PowerTALK™ News

Published Monthly by Power Systems Research
Data · Forecasting · Solutions™

May 26, 2026 Volume 11 No. 5

Worldwide News & Analysis

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Questions, Comments? Contact Joe Delmont, Editor
jdelmont@powersys.com | +1 651.905.8400 | www.powersys.com

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Alternative Power

By Guy Youngs, Forecast & Adoption Lead

Zwitterions May Be Key To New Solid-State Batteries

Guy Youngs

Liquid electrolytes have been key EV batteries for some time now and the lithium-ion formula is the most important component. There are a lot of different formulae that do various things such as the removal of toxic inputs from the supply chain, or reductions in weight, elimination of fire hazards, and cutting costs.

The ultimate goal is to combine all these improvements in one electrolyte, but solid state or semi solid state batteries are appearing before that goal can be achieved and they promise to revolutionize the battery market. But, getting the electrons to move about within a solid is difficult at best. And that's where Zwitterions come in.

Zwitterions are the building blocks of a new electrolyte created by a team of scientists at Oak Ridge National Laboratory, a branch of the US Department of Energy located in Tennessee. ORNL scientists believe that when changing the battery polymer by the interdiction of Zwitterions they can make significant improvements to batteries. But what is a Zwitterion? A Zwitterion is a molecule that contains both positive and negative charges but is overall electrically neutral.

Source: *CleanTechnica* **Read The Article**

PSR Analysis: While this technology is a few years away (it's only in the early stages of research right now) it shows great potential in making solid state batteries actually work as designed. **PSR**

GMG Reports Graphene Aluminum-Ion Energy Density of 101 Wh/kg

One of the new battery technologies is graphene aluminum-ion battery which is designed specifically with rapid charging in mind. Graphene aluminum-ion batteries avoid the use of lithium and copper, instead using aluminum substrates and a newly developed chloride-free electrolyte. This enables cost and weight reduction, improved safety risks, and eliminates the need for thermal management system. The battery has similar performance characteristics as lithium titanate oxide cells, but can be produced at a much lower cost

The technology works by making atomic sized holes in the graphene, which allows the aluminum ions to penetrate and be held in the graphene to make a higher energy density, thus enabling them to outperform standard lithium batteries.

Australia-based Graphene Manufacturing Group has reported a significant increase in the energy density of its graphene aluminum-ion battery technology, as it moves closer to commercialization of ultra-fast charging cells

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Alternative Power

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In 2026, the U.S. critical minerals list include 60 minerals that companies in defense, agriculture, power, mining, and other industry sectors, need to get their jobs done.

Source: *BEST Mag* **Read The Article**

PSR Analysis: Graphene Manufacturing Group started developing prototypes back in 2021, so these improvements in energy density, along with rapid charging abilities, make graphene aluminum batteries a potential market disruptor. **PSR**

The Fast Lane: 3 Ways To Get More Critical Minerals, Now

In modern life, thousands of products (ranging from mobile phones to missiles, or fertilizer even) depend on a few critical minerals such as copper, cerium, rare earth elements and potash. Governments around the world consider these essential to their economy and national security, and their supply chains can be disrupted by geopolitical tensions, extreme weather, or trade restrictions.

For instance, in 2026, the U.S. critical minerals list include 60 minerals that companies in defense, agriculture, power, mining, and other industry sectors, need to get their jobs done. But spiking demand, restricted access, and rising prices can make it challenging to get these minerals

This is why experts at the National Laboratory of the Rockies (NLR) are researching other ways to make, mine for, or recycle these minerals. This article looks at three ways to get more of these precious minerals:

- How To Mine Metals From Seawater, Industrial Waste, and More
- An Economic Way To Recycle Graphite
- Supply Chain Recipes To Cut Costs and Energy

Source: *CleanTechnica* **Read The Article**

PSR Analysis: Given the Chinese near monopoly on Rare Earths and the resulting global supply constraints there is a big rush to secure supplies of critical minerals, and this is taking place all over the globe. Any way to improve access is vitally important. **PSR**

A Closer Look at CATL's New Sodium-Ion Battery

CATL unveiled a new sodium-ion battery for energy storage at the ESIE 2026 show in Beijing, in April. The show is the 14th Energy Storage International Conference and Expo (ESIE). ESIE was born alongside the development of China's energy storage industry and serves as a key communication and cooperation platform in the energy storage field.

