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Automotive Industry Weekly Digest

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[OEM Highlights] China registers strong demand for pick-ups during 2021; Great Wall leads sales in segment

IHS Markit perspective

Implications Sales in China's pick-up truck segment grew strongly last year, data from the China Passenger Car Association show. Sales of pick-up trucks last year grew 14% to 546,000 units.

Outlook Although pick-up trucks in many Chinese cities still face regulations that limit their use in certain areas, sales of pick-up models are expected to continue to grow thanks to rising demand from private vehicle buyers.



Photo by Shutterstock

Sales in China's pick-up truck segment grew strongly last year, data from the China Passenger Car Association show. Sales of pick-up trucks grew 14% to 546,000 units in China during 2021. In December 2021, sales of pick-ups increased 21% year on year (y/y) to 59,000 units. Demand for such models is particularly high in the country's northwestern and southwestern regions, which accounted for 40% of the total sales during 2021, according to the CPCA.

Chinese authorities' aim to boost pick-up sales and the growing availability of pick-up models for passenger use are cited as two factors pushing up demand for pick-up trucks. Great Wall Motor, Jiangling Motor, and Zhengzhou Nissan were the three leading manufacturers of pick-ups in China last year, with Great Wall having a dominate share of 42.4% of the segment. With an expanding product line developed to appeal to private-sector buyers, pick-up sales of Great Wall increased 3.5% y/y to 233,006 units in 2021. According to Great Wall's sales report, its pick-up sales in overseas market surged 119% y/y to 43,599 units last year. The Pao is the model with the fast-growing sales in Great Wall's pick-up line-up. Deliveries of the Pao product line reached 127,940 units last year, an increase of 11.4% compared with 2020. Reportedly, in comparison, retail sales of Jiangling Motors and Zhengzhou Nissan were 67,445 units and 50,067 units respectively, trailing far behind Great Wall. According to a China Daily report, China's authorities' efforts to facilitate use of pick-up trucks in cities has played an important role in boosting sales of pick-ups among private car buyers. The country's commerce ministry issued a guideline in March 2021 calling for local authorities to relax promptly restrictions on the entry of pick-up trucks into cities to give a further boost to auto consumption.



Outlook and implications

Although pick-up trucks in many cities still face regulations that limit their use in certain areas of the city, sales of pick-up models are expected to continue to grow thanks to rising demand from private vehicle buyers. A growing number of consumers are enticed by the unique styling of certain pick-up models and many car buyers believe pick-up trucks can fit in with their lifestyles. Great Wall, for instance, is trying to cultivate a “pick-up truck culture” among its pick-up owners. In the past two years, the automaker has expanded its Pao product line to cover a range of model variants. The effort enables its vehicles to appeal to both business-orientated customers and those who just want a pick-up truck for off-roading activities.

Meanwhile, enticed by booming demand for pick-up trucks, Ford announced in November 2021 plans to introduce the next-generation Ford F-150 Raptor in China this year. Reservations for the next-generation F-150 Raptor are due to begin in China in the first quarter of 2022 and Ford said it is exploring new ways of interacting with customers. The new-generation F-150 Raptor is to be sold through a direct-to-customer sales model, exclusively via the “Ford Pickup Community” channel on the WeChat social media platform. In addition, Geely is mulling over a plan to spin off its pick-up business into a separate entity, according to a Caillan Press report. The automaker reportedly plans to introduce a premium electric pick-up in the second half this year.

[OEM Highlights] Great Wall Motor posts net profit increase of 26.5% during 2021

Great Wall Motor (GWM) has said in a filing to the Shanghai Stock Exchange that its net profit to shareholders of the company jumped by 26.5% year on year (y/y) to CNY6.78 billion (USD1.07 billion) during 2021. The automaker's revenue jumped by 32% y/y to CNY136.3 billion. The results are yet to be audited and may differ from the final data, according to GWM.



