS Yuasa president Takashi Abe said lead batteries would continue to be the mainstay of the Japanese headquartered corporation's global business beyond the next decade.

Meanwhile, Belgium-based Campine pledged to expand use of battery recycling and speciality lead manufacturing operations newly acquired from Ecobat in France.

Campine circular metals director David Wijmans said the Ecobat facilities had free smelting capacity that the firm planned to use immediately. ■

Ontario launches critical minerals processing fund

Ontario has launched a C$500 million ($364 million) critical minerals processing fund to support investment in projects in the province including EV and battery manufacturing.

The fund will strengthen the province's position as a global leader by ensuring critical minerals mined in Ontario are processed and refined in Ontario, by local workers, the provincial government said on December 12.

Funds will be made available through Invest Ontario, the province's investment attraction agency.

Ontario's critical minerals advantage will play a key role in growing the province's strategic sectors, including defence, EV and battery manufacturing, technology, aerospace and advanced manufacturing, the province said.

"We are finally ending the ripping and shipping of Canada's vast resources by stepping up with a plan to build mines faster and expand domestic processing," said Stephen Lecce, energy and mines minister. ■

Vianode graphite deal to power C4V BESS plans

Norwegian battery materials firm Vianode is set to supply US lithium tech venture C4V with high-performance synthetic anode graphite for BESS systems, under a letter of intent announced on November 25.

The companies are planning an offtake agreement through which Vianode would supply synthetic graphite to New York-based C4V and its gigafactory joint ventures through 2032, with first deliveries in the second half of 2026.

Under the collaboration, Vianode's materials would be combined with C4V's innovative cobalt- and nickel-free cathode technology.

The letter of intent marks Vianode's first agreement in the BESS segment. Initial material supplies will be produced at the group's 'Via ONE' graphite plant in Norway, followed by shipments from Via TWO — Vianode's recently announced large-scale facility to be developed in Ontario.

The partners said their collaboration would develop a regional supply chain for synthetic anode graphite and critical battery materials, while eliminating US concerns of being dependent on so-called foreign entities of concern.

That is important as more than 95% of synthetic graphite used in lithium ion batteries for BESS and EVs is produced in Asia, which Vianode said creates significant import requirements in North American markets. ■

Korea Zinc partners US for Tennessee 'super smelter' plan

Korea Zinc is to partner the US government in building a US-based super smelter, boosting domestic supply of critical materials including lead, zinc and copper, at a total investment cost of $7.4 billion.

Korea Zinc will jointly invest with the US departments of war and commerce to establish the 650,000m² smelting facility in Clarksville, Tennessee, the partners revealed on December 15.

The announcement coincided with Korea Zinc's confirmation that it had entered into an agreement to acquire Nyrstar USA — including Nyrstar's fully-permitted development sites in Tennessee, where the new smelter will be constructed.

The existing Clarksville smelter, operated by Nyrstar, is currently the sole primary zinc smelter in the US and has run for almost 50 years. Together with associated eastern and mid-Tennessee mining complexes, these assets represent a key domestic US mine-to-metals value chain, Nyrstar said.

Subject to regulatory and other approvals, the acquisition is expected to close in the first half of 2026. Under the terms of the proposed agreement, the Clarksville smelter's zinc metal production for 2026 would continue to be sold to Trafigura.

Construction of the new US smelter will begin with site preparation in 2026, followed by phased commercial operations from 2029. The facility will process around 1.1 million tonnes of raw materials annually and produce a total of 540,000 tonnes of finished products.

The total of 13 planned products include industrial metals such as zinc, lead, and copper, precious metals including gold and silver and key strategic minerals such as antimony, indium, bismuth, tellurium, cadmium, palladium, gallium, and germanium. The list also includes sulfuric acid and semiconductor-grade sulfuric acid.

Korea Zinc said the new smelter will be based on the design of its Onsan facility in Ulsan, which it said is the world's largest single-site smelter by production capacity, using world-leading smelting technology, optimal processes, and state-of-the-art control systems. ■

Elektros kickstarts Africa-US lithium shipping talks

Africa-focused lithium mining developer Elektros is in talks aimed at shipping hard-rock lithium from its project in Sierra Leone to the US.

Elektros said on January 22 it had started discussions with international freight and logistics providers to evaluate transport methods to help the firm become a major battery material supplier to the US. ■

Cabot to supply EV battery materials to VW's PowerCo

Cabot Corporation said on January 7 it had signed a multi-year materials supply deal with Volkswagen's PowerCo battery manufacturing subsidiary. The agreement includes supply of conductive carbons and dispersions for lithium ion battery applications for the EV battery sector.

Cabot said its conductive formulations are high-performance materials designed to enhance battery conductivity and efficiency. They play a critical role in improving the performance of lithium ion batteries by enabling higher energy density, faster charging capabilities, and extended battery life. ■

ABB to power Lithium Americas' Thacker Pass project

Swiss group ABB has been contracted by Lithium Americas to support production of around 40,000 tonnes of lithium carbonate annually in the US.

ABB said in November it will provide a range of electrification technologies, including switchgear and power management systems for the Thacker Pass in Nevada — North America's largest known measured lithium resource with a total nominal design capacity of 160,000 tonnes annually over five phases.

The group will work on the project alongside Lithium Americas and their engineering, procurement and construction management firm, Bechtel, in a move that will generate material to support the manufacture of around 800,000 EV batteries annually.

The US is encouraging a wave of critical minerals projects, following Donald Trump's executive order, published last April, in which the president instructed his administration to analyze critical mineral supply chains and propose ways to ramp up domestic production while reducing reliance on imports.

Plans to construct another US lithium extraction facility, the South West Arkansas Project, were designated as a federal priority in April to help expand domestic battery material production. ■

Stellantis, CATL launch $5bn LFP gigafactory in Spain

Auto giant Stellantis and Chinese battery major CATL broke ground on November 25 for a $5 billion LFP battery plant in northeast Spain.

The 'Contemporary Star Energy' joint venture project in the Aragon region marks one of the largest Chinese industrial investments in Spain, China's state Xinhua news agency said.

The plant is expected to operate entirely on renewable energy when it starts production by the end of 2026 — delivering up to 50GWh of LFP batteries annually for EVs.

Aragon regional president Jorge Azcón said the plant strengthens the region's long-standing automotive ecosystem, which includes more than 300 companies linked to the Stellantis factory in Figueruelas.

Wu Qi, CEO of Contemporary Star Energy, said the project is built on years of cooperation and shared vision. He said the new plant would bring long-term industrial opportunities, contribute to local development, and deepen collaboration on clean energy and technology.

The start of the project comes less than a month after European Commission president Ursula von der Leyen warned Europe's economy was being squeezed by China and the US amid their tit-for-tat battle over battery material supplies and trade tariffs.

She also said China's "dramatically tightened export controls" over rare earths and battery materials were part of wider economic friction with the US, which was having a big impact on Europe.

Meanwhile, a report released by Deloitte earlier last year — 'European Battery Sovereignty, Towards Greater Competitiveness' — said the continent's heavy reliance on Asian battery manufacturers posed growing risks to its automotive industry.

First phase of China microgrid BESS nears completion

The first phase of an eventual 400MW/1,000MWh BESS in China has been completed according to the China Energy Storage Alliance.

Construction of the first 107MW/428MWh phase of the project, which the Alliance said will become China's largest user-side energy storage project, began in Sichuan province on July 30.

The lithium ion BESS is being jointly developed by energy storage systems company Great Power and Zhongfu Aluminum in the Guangyuan economic and technological development zone.

The BESS will reduce electricity costs and boost power reliability for Zhongfu's manufacturing operations, as well as supporting the regional grid with peak shaving and load balancing.

The second phase of the project will include construction of a 220kV substation, plus wind and solar power facilities and EV charging stations.

Ultimately, the project aims to establish an integrated regional microgrid, which the Alliance said will provide a practical model for China's power market reform and carbon neutrality goals.

Last August, Great Power said it had supplied the DC-side energy storage systems with LFP batteries for a 200MW/400MWh independent shared BESS in China's Yunnan province.

Energy data analytics firm Wood Mackenzie said last year that China remains the global leader of the energy storage market, due to its booming solar market, with an average of 42GW/120GWh annual capacity additions expected over the next decade.

Global cumulative capacity will increase sixfold by the end of 2033, passing 1TW/3TWh, according to Wood Mackenzie.

EBRD backs financing for 1.4GWh Uzbekistan BESS with solar

The European Bank for Reconstruction and Development is providing $142 million to support construction of a 1.4GWh BESS and a 1GW solar power plant in Uzbekistan.

The EBRD said the financing package, comprising two senior secured loans, is for two special-purpose vehicles to develop the facilities.

The SPVs (ACWA Power Sazagan Solar 1 and ACWA Power Sazagan Solar 2) will be majority owned by ACWA Power — an international developer, investor, co-owner and operator of a portfolio of power-generation and desalinated-water-production plants.

The SPVs will be co-owned by Sumitomo Corporation, Shikoku Electric Power Company and Chubu Electric Power Company.

The investment marks the first foray into renewable energy and BESS systems in Uzbekistan by the Japanese investors, the EBRD said.

Co-financing should come from the Japan Bank for International Cooperation, Nippon Export and Investment Insurance covered lenders, the Asian Development Bank and Islamic Development Bank.

The two SPVs will introduce the largest combined solar photovoltaic and BESS capacity in Uzbekistan and across the region, the EBRD said.

"This unprecedented deployment of BESS capacity will help the grid to mitigate the intermittency of renewable energy sources. The BESS technology will improve grid reliability and flexibility by making additional energy capacity available during periods of peak demand."

Once commissioned, the new renewable energy capacity should generate around 2,300GWh of electricity per year that can power 600,000 households annually.

To date, the EBRD said it has invested €5.35 billion ($6 billion) in Uzbekistan and supported 1.65 GW of wind capacity, 1.4 GW of solar photovoltaic and 334MW/501MWh of BESS in Uzbekistan, with projects sponsored by international developers.

UAE breaks ground for 19GWh BESS and solar plant

The United Arab Emirates has launched construction of a Dh22bn ($6 billion) renewable energy project featuring a 5.2GW solar power plant with an advanced 19GWh BESS.

Clean energy group Masdar said on October 23 the BESS will be capable of delivering 1 GW of baseload renewable energy around the clock at a globally competitive tariff.

The battery chemistry to be deployed was not disclosed, but Masdar said the project it is developing with the Abu Dhabi Future Energy Company and the Emirates Water and Electricity Company will be the largest and most technologically advanced system of its kind in the world.

Once operational, the facility will set a new international benchmark, Masdar said.

The project will also act as a blueprint that can be replicated internationally.

Masdar said the design of the facility will feature cutting-edge technologies, including a virtual power plant, grid-forming and black start capabilities, and AI-enhanced forecasting and intelligent dispatch.

Mohamed Jameel Al Ramahi, CEO of Masdar, said: "This world-first project, the largest and most ambitious in Masdar's history, is a blueprint for the world, demonstrating that renewable energy can be dispatched around the clock.

Masdar said it has already established a strong presence in battery storage, including what it said is the world's first storage system connected to a floating offshore wind farm. The group, which has projects in operation and development in several countries, is targeting an overall project portfolio capacity across clean energy technologies of 100GW by 2030.

Leoch hails UL 9540 'China first' ESS certification

Lead and lithium battery giant Leoch said on October 16 it had secured what it said was China's first UL 9540 certification for its Epoch integrated energy storage system.

Leoch said certification of the 5MWh AC/DC lithium ESS, Epoch-S2580/5015-40L, marked a milestone in the group's development of innovative systems that are recognized as meeting international standards.

The cell-to-AC full-stack system underwent a comprehensive certification program and Leoch's engineering team integrated the DC battery cabin and AC electrical cabin into a unified system.

The product then underwent high intensity testing, covering electrical, mechanical, structural and environmental aspects, Leoch said. Each test validated performance under extreme operating conditions.

Leoch's proprietary lithium cells include fused busbar technology, biomimetic leaf-vein liquid-cooling channels and built-in aerosol-based fire suppression.

Leoch said the certification recognizes product safety and shows the group's ability to anticipate market needs.

"As demand for safe, efficient and high-quality energy storage continues to grow, we will leverage our technological expertise, deepen collaboration with industry partners and expand our global presence with sustainability at the core," Leoch said.

Group chairman Dong Li said last April that Leoch was stepping up its commercial march into the lithium ion battery market. "While deeply engaged in the lead acid battery sector, we are accelerating our strategic transformation towards the lithium ion battery field to seize the opportunities brought about by the global energy structure transformation."

He said the group's R&D team in Singapore was accelerating the improvement of a new generation of lithium products, including batter-

ies and battery management systems, which had already passed certifications in "multiple European countries" and were awaiting various regulatory approvals before being launched on the market.

C&D offers 20-year lead battery backup for US data-center

C&D Technologies says it had secured a lead battery-powered UPS backup deal for a data-center tailored to protect sensitive patient data for a major US healthcare provider.

C&D's XT series 2XTHC-27 flooded batteries will be used in the scalable UPS project for the unnamed healthcare organization, said to be one of the largest in the country.

C&D said its XT-Series flooded batteries, with a design lifetime of 20 years, provide superior performance and reliability for data-center and telecom applications.

Black Diamond-Yuasa battery partnership eyes Indonesian market

Black Diamond Structures has revealed plans to work with Yuasa Industrial Battery Indonesia to cater for growing regional demand for motorcycle lead acid batteries.

Black Diamond, a developer and manufacturer of nanomaterial additives for lead acid and lithium batteries, announced the partnership on November 26.

The collaboration reflects the firms' shared vision for innovation, quality, and sustainability in the sector, Black Diamond said.

The company did not disclose details of activities under the partnership but said: "Working closely with the Yuasa team, we look forward to delivering impactful solutions and expanding our footprint in the Indonesian market."

Yuasa Indonesia, established in 2021, manufactures a range of industrial and forklift batteries.

Eternity secures Canada battery distribution deal with CellCare

Eternity Technologies has announced an exclusive Canadian distribution deal with CellCare Batteries.

Eternity said the company ended 2025 on a high note by agreeing an arrangement for CellCare to distribute Eternity Batteries in Canada.

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.

Banner production powers ahead with €195m in new deals

Banner has been awarded two long-term battery supply contracts worth a total of €195 million ($231 million) in North American and European deals.

The Austria-headquartered lead battery manufacturer confirmed on January 16 the contracts, with long-standing partners from the automotive industry, secure continued use of its production capacity through to 2028.

One of the contracts, with an unnamed German company, amounts to €120 million and covers the supply of batteries for start-stop applications, plug-in hybrid vehicles and electric vehicles.

Deliveries will be made both for series production and for the original spare parts business.

The second contract, worth €75 million, strengthens the presence of the Banner Group in North America, the firm said. Batteries will be supplied for vehicles with start-stop systems as well as for conventional internal combustion engine vehicles.

The focus is on supplying the aftermarket in North America, particularly in Canada, although customer details were not disclosed.

Study to probe 'potential toxic emissions' from Li battery production

A new study is examining whether the manufacturing of lithium ion batteries could pose emerging health and environmental concerns stemming from emissions of toxic gases, handling of materials, and process waste management.

The research initiative from the University of Houston and Underwriters Laboratories (UL) will look into potential toxic emissions from small-scale lithium ion battery manufacturing.

UL revealed the study last August, although details have only recently come to light in a technical brief.

Research aims to develop methods to characterize emissions from battery manufacturing in a laboratory environment and establish emission profiles based on various materials commonly used in battery production.

According to UL, solvents like N-methyl-2-pyrrolidone, toluene, and isobutyl isobutyrate, which are used for solid-state battery production, may generate volatile organic compound (VOC) emissions during handling and processing.

Additionally, fine metal and carbon powders used in the manufacturing of electrodes and electrolytes may contribute to dust, heavy metals, and particulate matter (PM) in the air.

Exposure to VOCs, PM, and metals is associated with various adverse health outcomes, meaning the processes of Li battery manufacturing may present health concerns, UL said.

Systematic characterizations of these emissions are still being developed, which are essential for understanding potential exposure hazards and devising appropriate mitigation strategies.

Results of the study could potentially lead to the creation of data-driven feedback that "guides changes in battery formulation", UL said.

Antimony deal boost for Australia's Port Pirie

Nyrstar is to be part of a US-Australia critical minerals pipeline deal in a major boost for the firm's lead and zinc refining operation.

Nyrstar said on October 21 it had received a non-binding and conditional letter from Export Finance Australia (EFA) for financing and investment support for continued antimony production at the South Australia facility.

The announcement comes just weeks after *Batteries International* reported Port Pirie had secured a conditional cash injection of A$135 million (US$88 million) to continue critical metals processing, accelerating development of antimony and bismuth facility as well as scheduled maintenance at its lead and zinc refining operation.