CATL's new battery expands its sodium-ion lineup beyond passenger cars, commercial vehicles, and auxiliary power, into utility-scale and commercial storage.

In terms of applications, the battery is aimed at utility-scale storage, renewable energy base projects, and AIDC (artificial intelligence data center), storage scenarios, according to CATL. Interestingly the battery pack has compatibility with CATL's 587Ah Lithium battery.

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Source: *ESS News* **Read The Article**

PSR Analysis: Sodium-ion batteries offer several advantages over traditional lithium-ion batteries, namely that Sodium is more abundant and widely available than lithium, which reduces the cost of production and supply chain risks, and that Sodium batteries have a reduced environmental impact during disposal and recycling compared to lithium-ion batteries. **PSR**

Truck Production Report

By Jim Downey, Vice President-Global Data Products and Chris Fisher, Senior Commercial Vehicle Analyst

Q1 2026 Truck Production Index Falls 4.2%

Power Systems Research TPI *Truck Production Index*

St. Paul, MN—The Power Systems Research Truck Production Index (PSR-TPI) decreased from 119 to 114, or -4.2%, for the three-month period ending March 31, 2026, from Q4 2025. The year-over-year (Q1 2025 to Q1 2026) gain for the PSR-TPI was, 113 to 114, or 0.9%. The PSR-TPI measures truck production globally and across six regions: North America, China, Europe, South America, Japan & Korea and Emerging Markets. This data comes from OE Link™, the proprietary database maintained by Power Systems Research.

Jim Downey

Chris Fisher

All Regions. MHCV demand will vary by region in 2026. North America and European vehicle demand is expected to improve somewhat over last year; China is expected to see a single digit decline in production. Much of the decline comes on the heels of very high levels of production in 2025.

Global Index. Overall, global production is expected to decline slightly in 2026 over last year. Ongoing tariffs along with the conflict in the Middle East and the shipping disruption in the Strait of Hormuz are putting pressure on truck demand this year.

North America. Medium and heavy truck production in North America is expected to increase by 9.4% this year compared with low 2025 production. While class 8 truck production is expected to increase by 11.3% this year as order rates for class 8 trucks improved strongly from December – March. Improvement in freight rates and freight demand along with tightening truck capacity and some level of truck pre-buy ahead of the 2027 GHG emission regulations is expected to drive increased truck production this year. However, a protracted conflict in the Middle East would put significant downside pressure on truck demand primarily due to higher fuel cost, supply chain disruptions and an overall concern about the state of the economy moving forward throughout the year. **PSR**

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DATAPOINT:
North America 2026 Crawlers Production
3,000

By Carol Turner, Senior Analyst, Global Operations

In 2025, production of Crawlers in North America (US) decreased 9.7%, and production is expected to remain flat in 2026 with a nominal 1% drop.

3,000 units is the estimate by Power Systems Research of the number of Crawler Dozers and Crawler Loaders expected to be produced in North America during 2026.

Crawler Dozers are heavy, driver-operated machines used for clearing and grading land. Usually, they have continuous treads and a broad hydraulic blade in front. Large crawler dozers normally have a set of claws called a ripper that is installed at the machine's rear end and can crush hard rock.

A Crawler Loader is a piece of mobile construction equipment used to load materials; it's used primarily in tough, off-road terrain. It's similar to a wheel loader, except it has treads instead of wheels.

This product information comes from industry interviews and from two proprietary databases maintained by Power Systems Research: **EnginLink™**, which provides information on engines, and **OE Link™**, a database of equipment manufacturers.

Market Share. With combined plant totals of 58.5%, Cat leads in production of Crawlers in North America. In second position is Deere with 33%; third, Terramac with 6.5%.

Exports: Up to 30% worldwide.

Trends. In 2025, production of Crawlers in North America (US) decreased 9.7%, and production is expected to remain flat in 2026 with a nominal 1% drop. The decline is attributed to losing production by Case along with the weakening in construction related activities that include supply chain issues.

High dealer inventory (mostly cost related) and slower demand for new equipment resulted in lower production.

