FEBRUARY 2023 AUTOFORECAST MONTHLY REPORT

HIGHLIGHTS IN THIS ISSUE

BY SAM FIORANI

Cyclicality is expected in the auto industry. Economic expansions push sales to new highs while recessions soon turn everything negative. Today, the global industry is weighing just how much the negatives will affect demand for cars and trucks.

While companies prepare for a potential recession, issues over the past three years have suppressed so many aspects that any downturn could be reflected in a mild market improvement. In this issue, various aspects of the industry are outlined to explain why a unique situation is coming in 2023 and beyond.

Tesla, Xpeng and others have reduced EV prices in the US, China and Europe as competition intensifies

NEWS

BY SAM FIORANI

EV prices are easing

Competition between electric vehicle manufacturers is heating up. Even with the substantial growth in the global EV market, automakers are feeling the competitive pressure. Tesla, Xpeng and Seres, among others, have cut their prices in China, the US and Europe. In Tesla's case, the US price cut better positioned its products to take advantage of the new incentives generated by the Inflation Reduction Act (IRA), which places a US$55,000 cap on electric passenger cars eligible for tax breaks as large as US$7,500.

Rising costs of components have pushed the prices of some EVs, especially from more recent startups, higher and the price cuts by the more established players can help draw attention away from the launches of new players like Rivian, Fisker and Lucid. The moves pushed Tesla's stock price higher while Xpeng, Rivian and Lucid saw their valuations initially drop before recovering slightly.

China market is showing weakness

As light vehicles sales and production attempt to recover from the recent downturn, larger forces are slowing this movement. Population growth in China has stopped and the world's most populous country had 900,000 fewer births than deaths in 2022, which had been predicted for many years. China's "one-child" policy, enacted in the late 1970s, dropped the country's fertility rate to 1.18, where 2.1 is necessary to maintain a population. While the

population trend is a longer-term issue, more immediately, GDP growth of 3% in 2022 is considerably slower than in prior years and well below the country's target levels. "Zero COVID" shutdowns led by relatively low vaccination rates is part of the issue, as is the anti-China sentiment growing for trade around the world, especially in the US. Without easing tensions, both trade and military, China's growth will be hampered and negotiations in those areas are not expected to start in the near term.

Renault-Nissan restructure

Imminent announcements from Renault and Nissan are expected to follow a restructuring of the alliance. Formed nearly a quarter-century ago, the Renault-Nissan alliance continues to link the development of vehicles and powertrains and sharing of production facilities around the world. Nissan currently holds 15% of Renault while the French automaker holds a 43% stake in the Japanese company. The restructuring should narrow the ownership gap, potentially evening up the stakes at 15%, with the remaining 28% of Nissan shares moving to a new holding company. In addition to its work with Nissan, Renault is licking its wounds from its venture in China. Plans for production in China have been reversed and the French automaker is looking to India as a possible replacement. India could provide another source of entry-level models for the Renault and possibly Dacia brands as they expand their electric offerings around the world.


Dacia could benefit from production tie-up in India

Britishvolt closes

Expected to be a significant force moving the UK auto industry forward, EV battery startup Britishvolt has run out of money, closed its doors and laid off its staff of about 300 people. Former Aston Martin CEO Andy Palmer told the BBC World Service that the loss of Britishvolt was "an unmitigated disaster for the auto industry in the UK. Cars are, by 2030, mandated in the UK to move to electric and we don't have the battery capacity to support that and that means, ultimately, British car manufacturing will migrate to where the battery factories are, which is going to be in central Europe." A lack of contracts from automakers bigger than Lotus and Aston Martin was part of the reason for the company's troubles.

The UK government had offered £100 million in funding on condition that other funding could be found, which did not emerge. While the company is on life support, the investment needed to keep Britishvolt going is unlikely to be found.