The EFA deal was announced on the day that Australian prime minister Anthony Albanese and US president Donald Trump signed a bilateral framework on critical minerals and rare earths.

Alongside the framework, each country said it would provide at least (USD)$1 billion in investments towards an $8.5 billion pipeline of priority critical minerals projects in both countries over the next six months.

Antimony is an alloy hardener for other metals in ammunition and batteries and is critical to the manufacture of semi-conductors and important for the lead battery industry as a key performance ingredient in deep cycle lead batteries.

APG €300m boost for European BESS expansion

Dutch investment firm APG is investing €300 million ($348 million) for a minority stake in European battery storage developer Return.

APG said on October 17 its investment, on behalf of pension fund ABP, provides new growth equity for Return's expansion of BESS systems, which already connect sites across countries and strengthens electricity grids.

Return serves customers de across Europe and is active in the Netherlands, Germany, Belgium and Spain, with 70 MW of operational storage capacity in the Netherlands and another 450 MW under construction.

With over €2 billion in long-term customer contracts, Return said it is on track to meet future demand with a pan-European storage network of around 5 GW by 2030.

Bart Saenen, senior investment director at APG, said: "Return's integrated platform, long term vision on relations, and de-risked pipeline make it a strong partner for building grid resilience across Europe."

Last April, Return started construction of the 100MW/200MWh Antares BESS in Waddinxveen, the Netherlands, which will be capable of powering 50% of the city of The Hague when it goes live in mid-2026 and have a critical role in stabilizing the Dutch grid and accelerating the transition to renewable energy.

Redwood in $350m capital boost for ESS plans

Battery recycler Redwood Materials has closed a $350 million funding round that will accelerate the firm's creation of a new generation of US-made energy storage systems.

Redwood said on October 23 the oversubscribed Series 'E' round — the fifth major round of financing for start-ups aiming to expand further — will support the firm's drive to develop its portfolio of scalable, low-cost energy storage systems, which it said will power data-centers, industry and the grid.

Redwood said its ESS plans will help the US reduce reliance on imported LFP batteries.

Eclipse Venture Equity led the funding round with participation from institutions including tech investor NVentures.

Redwood said electric energy availability has become a key strategic issue for AI infrastructure growth and

low-cost, large-scale battery energy storage has emerged as the most immediate and scalable solution to enable AI factory deployment and unlock stranded grid and generation capacity.

Beyond powering data-centers, this storage capacity will benefit industrial electrification and help address the intermittency of domestic renewable generation, the company said.

Coupled with natural gas turbines and future nuclear generation, large scale energy storage can dramatically improve efficiency, utilization, and the reliability of those baseload assets.

Batteries International reported last July that Redwood had signed a non-binding memorandum of understanding with auto giant, GM, to accelerate deployment of energy storage systems using both new US-manufactured batteries from GM and second-life battery packs from GM electric vehicles.

The agreement followed a 2024 announcement that Redwood had partnered with Ultium Cells, a GM and LG Energy Solution joint venture, to recycle production scrap from the organization's US facilities.

Gravita to benefit from clamp down on India informal recycling sector

The CEO of Indian lead recycler Gravita is forecasting a battery recycling bonanza that will boost earnings over the next few years, as tough new national waste management rules take hold.

CEO Yogesh Malhotra said the company's planned expansion of lead processing capacity has continued at pace — with overall recycling capability set to approach 400,000 tonnes per annum in fiscal 2027, up from the 291,000 tpa reported in March last year.

Malhotra told an earnings call on October 31 only around 35% of total lead battery scrap reaches the organized (formal) recycling sector at present.

However, following the introduction of measures in 2022 aimed at forcing unregulated recycling out of the market, Malhotra said around 90% of the scrap is expected to shift to the formal sector in the next two to three years.

"There is going to be a huge opportunity for capacity expansion throughout the organized sector in India. I don't think that raw material is going to be an issue."

Scrap lead batteries from India and overseas will contribute to the expansion, he said.

The first phase of expansion at the firm's Mundra plant — increasing lead recycling capacity by 30,000 tpa was commissioned at the end of November, Malhotra said.

The second phase of Mundra's expansion, adding another 50,000 tpa, was set for completion by January 2026.

In a related move, the firm's Phagi lead recycling plant will see a 45,000 tpa capacity expansion completed by December 2026. Phagi, which started operations in 1994, supplies markets in Southeast Asia, the Middle East and Europe.

Malhotra also revealed the company is looking at the potential to acquire lead recycling businesses in eastern Europe.

He said Gravita had recently acquired a tyre recycling company in Romania — now operating as Gravita Europe — to boost its rubber recycling operations and was exploring other expansion options for lead, rubber and aluminium.

Batteries International reported last December battery makers in India feared that while new national battery recycling guidelines could boost sustainability, the move risked ramping up costs.

The Indian Battery Manufacturers Association said then that environmental compensation guidelines unveiled by the Central Pollution Control Board proposed a minimum pricing for extended producer responsibility credits at 30% of the environmental compensation.

New Clarios unit signs US car fleet contract for battery tech

Clarios has secured a contract with one of the largest private fleets in the US for an innovative product aimed at reducing idling times in heavy-duty vehicles.

The battery giant said on October 27 the fleet deal, with Iowa-based Ruan Transportation Management Systems, marked a milestone in the expansion of its new Connected Services business unit.

The contract comes less than a year after the unit signed its first commercial agreement with a European fleet operator for the 'IdleLess' product.

Clarios said then that the unit represented a new era of battery intelligence to transform the management of vehicle power systems and was designed to maximize the benefits of heavy duty Clarios AGM batteries.

Previously exclusive to Europe, the product is now available to fleets across the US.

Ruan will deploy IdleLess to reduce fuel consumption, avoid battery-related downtime events, and support its long-term sustainability strategy.

The firm, which has over 3,500 power units and 9,500 trailers, said it will begin deploying IdleLess in phases, with expansion planned alongside driver training programs to maximize idle reduction benefits and operational impact.

Connected Services is a modular platform that uses real-time battery data. IdleLess monitors battery charge levels and sends alerts informing when to start or stop the engine to maintain optimal battery health. This reduces unnecessary idling, lowers fuel consumption, and extends battery life, all while maintaining cabin comfort and vehicle operational readiness.

By integrating IdleLess into its fleet operations, Ruan aims to significantly reduce greenhouse gas emissions and boost its sustainability credentials.

"This agreement reflects the growing demand for intelligent energy solutions in commercial transportation," said Cagatay Topcu, VP of Connected Services.

Anaphite claims 'significant' battery cost reductions through dry coating technology

Anaphite, a UK battery technology company, announced in November that an independent analysis of the carbon emission savings carried out by life cycle assessment firm Minviro helped confirm its previous cost savings estimates. This was that its technology makes EV battery manufacturing 30% less energy intensive and up to 40% cheaper overall.

Minviro found that Anaphite's technology cuts carbon emissions by 3.57 kg CO2 eq. per kWh of cell capacity compared to the wet coating process.

"The energy reduction would result, on average, in a 1% to 2% reduction in the cost to an OEM for an EV battery," Jennifer Channell, head of commercial at Anaphite told *Batteries International* at the Battery Event in Lyon, France.

The savings come from using a dry coating process for manufacturing electrodes that eliminates the energy intensive

drying stage essential in traditional wet coating processes.

"There are other associated benefits," Channell said. "The reduction in facility size — wet coating requires drying sheds that may be as long as 100 metres — by some 43%, also reduces its footprint in terms of facility size and the amount of machinery required.

"This technology is not only strategically important to the West in making battery production more competitive with China — where the process is not used — but also means that it would meet carbon emission targets for battery manufacturing likely to be introduced in the EU Battery Passport regulations in August 2027." This is something that Chinese manufacturers may possibly be penalised for.

Dry coating electrode manufacturing is already being developed elsewhere. Korean battery giant LG is aiming to have the process on manufacturing lines by 2028. The lithium battery arm of VW, PowerCo and Elli, is looking for something similar by 2027 and Korea's Samsung says it is also pioneering the technology.

Anaphite is a start-up and last year raised $13.7 million in a Series 'A' funding round.

Anaphite's CEO Joe Stevenson says: "We're scaling-up the Anaphite technology platform at our facility in the UK and deepening our in-house dry coating capabilities and expertise. We are working in close collaboration with the global automotive industry to bring dry coating to market."

BMZ files for insolvency for business units

Lithium battery systems firm BMZ Group has filed for insolvency for two of its German subsidiaries after the loss of a key ESS customer.

The group said the filing for BMZ Germany and BMZ Holding was made on October 24 under self-administration rules.

BMZ said the move was against the background of an acute liquidity crisis and the need for restructuring, following the loss of what it described as a major customer in the energy storage segment, as well as the resulting legal disputes and costs. The customer was not named.

In Germany, self-administration proceedings allow companies to reorganize their finances and business under the supervision of a court-appointed administrator. The management retains control of the company and its assets, allowing for a structured reorganization process.

BMZ said its management team was now working to establish a viable restructuring plan, aiming to spin off the operational business of BMZ Germany into a new structure.

Despite the insolvency, existing shareholders have contributed bridge financing and additional capital to maintain business continuity.

BMZ entered the energy storage sector in January 2024 with the launch of its first ESS system — lithium-chemistry based Power Bloxx — for the commercial market.

In March 2024, BMZ said it was expanding into the sodium ion tech sector, with series production of its new 'NaTE' battery cell product range, which would include cylindrical and prismatic cell formats.

CATL launches 'safer Li transports' pilot in China

CATL has launched a pilot program that the Chinese battery giant said allows it to transport lithium battery cargo by road and rail in safety and at scale.

The battery manufacturer announced in November it had become the first company in China to obtain a conditional exemption for road transportation — which would boost distribution and shore up a critical link in the supply chain for new energy vehicles and ESS systems.

Under the scheme, CATL said "all types" of its lithium ion batteries had been reclassified from a 'special supervision' to 'safety exemption' designation.

The firm said the safety failure rate of its battery cells are controlled by PPB — an industry standard unit of measurement used to express the concentration of a substance in parts per billion.

The batteries have also passed new national standard tests in China and the UN38.3 transportation safety test for hazardous goods, a mandatory test standard for lithium battery transportation safety in the UN Manual of Tests and Criteria for the Transport of Dangerous Goods.

CATL said the batteries also complied with relevant thermal stability tests for transportation.

The company announced last April that it had become the first in China to pass new national certification standards for EV batteries — which come into force in July 2026.

Batteries International reported then that the new standards included updates to thermal diffusion testing of batteries, further clarifying the temperature requirements, observation time, and vehicle testing conditions.

CATL said its progress was the result of establishing a multi-level safety system in dimensions such as material selection, development and design, extreme intelligent manufacturing, and empirical testing.

Waste firms warn 'London's burning' from Li battery dumping

London's four largest waste authorities and several waste management organizations have urged the UK government to urgently overhaul battery disposal regulations in response to a surge in lithium fires across the capital.

Battery fires continue to have a real financial impact on struggling local authorities and the public purse, at estimated costs in excess of £1 billion ($1.3 billion) annually, the organizations said in a letter to environment minister Mary Creagh.

Signatories to the letter, including North London Waste Authority chair Clyde Loakes, said there was a 53% increase in incidents between 2023 and 2024 at waste processing sites serving North London.

Sites in the east of the capital reported a near 60% rise over the same period and the capital's Western Riverside Waste Authority recorded eight fires in 2024/25 and has already logged 10 incidents so far in 2025/26.

The letter said disposal organizations welcomed recently introduced regulations governing waste electrical and electronic equipment. However, many lithium ion batteries and chargers sold via third-party sellers originate overseas, where safety standards may be lower or poorly enforced.

"Without strengthened controls at the border and better enforcement of import standards, unsafe products will continue to enter the UK market and end up in homes, workplaces, and ultimately, the waste stream, fuelling further fire risk and undermining the aims of the new regulations."

Greater strategic direction from government is now required, including a review of battery regulations to encourage proper disposal and improved recycling rates, the letter said.

The call for action came just weeks after the UK's Environmental Services Association (ESA) warned of an epidemic of fires associated with battery dumping.

The ESA said in September that six billion batteries were thrown away across the UK last year — equivalent to 3,000 every minute. Of these, 1.1 billion were "hidden" in discarded electrical devices like electric toothbrushes, razors, mobile phones and electronic vapes.

Orbia triples Wisconsin electrolyte plant capacity

Production capacity of a new 'custom electrolyte' plant for lithium ion and other battery chemistries in the US state of Wisconsin has been expanded by around 300%, the facility's owners said on December 16.

The Orbia Advance Corporation and Fluor & Energy Materials business said the second and final phase of the expansion of the site, opened in August 2024, was completed earlier this month.

The facility has benefited from an $8.4 million US defence department contract to strengthen the national lithium ion battery supply chain, revitalize the Wisconsin battery industry and scale up production of electrolyte formulations.

Following the introduction of a second 75-litre mixer and a new 200-litre mixer, the site is now fully operational, the business said.

The plant caters for domestic sourcing of small and medium batch battery electrolytes in the US, tailored to exact specifications for lithium ion as well as emerging chemistries such as lithium sulfur, sodium ion, and beyond.

Orbia said the facility has already produced and supplied battery electrolytes for hundreds of businesses worldwide, including for industrial, medical, energy storage, EVs, the US defence department, lab-scale and aerospace applications.

In 2023, Orbia expanded its custom electrolyte business to a 11,000ft2 production facility following a limited release of product to a select group of users before full public availability (a beta launch).

Orbia had previously acquired Silatronix, a Wisconsin-based electrolyte tech startup.

US-based production reduces reliance on overseas suppliers, eliminating lengthy international freight shipping delays, extending product shelf-life, reducing the risk of excess and obsolete inventories, and enhancing supply chain resilience, Orbia said.

Carl Thoemmes, business development director for Orbia Fluor & Energy Materials,

said: "By tripling our production capacity, we're not only meeting the surging demand for battery electrolytes we are developing a more robust supply chain and creating more opportunities for innovation and collaboration."

The expansion will empower the battery industry to accelerate journeys from concepts to commercialization, all while cutting the carbon footprint associated with importing electrolytes and driving the next generation of sustainable technologies, Thoemmes said.

China research team tests LIB performance in space

Chinese astronauts have been conducting novel battery performance tests in space — designed to observe technical processes without the interference of gravity.

The tests on lithium ion batteries were carried out aboard China's Tiangong space station, the Dalian Institute of Chemical Physics of the Chinese Academy of Sciences told China's state Xinhua news agency on January 7.

This experiment, conducted by the three astronauts comprising the 'Shenzhou-21' crew, aims to uncover the mechanisms behind battery performance by using the unique conditions of space.

Lithium ion batteries are essential for modern space missions due to their high energy density and reliability. However, the institute said a thorough understanding of the batteries' internal behaviour, particularly how chemicals distribute within the electrolyte, which critically impacts power output and lifespan, has been challenging to achieve under conditions on Earth.

"The fundamental challenge on the ground lies in gravity," said the institute. "Gravity is constantly intertwined with electric fields, making it difficult to isolate the influence of gravity on internal battery processes."

In contrast, the microgravity environment of the space station offers an ideal setting to observe these processes without the interference of gravity.

According to the institute, insights gained from the microgravity research are expected to overcome current limitations in understanding the interplay between gravitational and electric fields.

These findings are expected to help improve existing battery systems in orbit and support the design of a new generation of safer, higher-energy-density batteries for future space exploration.

CATL opens 'battery aftermarket' plant in Riyadh

CATL has opened a 'new energy aftermarket' plant in Saudi Arabia featuring battery diagnostics, repair, maintenance, rework, training and recycling services to support its operations in the Middle East.

The China-based lithium battery major said the 'Ning Service Experience Center in Riyadh opened on January 10 and is its largest such facility outside China to support EV and ESS battery tech.

The site offers comprehensive full-lifecycle after-sales support, cultivates local technical talent and accelerates the deployment of advanced electrification and energy storage solutions.

The opening comes as Saudi Arabia and the wider Middle East advance ambitious electrification and decarbonization goals under Vision 2030 and similar national initiatives, CATL said.

In Saudi alone, the kingdom has set a goal to transition 30% of all vehicles in Riyadh to electric by 2030.

However, progress is tempered by persistent challenges, including longstanding oil dependency, surging electricity demand, extreme climatic conditions, and limited charging and service infrastructure.

Covering more than 7,000m2, the Riyadh center combines exhibition areas, diagnostics and maintenance zones, refurbishment facilities, training spaces, and a customer lounge.

Bruce Li, president of CATL's quality system, aftermarket business and battery management system department, said: "Starting from here, CATL will continue to expand its after-sales service network across the Middle East, align closely with Saudi Arabia's Vision 2030, and support the region's energy transition through a reliable, end-to-end service system." ■

The inevitability of the introduction of the battery passport — next February — is proving worrying for large swathes of the battery industry. Their fear? Inability to comply with the rules will bar them from EU access. But for the moment everyone is just going with the flow.