Outlook and implications

GWM has attributed the profit jump to its increased vehicle sales and improved volume mix. No details, however, have been given in this filing, which only listed out key financial indicators. The Chinese automaker ended 2021 with a strong increase in sales. For the full year 2021, its sales increased by 15.2% from a year earlier to 1,280,993 units. The new TANK brand and the Pao pick-up product line are highlights of GWM's recent product launches. The model line-up under the TANK brand will continue to expand to cover a range of rugged looking off-road utility vehicles, while the Pao pick-up line presents GWM a fresh opportunity to tap into overseas markets, including Australia and South Asia, where pick-up models have a steady demand. The success of the TANK and



GWM's electric vehicle brand Ora have helped offset the sales decline of the WEY brand. Sales of the WEY brand contracted by 26% last year to 58,363 units.

[EV & Energy Efficiency Highlights] Foxconn inks EV partnership with Indonesia

Taiwan's Foxconn has signed a memorandum of understanding (MOU) with the Indonesian Ministry of Investment as well as Indonesia Battery Corporation, energy firm PT Indika Energy, and Taiwanese electric scooter vendor Gogoro to jointly develop a battery manufacturing and electric vehicle (EV) ecosystem in the country, according to a company press release. Under the MOU, Foxconn, together with its partners, aims to explore a wide range of investment, from electric battery manufacturing – including battery cell, battery module, and battery pack development – to the formation of a four-wheeled and two-wheeled EV ecosystem. The co-operation will also include the development of EV supporting industries such as energy storage systems (ESSs), battery exchange stations, and battery recycling. In the initial phase, the development of new energy and full battery platform production in Indonesia – producing lithium iron phosphate or solid-state EV batteries – will be the priority. The press release did not highlight any information regarding timeline or investment costs for these.



Outlook and implications

Foxconn, best known for contract manufacturing high technology consumer goods, such as Apple's iPhone, has recently expanded its activities in EVs. The company presented its EV platform in October 2020 and has since announced partnerships for EV production and technology sharing with several automakers, including Zhejiang Geely Holding Group, Stellantis, Fisker, and Lordstown Motors. It has also signed an MOU with Thailand-based oil and gas conglomerate PTT Plc to collaborate in setting up an open platform to produce EVs and main components to serve the country's EV sector. Foxconn is also looking at building its newly unveiled battery electric vehicle (BEV) models in Europe, as well as potentially India and Latin America. The company unveiled three new prototypes, including its new premium-positioned Model E flagship BEV sedan, with Italian design house Pininfarina contributing to the car's design. The latest development is also in line with the Indonesian government's aims to make the country an electrified vehicle hub for Asia and beyond, with the target of starting production of such vehicles in 2022. The government also aims for electrified vehicles to account for 20% of the country's total car production by 2025 and intends to produce 600,000 BEVs by 2030. By pushing for electrified vehicles, the government plans to reduce Indonesia's carbon footprint and reliance on fossil fuels, and attract foreign investments. The government also aims to create a downstream industry for the country's rich supplies of nickel laterite ore.



[EV & Energy Efficiency Highlights] Sony to partner with technology companies for its EV project

Japanese multinational conglomerate Sony Group is planning to add technology partners to help it transform electric vehicles (EVs) into entertainment spaces, reports Reuters. According to the report, the move is driven by the expectation that autonomous vehicles and 5G connectivity will reshape the automotive industry by turning cars into mobile platforms for information and entertainment and shared mobility services. Sony's senior general manager, Izumi Kawanishi, said that the future transformation of cars will in some ways be similar to how information technology turned phones into smartphones.



Outlook and implications

Sony has been working in the direction of autonomous vehicles (AVs) since at least 2015. As vehicles incorporate more technology, the door opens for non-traditional suppliers such as Sony. The company showcased its Vision-S concept at the CES 2020 and unveiled the Vision S 02 sport utility vehicle (SUV) concept at the CES expo 2022. Sony envisions that its EVs will have the latest safety features, including driver assistance, in-cabin monitoring, and lane change support system. The safety system will include sensors installed all around the vehicle. At this stage, it has not been confirmed whether the concept vehicles will make it to mass production, but the company has indicated its growing interest in the future mobility market and the technology it is developing to pursue this.