'RENAULT IS LICKING ITS WOUNDS FROM ITS VENTURE IN CHINA'


Lack of funding ended Britishvolt's EV battery plans

VW-based EVs at Ford short-lived

Ford and Volkswagen are currently working together to develop EVs to be sold under the Ford brand, specifically in Europe. To be launched in 2023, the first Ford model based on Volkswagen's MEB platform will be produced at Ford's Cologne plant in Germany. Initially believed to continue beyond this model, the partnership may taper off after this one model as the next-generation Ford EVs will ride on a platform developed in-house.

Tesla global expansion

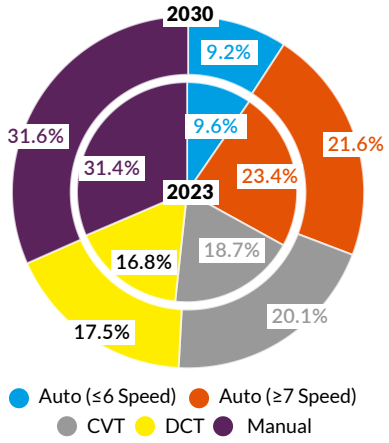
Tesla CEO Elon Musk anticipates total production of its EVs will top 20 million units by the end of the decade. To reach such lofty goals, Tesla needs to increase its production footprint and a second plant in China was in the offing, but it has been taken off the table for the immediate future. Adding production plants in Mexico and Indonesia as well as expansion plans for the German plant are being discussed, but no firm plans have been established. What has been set is an expansion of the plant in Austin, Texas. With an investment of US$776 million, the company's second US assembly plant will grow, with the expansion planned to be completed by the end of 2024.

GM powertrain investment

With the ongoing transition from internal combustion engines (ICE) to battery-electric power, a number of General Motors' powertrain facilities have been held in limbo. In January, GM announced that it will invest US$918 million in four US manufacturing sites. US$579 million is earmarked for the Flint engine plant and the sixth-generation small-block V8. Camshafts and connecting rods for the updated V8 will be produced by the Bay City GPS plant, which receives US$216 million in investment. Another US$64 million will be invested in the Rochester, New York, and Defiance, Ohio, factories, which provide components for ICE and EV production.