March of the lemmings

Confusion. That's probably the best description of market reaction to the now-imminent introduction of the EU Battery Passport coming next February. The passport will cover industrial batteries above 2kWh, EV batteries and those used in light transport.

"We've gone through it, line by line. All the details of what's going to be required are there but not all the regulations are clear and some are, quite frankly, ambiguous," said one automotive engineer who is leading a compliance team for a global OEM and requested to be quoted anonymously, told *Batteries International*.

"There was one sentence about direct data access that had us completely stumped. What did it mean? What do we have to do to comply?"

Zoriana Baloha, a procurement engineer for Yanmar, agrees: "Yes, the regulation is saying what they want but they're not saying how they want it done."

And that is at the heart of the dilemma many in the industry are facing — part of the problem for everyone is that compliance to the regulations costs money. And ambivalent rule-making can mean a lot of money could be wasted.

With the best will in the world, large swathes of the battery industry worldwide are ploughing through the legislation knowing that failure to meet the rules could bar them from selling their batteries in the EU.

"It's the march of the lemmings," one commentator, told Batteries International, at a recent conference. "We're all being forced towards the edge of the cliff, along with everyone else. We've no choice. Unfortunately, free will doesn't much come into play."

Certainly, the time pressures are mounting and there is a general sense that some firms are already laggards in getting ready.

Marie Pètre, a Brussels-based lawyer for Cattwyk says: "I work a lot on regulatory aspects and on helping companies put their products on the

"We've gone through it, line by line, all the details of what's going to be required but not all the regulations are clear and some are, quite frankly, ambiguous."

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European market and I don't think that the battery passport is very high on the agenda of some of those companies.

"And I'm more than a little worried about how they're going to get ready for this in such a short time. There's a lot of uncertainty. And the effort to comply is going to be huge."

Everyone is acutely aware that they could be spending millions of dollars on updating IT systems, verifications and audits that aren't needed by the rules for compliance. "We know that the purpose of the passport is not a box-ticking exercise," says the engineer, "but a way of seeing the whole value chain of the industry. That said, how much granularity is required?"

From factfinding to fiction

There's also the strange situation that the passport regulation is mandating disclosure of data that as yet doesn't exist!

The first example to spring to mind is so-called 'upstream mining provenance.' This is data that needs to be collected from the very start of the battery life — mining the raw materials.

It's a huge area in itself. The basics that need to be listed go well beyond the name of the mine and its location, to who owns the mine, how the minerals are extracted, what environmental controls and permits are in place and what the labour conditions are like. All this, even if the mine is in an area of conflict.

And much more is required than this one paragraph simplification. But, again, the exact detail is not stated. Who is to judge, for example, if the country's labour law at the mine is being upheld or not? What mining company in, say the DRC, would admit to using child labour? Or flouting the modern slavery laws?

Add on top of this calculation of the CO2 used in this cradle to grave approach following the life of a battery

"The regulation is saying what they want but they're not saying how they want it done"

— Zoriana Baloha, Yanmar

"The battery passport isn't very high on the agenda of some companies. I'm more than a little worried about how they're going to get ready for this in such a short time. And the effort to comply is going to be huge"

— Marie Pètre, Cattwyk

Take a number and add six noughts ...

Many feel that working out the cost of the Battery Passport largely involves plucking a big number out of the air and then adding a few million to it. Most agree, however, that its inception will be short-term pain for longer-term gain.

A digital product passport has, of course, been successful in other sectors such as textiles, toys and electronics — but the gain only occurs when regulation is properly formulated and compliance achieved.

Logical progression

For this reason, the European Commission believes that secondary legislation being introduced after the rules come into force will fine-tune.

Johan Bracht, a consultant with McKinsey Battery Insights, says he reckons that the average extra price for the introduction of the passport will be around $10 a battery as an overall average.

Others have painted much higher and also much lower numbers; as low as $8 and as high as $14.

A European Commission Staff Working Document known as an Impact Assessment Report — admittedly prepared in February three years ago — suggested that the one-off costs for SMEs are estimated at €541,000 for small SMEs to €3.6 million for larger SMEs.

Perversely these costs will act as a barrier-to-entry for players with SMEs and those not familiar with the battery passport requirements. It may be a small plus, but a plus all the same, for the larger OEMs in offering the possibility of a less crowded market and larger sales.

Administrative worries

Another major industry concern is not just the higher compliance cost but the larger administrative burden. The same European Commission report suggests that the ongoing costs for SMEs would range from €350,000–€2.3 million.

One thing is certain. Luck is on the side of the big players — principally the large OEMs and tier-1 suppliers — as the costs are largely fixed.

The result of this will disadvantage smaller SMEs, most notably mid-tier cell makers, pack assemblers and any non-EU supplier with fragmented data.

Again, the EU dream of a level playing field, will be compromised. Fortune doesn't favour the brave here, it favours the big boys. ■

— from mines, to transportation, to manufacture, to deployment and eventual disposal — and one has a headache of gargantuan proportions.

One recent study of analysis by 10 different carbon-footprint tools using the same data found that the results varied by 500%. Is this fact-finding or myth-making?

Also difficult to calculate, will be the precise recycling levels of battery content. The targets set for the proportions of lithium, nickel, cobalt and manganese to be recycled by the European Commission were set deliberately higher than that achievable.

The latest regulation sets a target for lithium recovery from waste lithium-ion batteries of 50% by the end of 2027 and 80% by the end of 2031.

It also provides for mandatory minimum levels of recycled content for industrial, SLI batteries and EV batteries. These are initially set at 16% for cobalt, 85% for lead, 6% for lithium and 6% for nickel. These are later to be raised to cobalt 26%, lead 85% (unchanged) lithium 12% and nickel 15%.

The regulation included provisions for the European Commission to revise in 2028 when more information about the market availability of battery grade recycled material will be known. This may prove to be a key proviso in balancing regulation against realism.

However, the recycled content target levels proposed in the Battery Regulation have been set by political will rather than expert analysis.

"The consultants who advised the Commission wanted to set more realistic, achievable targets than these, but their views were overruled during the political process," said Steve Binks, technical director at the ILA.

This certainly goes beyond compliance with a relatively uncharted set of targets, and the whole picture is complicated by the fact that OEMs are legally responsible for data provided by suppliers and the suppliers will not necessarily be willing or able to furnish the information.

"What if we provide this data? Who will control it? How will it be verified? Who will tell us if it sufficient or not? says Baloha from Japanese firm Yanmar.

The automotive engineer. "I can see disputes over who is going to be liable when the data is inaccurate or incomplete. And, in the end, we might be left with a system where we are all formally compliant but the data is of low quality. In which case, what use is it?"

This also raises the issue of commercial sensitivity and protection of confidentiality and intellectual property.

Non-EU competitors may be forced to disclose more than EU incumbents in other markets. Where you source your battery materials and your manufacturing performance could well be part of a company's core IP and not something that they want revealed to all and sundry.

The level playing field envisaged by the European Commission has suddenly started to look uneven.

Other countries in the world, most notably China, Japan and the US are also looking at the introduction of digital battery passports raising the question of how these can be integrated into the EU scheme. So far, the European Commission has led the way in the thinking behind the digital battery passport and it clearly hopes that other nations will follow its own initiative.

The European Union supply chain finds itself in a position where —

Slaps on the wrist: compulsory compliance

The rules aren't out yet but non-compliance — and this can come from a variety of directions — will be costly. Most industry players reckon that a self-certification programme will suffice for the moment. Given the wooliness of some of the guidelines behind the regulations this is expected to be a reasonable and fair approach by the European Commission.

Further on, little has been announced — despite the imminence of the February 2027 deadline — and guidance has been vague. Regulatory fines for general non-compliance in similar digital sectors could reach up to 2% of total annual worldwide turnover.

Penalties for non-compliance will likely come in three ways.

The first will be fines. They will be set by individual member states so will vary from country to country. The fines are likely to be punitive — the European Commission likes to apply their thinking through phrases such as: "effective, proportionate and dissuasive" — though national levels have yet to be set.

Secondly, market access will be denied almost immediately the regulation comes into force. No compliance, no battery sales. There is already a mad rush by OEMs and those firms affected by the rules in the supply chain, to ensure this does not affect them. SMEs, with their more constrained budgets, will be worst hit here.

Third, products not up to scratch as per their passport will end up in product recalls. This should enforce quality and will be a positive spin-off for the regulators.

The punitive side of non-compliance is expected to increase over time. Minor infringements at the beginning may be glossed over but later on this will not be the case. ■

"The consultants who advised the Commission wanted to set more realistic, achievable targets than these, but their views were overruled during the political process" — Steve Binks, ILA

mostly, with a couple of exceptions — regulation is being introduced which it has neither created, innovated or even had working in actual practice. Would it be fair to say that the bureaucrats are setting the rules before businesses have even defined their operations.

There is a gaping hole between hope and reality. Why should other nations enforce rules in the same way as Europe? China, for example, has a thriving (if over-thriving) EV battery industry. They have the systems and commerce in place and can speak realistically about issues of disclosure, best practice and, if they should choose, CO2 emissions.

But, again, why should one format be used universally? The likelihood is that multiple passport platforms will be designed so how will they interact? Could Catena-X, for example, an open-source based standard being developed by the German government and being adopted for the automotive industry, be a one-stop solution? It's too early to say.

In the predictable gold-mine rush of multiple digital passport platforms flooding the market, the future doesn't look bright. It looks like one of greater costs and complexity which, in the end, will surely undermine the goal of a EU-wide digital record.

To 2030 and beyond

Another hiccup lurking in the esophagus is one of timing. Although it may make sense to a regulator to be ahead of a developing market, it makes little sense to the operators themselves because nobody has the winning formula.

Moreover, the recycling technologies are neither mature, nor technically up to scratch to deal with the volumes of scrap batteries that will need to be disposed of. With the growing abundance of LFP batteries — containing little of any value to be recycled — the process will always be via a tolling mechanism whereby payment has to be made.

This doesn't look as if it will be the simplest of solutions. Anecdotal evidence a couple of years ago in Australia was that lithium battery packs were being stacked away in warehouses because that was cheaper than putting them through a recycler.

Also, the second-life markets for used EV batteries, for example, are still in their infancy. Disposing of an EV battery that has reached 80% of its capacity and putting it into a BESS, either domestically or commercially, may look good on paper but is still largely unchartered territory commercially for now.

In short, this part of the industry is being regulated ahead of any kind of operational maturity.

This isn't to say that this is a grievous problem — merely hurdles as these markets mature. In the longer term the benefits may materialize. The question is one of timing and this is still vague. ■

The basics that need to be listed in the passport go well beyond the name of the mine and its location, to who owns the mine, how the minerals are extracted, what environmental controls and permits are in place and what the labour conditions are like. All this, even if the mine is in an area of conflict

If the energy storage, recycling and EV markets are still coming to grips with regulations around the passport, they should also aware that, once the initial teething problems are over, a host of accrued benefits could be awaiting them.

Always look on the bright side

In theory, the Battery Passport should not just be a good thing but a very good thing. For the EU regulators it ticks all the boxes in bringing batteries into fuller alignment with the over-arching Green Deal. But the rewards extend further than that.

Theoretically — when it has been fully thought out — it will prove a benefit for most in the energy storage industry.

For the first time it will be possible for everyone from regulators, through to vendors, marketers, recyclers and more, to take a simple scan of a QR code and immediately know about a battery's origin, composition, carbon footprint and compliance across its entire lifecycle.

If this works, it will offer regulatory credibility and market trust. Current problems such as the rash of dangerous battery fires associated with the cheap import of e-bikes and e-scooters three years ago will be a thing of the past.

Because every step in the lifetime of a battery can be digitally recorded it will be relatively easy for OEMs to identify bad batches of poor quality batteries and their suppliers resulting in greater market confidence.

It also enables information at scale to industrial and environmental bodies in that tens of thousands of batteries can be analysed simultaneously. In effect, it becomes the lynchpin of moves to a circular economy. Europe, in particular, has a strategic goal in wanting to have a complete domestic recycling capacity. Standardized data will be invaluable for reuse, repurposing and recycling purposes.

For example, second-life and recycling economics depend on knowing battery condition and

"In a recent study on a nationwide vehicle resale platform in Germany (mobile.de) there was a 26% increase in sales contact enquiries when the battery passport was mentioned," he said. "There is a lower insurance cost for EVs with a battery passport."

— Johan Bracht, McKinsey

composition. Today, that lack of data leads to premature shredding, overly conservative reuse decisions, and the time spent in working out the value of whether a battery is no longer fit for purpose.

Once systems are built, passport data can be reused for: ESG reporting, recalls, warranty management and second-life qualification.

At the very heart of much of the European Union thinking are its environmental concerns. Circularity in the passport regulations represents one facet of the European Union's flagship strategy known as the Green Deal. This is to make the region's economy climate-neutral by 2050 while ensuring that it performs better — rather than be disadvantaged — by the rule changes.

Launched in 2019, it reshapes policy across energy, industry, transport, agriculture and finance, with binding targets to cut greenhouse-gas emissions by at least 55% by 2030. The plan promotes renewable energy, cleaner manufacturing, circular supply chains and biodiversity protection, backed by tighter regulation and large-scale public and private investment.

The Battery Passport should provide a standardised method for reporting battery carbon footprint per kWh the result of which is to enable comparison across suppliers and technologies. The rules start to catch up with more up-to-date procurement criteria for OEMs and fleets.

There are also side benefits — extra sales — from the environmentally concerned who are making efforts to reduce their carbon footprint. Johan Bracht, a consultant at McKinsey Battery Insights, says a variety of other factors that come into play for consumers and OEMs.

"In a recent study on a nationwide vehicle resale platform in Germany (mobile.de) there was a 26% increase in sales contact enquiries when the battery passport was mentioned," he said. "There is a lower insurance cost for EVs with a battery passport."

Knowledge of the type of battery, in particular its carbon footprint but also its safety characteristics are positive for EV sales.

But aiming to get the exact carbon footprint needs to be looked at from a variety angles — highlighting the complexity of arriving at any standard solution.

A good example of this comes from Bill Williams, global director, Baltimore Aircoil Company, who told

"It's very important that the battery passport does talk about carbon footprint, but they're only talking about the materials and the minerals, not the process of how they're manufactured"

— Bill Williams, global director, Baltimore Aircoil Company

Snapshot opportunities for the testing market

Howard Alt

Howard Alt, president, Micantis: We do battery data analytics and this is going to represent a huge opportunity for us. We're already measuring data from batteries and helping our customers do incoming quality control.

If you have a batch of 100,000 batteries that shows up in your loading dock, and you want to see if those batteries meet specifications, we help you figure out what test to run, and we help you collect all the data and turn it into reports.

Our customers are very brand sensitive and they're super interested in the quality of their batteries already.

They know that if they're going to buy batteries from battery suppliers, they need to test every single batch that comes through, because, you know, there's an old saying: "Liar, liar, battery supplier." You've got to validate everything that comes in and make sure that you're getting the quality you need.

With regards to the battery passport, I think everybody has got to take responsibility. If you're a European, and you're shipping products in Europe, you need to take responsibility for the European battery passport and not try to assume that standards from another country are going to apply. Is the data going to be right? There's going to have to be a lot of standardisation work."

Steven Lans, CEO/founder of Back to Battery: "We do battery recycling. We make critical raw materials from end-of-life lithium-ion batteries. The EU battery regulation is, of course, important because we need to extract and we need high recovery rates but we help the OEMs with compliance of recycled content because we produce recycled materials locally. The regulation is quite complicated. There's a lot of data. Getting the data and the quality of the data and putting it all together.