[Technology & Mobility Highlights] Intel plans semiconductor facility in US

Intel has announced plans to invest USD20 billion to establish a new “epicentre” for advanced microchip manufacturing in the United States. According to a company statement, under the plans, the facility would come online in late 2025. Intel said it expects the project to create 3,000 jobs at Intel and 7,000 building jobs over the course of construction at the site. The company plans to build the new facility on a 1,000-acre site in Licking county, near Columbus, Ohio. Intel says the facility will be a mega-site capable of accommodating eight microchip factories and support operations and ecosystem partners. Intel says that its full development of the site over the course of a decade could involve an investment of USD100 billion. Intel says planning for the first two factories is to start immediately and construction is to begin in late 2022, with production due to start in late 2025. Intel also says several of its suppliers have indicated plans to establish a physical presence at the site as well. Keyvan Esfarjani, Intel senior vice president of manufacturing, supply chain and operations, said in the statement, “The impact of this mega-site investment will be profound. A semiconductor factory is not like other factories. Building this semiconductor mega-site is akin to building a small city, which brings forth a vibrant community of supporting services and suppliers. Ohio is an ideal location for Intel’s U.S. expansion because of its access to top talent, robust existing infrastructure, and long history as a manufacturing powerhouse. The scope and pace of Intel’s expansion in Ohio, however, will depend heavily on funding from the CHIPS Act.”



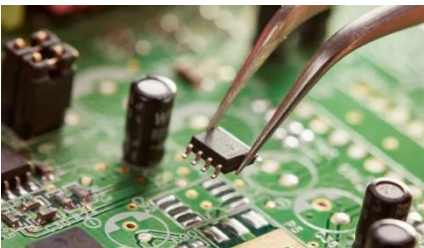
Outlook and implications

The investment in microchip production is expected to benefit the auto industry as well as others when the facility comes online, although this will not be soon enough for its output to have an immediate impact on inventory pressures. In the longer term, however, this facility should provide additional, domestic fabrication capacity to be used for devices used in autonomous cars and other advanced automotive applications. However, Intel also states that the investment is dependent on US government funding. US President Joe Biden has proposed USD52 billion in government funding for projects such as this one, although the funding has not been passed yet. The president used the opportunity of Intel’s statement to push again for Congress to pass the funding, saying, “I want other cities and states to be able to make announcements like the one being made here today. And that’s why I want to see Congress pass this bill right away,” The Senate passed the funding in mid-2021, but it remains stalled in the House of Representatives. The proposed USD52 billion to support manufacturing and research and development of semiconductors is part of a larger bill.



[Technology & Mobility Highlights] Mercedes-Benz partners with Luminar for LiDAR technology

Luminar has announced that it has partnered with Mercedes-Benz for deploying LiDAR technology; Mercedes intends to use Luminar's Iris LiDAR technology, being prepared for series production, according to a Luminar statement. Luminar founder and CEO Austin Russell said, "This partnership is a landmark moment in the industry, demonstrating how substantially increased safety and autonomous driving functions on consumer vehicles are going from sci-fi to mainstream. Mercedes-Benz has always been a technological leader and first mover for the industry, with the brand synonymous with automotive innovation, safety, luxury, and quality." Markus Schäfer, Member of the Board of Management of Daimler AG and Mercedes-Benz AG, Chief Technology Officer responsible for Development and Procurement, said, "Luminar is the perfect addition to our existing roster of first-class cooperations with leading and cutting-edge tech companies. Mercedes-Benz's achievement of SAE Level 3 already marked a huge milestone for automated driving and I am absolutely convinced that partnerships will increase our level of ambition for what is possible in the future. Cooperation is an essential part of Mercedes-Benz's strategy. Therefore, I am highly delighted to have Austin Russell and Luminar on board for our journey." According to an Automotive News report, Mercedes-Benz receives 1.5 million shares of Luminar stock in the partnership agreement as well. The Iris system is being developed to be able to spot objects at a maximum of 600 metres and reach 250 metres at 10% reflectivity, which helps with detecting objects in the dark. The Luminar-Mercedes agreement also represents a direct relationship to the OEM, rather than Luminar working with a Tier 1 supplier. Russell is quoted by Automotive News as saying he prefers the direct relationship. "You don't have the talent and the expertise when it comes to these complex lidar systems. You can't just throw a design over the wall and say, 'Hey, build a million of these.' That direct relationship allows us to have a great, close feedback loop that enables those extra capabilities and move quickly to make all this happen," Russell is quoted as saying.