TRANSMISSION CONSUMPTION BY TYPE

Excludes BEVs



Source: AutoForecast Solutions

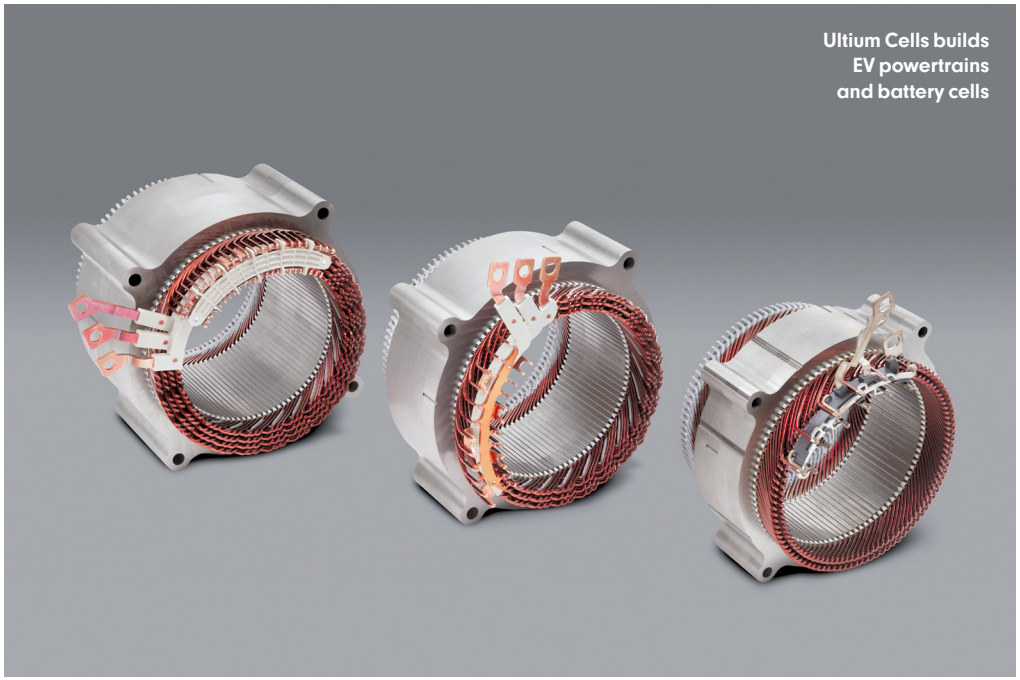
GLOBAL ELECTRIC VEHICLE INITIATIVES

BY CONRAD LAYSON

GM and LGES slow growth

Ultium Cells LLC, the joint venture between General Motors (GM) and LG Energy Solution (LGES) to build proprietary battery cells and all-electric powertrains, has scrapped plans to build its fourth battery cell making facility. The original three EV battery cell factories are either in production now or have broken ground. Ultium Cells in Warren, Ohio, is in operation, ramping up production now. Ultium Cells in Spring Hill, Tennessee, will go online later this year, after receiving additional funding to increase overall plant capacity to 50GWh. Ultium Cells in Lansing, Michigan, has broken ground and is moving towards an SOP in Q4 2024. The fourth factory was thought to be slated for New Carlisle, Indiana, although no formal announcement was ever made.

While the joint venture continues with the three existing plants, a number of separate issues culminated in the decision not to build the fourth plant. The supply of battery cells needed for GM to achieve 100% EV output by 2035 underpins much of the tension. GM wants to ramp up EV volume much faster than does its LGES partner. GM's interim goal of producing 400,000 EVs in North America by Q3 2024 is achievable if the new Ultium Cells Spring Hill facility joins Ultium Cells Warren in producing cells. However, the one million EV production goal for 2025 would need Ultium Cells Lansing to join the effort by late 2024. And GM's rapid rise in volume demands a similar ramp-up in battery cell output from all three plants.



Ultium Cells builds EV powertrains and battery cells

That's much faster than LGES is comfortable providing, given that cell production ramp-up is dependent on successfully managing electrochemical processes and reactions at scale. Securing the fourth plant and bringing it online quickly ran into trouble when LGES didn't commit to GM's timeline.

But the first disagreement can be traced to the recall of all 143,000 Chevrolet Bolt EVs, due to a total of 16 confirmed battery fires. The causes of those were eventually traced to folded separators or torn anodes in the cells. Parent company LG Chem shouldered US$1.9 billion of the US$2 billion cost to replace all of the battery packs in new and previously sold vehicles.

The United Auto Workers effort to organize the Ultium Cells plant in Warren, Ohio, was another disagreement. GM wanted to use an expedited "card check" process to determine whether half of the workers wished to organize. With one more board member than GM, the LGES contingency prevailed and went with the more precise and contentious election process. The plant workforce voted to unionize this past December.

> 'A NUMBER OF ISSUES LED TO THE DECISION NOT TO BUILD THE FOURTH PLANT'

In spite of this halt in growth with its LGES partner, GM recommitted to building a fourth battery cell making facility to achieve its EV volume goals. GM did say it was speaking with other potential partners with which it would build the fourth cell production facility, although it declined to name any of them. If GM continues to use the pouch form factor already found in the current generation of Ultium battery packs, then AFS forecasts the possibility of SK On becoming the new partner in the fourth factory. If GM decides to take the opportunity of the break in the Ultium partnership to explore using a different form factor, then the number of companies potentially involved in discussions with GM rises. GM has not announced a timeline for a decision.

Public Policy Day: insight into the IRA

Public Policy Day at the 2023 Washington DC Auto Show consisted of a number of announcements by OEMs as well as five panel discussions, made up of personnel from transportation-oriented government and non-government agencies. However, the Supporting Clean Vehicle Transition panel discussion provided a perspective on the "buy American" provisions of the Inflation Reduction Act (IRA) by no less a luminary than Ambassador Stavros Lambrinidis of the EU.