"It's going to be good for our business in many ways. There will be a mandatory amount of recycled content in the batteries. People will look for exactly that." ■

Steven Lans

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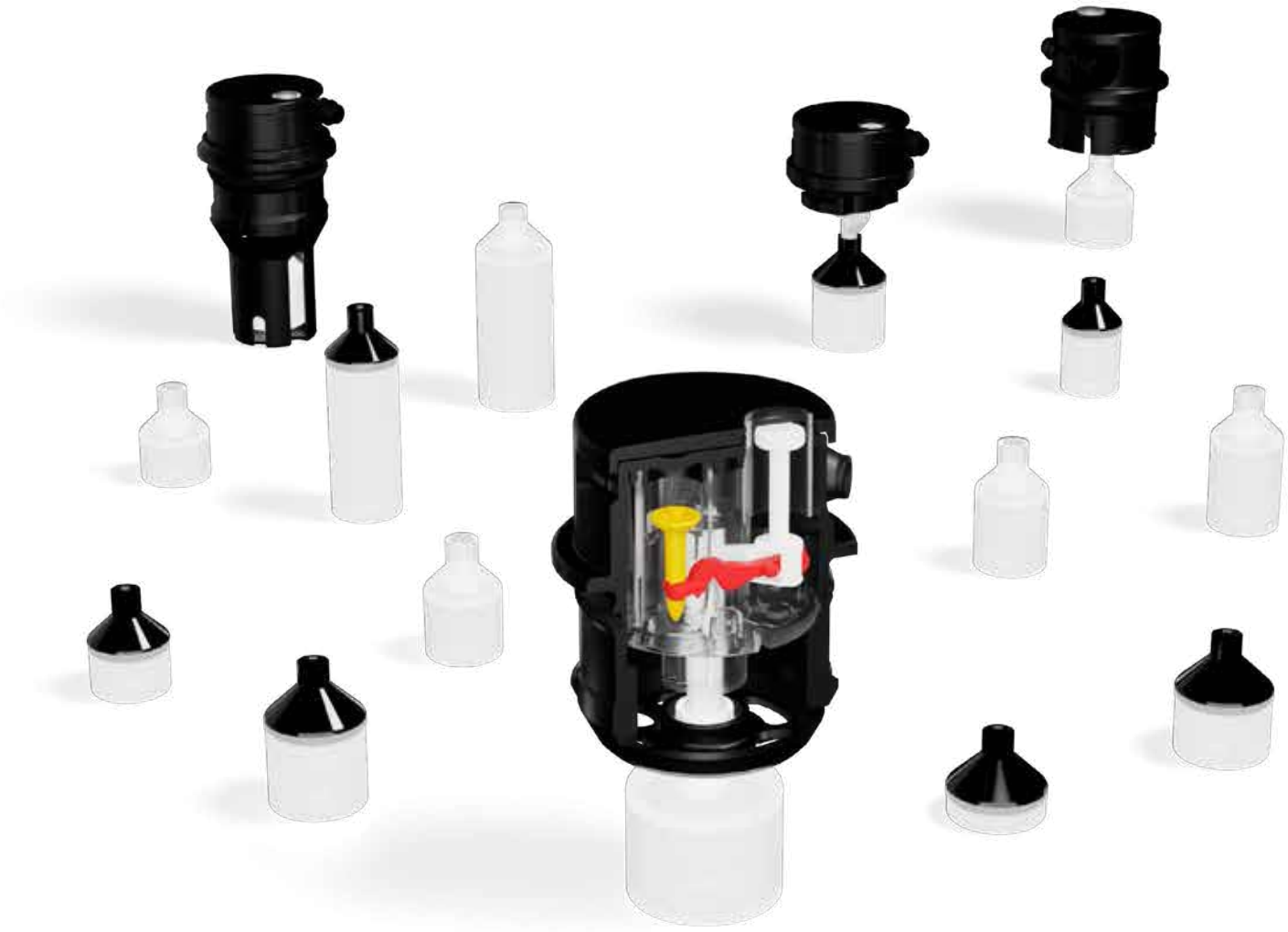

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Batteries International at the recent Battery Passport conference in Lille about his fears. "We manufacture the cooling towers and design those that cool the entire gigafactory. Our equipment goes on the outside of the buildings.

|"It's very important that the battery passport does talk about carbon footprint, but they're only talking about the materials and the minerals, not the process of how they're manufactured. And that process is a big sustainability footprint because these factories will eat and drink a lot of water and energy over the next 25 years.

"Sustainability is my biggest pet peeve – to sustain the local economy. And these equipment and factories, and these batteries should be built in Europe. They should be built locally. We should emphasize this, instead of allowing a lot of the companies to get an EU battery passport, even though they're not being built in Europe. "And shipping batteries from another country is not sustainable." ■

"When we started with our first customer, Volvo Cars, the technical implementation guidelines weren't even released. So back then, we were just interpreting primary legislation and doing the hard work of figuring it out "

— Yue Jin Tay, Circulor

Case study: Volvo Cars lead the way

One of the earliest facilitators of the Battery Passport is the UK startup, Circulor, which worked in partnership with Volvo to develop the passport over a five year period using blockchain technology to map supply chains for companies.

CEO Douglas Johnson-Poensgen claimed their product was a world first EV battery passport which would record the origins of raw materials, components, recycled content and carbon footprint for Volvo's flagship EX90 SUV.

He said would also include up-to-date information on the EV battery's state of health — vital for assessing used EV values — for 15 years and would Volvo cost around $10 per car.

But speaking at the Battery Passport conference in Lille, Circulor's Yue Jin Tay, senior VP global sales said: "There's a lot more to think about once the passport has been placed into the market. And for ESS system integrators or power producers, there are slightly different technical considerations because of the different operating environments and the different commercial environments as well.

"When we first started with our first customer, Volvo Cars, the technical implementation guidelines weren't even released. So back then, we were just interpreting primary legislation and doing the hard work of figuring it out.

"Since then, technical standards have evolved in the battery pass implementation guidelines, and there is also an industry standard spec that has improved on the guidelines as well.

"So creating the passport in the first instance, that's one big challenge, but that's just the initial challenge. Then you have to be able to update it constantly as required through life with dynamic data as well as lifecycle status information, and then to make all of this interoperable within the ecosystem for battery passports to be exchanged between economic operators as part of circularity.

"Volvo cars was the first to implement this at scale. They started with their EX90 at the beginning of 2024, but before that we worked on a pilot. And so this was probably a combination of nearly three years of work with Volvo Cars, and since then it's been scaled across all their platforms.

"Even now, it's not 100% compliant aligned with the regulatory requirements yet, because it's not February 2027. But this is what Volvo has decided to go to market with, and we are working with them to extend that towards full compliance." ■

Volvo released the world's first EV battery passport which recorded the origins of raw materials, components, recycled content and carbon footprint for its flagship EX90 SUV. (pictured below)

Battery Passport content guidance — summary table of required passport fields

Field / cluster	Short definition / what to record	Suggested access level (Battery Pass)
Battery passport identifier (DPP ID / serial / GTIN)	Unique digital identifier for the battery item (pack or battery): serial number, batch, GS1/GTIN where applicable.	Public / Machine-readable; regulator can map to producers.
Manufacturer & basic product data	Manufacturer name, brand, model, part no., manufacture date, production site, warranty start.	Public / Regulator
Battery type & capacity	Type (Li-ion, LFP, lead, NiMH, etc.), nominal capacity (kWh or Ah), nominal voltage, energy density, intended application (EV, industrial, LMT).	Public
Chemistry & cell format	Cell chemistry (NMC, NCA, LFP…), cell format (pouch/prismatic/round), cell manufacturer, cell model.	Public/Restricted (sensitive supplier info)
Materials & composition (bill of materials)	Detailed list of materials and components (active materials, cathode/anode chemistries, electrolytes, current collectors, separators, casing) and mass or % share per battery or per cell.	Restricted-to-authorised / Regulator (some high-level fields public)
Origin of materials / provenance	Country/region of provenance of critical materials (e.g., cobalt, lithium, graphite, nickel) and upstream supplier identity where available; chain-of-custody references.	Regulator / Restricted
Recycled / secondary content	Share (mass %) of recycled or reclaimed materials in battery (e.g., recycled cathode active material, Cu/Al recovered), plus evidence/claims (certificates).	Public / Regulator
Supply-chain due diligence	Evidence of supplier due diligence: supplier declarations, conflict minerals checks, audit/certification references, social & environmental risk assessments.	Regulator / Restricted
Compliance, conformity & declarations	EU Declaration of Conformity, CE/REACH/other certificates, safety standards, WEEE/transport/regulatory identifiers.	Public / Regulator
Carbon footprint (Battery CF)	Battery GHG footprint (method & boundary specified) — typically gCO_2e per kWh or kg, cradle-to-gate and recommended cradle-to-grave rules, methodology reference (e.g., GBA Rulebook mapping).	Public summary + Regulator detailed data (activity data).
End-of-life & recycling information	Recommended end-of-life steps, recycling rates, EOL allocation approach, known recyclers, safe handling and disposal instructions.	Public / Regulator
Circularity / design for reuse	Removability, reparability, possibility to remanufacture, presence of second-life suitability info, expected recoverable material share.	Public / Regulator
Battery Management System (BMS) metadata	BMS model, firmware version, communication interfaces, data types that BMS can expose (SoC, SoH, cycles), data sampling/format conventions. (Battery Pass recommends standardised machine-readable BMS metadata.)	Machine-readable / Restricted-to-authorised (operational)
Operational & performance data	Key performance attributes: recommended charge/discharge profiles, maximum charge/discharge currents, cycles to X% retention, calendar life expectations, typical degradation curves, measured SoH/SoC history where available.	Restricted / Regulator (aggregated public metrics possible)
Safety & transport data	UN transport class, safety instructions, thermal runaway test results, safety critical incidents (where applicable).	Public / Regulator
Traceability & verification references	Links to certificates, third-party verification reports, audit IDs, blockchain/hash references or other provenance proofs.	Regulator / Restricted
Intended & actual use / deployment history	(Where available) application history (vehicle ID / fleet), major repairs, remanufacturing acts, calendar of deployments — important for second-life suitability.	Restricted (privacy & IP concerns)
Data provenance & timestamping	For each attribute: who supplied the value, timestamp, method of measurement, and evidence (documents, lab reports). Battery Pass stresses provenance metadata for trust.	Regulator / Restricted / machine-readable
Access & user roles metadata	Specification of who can read which fields (public, authorised users, national authorities), API endpoints and machine-readable schema.	

Source: European Commission

Strategic & indirect economic gains

- **Enhanced bankability:** The passport provides transparent data on battery state-of-health, durability, and safety. This allows investors to accurately calculate IRR (Internal Rate of Return) and reduces the risk premium for financing large-scale battery energy storage systems (BESS).
- **Secondary market value:** Detailed usage history (e.g., charging cycles, temperature logs) allows for precise residual value assessment, making it easier and more profitable to sell batteries for "second-life" applications in stationary storage.
- **Access to incentives:** In some global contexts, such as the US Inflation Reduction Act, digital passports are used to prove material sourcing to qualify for tax credits.
- **Supply chain resilience:** By integrating passports into vehicle de-registration, the EU could unlock 5%–20% of the active material demand from recycled sources by 2045, reducing dependence on volatile primary raw material markets.

Source: Battery Pass Consortium (2024)

Projected gains from Battery Passport implementation

	Financial impact	Driver
Procurement	2–10% reduction	Lower technical testing and verification costs for independent operators.
Recycling costs	10–20% reduction	Reduced need for expensive manual sampling and pre-processing due to available chemistry data.
Recycling revenue	5–15% increase	Higher recovery of valuable active materials like lithium and cobalt.
Compliance	~15% reduction	Lower administrative burdens through digital rather than paper-based compliance.
Profitability	Up to 58% gain	Optimized use and recycling pathways for LFP batteries (19% for NMC).

Source: Battery Pass Consortium (2024)

The Maui Method, developed in the US state of Hawaii, has the potential to be a landmark moment in dealing with damaged lithium-ion batteries. It demonstrates that even severely ravaged, high-energy battery systems can be neutralized safely and in scale.

Hawaii's simple saltwater solution to a dangerous battery problem

It's 6.37 in the morning of August 8, 2023. Sparks from a downed powerline set fire to dry grass in the city of Lahaina on the Hawaiian island of Maui. The flames, fanned by a dry wind with gusts of some 80 miles per hour, had just started the deadliest US wildfire in a century.

It was eventually to claim 102 lives, devastate large swathes of town and countryside and showed for the first time how wildfires and lithium batteries are a dreadful combination.

And then came the clear-up. Hundreds of damaged EV battery packs remained on the island, with no established pathway for safe neutralization or shipment to the continental US.

Out of that operational deadlock emerged what is now known as the Maui Method — a multi-stage, open-source process designed to systematically de-energize, dismantle, destroy, and reclassify damaged lithium-ion batteries into a non-hazardous material suitable for transport and downstream processing.

The need was great. When lithium batteries are damaged by fire, flooding, mechanical impact, or manufacturing defects, they don't behave like conventional hazardous materials.

They present a hybrid risk profile that includes flammable gas generation, corrosive and toxic vapours, and fine metal particulates released during thermal runaway. In jurisdictions without local hazardous-waste recycling or battery processing capacity, these damaged batteries create a logistical and regulatory dead end.

What began as a crisis response has evolved into a replicable framework with implications far beyond Hawaii.

Lithium-ion batteries are not inherently dangerous when manufactured, used, and disposed of under controlled conditions. The risk arises when cells or modules are physically compromised or thermally abused

Lithium-ion batteries are not inherently dangerous when manufactured, used, and disposed of under controlled conditions. The risk arises when cells or modules are physically compromised or thermally abused

As one Maui responder put it, "I had never said 'nickel' and 'IDLH' [Immediately Dangerous to Life or Health] in the same sentence until I started working with batteries"

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risk arises when cells or modules are physically compromised or thermally abused.

Three primary hazard vectors define damaged lithium-ion batteries:

• Flammable gas generation
During failure or decomposition, lithium-ion batteries can release hydrogen and other flammable gases. If these accumulate in enclosed or poorly ventilated spaces, they can reach lower explosive limits.

• Toxic and corrosive vapours
Electrolyte decomposition can generate hydrofluoric acid (HF), a highly corrosive substance capable of causing severe injury and long-term health effects even at low concentrations. (For a detailed examination on toxic vapours read George Brilmyer's excellent analysis in the last issue of *Batteries International*.)

• Fine metal particulates
Thermal runaway events can aerosolize nickel, manganese, cobalt, and other cathode materials into extremely fine particulates. These can present inhalation hazards and environmental contamination risks.

For hazardous-materials professionals accustomed to working with conventional chemical hazards, lithium-ion batteries represent a novel convergence of fire science, electrochemistry, and environmental engineering.

As one Maui responder put it, "I had never said 'nickel' and 'IDLH' [Immediately Dangerous to Life or Health] in the same sentence until I started working with batteries".

IDLH describes atmospheres that pose an immediate threat to life, cause irreversible health effects, or prevent escape. It applies to toxic, oxygen-deficient (<19.5%) or explosive environments. IDLH values help determine the maximum concentration from which a worker could escape within 30 minutes without permanent damage.

In Hawaii, the challenge was compounded by geography and regulatory structure. The state does not have a Subtitle C hazardous-waste recycler capable of processing lithium-ion batteries. As a result, damaged batteries must ultimately be shipped to the continental US.

Under US regulations, damaged lithium-ion batteries typically qualify as characteristic hazardous waste. They also fall under strict Department of Transportation hazardous materials rules. Maritime shippers, in particular, are increasingly unwilling to accept damaged batteries due to the fire risks associated with onboard incidents.

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This created a paradox: the batteries were too dangerous to ship in their damaged state, and there was no local infrastructure to neutralize them safely and leaving them in place indefinitely created unacceptable public-safety and environmental risks.

The Maui Method was developed specifically to resolve this impasse.

From its inception, the Maui Method was guided by five core principles:

Incremental risk reduction
Every step in the process must measurably reduce fire, toxicity, or explosion risk.

Open-source transparency
The method and its standard operating procedures (SOPs) would be fully public and non-proprietary.

Regulatory defensibility
Each stage had to be aligned with EPA hazardous-waste definitions and DOT transport classifications.

Operational simplicity
The process should rely on readily available equipment and materials wherever possible.

Scalability
The same framework must work for a single battery or for hundreds of EV packs.

Before any batteries were touched, Maui operators conducted baseline soil sampling to establish pre-existing conditions. The processing site was then engineered with multiple layers of environmental protection: there was a thick polymer liner to prevent soil contact; geotextile matting for structural stability; a gravel working surface; full containment for all liquids; and, post-operation resampling to confirm no contamination

Real-time air monitoring was installed across the site. This included: five-gas meters measuring flammable gases, oxygen, and volatile organic compounds; particulate monitors capable of detecting fine metal aerosols; wind socks defining exclusion zones and wind direction; and all monitoring data were logged continuously. According to project leaders, their benchmark metric was "zero or non-detect".

Stage 1: Brine discharge of residual energy

The first substantive step in the Maui Method is electrochemical de-energization.

Damaged batteries are submerged in a buffered saltwater solution consisting of sodium chloride and sodium bicarbonate. The bicarbonate buffer prevents the solution from becoming excessively caustic and corroding metallic components too aggressively.

Batteries remain submerged for a minimum of three days. During this period: the residual electrical energy is dissipated; internal short circuits are encouraged; and surface voltages fall to near zero

Alternative chemistries such as sodium hydroxide discharge solutions work faster but introduce additional hazards. The Maui team prioritized a formulation that fire departments and emergency responders could source cheaply and safely.

Stage 2: Controlled dismantling and waste stream segregation

After discharge, batteries are moved to a preparation cell where surface voltage is checked continuously as fasteners and casings are removed.