Prior manufacturing increases were reduced with newer efficient models that make tasks more productive and safer. 2021-year declines were mostly due to COVID-19 related factors such as plant shutdowns, parts availability and lack of workforce.

The market also dropped significantly in the Spring of 2020 – 2021 caused by low oil prices along with a lull in mining and construction projects.

A few years ago, construction spending in the United States was above yearly levels, according to a new analysis of federal data released by the Associated General Contractors of America.

Construction and mining activities increased, generating a gain for 2018. Decreases in production are also attributed to divergent trends, however, as public sector

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DataPoint Report

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construction activity continues to decline at the same time private sector demand for new construction continues to strengthen.

Even though sales dropped considerably in 2020/2021, production is expected to gain up to 10% by 2035 primarily influenced by the outlook of construction (infrastructure) and mining related activities. **PSR**

Global Report

By Chris Fisher, Senior Commercial Vehicle Analyst

Mack Says MP13 Engine Is EPA '27 Compliant

Chris Fisher

Mack Trucks said at the ACT Expo in Las Vegas said its MP13 powertrain has been re-engineered to meet stringent EPA 2027 emissions standards while also getting a performance boost for both highway and vocational applications.

The new MP13 will deliver up to 540 horsepower and 1,950 lb.-ft. of torque, but beyond raw power, the engine increases braking horsepower by more than 20%, reaching 630 braking hp for improved stopping capability.

To meet the 2027 federal standards, Mack Senior Vice President Govi Kannan said engineers focused on more complete combustion cycles to reduce CO2, soot, and particulate matter. "This will be our strongest 13-liter that we have built," Kannan said. The cost of compliance, Kannan said, is expected to be roughly $10,000 over the prior generation engine.

The engine is paired with an updated mDRIVE automated manual transmission, featuring enhanced engine-to-transmission communication for faster shifting. Advanced predictive software and an optimized torque curve—peaking as low as 900 RPM—further support fuel economy through down speeding.

The efficiency gains vary by model. While the MP13 offers a 3% fuel improvement in the Mack Pioneer, Anthem, and Granite models, it reaches a 6% efficiency increase in the all-new Mack Keystone compared to its predecessor, the Pinnacle. Mack officials noted the Keystone's gains were achieved without sacrificing the off-road versatility required for vocational work.

The EPA 2027-compliant MP13 will be available for order in August 2026 and be available in Mack's entire long-haul and vocational lineup.

Source: CCJ

PSR Analysis. Depending on the application, the improvement in fuel economy will help off-set the additional up-front cost of the 2027 compliant engines. While the

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Global Report

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13 liter engines for both Mack and Volvo will be able to meet the 2027 emission regulations for their 13 liter engine program, they will be replacing the current MP7 11 liter engine with the new Cummins X10 engine program. **PSR**

Europe Report

By Emiliano Marzoli, Manager of European Operations

Volvo Trucks' New Alternative-Fuel Engine Platform

Emiliano Marzoli

This May, Volvo Trucks unveiled a multi-billion SEK investment of an entirely new 13-liter combustion engine platform. Engineered to meet Europe's strictest efficiency mandates, these engines are the most fuel-efficient ever produced by the OEM, delivering immediate reductions in CO2 emissions.

Crucially, the platform is built with a "fuel-agnostic" architecture; the base engine is ready to run on renewable diesel (HVO) and bio-gas, and is structurally designed to accommodate future hydrogen internal combustion engine (H2ICE) applications. This platform rollout complements Volvo's existing battery-electric and fuel-cell programs, cementing their "three-path" strategy toward net-zero emissions by 2040 while continuing to secure top-tier safety marks, including recent five-star Euro NCAP ratings for its regional distribution trucks.

Source: Volvo Trucks Global Product Launch (May 12, 2026)

PSR Analysis. This massive powertrain investment signals that Europe's leading heavy-truck manufacturer is doubling down on the internal combustion engine's future by decoupling it from fossil fuels. For players like Traton (MAN/Scania) and Daimler Truck, Volvo's move sets a high technical benchmark: zero-emission targets cannot rely solely on batteries.