Outlook and implications

The announcement adds to Luminar's earlier inroads, including a 2022 CES announcement about working with Volvo. Neither company specified which Mercedes projects might deploy the technology first, however. These projects suggest automakers believe the Iris technology has promise. Luminar is also working with Toyota and SAIC. In addition, there was already a connection to Daimler, as Luminar is working with Daimler Trucks. Luminar became a publicly traded company in late 2020.



[GSP] Greater China Sales and Production Commentary -2022.01

Greater China sales

December 2021: -2.2%; 2.69 million units vs. 2.75 million units

YTD 2021: +1.1%; 24.40 million units vs. 24.14 million units

In December 2021, 2.69 million light vehicles were sold in Greater China, down by 2.2% compared with the same month of 2020. Specifically, light vehicle sales in mainland China dropped by 2.1%, from 2.70 million units in December 2020 to 2.65 million units. Passenger vehicles recorded sales of 2.27 million units, decreasing by 1.7% year on year (y/y), while light commercial vehicle (LCV) sales decreased by 4.1% y/y to 0.38 million units.

On a year-to-date (YTD) basis, light vehicle sales in mainland China increased by 1.1% to 23.93 million units, from 23.67 million units. Passenger vehicle sales increased by 2.0% y/y to 20.19 million units, while LCV sales decreased by 3.5% y/y to 3.74 million units. Segment wise, YTD sedan sales rose by 5.0% y/y to 9.95 million units from 9.47 million units and the sport utility vehicle (SUV) segment decreased by 0.7% y/y, from 9.55 million units to 9.48 million units. As for multipurpose vehicles (MPVs), YTD sales decreased by 0.8% y/y to 0.78 million units.

The new-energy vehicle (NEV) market in mainland China rallied again in 2021, hitting a new sales record. Local OEMs benefited most from mainland China's push to widen NEV adoption thanks to their strong presence in the NEV market and their ability to adapt quickly to changing consumer demand. The country's transition to electrification is set to accelerate in the next few years, making mainland China a leader in the world's transition to zero-emission transportation. According to the latest IHS Markit forecasts, production volumes of battery-electric vehicles (BEVs) in mainland China should hit over 4.5 million units in 2023, accounting for half of global BEV output. The market's shift toward EVs is driven by the increased availability of appealing models rather than government subsidies.



Looking to 2022, the major risk to the forecast remains semiconductor supply shortages; moreover, the rise in cases of the COVID-19 Omicron variant poses significant additional risk. The net light vehicle sales loss will likely amount to 1.1 million units in 2021, and 700,000 units for 2022 owing to the disruption in chip supply. For mainland China, we anticipate light vehicles sales to grow by 3.5% to 24.60 million units in 2022. Specifically, passenger vehicles should increase 5.0% y/y to 21.13 million units, while light commercial vehicles are estimated to decline 4.7% to 3.48 million units.

Greater China production



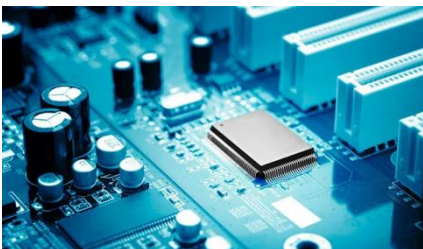
December 2021: -6.0%; 2.54 million units vs. 2.65 million units
YTD 2021: +4.0%; 24.53 million units vs. 24.67 million units

Greater China's light vehicle production in December recorded 2.54 million units, down 6.0% year on year (y/y). In mainland China, light vehicle production declined 5.6% y/y, to 2.52 million units. As the chip supply situation continues to improve, light vehicle production in November outperformed our last estimation by 300,000 units, at 2.52 million units. The strong motivation of most of Chinese domestic OEMs and premium-brand carmakers drove the upgrade in the December light vehicle production forecast to 2.54 million units.