Materials are segregated into three waste streams. These are non-battery components, such as casings, structural frames, fasteners; e-waste such as control units, wiring, copper, capacitors; and battery cells and modules which are designated for destruction.

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This segregation simplifies downstream handling and reduces unnecessary processing of inert materials.

Stage 3: Mechanical destruction

The core regulatory objective of the Maui Method is to eliminate the material's legal status as a "battery."

US EPA and DOT definitions hinge on the presence of intact electrochemical cells capable of storing energy. Once those structures are physically destroyed and electrical circuits eliminated, the material no longer meets those definitions.

Mechanical destruction is performed using excavators equipped with toothed buckets and thumb attachments. Where shredders are used, they operate at low RPM using torque rather than momentum — comparable to grinding peanuts into peanut butter rather than using a wood chipper.

The goal is controlled failure, not fragmentation.

After destruction the material may continue generating small amounts of hydrogen gas but internal electrochemical reactions will gradually cease and temperatures should return to ambient within 24 hours

Stage 4: Drum packaging and thermal monitoring

Destroyed battery material is compacted into steel drums weighing approximately 160kg-180kg each.

Each drum is temporarily sealed for lifting monitored using infrared thermometers (and rechecked periodically for temperature trends). It is important that external drum temperatures have not exceeded 220°F (104°C) and consistently return to ambient within 24 hours and only after a clear downward temperature trend is confirmed are drums approved for overnight staging and eventual shipment.

Waste reclassification

One of the most important regulatory outcomes of the Maui Method is the reclassification of both solid and liquid waste streams.

Extensive profiling of used brine solutions in both Maui and Los Angeles showed there was no failure of RCRA hazardous-waste criteria or TCLP (toxicity characteristic leaching procedure) exceedances for regulated metals though there was the presence of trace metals and sludge these were below regulatory thresholds and the salinity was approximately twice that of seawater

As a result, both the solid battery remnants and the spent brine solution can be classified as non-hazardous waste.

This reclassification is what ultimately makes maritime and overland transport legally and commercially feasible.

The Maui Method would not have been possible without an unusually tight integration between the Maui County authorities, the Hawaii Department of Health, emergency management agencies, environmental contractors and fire and hazardous-materials teams

Governance

The Maui Method would not have been possible without an unusually tight integration between the Maui County authorities, the Hawaii Department of Health, emergency management agencies, environmental contractors and fire and hazardous-materials teams

The project required navigation of emergency permitting, hazardous-waste treatment authorizations, and interagency coordination rarely seen in routine waste-management operations.

Project leaders describe the unified command structure as one of the method's most important achievements.

The Maui team explored patent protection in 2023. The process was ultimately deemed non-patentable, a result the team welcomed.

Their explicit intent was to prevent private entities from monopolizing emergency battery neutralization technology and licensing it back to public agencies.

All standard operating procedures are now publicly available. The method is being shared with other US jurisdictions and international stakeholders.

As one leader described it, "We wanted this to be the polio vaccine for batteries." That said the Maui Method's developers say this is not necessarily the optimal or final solution.

Higher-throughput shredders, automated dismantling lines, and purpose-built neutralization systems will almost certainly emerge. The Maui Method is best understood as a minimum viable framework — a reliable hammer that works today.

What distinguishes it is not technical elegance, but operational defensibility. It is proven at scale, accepted by the regulators, compliant with transportation and environment rules and perhaps most importantly, commercially feasible.

For battery manufacturers, recyclers, insurers, fleet operators, utilities, and regulators, the Maui Method highlights an emerging gap in the energy-storage value chain: end-of-life crisis handling.

As EV adoption accelerates and climate-driven disasters intensify, damaged battery volumes will grow. Jurisdictions without local processing capacity will face the same dilemma Maui confronted.

The Maui Method provides a blueprint for bridging that gap — now, not five years from now.

By combining electrochemical discharge, mechanical destruction, environmental containment, regulatory transparency, and open-source dissemination, Maui has demonstrated that large-scale damaged battery neutralization is not only possible, but practical.

In an industry racing toward electrification, the Maui Method may prove to be one of the most quietly consequential innovations of the decade. ■

As EV adoption accelerates and climate-driven disasters intensify, damaged battery volumes will grow. Jurisdictions without local processing capacity will face the same dilemma Maui confronted

Lithium lessons from the Lahaina fire

When the Lahaina wildfires swept through the island of Maui in August 2023, they destroyed more than 2,000 structures and burned thousands of vehicles, e-bikes, scooters, and home energy storage systems.

Alongside the familiar hazards of an urban wildfire — plastics, treated wood, fuels, and building materials — the fires also involved a large and poorly characterised population of lithium-ion batteries.

The EPA later said that it collected 30 tonnes of lithium batteries from damaged EVs and home storage systems to prevent reignition and further exposures. Their failure added a distinctive chemical and operational dimension to the disaster.

Lithium-ion cells exposed to intense heat can enter thermal runaway, a self-accelerating decomposition reaction in which the electrolyte and electrodes break down violently.

In contrast to conventional hydrocarbon fires, battery thermal runaway produces not just heat and flame but a complex mixture of toxic and corrosive gases.

Of particular concern is hydrogen fluoride (HF), generated when fluorinated lithium-salt electrolytes (typically $LiPF_6$) decompose. HF is acutely toxic, highly corrosive to lung tissue and skin, and dangerous even at low concentrations. Other decomposition products include carbon monoxide, hydrogen, light hydrocarbons, phosphoryl fluoride, and fine particulate aerosols.

In Lahaina, these battery-derived emissions were mixed into a much larger cloud of smoke from burning buildings, vehicles, and infrastructure. As a result, no direct measurements were made that isolated lithium-battery-specific toxicants from the broader wildfire plume.

Nevertheless, the chemical species expected from large-scale battery involvement — especially HF and ultrafine particulates — are well established from laboratory and industrial battery-fire studies, and almost certainly contributed to the acute respiratory irritation reported by residents and first responders.

Post-fire ash sampling across Lahaina showed elevated levels of heavy metals and metalloids, including lead, arsenic, cobalt, antimony, and copper. Some of these contaminants are consistent with lithium-ion battery materials (e.g., cobalt and copper), while others originate from legacy building materials, wiring, and consumer products. Again, attribution is difficult, but the presence of battery metals in the debris field added to the overall toxic burden and complicated clean-up.

In terms of direct health outcomes, there is no evidence that the battery fires caused mass poisonings or distinctive clinical syndromes beyond what is typical of severe urban wildfire exposure. The dominant acute effects were those associated with dense smoke and particulate matter: coughing, eye irritation, breathing difficulty, and exacerbation of pre-existing respiratory disease.

The more serious long-term concern is chronic exposure to contaminated ash and dust, which can be inhaled or ingested during clean-up and rebuilding. This pathway poses potential cancer, cardiovascular, and neurotoxicity risks over time.

Operationally, the most striking lesson from Lahaina was that fire-damaged lithium-ion batteries are not inert. Many remained partially charged and chemically unstable for weeks after the fire, posing risks of delayed reignition, toxic gas release, and explosion during debris handling. Thousands of battery packs from electric vehicles and home storage systems had to be removed by hazardous-materials crews. Ultimately, a new neutralisation protocol — informally known as the "Maui Method" — was developed, involving controlled discharge of batteries in brine followed by mechanical destruction to render them non-hazardous.

The broader lesson is that as lithium-ion batteries become ubiquitous in homes, transport, and infrastructure, they are becoming a routine component of wildfire and disaster toxicology. Emergency planning, debris management protocols, and firefighter training have not yet caught up with this reality. Lahaina showed that battery fires do not just burn hotter; they introduce new chemical hazards, prolong clean-up, and demand specialised post-fire handling methods. For regions facing increasing wildfire risk alongside rapid electrification, that is a warning that can no longer be ignored. ■

Clarios plans new US recycling capacity, boosts Mexican battery pipeline

Battery giant Clarios has revealed it is in the site selection and engineering phase for a new US-based battery recycling and critical minerals processing facility.

Meanwhile, the lead and lithium company said in November it planned to fast-track the restart of idled facilities at its plant in Florence, South Carolina to "quickly expand" battery recycling capacity and boost critical minerals processing.

There will be a rapid retooling of the facilities which Clarios said offers one of the fastest routes to scale and secure domestic capacity.

And in a related move, to immediately increase US-available battery supply, Clarios is implementing AI automation and capacity upgrades at its existing facilities in Mexico.

In terms of the new facility, Clarios did not disclose the cost or timetable of the project but said it would represent a major investment in US-based recovery and refining, creating a cornerstone for domestic supply chain resilience.

Collectively, these initiatives will provide additional recycling capacity of up to 400,000 tonnes, the company said.

Clarios will also continue to evaluate opportunities to acquire existing battery recycling capacity.

All of the announcements are parts of a 10-year, $6 billion plan, announced last March, to expand battery manufacturing and help boost US energy and critical minerals independence.

Clarios' upgrading of its Mexico facilities comes just months after battery-making rival EnerSys said it would close its flooded lead acid battery manufacturing facility in Monterrey, and switch production to its existing Kentucky plant while expanding capacity in the US and Europe.

Batteries International reported last August that Clarios would acquire three lead battery recycling plants in Europe from Ecobat — as predicted by the magazine. ■

Ecobat US plant in 'sell-off talks' wins recycling permit renewal

Ecobat Resources has secured a 10-year permit renewal for operations at its lead battery recycling plant in California, which is understood to be at the center of potential sell-off talks.

The renewal by the California Department of Toxic Substances Control (DTSC) for the City of Industry site was announced on November 21 and took effect from December 29.

The announcement came just weeks after *Batteries International* reported that negotiations for the potential sale of the three facilities Ecobat owns in the US — in California, Indiana and New York — were reportedly edging toward a conclusion.

In terms of the California renewal, DTSC said it had added specific conditions to both the final operating and post-closure permits to ensure long-term environmental and public health safeguards.

Conditions include a requirement for Ecobat to maintain over $50 million in financial assurances to cover clean-up or closure costs and hold annual public meetings to discuss environmental data and issues concerning the plant.

The company also must install a community air monitor near the facility, implement a soil sampling plan to study potential lead impacts and continue groundwater monitoring.

The plant, currently operating under a permit effective from September 2005, runs a secondary lead smelter that process lead acid batteries and other lead-bearing waste or materials.

There is also a wastewater treatment plant, battery wrecker building, and storage area where batteries are kept ahead of processing.

This October, private equity investor Splitstone Capital said it was acquiring Ecobat Resources UK's lead battery recycling business from the firm's US parent company.

Separately, Belgium-based Campine has pledged to expand use of battery recycling and speciality lead manufacturing operations that it acquired from Ecobat in France earlier this year.

Meanwhile, industry observers say the US government's backing for lead to be added to the nation's list of critical minerals is seen as a boost for owners — or prospective buyers — of lead processing facilities. ■

Ace Green in Asia lead and lithium recycling projects update

Ace Green Recycling said in December it is set to despatch equipment for the planned second phase of a project with Taiwanese lead refiner ACME Metal Enterprise.

Equipment arrival and commercial operation of phase two at ACME's Keelung City facility is expected early 2026 and follows an expanded recycling agreement announced by the partners last June.

This next phase will give ACME the capacity to produce refined lead and lead alloys from paste and metallics extracted from up to 60 million pounds of used lead acid battery scrap annually — equivalent to around two million car batteries each year — using Ace's proprietary 'GreenLead' technology.

Meanwhile, Ace said it is also preparing to ship equipment to Thailand and has already started shipments to Armenia for two separate lead and lithium projects in that country.

The recycler said its Grid Metallics Processing System (GMPS) for IPP Lead and Metals in Thailand, remains on schedule, with onsite deployment expected between March and April 2026.

On its projects in Armenia for Mel Metals, announced earlier, Ace said the lead recycling system is being shipped in batches through this month and into January. The Li recycling system was shipped last month. Commissioning and full commercial production for both facilities are targeted for April-May 2026.

Ace has not given a detailed technical breakdown of GMPS's capabilities, but said it expects that its solution can enable lead battery recyclers to increase their throughput by up to 25%, by freeing up smelting capacity.

The company claims its GreenLead tech replaces the smelting furnace, operates at room temperature, runs on electricity and has zero Scope 1 greenhouse gas emissions (direct GHG emissions such as those made while running boilers and vehicles) and reduces solid waste by more than 85%. ■

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China, Hungary workshop eyes lithium partnerships

China and Hungary have held talks that could pave the way for developing partnerships in lithium battery recycling.

A Chinese delegation attended an international workshop on the subject hosted by the Hungarian Battery Association (HBA) on November 5.

In addition to considering recycling-related issues, Hungarian and Chinese experts discussed latest technological developments, opportunities, and prospects for lithium recycling of lithium-battery recycling and considered requirements of Hungary's extended producer responsibility for batteries on the market.

The event was organized within the framework of the New Energy Battery Joint Laboratory, a facility established through Chinese-European cooperation by the Faculty of Science at Hungary's Eötvös Loránd University, Hungarian recycler NT Recycling and the HBA.

HBA managing director Péter Kaderják said Hungary's battery sector will be one of Europe's largest industry hubs by 2030. The country is poised to become an important market for batteries used in EVs and for those produced for energy storage systems.

Kaderják, who is also a director of Zero Carbon Hub at the Budapest University of Technology and Economics, said cooperation with international companies plays an essential role in the sector's growth.

Establishing recycling capacities is particularly important given the limited liability of raw materials such as lithium and cobalt in Hungary and the wider European region, Kaderják said.

Additional tasks include building battery testing capabilities, developing R&D activities, and fostering collaboration.

But he urged HBA member companies to be more transparent in communications about the battery sector to overcome any public resistance to industrial activities.

Ádám Nagy, deputy state secretary for industrial affairs at the Ministry of National Economy, said establishing recycling capacity should be part of the country's moves to create a full domestic battery production chain.

Dongchang Zhao, senior expert at the China Automotive Technology and Research Center (CATARC) and MD of the CATARC Carbon Digital Center, said it was essential that countries cooperated in creating databases, such as for measuring the carbon footprint of batteries from production to recycling.

China's state Xinhua news agency said on November 5 that Hungarian and Chinese officials saw vast opportunities for cooperation in battery recycling and new energy for the two countries.

According to Xinhua, Hungary's battery production capacity has grown from zero to 87GWh in seven years, attracting €20 billion in foreign investment — mainly from China, South Korea and Europe. Capacity is projected to reach 250GWh by 2030.

Péter Kaderják: "Cooperation with international companies plays an essential role in the sector's growth"

Ádám Nagy: "Establishing recycling capacity should be part of the country's moves to create a full domestic battery production chain"

However, a study released by European clean transport campaign group Transport & Environment (T&E) in February cast doubt on the benefits of European partnerships with Chinese and Korean battery majors. ■

According to Xinhua, Hungary's battery production capacity has grown from zero to 87GWh in seven years, attracting €20 billion in foreign investment

Campine invests in antimony boost after Ecobat deal

Campine has announced a €7 million ($8 million) investment to expand use of its proprietary antimony recycling technology, following its acquisition of two battery recycling plants and one semi-finished lead-products facility from Ecobat in France.

Campine's board approved the investment in the third generation of its tech to produce an extra 800-1,000 tonnes annually of commercial-grade antimony metal from a wide range of industrial waste streams.

The metals recycling and speciality chemicals group's new installation is expected to start up by mid-2027.

Campine said it continues to be a global leader in the antimony trioxide market and integration of the former Ecobat sites into its circular metals division is progressing as planned.

Initial synergies in battery recycling have already been implemented, with "full synergy benefits" during 2026, the group said.

Meanwhile, Campine reaffirmed its operational outlook for 2025, expecting an EBITDA exceeding €80 million for the group (excluding the Ecobat acquisition). The consolidation of fourth-quarter 2025 results of the Ecobat plants, together with acquisition accounting effects, is expected to further increase this result.

The group said exceptional profitability expected for 2025 will represent an absolute record, more than doubling the result achieved in 2024 — when Campine posted a turnover of €365 million.

In 2022, Campine acquired two lead battery recycling plants from French recycler Recyclex. ■

A conference caught between celebration and concern

In many respects, this year's Batteries Event in Lyon was an unusual one. The exhibition hall thrummed with energy — deals were struck, partnerships formed, and innovations displayed. Networking, by anybody's measure, was a success.

Yet, amid the bustle, a subtle tension lingered in the air. Not fear exactly, but a sense of foreboding. Something was coming — though no one could quite say what.

To their credit, the organisers ran a smooth and well-oiled event, as they have for more than 25 years. Batteries Event, the respected, long-running conference series founded by Christophe Pillot, director of Avicenne Energy (Avicenne Group), first launched in 1999 as a niche gathering for experts across the battery industry—covering materials, components, cell manufacturing, market trends, and energy storage technologies. Since then, it has evolved with the industry — growing and contracting in step with the fortunes of rechargeable batteries, particularly lithium-ion technology.