By ensuring the new engine platform can transition seamlessly to hydrogen combustion, Volvo creates an incredibly flexible asset for transport operators. Hauliers can buy the truck today for HVO or biogas compliance and trust the architecture for future hydrogen integration, avoiding the risk of stranded assets. It also shifts the regulatory conversation in Brussels, validating the argument that the mechanical ecosystem of the European automotive supply chain can be preserved while achieving aggressive decarbonization. **PSR**

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Europe Report

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The finalized text of the IAA represents the most aggressive, defensive pivot in modern EU trade policy, directly establishing a subsidized "lead market" for domestic.

The Industrial Accelerator Act (Legal Framework Finalization)

Legal and structural reviews finalized this May have clarified the exact mechanism of the European Commission's proposed Industrial Accelerator Act (IAA). The draft framework establishes a hard target to lift manufacturing to 20% of EU GDP by 2035 by weaponizing public procurement and introducing strict "Union origin" mandates. Under the final text, specific material quotas will apply to public contracts for buildings, infrastructure, and motor vehicles: 25% of all aluminum used must be low-carbon and of Union origin, while concrete and mortar carry a 5% Union-origin mandate. Most critically for the automotive and industrial machinery list, public procurement and consumer subsidies for electric vehicles (EVs) and net-zero technologies will be legally restricted to Union-origin products, while completely banning any suppliers deemed "high risk" under the EU's Cybersecurity Act from remote-access or SCADA supply chains.

Sources: European Commission Draft-IAA Analysis & Review (May 2026)

PSR Analysis. The finalized text of the IAA represents the most aggressive, defensive pivot in modern EU trade policy, directly establishing a subsidized "lead market" for domestic. Non-EU OEMs—particularly Chinese and US manufacturers—will find themselves legally locked out of lucrative municipal tenders and state-backed construction projects unless they establish massive, vertically integrated European facilities that fulfill local-content quotas.

However, the strict origin requirements for core materials like aluminum and concrete mean European machinery manufacturers will face a "green premium" spike in raw material costs. Companies must quickly restructure their supply lines to guarantee that components are tracked and verified as "Union-origin," accelerating the adoption of digital supply-chain tracking across the Continent.
PSR

South America/Brazil Report

By Fabio Ferraresi, Managing Director - South America

Daimler Truck Launches US$110 Million Zárate Plant

Daimler Truck inaugurated a new US$110 million industrial complex in Zárate, Buenos Aires Province, Argentina, reinforcing its long term manufacturing strategy in South America. The facility will produce Mercedes-Benz Atego and Accelo trucks alongside OH and OF bus chassis, while also integrating a logistics center and Argentina's first remanufacturing operation dedicated to commercial vehicle spare parts. The plant replaces part of the former Virrey del Pino operations and is expected to support both domestic demand and export activities across Latin America.

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South America Report

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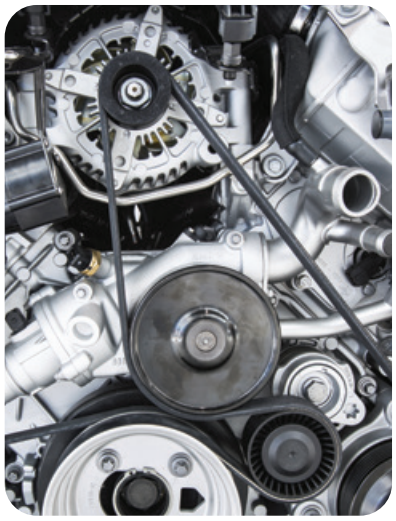

The project represents the first greenfield automotive manufacturing investment in Argentina in approximately 15 years and follows the operational separation of Daimler Truck from Mercedes-Benz Group in 2021. According to company statements, the site is designed to improve logistics efficiency due to its proximity to port infrastructure and to increase production scalability. Installed annual production capacity may reach approximately 10,000 units.

Fabio Ferraresi

Source: Automotive World

PSR Analysis. The Zárate investment signals Daimler Truck's intention to consolidate Argentina as a regional manufacturing platform for medium duty trucks and bus chassis, complementing Brazilian operations through CKD integration and shared supply chain structures. The inclusion of remanufacturing capacity also aligns with growing circular economy strategies in the commercial vehicle sector.