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The full-year 2021 light vehicle production forecast for Greater China is set at 24.53 million units—a 4.0% y/y increase. In mainland China, production will likely reach 24.28 million units, marking an increase of 4.0% y/y. Given the strong performance in the fourth quarter, light vehicle production in 2021 likely posted growth for the first time in three years, standing at +4%. Annual production and sales of new-energy vehicles both exceeded 3.5 million units, with a year-on-year increase of 1.6% according to the statistics of the China Association of Automobile Manufacturers (CAAM). Besides, mainland China's auto exports also broke new records in 2021. SAIC Motor, Chery, and Tesla were the largest exporters in 2021.

The latest vehicle inventory alert (VIA) index, issued by the China Automobile Dealers Association (CADA), stood at 56.1%—0.7% month on month (m/m) higher and 4.6% lower than the same period of 2020—above the threshold. In December, although the chip shortage problem eased in the fourth quarter, dealers started to actively stockpile to recover inventory levels. However, the market was still affected by the dual impact of chip supply shortages and the epidemic. Sporadic outbreaks and small-scale lockdowns across the market would affect consumers' car buying decisions.



In December, passenger vehicle production in Greater China decreased 4.4% y/y, to 2.2 million units. Market segment-wise, car production stood at 1.09 million units, with a 1.8% y/y increase. Production of multipurpose vehicles (MPVs) decreased 6.4% y/y, to 79,970 units. Production of sport utility vehicles (SUVs) decreased 9.9% y/y, to 1.04 million units. Passenger vehicles were expected to grow 5.8% for the full year. Driven by the strong momentum from A-segment battery-electric vehicles (BEVs) such as the Wuling Hongguang Mini, car output already surpassed that of SUVs in 2021. In addition, BYD's new hybrid system helped it become one of the fastest-growing companies in the second half of the year. The Qin Plus had exceeded 25,000 units per month for three consecutive months. Mainland Chinese startups also likely achieved excellent results in 2021.

In December, light commercial vehicle (LCV) production in Greater China posted 0.34 million units, down 15.2% y/y. Market segment-wise, production of chassis-cabs stood at 0.18 million units, marking a decrease of 14.3% y/y. Vans decreased 15.0%, to 0.11 million units. Pickups fell 19.1% y/y, to 46,034 units. Owing to the higher base of 2020, production of LCVs likely fell 4.9% in 2021.



[Supplier Highlights] Qualcomm to offer advanced in-vehicle experiences in Honda vehicles

Honda expects the vehicles to be commercially available in the US from the second half of 2022



Source: Getty Images/metamorworks

Qualcomm Technologies has announced that it would offer advanced in-vehicle experiences to Honda models, according to a company press release dated 4 January. Qualcomm said that the 3rd Generation Snapdragon Cockpit Platforms will be used in upcoming Honda models.

“We pride ourselves in having the ability to offer cutting edge automotive solutions, like our Snapdragon Digital Chassis, to help industry-leading automakers like Honda meet the growing demand for digitally advanced and personalized driving experiences. We look forward to continuing our long-standing working relationship with Honda to help accelerate the future of automotive innovation and having our 3rd Generation Snapdragon Cockpit Platforms bring personalized and highly immersive experiences to Honda’s next generation vehicles,” said Nakul Duggal, SVP and GM, automotive, Qualcomm Technologies.

Outlook and implications

The upcoming models will be Honda’s first-ever to utilize a 3rd generation Snapdragon Cockpit Platform and feature an Android-powered infotainment system. The Japanese automaker expects the vehicles to be commercially available in the US from the second half of 2022 and globally in 2023.

[Supplier Highlights] Bosch partners with CARIAD for automated driving solutions

The companies will initially develop Level 2 and 3 autonomous solutions



Source: Getty Images/metamorworks



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Bosch has partnered with Volkswagen's software unit CARIAD to develop partially and highly automated driving solutions for volume production, the German supplier said in a press statement on 25 January. The companies will be looking to develop hands-free driving functions for the vehicles sold under the Volkswagen Group brands. The companies will look to develop Level 2 hands-free systems for urban, extra-urban, and freeway driving, as well as a system that takes over all driving functions on the freeway (SAE Level 3). The first of these functions will be installed in 2023.