Ambassador Lambrinidis outlined the EU's position on the IRA as being concerned by what he called the discriminatory provision of the EV Clean Vehicle Tax Credit, which requires that final assembly of EVs occurs in the US. Ambassador Lambrinidis argued that US consumers "will have much less choice in what they can buy" while remaining eligible for the tax credit. The ambassador went on to speak

'BMW WILL PROGRESSIVELY SCALE UP THE PROTOTYPE BATTERY CELLS'

about how the US consumer would be better served with a more liberal interpretation of the law, arguing that politically allied nations such as those that form the EU, and perhaps the EU itself, be considered as being qualified to sell EU-built EVs in the US that would receive the tax credit, while a more formal trade agreement was being worked out.

This past December, the Treasury Department released an interim guidance document that indicated the direction the final rules would take. Much to the relief of both the EU and free-trade agreement holder South Korea, the Treasury Department indicated that they would allow EVs leased by consumers to qualify for up to $7,500 in commercial Clean Vehicle Tax Credits for vehicles not assembled in the US. The decision was immediately lambasted by West Virginia Senator Joe Manchin, one of the authors of the IRA. In his comments in Washington, Ambassador Lambrinidis indicated that the leasing loophole was a good start. However, the leasing exception alone does not completely address the EU's concerns.

The rules for US assembly and limiting battery mineral and component content still apply for EV purchases. AFS does not expect the Treasury's final rules, due out in March, to change significantly from the December guidance.

As long as the Treasury continues to enforce the IRA as written, then the only relief from the US assembly requirements left for foreign OEMs is either receiving a waiver from another government agency, such as the State or Commerce Departments, or to take advantage of the commercial leasing loophole that the Treasury will not close on its own. Congress will have to revisit the IRA and amend it to do that.

BMW sharpens focus on solid-state batteries

The BMW Group is expanding its joint development agreement with solid-state battery (SSB) developer Solid Power, based in Louisville, Colorado. The new agreement adds an R&D license that allows BMW to develop and produce prototype cells using Solid Power's SSB design at the company's Cell Manufacturing Competence Center in Parsdorf near Munich.

BMW's US$20 million licensing fee will allow it to use Solid Power's battery cell design and production process. BMW and Solid Power personnel will work together to install a pilot assembly line at Parsdorf and then optimize the cell manufacturing process. When completed, the Parsdorf facility will be a duplicate of the Solid Power pilot assembly line currently in operation in Thornton, Colorado. Work is scheduled to begin almost immediately.

With the new pilot production line in place, BMW will progressively scale up the prototype cells to reach a capacity sufficient to propel a demonstration vehicle before 2025. If successful, future BMW EVs could enjoy battery packs that are more cost-competitive, lighter and safer and charge much more rapidly than current wet-electrolyte lithium ion cells. Solid Power estimates that a 77kWh pack of its design could weigh as much as 46% less than current lithium ion packs, enjoy a 16% improvement in range and cost almost 40% less than what OEMs use now.

BMW is the first investor to expand its joint development agreement with an R&D license and install the Solid Power-designed pilot line.

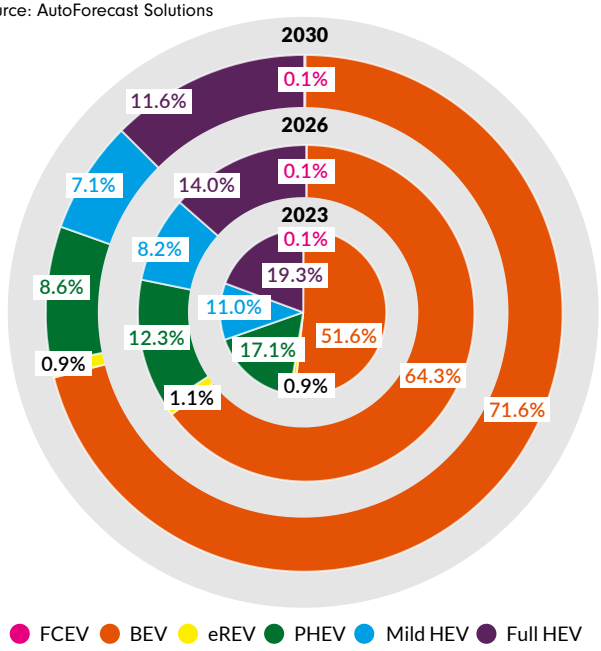
Solid Power's business model revolves around developing a viable SSB cell for use in EVs and then licensing the technology back to the investing OEMs for use. Solid Power will also gain revenue from the production of the electrolyte powders used in the manufacture of its design and selling that to its customers. In addition to the BMW Group, Solid Power's investors include Ford Motor Co., Hyundai, Korean battery maker SK Innovation, Volta Energy Technologies and electro-chemical makers Umicore and Solvay.