The project improves industrial resilience and regional localization at a time when South American OEMs are seeking greater flexibility against currency volatility and import dependency. **PSR**

EU–Mercosur Agreement May Reshape SA MHV Industry Dynamics

The European Union and Mercosur trade agreement started in May 1st and it is expected to affect the competitive landscape of the truck and bus industry in South America, particularly in Brazil and Argentina. The gradual reduction of tariffs and expanded market access could increase the presence of European commercial vehicle technologies and components in the region.

The agreement may lower import costs for trucks, buses, engines, and advanced systems from Europe, potentially accelerating fleet modernization and technology transfer. At the same time, regional manufacturers are evaluating possible impacts on local production competitiveness, supplier localization, and industrial employment.

Industry representatives also noted that the agreement could create export opportunities for Mercosur-produced commercial vehicles in Europe, although stricter European environmental and safety regulations would require additional investments and technical adaptation.

Source: Transporte Mundial

PSR Analysis. The agreement could reduce costs for imported European components and systems, benefiting OEMs with manufacturing operations in Brazil through improved access to technologies, powertrain systems, and specialized suppliers. This may strengthen the competitiveness of European truck and bus manufacturers already established in Mercosur.

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South America Report

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At the same time, the framework could create new export opportunities for Brazilian commercial vehicle manufacturers and component suppliers targeting European markets, particularly in selected niches where Brazil maintains industrial scale and production efficiency advantages. **PSR**

Yanmar Announces $55.77 million USD Manufacturing Plant in Brazil

Yanmar has announced an investment of approximately $55.77 million USD (R$280 million) to build a new manufacturing facility in Indaiatuba, São Paulo State, Brazil. The project is designed to expand the company's industrial capacity in the country and support growth in the agricultural machinery and compact equipment segments.

The new plant is expected to centralize production operations distributed across different facilities and improve manufacturing efficiency, logistics integration, and future expansion capability. According to the company, the investment reflects increasing demand for agricultural and compact construction equipment in Brazil and other South American markets.

The operation will strengthen Yanmar's local industrial footprint while supporting production of tractors, engines, and compact machinery for regional distribution.

Sourc: Revista MT

PSR Analysis. The investment reinforces Brazil's position as a strategic manufacturing base for agricultural and compact equipment in South America. Increased local production capacity may reduce logistics costs and improve supply chain responsiveness for regional markets. It also reflects sustained demand expectations in agribusiness and compact machinery segments, although long term performance will remain linked to agricultural commodity cycles and financing availability, especially for this size of equipment. **PSR**

Far East: Japan Report

By Akihiro Komuro, Research Analyst, Far East and Southeast Asia

Komatsu Reports Record 2025 Sales but Profits Decline

Komatsu announced that its revenue reached a record high for fiscal 2025 due to the effects of a weaker yen and improved pricing. However, the company explained that profits fell below the previous year's level due to declining demand for construction machinery in North America and rising costs.

In North America, the company reported that demand for residential construction remained sluggish and that machinery purchases by rental companies had also declined. It also noted that the Asian market remained generally weak.

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Japan Report

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> *Although Komatsu acknowledged that 'the business environment remains uncertain', the company expressed the view that 'infrastructure investment and mining demand will remain robust'.*

Conversely, demand for mining equipment remained high, with the resources sector underpinning its performance. It also stated that its parts and services business had performed steadily.

Akihiro Komuro

Furthermore, although Komatsu acknowledged that 'the business environment remains uncertain', the company expressed the view that 'infrastructure investment and mining demand will remain robust'.

Source: Komatsu Newsroom

PSR Analysis: Komatsu's FY2025 results suggest that the global construction equipment market is no longer moving in a synchronized cycle. While North American construction equipment demand weakened due to high interest rates and softer residential activity, mining equipment demand remained resilient, creating an increasingly bifurcated market structure.

More importantly, the results highlight how aftermarket and service revenues are becoming strategically more important than unit sales growth. In previous downturns, OEM performance depended heavily on new equipment demand. Today, fleet digitization, predictive maintenance, and long-life mining assets are allowing major manufacturers to stabilize earnings even as equipment replacement cycles slow.