"Together with CARIAD, we will now be accelerating the market launch of partially and highly automated driving functions across all vehicle classes, and thus making them available for everyone. This will make driving on the roads safer and more relaxed. We will be able to offer the solutions we create to our other customers as well, and in this way set new standards," said Markus Heyn, Bosch board of management member.

Outlook and implications

For partially and highly automated driving, the companies will jointly develop a standardized software platform. The project will be data-driven and the software development will be on the basis of information from 360-degree surround sensing. Bosch and CARIAD will examine the possibility of joint development targets and timelines on the path to fully automated driving (SAE Level 4).

"The best proving ground for the development of automated driving is road traffic. With the help of one of the world's biggest connected vehicle fleets, we will gain access to a huge database. This will allow us to take automated driving systems to a new level. All our customers will be able to benefit from this," said Mathias Pillin, president of Bosch Cross-Domain Computing Solutions.



[VIP ASSET] Toyota joins competitors in strategic commitment to battery EVs



21 January 2022 Kevin Adler

Toyota announced a plan to invest \$35 billion from 2022 through 2030 in the development of battery electric vehicles (BEVs), the latest major announcement by a global automaker about a new strategic direction.

The Japanese firm intends to invest \$70 billion globally this decade in all forms of electrified vehicles including hybrids, plug-in hybrids, and fuel cell vehicles, as well as BEVs.

Toyota's commitment places it in between Nissan's \$17.7 billion and Volkswagen's \$100 billion pledges, both also made last year. It matches those of General Motors and Stellantis for their EV development programs for 2020-2025, and is comfortably above Ford's figure of \$11.4 billion.

"It's been a step-change in the last couple of years," said Mark Boyadjis, associate director, advisory services, RL Polk (which is owned by IHS Markit). "Number one, everyone in the auto industry has [become focused on] climate change, and they see ways that Wall Street will reward you for investing properly. Number two, the Chinese market called their bluff. China is where a lot of rare earth minerals for batteries is available, and they set some [high] targets for EVs, so anyone who is in that market or around that market needs to catch up fast."

China's Office of the State Council issued a "New Energy Vehicle Industry Development Plan (2021-2035)" in October 2020 that set a goal of 20% of new vehicles being EVs and hybrids in 2025. The China Association of Automobile Manufacturers issued an estimate that 3.5 million electrified cars were sold in China in 2021, more than doubling in a year and representing nearly 13.5% of the country's vehicle sales of 27 million last year.

Different strategies, similar goals

Each automaker's strategy is different, of course, but they share a few priorities, said Stephanie Brinley, IHS Markit principal automotive analyst. The companies are expanding their EV offerings to more of their product lineup by transitioning their popular models to a hybrid or BEV format. They also are developing entirely new models. And they are still producing internal combustion engine (ICE) cars, which are their current profit centers and will fund the transition to EVs.

In announcing Toyota's plan, Akio Toyoda, global president, said the company is aiming for sales of 3.5 million BEVs per year by 2030. At current volumes of about 9.5 million vehicles, this would represent nearly 40% of its annual sales. Toyota will offer 30 BEV models across the Toyota and Lexus brands by 2030.

"I wasn't interested in Toyota's EVs until now. But now I'm interested in future EVs," Toyoda said in a press conference on 14 December.



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Other automakers had come to the same conclusion earlier, and with more aggressive ambitions. For example, General Motors said that all of its cars and light-duty trucks would be electric by 2035, and Stellantis said 98% of its new vehicles will be electric by 2035, across 14 brands. Volkswagen has pledged half of its new car sales will be electric by 2030.

But to reach their lofty goals for EV production, the companies must redesign their vehicles, create a reliable battery supply chain, and deal with the shortage of computer chips caused by production interruptions due to COVID-19.

Strategic shift

From Toyota, the \$35-billion plan is a significant strategic shift, though not necessarily a commitment to additional spending, said Mike Ramsey, vice president and analyst, automotive and smart mobility for Gartner.

"Toyota over that period [2022-2030] is likely to have spent ... a very similar amount of money on plants, engines, transmissions, exhaust systems, and new platforms for gasoline, diesel, and hybrids," he said. "But now it's saying, we're going to take the money we would have spent on those things, and we will spend it on EVs."