BMW's latest leap is cylindrical cells. Will solid state be next?

GLOBAL LIGHT VEHICLE ELECTRIFICATION

Percentages based on electrified vehicle market only

Source: AutoForecast Solutions



GLOBAL LIGHT VEHICLE PRODUCTION OUTLOOK

BY SAM FIORANI

All of the issues in the automotive industry and threats to economies around the world did not prevent light vehicle production from growing in 2022. Output growth of 5.3% improved on the growth in 2021, reversing the production slide in the prior years. Returning to the global growth path has many factors working against it, including threats of recessions, especially in the larger economies.

Getting the EU, US, and China back on a growth track powers the industry, which could be difficult in 2023. The EU industry took a huge hit through 2021 before recovering slightly last year and that will provide a basis for a larger improvement in 2023 as it claws back the lost volumes through the rest of the decade. North America also experienced a significant loss of output over the past few years before leveling off in 2021 and recovering some lost volume last year; additional growth will happen in 2023 but not enough to get the market back to 2019 levels. Light vehicle production will grow in China by 3.6%, which will be slower than the 7.1% increase in 2022 as the market tries to stabilize following the 15.7% drop in production between 2017 and 2020.

Overall, global production of light vehicles will top the annual output of the preceding three years. Still lagging behind 2019 and far less than the growth that produced more than 95 million units in 2017, production will continue to grow for the rest of the decade.

The current shift toward EVs and the additional cost involved in those new products will slow this growth, keeping output below 95 million units through the 2027 calendar year.

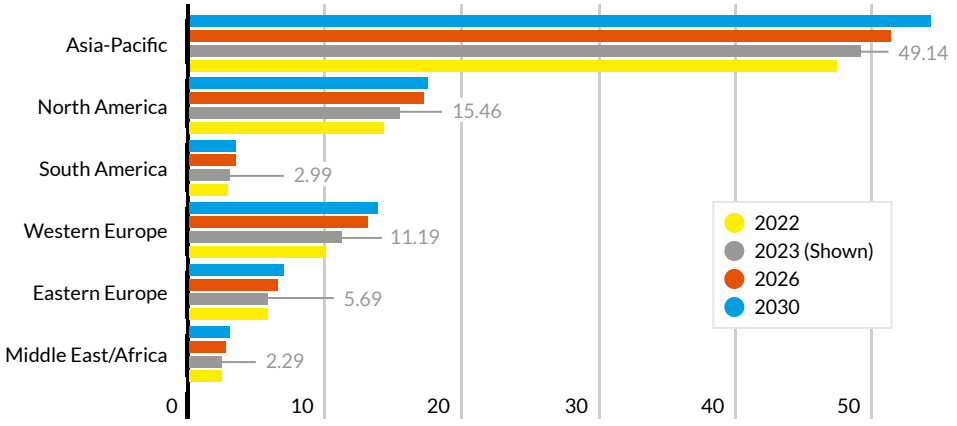
After a year of many chip-related revisions in its production plan, Toyota expects the 2023 fiscal year will finish with 10.6 million vehicles being produced. Up from the 2022 production of an estimated 9.2 million units (fiscal year ends in March 2023), next year's production will place the Japanese manufacturer in prime contention for the world's top producer. With the fears of a recession around the world continuing and residual issues in the supply of semiconductors remaining, getting Toyota to 10.6 million will take a proper alignment of the planets and a magical uptick in consumer sentiment.