Another notable point is that weakness in Asia contrasts with continued strength in resource-related investment. This suggests that future equipment demand may become increasingly tied to energy transition infrastructure, mining development, and strategic commodity supply chains rather than traditional urban construction growth.

The regional divergence also creates a more favorable environment for lower-cost Chinese manufacturers in emerging markets. As financing costs remain elevated, contractors in Southeast Asia, the Middle East, and Africa are likely to prioritize acquisition cost over lifecycle efficiency, particularly in non-premium applications.

For Japanese manufacturers, this may accelerate a strategic separation between "premium lifecycle-oriented markets" and "price-driven replacement markets." In that environment, competitiveness may increasingly depend not only on machine performance, but also on financing capability, parts logistics, uptime support, and digital. **PSR**

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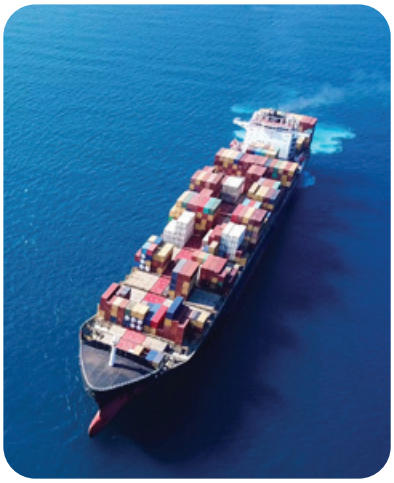

Far East: South Korea Report

By Akihiro Komuro, Research Analyst, Far East and Southeast Asia

Akihiro Komuro

Three South Korean Shipbuilders Win $1.1 Billion in Orders

Major South Korean shipbuilders HD Hyundai, Hanwha Ocean and Samsung Heavy Industries secured a total of approximately $1.1 billion in new orders in a single day, it was reported.

The article explains that demand for LNG carriers and high-value vessels remains strong. It also states that demand for low-carbon, high-efficiency ships is growing due to stricter environmental regulations.

The report emphasizes that South Korean shipbuilders have a strong presence in the high-value-added vessel market. While Chinese companies have the upper hand in terms of volume, the analysis suggests that South Korean firms remain dominant in cutting-edge sectors such as LNG carriers.

The increase in orders is due in part to the expansion of Middle Eastern energy projects and the recovery of the shipping market. It also notes that expectations for improved profitability in the shipbuilding industry are rising.

Source: Seoul Economic Daily

PSR Analysis: The recent surge in large vessel orders for Korean shipbuilders suggests that the industry is entering a new phase in which technological complexity is more important than production scale.

While China continues to dominate global shipbuilding volume, Korean shipyards remain highly competitive in building LNG carriers and other technically demanding vessels. This distinction is becoming increasingly important as environmental regulations tighten, and shipowners prioritize fuel flexibility, efficiency, and long-term compliance.

What is often overlooked is the broader industrial impact of this trend. LNG carriers and advanced vessels generate high demand for high-value subsystems, including marine engines, generators, power electronics, cryogenic equipment, and automation systems. Consequently, the current shipbuilding cycle could have a greater multiplier effect on industrial supply chains than previous commodity-driven shipping booms.

Another significant shift is the growing connection between Middle Eastern energy investments and Northeast Asian industrial manufacturing. LNG infrastructure expansion is not just an energy issue anymore; it is also supporting sustained demand for Korean heavy industry exports.

The competitive landscape may evolve differently than in previous cycles. While Chinese shipbuilders are rapidly improving their technical capabilities, Korean companies are moving further upstream toward integrated, engineering-intensive

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South Korea Report

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solutions rather than competing purely on vessel output.

This suggests that future competition may focus less on shipyard capacity and more on controlling advanced marine systems, propulsion integration, emissions technology, and lifecycle service capabilities. **PSR**

Vietnam Report

By Akihiro Komuro, Research Analyst, Far East and Southeast Asia

Power Shortages Boost Reliance on Generators

Akihiro Komuro

The Vietnamese agricultural machinery market is expected to grow steadily over the forecast period due to labor shortages in rural areas and rising demand for mechanization. Efforts to improve rice production are boosting demand for agricultural machinery, especially small tractors and tillers. Japanese brands like Kubota and Yanmar maintain a strong market position, but Chinese competitors are increasing their presence. Small-scale farmers consider initial costs, durability, and after-sales service when making purchases. Government policies aimed at modernization are also supporting market growth.