Technology, Policy, and "Battery Valley"

This year's agenda reflected the sector's major preoccupations of recent years: what is happening to the next generation of battery chemistries? How advanced are EU plans for sustainability and the circular economy?

Of particular interest were the sessions updating us to the growing industrialization in manufacturing, specifically the advent of France's so-called 'Battery Valley' around Dunkirk. Of special note were the sessions exploring market trends and policy impacts — topics that visibly captured the attention of delegates.

A Night of Extravagance

Socially, the event set a new benchmark. The gala dinner was noth-

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ing short of opulent — an ocean of oysters, Savoyard fare, and culinary sophistication that left other conference hosts envious. The evening culminated in a breathtaking dance display of virtuosity that would have easily graced the stages of Broadway or London's West End.

But beneath the gaiety an unease simmered. Market outlook weighed heavily on conversations. Delegates spoke of uncertainty. Not panic, but clear apprehension about what the next year might bring for energy storage, and especially for lithium batteries.

"Nobody's making money or being fuelled by investment money at the moment," one exhibitor told *Batteries International*. "The big players in this sector are drawing in their horns in the welter of the confusion over tariffs and supply chains and the assault the Chinese will make into the European market.

"The fact is that at the gigafactory level we can't compete with China. They know how to make LFP at scale and we can't."

Gigafactory Growing Pains

That disparity was echoed in reports from northern France's emerging gigafactories near Dunkirk. One delegate told us that the scrap rate at one of the potential giga-factories was above 60% — that's two thirds of battery cells being made, unfit for purpose — making it impossible to move into large scale lithium ion cell production until the manufacturing details had been solved.

"Until they reduce that to under 5%, profitability is out of reach," she noted. "The industry norm is closer to 1–2%."

Such teething problems are not unusual. Fine-tuning a new production line can take two years or more, but the real question is how long investors can sustain mounting financial losses before results materialise.

Despite these concerns, one of the conference's enduring strengths — its diversity of exhibitors — shone through. Every stage of the lithium battery lifecycle, from raw material to end-of-life recycling, was represented.

Several companies showcased near-breakthrough technologies. Two, in particular, demonstrated next-generation x-ray and spectrographic systems capable of analyzing battery stream composition within recycling plants — an area that has long challenged the sector.

The consensus among exhibitors was positive: attendance was strong, engagement high, and conversations promising.

Looking Ahead

As Europe's battery landscape evolves, next year's event promises to be revealing. Will Europe's lithium manufacturers regain ground, or will consolidation reshape the sector yet again? By the close of 2026, we may learn which players have adapted — and which have been left behind in the race for sustainable energy storage. ■

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The art of doing business with Europe

Battery Passport Conference
Lille, France • February 4, 2026

It was a great — and much needed — conference idea. A single event dedicated to one of the most crucial tasks facing the battery industry in Europe and to its suppliers outside of the EU.

The premise of the meetings was a simple one. Here is the European Commission's Battery Passport regulation, how are we going to deal with it now that it is so pressing?

Given that this is one of the most pressing and imminent issues facing our industry — its importance is reflected in that the topic has become the cover story of this issue — the organizers had clearly spent a lot of time thinking about its content and who should speak.

In his opening introduction conference organizer Ken Davies outlined the brief of the sessions. "EU battery passport is going to change the way our batteries abroad will be sold, used and valued. It's going to mean new obligations, but more importantly, it's going to create clarity, and clarity is generally good for business," he said.

"So in a market where sustainability and transparency and resilience increasingly define success, the battery passport will reward companies that know their products, that know their supply chain and know their data. And the question for business is not going to be whether the battery passport will affect you, because we know already that it will.

"The real question is whether you choose to treat it as a cost of doing business or as a mechanism for building competitive advantage."

Although some of the talks followed the "challenges and opportunities" approach, and were, occasionally, too upbeat given their enthusiasm for the subject, there was a surprising and very welcome level of factual information and detail.

Perhaps the best and most useful thing about the way the one-day conference was organized was the variety of subjects that needed to be addressed. It was interesting to see how the bare bones of the entire supply chain were more or less covered in the talks.

Given that this is one of the most pressing and imminent issues facing our industry — its importance is reflected in that the topic has become the cover story of this issue — the organizers had clearly spent a lot of time thinking about its content and who should speak

Many of the practicalities of compliance with the new regulations were answered at the conference. Think, governance, cyber security, validation, acceptance to name just a few.

One strength of the conference was that the speakers were covering unusual ground. In most energy storage conventions nuances of the same technologies are endless discussed.

This was virgin territory especially given it was an attempt to explore what the landscape will look like in the run-up to the introduction to the regulation. And how it would look later, next year or beyond.

So, for example, there will clearly be difficulties in amassing the data required for the sourcing of the minerals in the batteries, there are huge IP hurdles to overcome mostly from the anticipated unwillingness of the mining firms themselves. This of course immediately digs into how the validation process of the data works. There are clearly as many headaches for the army of fact-checkers that will be needed to verify these as there will be for those seeking to compile them.

One intriguing question is how the data will be stored and what access should be given to retrieve this. Given the value of the information, a host of export licences are at stake, the integrity of the battery passport is a must.

And that will mean cryptography of the highest order. Carsten Stöcker the founder of Spherity and speaker at the event said that the level of code-breaking now was enormous as was the ability to generate credible fakes. He foresaw a time when quantum computing might even be the only solution to keeping data truly safe.

There were around 170 attendees with five exhibiting booths. Co-located the following day a major exhibition was held with approximately 40 booths and some 600 people. ■

NAATBatt 2026

February 9-12, 2026
Tucson, Arizona, USA

NAATBatt's 2026 Annual Meeting & Conference will be held February 9-12, 2026 at the stunning JW Marriott Starr Pass Resort & Spa in Tucson, Arizona. Stay where all the action is! Booking your room at the meeting hotel ensures you'll be right at the center of networking events, sessions, and social activities. Don't miss out! Once the room block is full, availability cannot be guaranteed.

Contact
https://nac.naatbatt.org/
E-mail: info@naatbatt.org
Phone: +1 312 588 0477

International Energy Week 2026

February 10-12
London, UK

International Energy Week 2026 is set to be the first major global energy gathering following COP30, bringing together the world's energy leaders to transform climate commitments into real-world action.

Supported by the Energy Institute and its 20,000-strong membership, the event provides a unique platform to address today's most pressing energy challenges — from grid resilience and supply chain risks to financing the transition and accelerating innovation.

As the UK's premier energy event, International Energy Week goes beyond a traditional conference. It serves as a powerful convening force, a dynamic networking hub, and a strategic platform advancing the Energy Institute's mission to shape a better energy future.

Contact
https://www.ieweek.co.uk/
E-mail: ieweek@energyinst.org

Energy Storage Summit

February 24-25
London, UK

The year 2026 represents a pivotal milestone not only for Europe's energy storage industry, but also for the global clean energy transition. The Energy Storage Summit will highlight the essential role storage plays in reaching net zero, while exploring both the challenges and opportunities shaping markets worldwide. In the UK, grid-scale storage has already surpassed 120 MWh of approved projects, with a further 14 GW in development.

Contact
www.storagesummit.solarenergyevents.com
E-mail: sm.energystorage@informa.com

ees India 2026

February 25-27
Gandhinagar, India

This will take place alongside Intersolar India and Power2Drive India. ees India will spotlight batteries and electrical energy storage technologies and systems, drawing investors, utilities, installers, manufacturers, and project developers from across the globe.

Contact
https://www.thesmartere.in/home

KEY – The Energy Transition Expo

March 4-6
Rimini, Italy

The layout will feature seven interconnected thematic areas: photovoltaics, wind power, storage, energy efficiency, electric mobility, sustainable cities, and the Innovation District.

Within the sections focused on solar, storage, and wind, a dedicated pavilion will be reserved for EPC (Engineering, Procurement, and Construction) and finance, reflecting their growing strategic importance in the development of new renewable energy projects and utility-scale storage solutions.

Contact
https://www.key-expo.com/en

The Battery Show Asia 2026

March 10-12
Hong Kong, China

The world's leading battery and energy exhibition, The Battery Show, made a powerful Asian debut in 2025, welcoming 17,893 buyers from 132 countries and regions alongside 314 global exhibitors across four co-located events.

In 2026, The Battery Show Asia returns to AsiaWorld-Expo in Hong Kong from March 10–12, offering three days of high-impact networking and cutting-edge innovation showcases.

Contact
https://www.thebatteryshow.asia/
E-mail: info@thebatteryshow.asia

Giga Europe 2026

March 11-12
Brussels, Belgium

Autoworld, Belgium's national automobile museum, is located in the heart of Brussels within the distinguished Cinquantenaire Park. Home to one of Europe's most exceptional automotive collections, it stands within walking distance of the European Parliament and is surrounded by a wide range of accommodation options.

The combination of its prestigious architecture, extensive collection, central location, and high-quality service ensures that every event hosted at Autoworld offers a truly distinctive and memorable experience.

Contact
/www.benchmarkminerals.com/events/giga-europe

ASEAN Battery Energy Storage Expo 2026

March 25-27
Bangkok, Thailand

Scheduled for three days, it is expected to welcome 200+ exhibitors from countries and regions around the world. The $100 billion market welcomes global participants to join the competition.

Contact
www.aseanbatteryexpo.com
E-mail: compass@compassexhibition.co.th
Phone: +86 13539992305

The Battery Show Middle East 2026

April 7-9
Dubai, UAE

For 50 years, Middle East Energy connects qualified buyers with proven suppliers to move real projects forward. Showcase what's new, validate it in the conference, and convert meetings into orders. At Middle East Energy, each sector is built to help you meet the right buyers, discover innovation relevant to your projects, and spot growth areas; making this the Middle East's definitive energy market place.

Contact
https://www.middleeast-energy.com/en/home.html
E-mail: info@middleeast-energy.com

CLNB 2026 – The 11th New Energy Industry Chain Expo

April 8-10
Suzhou, China

CLNB 2026, organized by SMM (Shanghai Metals Market), will be held from 8–10 April 2026 in Suzhou, China. The event is expected to bring together over 1,500 exhibitors, conference delegates, and more than 30,000 industry professionals. It will feature five key exhibition zones: Innovative Battery, Mining & Raw Materials, Advanced Materials, Battery Recycling, and Integrated Energy Solutions—covering the entire value chain from minerals to end-use applications

Contact
www.clnb.smm.cn/en/home?fromId=11215cb114
E-mail: chudan@smm.cn
Phone: +86 177 2134 3809

SolarPLUS Europe 2026

April 15-16
Milan, Italy

After more than a decade as Large Scale Solar Europe, we are now evolving into SolarPLUS Europe — a rebrand that reflects both the industry's remarkable progress and its future direction. This change is more than a new name. It signals a fresh era for Europe's longest-running solar conference, one that mirrors the transition from standalone solar projects to integrated, flexible energy systems combining solar, storage, and hybrid technologies. As Europe accelerates its decarbonisation journey, the focus is shifting from simply adding clean megawatts to the grid. The next phase is about delivering firm, reliable, and bankable renewable power at scale, and SolarPLUS provides the platform to make this a reality.

Contact
https://lss.solarenergyevents.com/
Phone: +44 7515 541 257

International Battery Seminar and Exhibition

March 23-26
Orlando, Florida, USA

Since its founding in 1983, the International Battery Seminar & Exhibit has become the leading global forum for showcasing cutting-edge advances in energy storage technologies across consumer, automotive, military, grid, and industrial sectors.

As the world's longest-running annual battery event, it has consistently served as the premier stage for announcing breakthroughs, unveiling new products, and highlighting the most innovative battery solutions. Notably, in 1991, Sony introduced its groundbreaking lithium-ion technology at this very seminar—an achievement that went on to transform industries worldwide.

Contact
www.internationalbatteryseminar.com/
E-mail: ce@cambridgeenertech.com
Phone: +781 972 5400

The Battery Show South

April 22-23
Charlotte, USA

The Battery Show South will convene the regional value chain of the Battery Belt to examine the latest advancements in commercial and industrial transportation, advanced batteries, hybrid and electric vehicles (H/EV), materials, stationary energy storage, recycling, components, mining, medical technology, aerospace, and related sectors.

The event will provide a forum for engineers, executives, leading enterprises, and innovators who are developing impactful solutions and influencing the future trajectory of battery and electric vehicle technologies. Attendees will benefit from two days of structured educational sessions, strategic networking opportunities, and exposure to cutting-edge market innovations presented by leading exhibitors throughout the Battery Belt.

Contact
www.www.thebatteryshowsouth.com
E-mail: registration.ime@informa.com
Phone: +310 445 4273

Battery Tech Expo

April 23
Silverstone, UK

Battery Tech Expo is recognized as the United Kingdom's largest dedicated event for the battery industry, convening a wide range of buyers, suppliers, and technical specialists under one roof.

Serving as an annual meeting point for the sector, the event provides a platform for professional networking, knowledge exchange, and the presentation of emerging technologies and products.

The programme features distinguished speakers representing manufacturers, investors, and research and development experts, who will present on pioneering projects and advancements shaping the future of battery technology.

Contact
www.batterytechexpo.co.uk
E-mail: david.reeks@104-media.com
Phone: +44 1283 381719

2026 BCI Convention + Power Mart Expo 2026

May 3 - May 6
Nashville, Tennessee

The BCI Convention + Power Mart Expo is the premier spot for the global battery industry. For more than 100 years, BCI has united leaders, innovators, policymakers, and decision-makers to exchange insights, build partnerships, and shape the future of energy storage.

The BCI Convention + Power Mart Expo is more than just a gathering — it's the place where the battery industry unites to define priorities, exchange solutions, and ignite collaborations that drive business forward.

With insightful sessions and an expo floor showcasing the latest innovations, the event offers unparalleled opportunities to learn, network, and engage with the leaders shaping the future of energy storage.

One of the keynote speakers is John Ellis the president and head of product for Codethink, a provider of critical, high-performance software projects for international-scale companies in a range of industries including Automotive, Finance, Medical, and IoT.

Start your Convention experience with an afternoon at Belle Meade Historic Site & Winery, Nashville's oldest winery and one of its most well-known historic estates. This off-site experience takes place before conference sessions begin, giving you the chance to connect with fellow attendees in a relaxed, social setting before the week gets busy.

Contact
https://convention.batterycouncil.org/
E-mail: info@batterycouncil.org

Battery Safety UK 2026

May 6
Warwick, UK

Join leading experts from industry, academia, and government for a one-day event focused on addressing the battery safety challenges critical to the UK's transition to electrification.

The event will convene key stakeholders from research, manufacturing, and policy to exchange cutting-edge insights, examine practical solutions, and strengthen collaboration across the battery ecosystem.

Contact
https://www.faraday.ac.uk/event/battery-safety-uk-2026/
Phone: +44 1235 425300

AABC Europe 2026 – Advanced Automotive Battery Conference

May 18-21
Mainz, Germany

Each year, AABC Europe convenes a global community of top battery technologists and key suppliers for a premier forum on development trends, breakthrough technologies, and forward-looking market insights.

Europe's shift toward vehicle electrification remains a strategic imperative, yet the pace and character of that transition are evolving. Battery-electric vehicles and other electrified powertrains have grown rapidly, with fully electric cars accounting

for approximately 17% of new EU passenger car registrations in 2025, while hybrids and plug-in hybrids further expand overall electrification.

At the same time, policy adjustments and diverse national strategies highlight emerging complexities: some markets have introduced new incentives, while others have experienced variable growth due to changing support measures.

Ongoing discussions around emissions targets — including proposals to revise the 2035 zero-emission sales mandate — illustrate how regulatory frameworks are adapting to industry and market dynamics.

Against this backdrop, the 2026 event in historic Mainz will build on this momentum, offering comprehensive coverage of the research and development driving performance, competitiveness, and the next generation of electric vehicle battery technologies.

Contact
https://www.advancedautobat.com/Europe
E-mail: ce@cambridgeenertech.com
Phone: +781 972 5400

The Battery Show Europe

June 9-11
Stuttgart, Germany

The Battery Show Europe returns to Stuttgart, Germany, providing attendees with opportunities to learn how to navigate complex industry challenges and supply chain risks, network with existing and new suppliers and partners, and keep their business future-proof.

Connect with engineers, OEM's, Tier 1 & 2 suppliers and innovators shaping the future of battery and H/EV technology during three days of conference and expo education, networking opportunities, and face-to-face demonstrations of the latest technology and solutions from leading exhibitors across the globe.

This event is more than just a trade show, this is a strategic platform where the entire electrification eco-system comes together.

Reasons to attend:
Discover cutting-edge products and solutions Explore the latest in battery design, manufacturing processes, materials, and technological advancements.