The cost of building a new vehicle assembly plant varies based on factors such as anticipated volume and location, but Toyota's most recent North America assembly plant was a \$2.3-billion facility in Huntsville, Alabama, which began production in September 2021 (a joint venture with Mazda).

Toyota has said it will establish EV and battery manufacturing plants, motor production, and all the other elements of the EV supply chain. This will require a new way of operating and a great deal of money, Ramsey said. A battery cell production facility could cost \$2 billion or 2.5 billion.



"Battery plants are largely not going to be put in existing auto facilities. They are more like pharmaceutical plants" in the precision and cleanliness that's needed for production, Ramsey said. "And it will be a massive task to support millions of EVs."

Given that EVs are an emerging technology, it wouldn't be surprising if facility costs come in higher than those for conventional auto plants. That might be indicated by the \$5 billion price tag on US EV company Rivian's announcement in December of an electric truck plant in Georgia. Rivian is financing the factory on the back of a 100,000-unit order from Amazon for its Prime delivery service.

An established automaker has advantages and disadvantages in the EV business, said Boyadjis.



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"A startup OEM [original equipment manufacturer] like Rivian or Lucid Motors has to make investments in the billions of dollars, even to produce startup volumes of thousands or tens of thousands," he explained.

Toyota doesn't have to acquire auto design and engineering capability, real estate for factories, or manufacturing expertise. And it can spread the costs it does incur across production of hundreds of thousands or millions of vehicles.

On the other hand, the scale of operation of Toyota or GM brings other challenges. "For Toyota to transition its entire lineup, it can't just do one model at 10,000 units," Boyadjis said. "They've done that before, with the RAV4 EV in a couple of markets as a trial, and it died. GM did the same with the EV1.... When you want to ... take five, six, eight lines from ICE to electrification, it takes tens of billions of dollars."

And thus, the spending announcements made last year by the legacy automakers— even as they outline different ways they will spend their money.

Ford announced in September it would build two sets of EV facilities in the US. These are entirely new greenfield plants. In Tennessee, Ford will build BlueOval, a \$5.6-billion battery factory and adjoining assembly plant for electric F-series pickups. In Kentucky, BlueOvalSK (with partner SK) will consist of two battery factories at a cost of about \$5.4 billion, and will supply Ford and Lincoln models produced elsewhere in North America.

General Motors, on the other hand, is retooling existing facilities to produce a growing lineup of EVs.

For example, it announced in November the opening of Factory ZERO in Detroit-Hamtramck to make electric models of the Hummer, Chevrolet Silverado, and Cruise. Speaking at the grand opening of Factory ZERO, GM Executive Vice President, Global Manufacturing and Sustainability Gerald Johnson said the company's goal is that EV assembly will be 20% of GM's North America capacity in 2025 and 50% by 2030. GM believes it can save up to \$15 billion by 2030 by repurposing factories and retraining its current workforce, rather than starting anew with greenfield facilities.

GM's move points out the scale advantage that large, established automakers have as they compete with Rivian, Tesla, and other non-legacy EV producers. The automaker introduced in 2020 the Ultium Platform, its battery system for numerous car models that uses its proprietary Ultium battery. "If the cost of developing the Ultium Platform was \$1 billion or even more, but you can use it for 35 products, then that can be a cost-effective investment," Brinley said.

To cite one recent example of the expansion of Ultium, the company is investing \$2 billion in its existing Spring Hill, Tennessee, manufacturing plant to convert it to production of the electric Cadillac LYRIQ. Thanks to Ultium, CEO Mary Barra said in January that the company has moved up its timetable to produce all-electric heavy-duty pickups to 2035, to match its agenda for light-duty vehicles.

Boyadjis pointed out that GM also is planning to make the Ultium Platform available for non-auto uses, such as for boats, airplanes, and stationary energy storage. In addition to opening up new markets, it will have the benefit of pushing Ultium supply chain innovations more quickly because the company will be supplying higher volumes, he said.



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Promising future, but many unknowns

The bottom line is that the financial commitments announced in 2021 show that the world's drivers really will have an array of choices for electrified passenger cars and trucks by the end of the decade.

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