Source: Mordor Intelligence

PSR Analysis: Vietnam's agricultural machinery market increasingly reflects a structural divide between productivity-oriented mechanization and affordability-driven mechanization.

At first glance, rising mechanization appears supportive for all suppliers. However, the market is becoming segmented between larger commercial operators prioritizing reliability, durability, and aftersales support, and smaller farmers whose purchasing decisions are heavily constrained by upfront financing costs.

This creates a more nuanced competitive environment than simple "Japanese vs. Chinese" narratives suggest. Japanese brands continue to hold strong positions because downtime during planting or harvesting seasons carries significant economic risk. In many regions, service network reliability remains more important than headline machine specifications.

At the same time, lower-cost Chinese products are gradually expanding in secondary applications, entry-level ownership, and rural markets where utilization rates are lower, and replacement economics differ.

Another underappreciated factor is labor availability. Vietnam's industrialization is steadily drawing younger workers away from agriculture, indirectly accelerating demand for compact mechanization solutions even among smaller farms.

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Vietnam Report

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In the long term, Southeast Asia may not converge toward a single agricultural equipment market structure. Instead, multiple market tiers could emerge, with premium Japanese equipment dominating high-utilization commercial farming and lower-cost competitors expanding into price-sensitive segments.

For suppliers, distribution coverage, financing access, spare parts availability, and localized product adaptation may be more important than manufacturing scale alone. **PSR**

Saying it has solved core manufacturing challenges, CATL said it will start mass production of sodium-ion batteries this year.

China Report

By Jack Hao, Senior Research Manager - China

CATL Launches Mass Production of Sodium-Ion Batteries

Jack Hao

Saying it has solved core manufacturing challenges, CATL said it will start mass production of sodium-ion batteries this year. This marks sodium-ion technology's shift from a backup option to mainstream use. The company says sodium-ion batteries show strong potential for extreme weather and energy storage.

Volatile lithium carbonate prices have pushed the industry to hunt for alternatives and secure supply chains. Sodium offers clear cost advantages and better cold-weather performance. As CATL, BYD and other leading players now enter with full supply chains, technical hurdles are being cleared, and commercialization is picking up speed. A new "sodium-lithium parallel" energy landscape is taking shape.

This shift from backup option to mainstream strategy reflects CATL's heavy investment and bullish market outlook. By 2025, the company had poured nearly $1.47 billion US dollars (10 billion yuan) into sodium-ion R&D. Chairman Zeng Yuqun expects the technology to capture 30–40% of the existing battery market. In CATL's vision, sodium-ion batteries are no longer just a supplement to lithium, but a key force in reshaping the market.

Source: NBD

PSR Analysis: CATL's mass production of sodium-ion batteries is reshaping the global new energy industry across three dimensions: market structure, application scenarios, and supply chain systems.

In terms of market competition, its mass production cost of 0.45 yuan/Wh is 30%-40% lower than that of lithium iron phosphate (LFP) batteries, driving A0-class electric vehicle prices down to the $7,300 USD - $11,700 USD (50,000–80,000 yuan) range and reducing energy storage system costs by 15%-25%. The global sodium-ion battery market is projected to exceed 1,000 GWh by 2030, with CATL and BYD

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China Report

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forming a duopoly, squeezing the survival space of small and medium-sized lithium battery firms—over 50% of which may be eliminated within the next 3–5 years.

On the application front, sodium-ion batteries' exceptional performance in extreme cold and long cycle life is unlocking new market opportunities. With over 90% capacity retention at -40°C, their penetration in cold regions like northern China could rise from less than 5% today to over 30% by 2028. In energy storage, their 10,000+ cycle life and high safety make them ideal for AIDC and 5G base stations, where they will rapidly replace lead-acid batteries. The global sodium-based energy storage market is expected to reach 580 GWh by 2030, growing at a CAGR of over 80%. Additionally, sodium-ion batteries will drive the technological upgrade of China's 3-million-unit low-speed EV market, with penetration expected to exceed 50% by 2028.