- Network with industry leaders
- Forge strategic partnerships with OEMs, cell manufacturers, and Tier 1 integrators for future developments.
- Gather technical and strategic knowledge
- Learn how new R&D and innovations can optimise battery performance, cost, safety, and longevity.

Contact
https://www.thebatteryshow.eu/en/home.html
E-mail: thebatteryshowcs@informa.com
Phone: +44 20 8052 0660

ees Europe 2026

June 22-26
Munich, Germany

Each year, ees Europe, Europe's largest and most international exhibition for batteries and energy storage systems, provides a networking opportunity for the industry's key players, such as manufacturers, distributors, project developers, systems integrators, as well as professional users and suppliers – all under the motto "Innovating Energy Storage". It focuses on the latest technologies, trends and market developments.

As part of this, the organizers of ees Europe, working together with the experts from the ees Europe Conference committee and the prestigious conference partners, have also put together a highly topical two-day program focusing on the most important market and technology trends for energy storage.

We welcome everyone who would like to deepen their knowledge of the latest developments and trends in the battery and energy storage industry.

ees Europe conference is particularly interesting for C-level managers, executive managers and decision makers of the solar industry, storage industry and energy industry, especially in the following areas:

- EPC / project development
- Business development
- Manufacturers / suppliers
- Energy supply / grid management
- Consulting
- Investment / financial consulting
- Research & development

The energy industry is evolving: renewable energy, digital technologies and economically viable solutions are already shaping tomorrow's energy supply. The four conferences within The smarter E Europe offer diverse insights – from innovations in solar energy and energy storage to e-mobility, charging infrastructure and smart grids with digitalized energy solutions.

Discover how electricity, heating and mobility are being efficiently integrated, which economic opportunities arise and which technologies are driving the energy future.

Connect with leading decision-makers, deepen your expertise and strategically grow your international network – actively shaping a secure and future-ready energy world

Contact
https://www.ees-europe.com/conference-quick-facts

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electrical energy storage

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2026 ENERGY STORAGE EVENTS

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- **FEBRUARY 25–27, 2026, GANDHINAGAR, INDIA**
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- **JUNE 23–25, 2026, MUNICH, GERMANY**
  www.ees-europe.com
- **AUGUST 25–27, 2026, SÃO PAULO, BRAZIL**
  www.ees-southamerica.com
- **SEPTEMBER 1–3, 2026, MEXICO CITY, MEXICO**
  www.intersolar.mx

Follow us

18th Lithium Supply and Battery Raw Materials Conference 2026

June 22-25
Las Vegas, Nevada, USA

The 18th Lithium Supply & Battery Raw Materials Conference is the industry's largest and longest-running event, bringing together 1000+ delegates from 550 companies across 40 countries. It's where the leaders forge partnerships, close deals, and tackle the critical issues and innovations shaping the sector's future.

With insights on supply-demand dynamics, pricing trends, refining tech, battery innovation, recycling and sustainability, this is the must-attend event for growth and data-driven decisions.

Contact
https://globalevents.fastmarkets.com/

Battcon 2026

July 26-29
Orlando, Florida, USA

The premier conference for end users, battery engineers, and manufacturers to learn, collaborate, and connect with experts and peers across the data center, utility, and critical power sectors.

Battcon is where battery engineers, manufacturers and end users come together to tackle critical power challenges — a must-attend event for professionals in data centers, utilities and other sectors relying on stationary batteries.

Stay ahead of the curve! Gain access to cutting-edge industry knowledge from thought leaders and experts. Stay informed on the latest trends, innovations, and future directions in the world of batteries, all from professionals shaping the industry's landscape.

Meet like-minded professionals, thought leaders, and innovators across the battery sector. Whether it's through informal receptions or structured meetups, you'll have countless opportunities to build valuable relationships and explore new business prospects.

Gain in-depth knowledge from expert-led seminars covering the latest advancements in battery technology, standards and applications. These sessions provide a focused environment for technical discussions, giving you an edge before the main event begins.

Our workshops go beyond theory — participate in discussions, case studies and problem-solving exercises led by top professionals in the field. Whether you're troubleshooting battery system challenges or exploring emerging trends, these sessions offer valuable, real-world takeaways.

From relaxed evening receptions to structured networking meetups, Battcon's social events offer the perfect atmosphere to forge new partnerships and strengthen industry relationships. Expect great conversations, valuable connections and a dynamic mix of attendees from across the battery sector.

Contact
www.battcon.com

7th Oslo Battery Days Conference

August 24-25
Oslo, Norway

The 7th OBD Battery Conference we'll 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.www.oslobatterydays.com
E-mail: post@oslobatterydays.com
Phone: +47 90 73 91 59

ees South America 2026

August 25-27
São Paulo, Brazil

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
www.www.ees-southamerica.com/home

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.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

bci 2026

CONVENTION + POWER MART EXPO

May 3-6, 2026 Nashville, TN

REGISTER!

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 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
https://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
https://batterytechexpoeurope.com/
E-mail: david.reeks@104-media.com
Phone: +44 1283 381 719

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, OEM's, policy makers, materials and services providers, and many more.

Contact
Email: info@icm.ch
Phone: +41 62 785 10 00
www.icm.ch

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
https://www.elbcexpo.org/
E-mail: elbcexpo@ila-lead.org
Phone: +44 207 833 8090

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.ees-europe.com/conference-quick-facts

The Battery Show India 2026

October 22-24
Greater Noida, India

Welcome to the 4th edition of The Battery Show India, where innovation and expertise converge! Join us as we bring together engineers, business leaders, leading industry companies, and visionary thinkers from around the world.

Together, we'll explore cutting-edge advancements, unveil groundbreaking products, and create impactful solutions that will define the future.

Contact
https://www.thebatteryshowindia.com/
E-mail: Pankaj.sharma@informa.com
Phone: +91 99713 65776

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
https://criticalmineralsexpona.com/battery-recycling-expo-north-america
E-mail: info@trans-worldevents.com
Phone: +1 404 737 8307

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.

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Improvements in the mechanization of battery making have led to huge strides in productivity. Think COS, fixed orifice pasters, better Barton Mills, HV welding and more. And one individual, John Pierson, who died in 2020 aged 83, spent most of his career involved in these advances.

Transforming productivity by challenging the logic of the manufacturing line

Innovation means different things to different people. Often it's less about the creation of something entirely new rather it's seizing an existing idea and making it work in new or unexpected ways.

Such has been the legacy of John Ronald Pierson who has arguably been involved — in various guises and forms — behind the development of manufacturing techniques that have transformed the lead acid battery industry in the last decades of the last century.

Pierson, born in Racine in the US state of Wisconsin in 1936, was the youngest of three children and from an early age showed an interest in chemistry and science. (Oddly enough his first contact with the metal that would dominate his life occurred at a very young age — one of his earliest hobbies was casting lead soldiers using steel moulds.)

Moving on from Washington Park High School in 1954 — the school was to induct him into its Hall of Fame in 2003 — he later took a degree in chemical engineering at the University of Wisconsin–Madison.

That year was a fateful one in many ways. He married his life-long sweetheart Celine Schallhorn, and took up his first job moving to East Chicago in Indiana working as a management trainee with Youngstown Sheet and Tube Company and crucially for his future career deciding late in the year to return with his now-expectant wife to their home state of Wisconsin.

Fate intervened at this juncture. The battery world was calling!

While visiting home for Christmas of 1959, Celine noted a wanted ad in the *Milwaukee Journal*'s Sunday edition by a company named Globe-Union looking for chemical engineers.

High school yearbook photo — most recently used as a nametag at his 60th class reunion

Pierson later recalled in an interview with *Batteries International* in 2013: "Without knowing a thing about the company, its products or history, I applied, was interviewed and received a job offer. I didn't earn any more but we had a better place to work and live in — and most importantly a happy wife.

"Oddly enough, the night before my interview at Globe Union I saw an interesting piece of news on the TV. A large local company, Allis Chalmers, was demonstrating an all-electric tractor powered by a recently developed fuel-cell.

The following day I asked my interviewer, chief engineer Tony Sabatino, about fuel cells and the future of lead-acid batteries. I remember his answer to this day, 'don't worry, lead-acid batteries will be around for at least five years' — and that was half a century ago."

Pierson started as a battery process engineer on March 1, 1960 just a week after the couple's first daughter was born.

Globe-Union, a company founded in 1920 through the merger of two battery manufacturers Globe Battery of Milwaukee and Union Battery of Chicago was headquartered at 900 E Keefe Ave in an industrial area of Milwaukee. The products manufactured extended beyond batteries and included roller skates, golf clubs, spark plugs, ignition parts, radio components (capacitors, resistors) as well as automotive batteries. Globe-Union's major customer by far was Sears, Roebuck and Co.

He had a speedy introduction to the world of energy storage.

Pierson showed up for his first day of work equipped as a typical engineer with a briefcase, pocket protector and a slide rule, only to be handed a copy of the 1955 classic

"I asked my interviewer, chief engineer Tony Sabatino, about fuel cells and the future of lead-acid batteries. I remember his answer to this day, 'don't worry, lead-acid batteries will be around for at least five years' — and that was half a century ago"

"When I started, automotive batteries were strictly housed in hard rubber and primarily 6-volt, which was the electrical system of the day. Batteries had relied on individual rubber covers and terminals on each cell, and they had asphalt tops"

work *Storage Batteries* by George Wood Vinal and instructed to dress down the following day. "I was told it was going to be messy," he says. "We were to do experimental paste mixing to establish mixing curves for a new oxide source. And yes, it was messy!

"When I started, automotive batteries were strictly housed in hard rubber and primarily 6V, which was the electrical system of the day. Batteries had relied on individual rubber covers and terminals on each cell, and they had asphalt tops. At that time, there were only about 10 to 12 group sizes offered."

COS machines and beyond

Pierson became part of a small, talented engineering team that was already working behind closed doors on what would become a major breakthrough in battery assembly technology — the first cast on strap (COS) machine. A good deal of development effort on the four station automation device was required before rolling it out to the 15 small branch plants.

A second major development in battery assembly technology, thru-partition welding (HV) followed. HV stood for the high voltage of the product due to its low electrical resistance. This technology was also rolled out to the branch plants.

A third major development by the engineering team was made possible by the arrival of copolymers of propylene and ethylene. This material development plus German injection molding equipment and complex molds made possible the first successful thin walled polypropylene battery container and cover.

The resulting product was translucent allowing for the viewing of electrolyte levels, it was heat-

Top: Hawaii in the 1970s, John and Celine
Middle: JCI's 125th anniversary dinner 2010
Bottom: John and Celine, mid-2010s

Sear's Diehard battery

sealable but most importantly the strong thin walls allowed product designers to increase the number and size of electrodes in a given cube enhancing product performance.

A large, modern injection molding facility was constructed and equipped in Kentucky to provide containers and covers to meet the growing demand.

The combination of these three technical developments — COS, HV, and PP — allowed Globe Union to offer a differentiated product to its best customer — Sears, Roebuck. At the time, Sears was opening free-standing auto centres and needed a marque product to heavily advertise.

In 1967 the DieHard was born.

It is rare indeed in a strictly commodity-style business such as automotive batteries that a truly differentiated product is developed. However, the Sears Diehard looked and performed differently than any of its competitors.

At roughly the same time American Motors, now part of Chrysler Corporation, became the first vehicle manufacturer to accept polypropylene as containers for original equipment batteries.

Lead oxide

Until 1962 all Globe Union factories were supplied with lead oxide in 600lb (270kg) drums supplied by companies such as National Lead, Eagle Picher, Bunker Hill and Western Lead. A decision was made to begin vertical integration including oxide manufacturing on site.

A newly commissioned plant in Illinois was selected as the guinea pig and two process engineers — John Pierson and Bob Wiethaup were given the task of getting the facility going.

Intellectual heritage

A good deal of the process and material development that Pierson has been involved in was considered confidential trade secrets and therefore not patented much of the findings were published in four papers. That said his name is on a couple of handfuls of patents.

Two of the more recent ones are: 5,204,610 Long Lived Dual Battery, and 6,265,091 B1 Modular Electric Storage Battery issued in 1993 and 2001.

In his long career, Pierson has authored or co-authored 29 technical papers on subjects ranging from crystallography of battery-active material and the impact of impurities on battery performance to design of batteries for modern internal combustion engine, hybrid and electric vehicles.

His technical findings have been presented at conferences around the world.

Pierson has also chaired the battery division of the Electrochemical Society, the SAE Storage Battery Committee and BCI's Technical Committee.

I applied microscopy and X-ray diffraction technology to the reaction studies. I noted that plate curing was a particularly uncontrolled process yielding a variety of chemical compounds and crystalline structures

"After many months of equipment installation, start-up, operator training and learning our new Barton oxide system was up and running," said Pierson. "During the learning period we made frequent calls to consultant Tom Blair for advice and counselling. Barton oxide systems were subsequently installed in three additional plants."

Globe Union was successful in protecting its inventions through US and foreign patents and in 1967 was successful in a patent infringement suit of its thin-walled polypropylene container patents against Joseph Lucas in Birmingham, England.

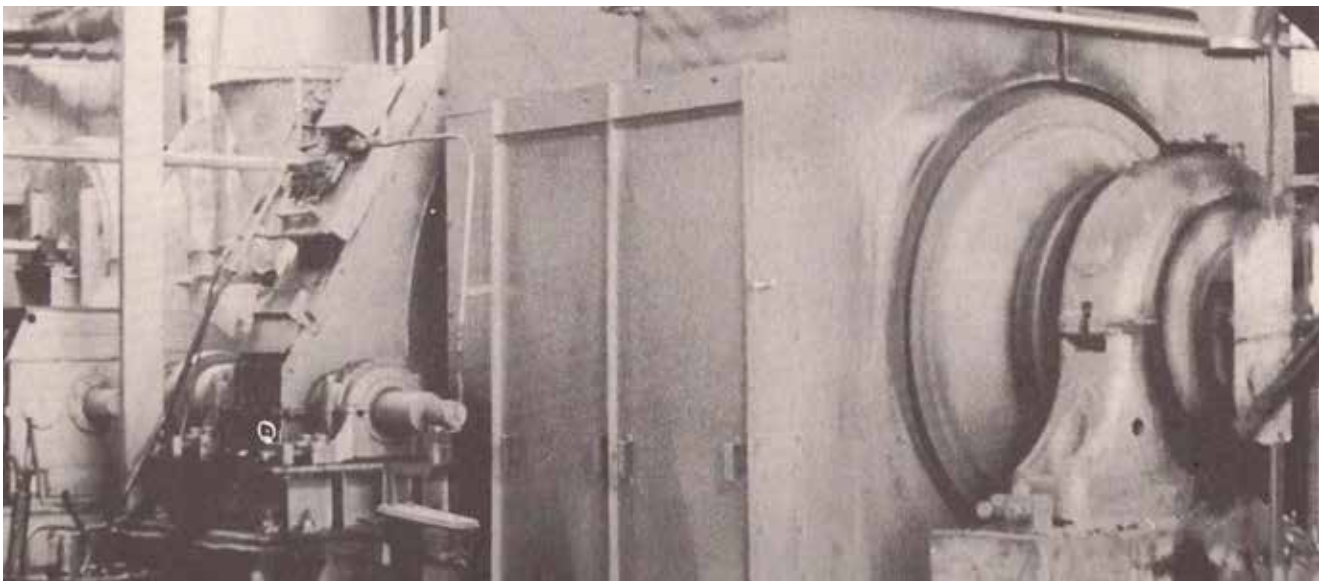
As a result of the litigation, Lucas was required to provide full technology in three areas to Globe Union — plate-curing chemistry, fast-setting epoxy resin and ball mill oxide manufacturing. The first two were straightforward and paralleled work already underway at Globe Union. The third however, ball mill oxide, provided an opportunity to directly compare a world class ball mill system and the oxide it produced to that of Globe's Barton Systems.

"I visited the Lucas plant on Foreman's Road in Birmingham, England in the fall of 1967 to begin the ball mill oxide technology transfer. The large array of Hardinge conical mills fed with shot cast by TBS made casters with temperature-sensos riding on the load was impressive," recalled Pierson.