Despite its bright prospects, the sodium-ion battery industry still faces technical, market, and ecosystem challenges. While its current energy density of 175 Wh/kg approaches that of LFP batteries, it remains below that of ternary lithium batteries, and issues like fast-charging capability and cycle life degradation need resolution.

Consumer awareness of sodium battery safety is still low, and the lack of a residual value assessment system hinders adoption. Upstream material supply remains unstable, and standards and certification systems are still evolving. Nevertheless, supported by policy, technological advancement, and market demand, a complementary coexistence between sodium and lithium batteries is taking shape—sodium-ion batteries are expected to capture around 10% of the global battery market by 2035, becoming an indispensable part of the new energy industry. **PSR**

India Report

By Aditya Kondejkar, Research Analyst – South Asia Operations

Aditya Kondejkar

Toyota–Maruti Strategic Realignment Reshapes Auto Future

The recent strategic announcements from Toyota and Maruti Suzuki mark the most significant supply-side shift in India's auto sector in years. Both companies—already deeply linked through product sharing, technology exchange, and electrification strategies—are now doubling down on India as a long-term manufacturing hub. Their parallel yet complementary decisions signal three major structural shifts: India's rising importance in global automotive supply chains, the pivot toward future-ready platforms, and an attempt to stabilize costs amid global supply volatility.

Sources: Reuters: Article 1, Article 2

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India Power

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Maruti Suzuki's US$1.48 billion capex plan (₹12,000 crore) for new capacity is designed to reinforce its position as India's small-car specialist while preparing for hybrid and flex-fuel transitions.

Toyota's New Assembly Plants: Capacity + Localization Strategy

Toyota's reported plan to set up three new assembly plants in Maharashtra is a bold capacity bet. For an OEM traditionally conservative in scaling Indian operations, this marks a new phase—one driven by three forces:

1. **Localization of hybrid technology.** Toyota's hybrid portfolio is constrained by import dependence on high-value components. New plants provide room to deepen localization of motors, power electronics, and battery packs.
2. **Export Hub Potential.** Toyota globally is under margin pressure in developed markets. India's low-cost base makes it ideal for exporting compact SUVs and MPVs to Southeast Asia, Africa, and Latin America.
3. **De-risking from geopolitical supply shocks.** Recent Middle-East disruptions have raised freight and input costs. Higher India localization reduces vulnerability to global shocks.

Maruti Suzuki's ₹12,000+ crore Capacity Expansion: A Volume Play

Maruti Suzuki's US$1.48 billion capex plan (₹12,000 crore) for new capacity is designed to reinforce its position as India's small-car specialist while preparing for hybrid and flex-fuel transitions. Key structural drivers here are:

1. **Small-car demand consolidation**. Even though the small-car segment stagnates overall, Maruti still dominates >65% of this space. Additional capacity helps maintain cost leadership through economies of scale.
2. **Hybrid and CNG scale-up.** Maruti's strategy is not pure EV. They are betting big on strong-hybrid, CNG, and future ethanol blends—segments where scale dramatically improves margins.
3. **Shared product pipeline with Toyota.** More capacity strengthens cross-badging economics for the two companies, reducing per-unit costs and enabling faster rollouts.

Industry-Level Impact: Why This Matters

1. **Cost Structure Reset.** More localization means lower import bills for batteries, motors, and electronics—eventually softening prices for hybrids and CNG cars.
2. **Competitive Pressure on Hyundai-Kia, Tata Motors.** Tata dominates EVs; Hyundai-Kia dominates SUVs. Toyota-Maruti's capacity surge signals an aggressive comeback in hybrids and CNG SUVs.
3. **Supplier Ecosystem Growth.** Tier-1 and Tier-2 suppliers will see new opportunities in electronics, castings, plastics, and battery components.
4. **Export Growth.** If Toyota uses India as a regional export base, it lifts India's status as a global automotive hub.

Bottom Line. Toyota's capacity build and Maruti Suzuki's mega investment are not routine expansions—they represent a strategic reset. Together, they are shaping India into a central node for hybrid, CNG, and next-generation compact vehicle manufacturing, with long-term repercussions for the domestic and global auto landscape. **PSR**

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