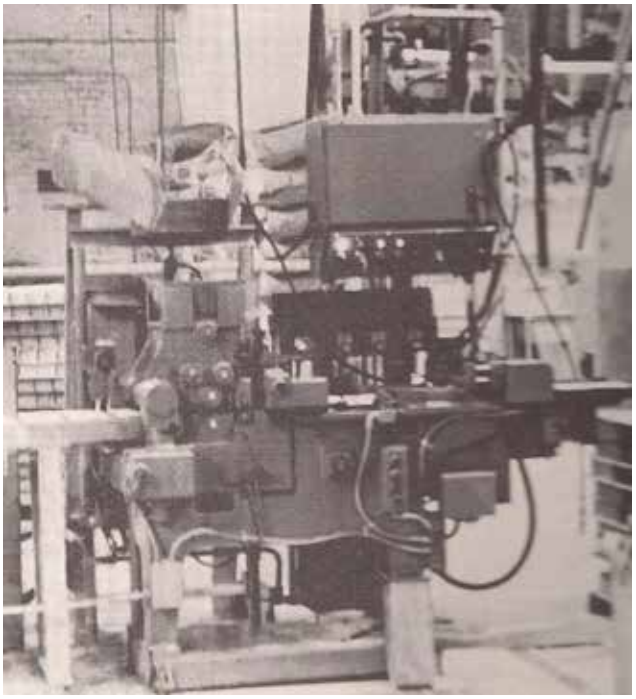
"I ordered a shipment of oxide to be delivered to the Keefe Avenue facility for evaluation. The battery test results were sufficiently encouraging to warrant that I purchased a small obsolete Lucas mill for a more thorough evaluation.

"Subtle enhancements in plate strength formation efficiency and product performance were attributed to the oxide. Full scale Hardinge mills were subsequently installed in most Globe Union facilitates. Modern smaller mills provided by Sovema [now known as ANDRITZ Sovema]

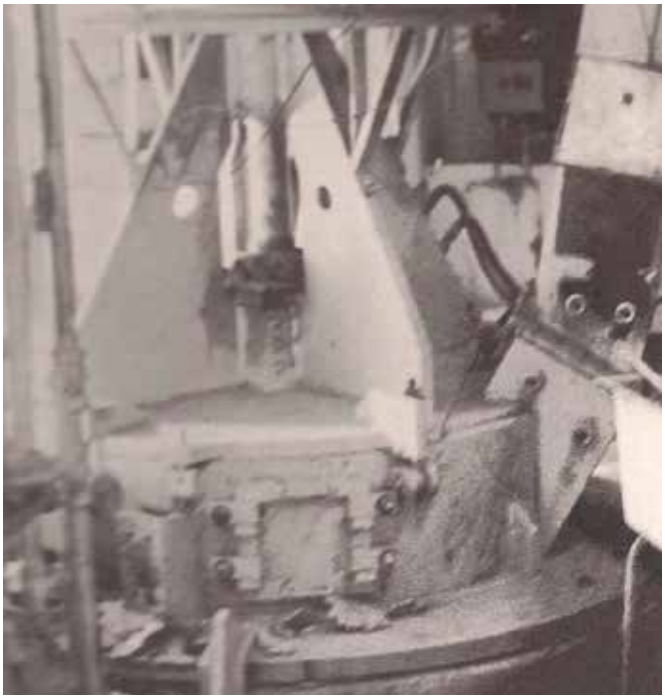
A third major development by the engineering team was made possible by the arrival of copolymers of propylene and ethylene. This material development plus German injection molding equipment and complex molds made possible the first successful thin walled polypropylene battery container and cover



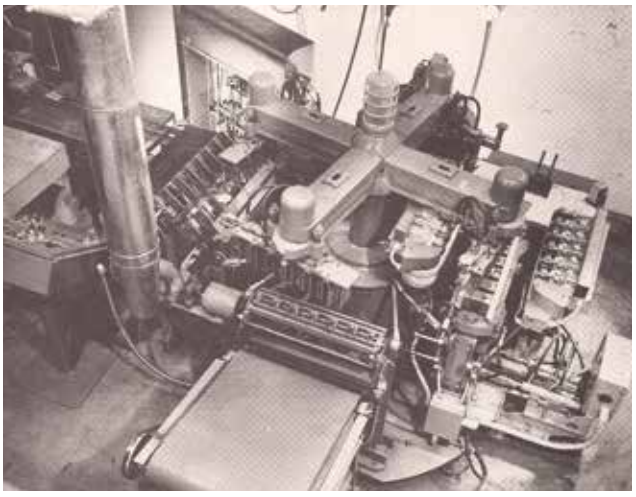
Pierson Lucas Type Hardinge Conical Ball Mill



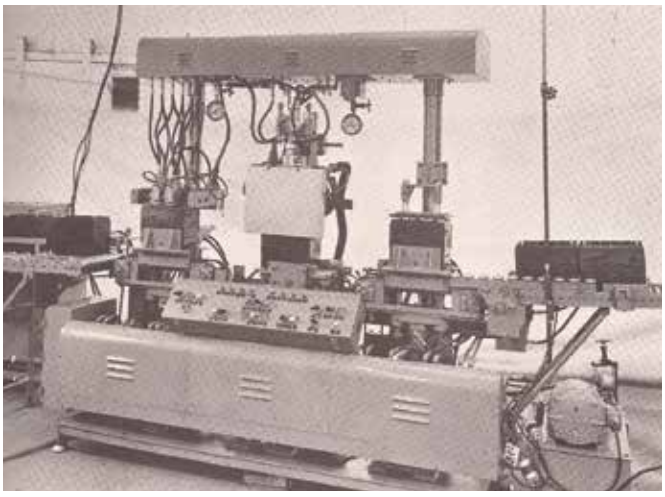
Pierson Early Fixed Orifice Paster



Pierson Globe Barton Pot Oxide Reactor



Cast on strap machine



Pierson HV Welder

"We decided to charge the mechanical engineering team with designing a high speed horizontal flow fixed orifice paster. Progress was slow due to variations in cast grid thickness and the initial attempt to roll it out to the plants was unsuccessful due to low productivity"

have more recently become the oxide system of choice."

As a result of being active in the introduction of oxide manufacturing to Globe Union, Pierson became interested in the chemical and crystallographic characteristics of oxides and the reactions encountered in process of battery plates.

"In addition to his chemical process training and natural curiosity I applied microscopy and X-ray diffraction technology to the reaction studies. I noted that plate curing was a particularly uncontrolled process yielding a variety of chemical compounds and crystalline structures. So I built the first controlled curing chamber using wooden 2x4s and plastic sheeting and supplied it with heated humidified air.

"Then I revised the plate stacking procedures leaving spaces between plate stacks. The results were plates of consistent chemistry and crystallography optimized for life and initial performance."

Similar studies of chemical crystallographic changes encountered in battery electrode process have led to optimization of the oxide making, paste mixing, curing and formation process. This included a high rate one shot formation system using cooling water for temperature control

In the late 1960s and early 1970s Ford Motor Company decided to embark on a vertical integration mission and purchased a large old battery factory in Owosso, Michigan from Auto Lite.

Ford then broke ground on a second state-of-the-art battery factory in Shreveport, Louisiana. However, the US courts ruled that the acquisition violated the anti-trust laws and forced Ford to divest itself of the two facilitates and discontinue battery manufacturing.

Pierson with product engineering manager, Chuck Wright, were commissioned to explore the potential of the Owosso facility. The plant was acquired by Globe Union, substantially upgraded and eventually closed several decades later. The Shreveport plant was bought by Gould National Battery where several of the pieces of novel equipment had to be replaced with tried and tested technologies. This plant was also ultimately closed.

The Owosso plant acquisition propelled Globe Union into the original equipment battery business and allowed the firm to access to Ford's substantial research reports on calcium alloy maintenance free batteries.

In 1967 Globe Union's headquarters were relocated from the old Keefe Ave facility to a newly constructed campus of buildings in suburban Glendale, Wisconsin. These ultramodern facilities were eventually adapted by Johnson Controls as headquarters for its corporate and power solutions (battery) division and have been significantly expanded and upgraded over the past decades. The Keefe Ave facilities and the specialty battery businesses were eventually sold to C&D Battery Co and are still in operation.

In the 1970s Globe Union bought a vacant facility near its corporate headquarters on Teutonia Avenue in Milwaukee and equipped it as an engineering pilot facility.

This facility with its single casting, pasting, assembly and formation lines along with a mechanical engineering and process engineering lab was the site for major process and product development programmes for several decades.

The engineering facility under the banner "Home of the Unfair Competitive Advantage" was the original manufacturing site for Ford maintenance free batteries as well as the new high powered Group 65 and 33 batteries for Ford's diesel powered automobiles.

All new concepts were piloted at the facility including new grid designs and alloys, plastic/lead combination girds, paste additives and continuous (expanded metal) negative and positive (wrought punched) grids.

The nearby facility allowed its engineers to conduct complex projects without the expense of travel or the interruption of productions lines at branch plants.

"In conducting experiments aimed at enhancing initial performance and life of batteries it became apparent to us that many potential improvements were masked by the lack of control of paste weights and density of belt pasted plates," recalled Pierson.

A pasting machine capable of producing consistent plates with the grid centred in the paste became Pierson's priority. Winkel belt pasters were the standard of the industry and a search of machine vendors came up blank. One device, the Lund fixed orifice paster was in use but was exclusively available in the US to the Gould National Battery Co. A Lund paster was found in Australia bought and installed in the Keefe Ave plant.

The fixed orifice paster

"I was charged with commissioning the machine and evaluating the quality of plates it produced," recalled Pierson. "The grids supplied to the vertical orifice plate paster were milled to reasonably consistent thickness and sample quantities of plates were produced. The machine was slow and very selective relative to grid uniformity but the resulting plates performed uniformly and well.

"We decided to charge the mechanical engineering team with designing a high speed horizontal

"I'm grateful that I had the opportunity to work as part of a talented, supportive team during my 38 years with the company and beyond. I've also been blessed with longstanding relationships established with friends throughout the battery industry — including suppliers, customers, and competitors"

flow fixed orifice paster (FOP). Progress was slow due to variations in cast grid thickness and the initial attempt to roll it out to the plants was unsuccessful due to low productivity."

The devices were recalled and after significant re-design of the orifice plates and a focus on enhanced grid quality the FOP, renamed the JCI paster — in 1978 Globe-Union was acquired by Johnson Controls — was successfully re-launched. The uniformity and quality of the resulting plates was exceptional.

In the meantime JCI product engineers under the direction of Vince Halsall, Chuck Wright and Pierson developed a continuous stream of enhanced product features to offer an ever growing customer base.

Developments included: safety vent systems, side and dual termination, computer modelled grids with central lugs and tapered radial wires, and climatized batteries. The overriding objective was to enhance product performance, extend life and lower cost and weight of the product.

JCI and globalization

In the early decades of the battery business there was little concern about global competition. Batteries were heavy and full of sulphuric acid and difficult to transport. Also specifications and product sizes differed for different continents.

"As a result sharing of technologies know-how and equipment became common," said Pierson. "Globe Union had an international division which marketed equipment and know-how worldwide. I participated with this team as a technical adviser including assignments such as equipping two factories in the former Yugoslavia with up-to-date battery-making technology.

"I also worked with FEMSA in Spain on updating their technology as well as facilitating gelled electrolyte technology transfer from Sonnenschein in Germany to Globe Union.

Two extensive technology exchanges based on relationships established by Pierson proved beneficial to all parties.

The first was in 1980 with Matsushita through Terry Kawase and the second with Varta and through Robert Friedrich. The Matsushita exchange resulted in JCI gaining access to many automation advances used by Matsushita at its vast Hamanako, Japan plant.

Batterymen and music

What is there about batterymen and music? Growing up, Pierson became an accomplished musician, participating with bands, orchestras, and as a French horn bugler with several renowned drum and bugle corps.

It was with the latter that he met his future wife Celine Schallhorn who marched with a colour guard in many of the same parades and contests around the country.

The Varta exchange culminated with acquisition of the German auto battery business by JCI.

Pierson spent many weeks during the 1980s negotiating battery specifications in Japan with engineers representing car companies interested in starting assembly expansions in the US. The relationships built assisted JCI in becoming a source of original equipment batteries to each manufacturer.

Pierson's travelling was extensive — and he was part of the team that opened up South America to JCI. For example, Pierson with other JCI executives, visited battery plants in Brazil and Argentina to determine the viability of jointly or solely acquiring the facilities. (In the event the São Paulo Brazil plant was chosen.)

Sometimes seeds of coincidence combined with endeavour were to lead to business opportunities.

Pierson visited MAC Battery in Colombia as a consultant to comment on plans for a new battery factory. The majority of MAC was acquired by JCI in 2014.

In the mid-1990s, Pierson was one of three board members — working with chairman Art Nenning (finance) and Jerry O'Karma (legal) — to work on improving a joint venture with the Chinese in Shanghai. Many modifications were made to enhance productivity and quality and the overall experience of quarterly meetings was excellent.

Pierson recalled the convivial way that business was — and probably still is — conducted on the fringes of the main battery industry events. "I remember we were at the opening reception of 5ELBC at Sitges just south of Barcelona in Spain, I was approached as the sole JCI representative by two principals of Amara Raja Battery Company of India — Ram Galla and his son Jay were interested in obtaining technical and financial support for their business.

"So I invited them to Milwaukee which they accepted and he subsequently visited their facilities in India. The rest is history. JCI agreed to support the company providing technical support and taking an equity position in this now thriving venture."

Retirement

Following his retirement, Pierson worked as a consultant in countries such as Ecuador, Colombia, Brazil and Mexico, in addition to the US. Looking back, Pierson said in 2013: "I'm grateful I had the opportunity to work as part of a talented, supportive team during my 38 years with the company and beyond. I've also been blessed with longstanding relationships established with friends throughout the battery industry — including suppliers, customers, and competitors." ■

In the first decades of the battery business there was little concern about global competition. Batteries were heavy and full of sulphuric acid and difficult to transport. Also specifications and product sizes differed for different continents

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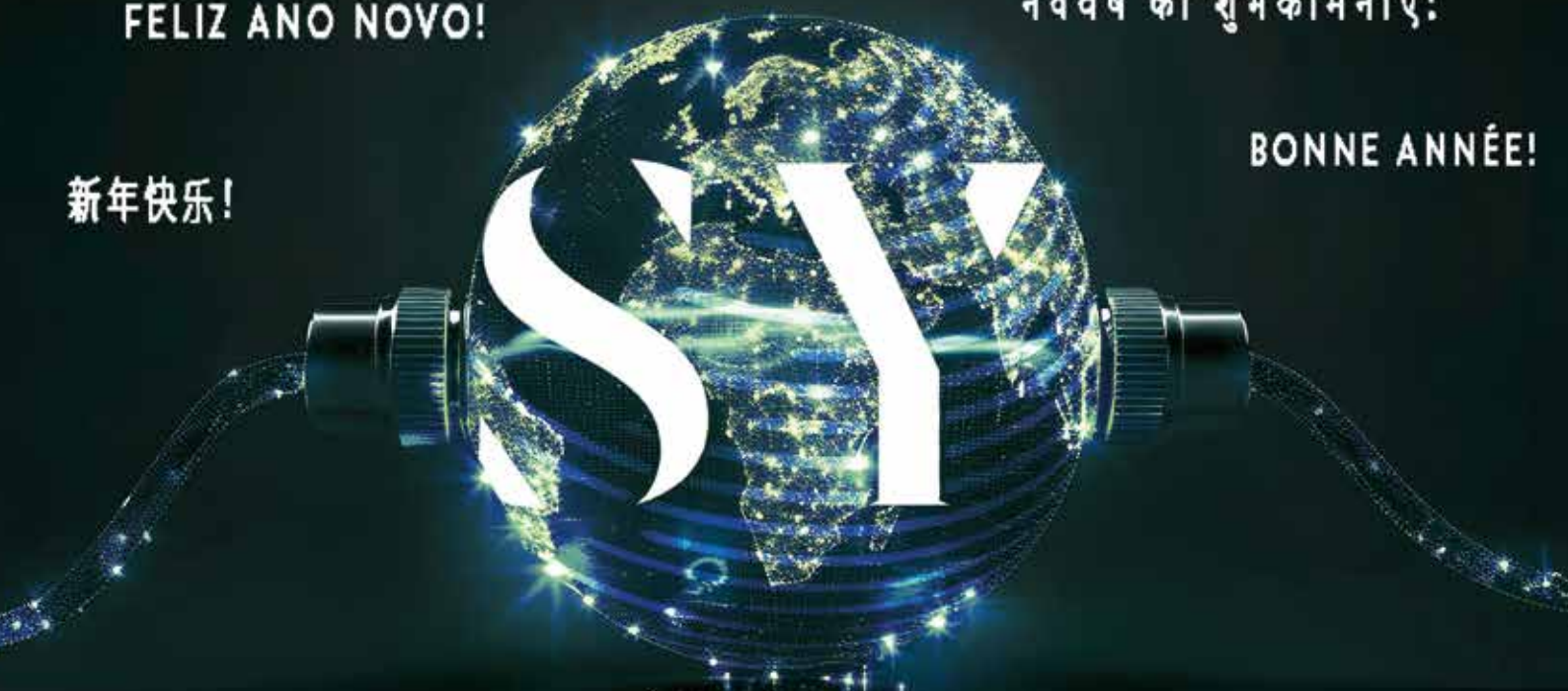

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