'VOLKSWAGEN SEEMS TO BE PREPARING FOR A PRODUCTION SLOWDOWN'

Volkswagen is also being impacted by the chip shortage. Production continues to move forward, but some vehicles are rolling off of the assembly line missing optional features such as the heat pump on the electric ID.4. Continued issues could impact production in the near term and Volkswagen seems to be preparing for a production slowdown as VW's US website is no longer taking orders for the ID.4 and the website warns "availability of some equipment, options or features may be limited due to global supply issues affecting the auto industry".

AFS forecasts that issues with the supply of semiconductors will pull about 2.8 million units from production plans in 2023. This number could potentially be reduced as the year progresses as manufacturers find other reasons, most likely economic, to reduce output.

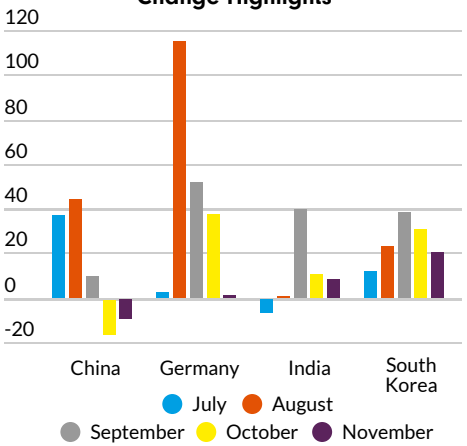
GLOBAL LIGHT VEHICLE PRODUCTION OUTLOOK



Source: AutoForecast Solutions

Toyota estimates it'll make 10.6 million units in the next year

Year-Over-Year Production Change Highlights

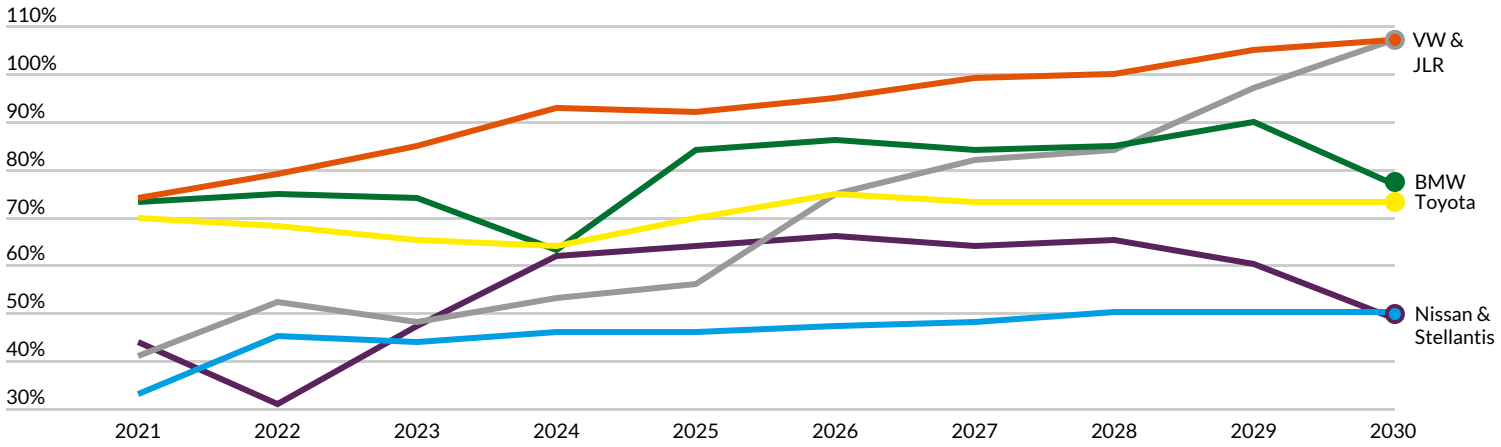


The AFS Forecast covers 60 countries. Chart shows changes 2022 over 2021.

UNITED KINGDOM CAPACITY UTILIZATION BY VEHICLE MANUFACTURER

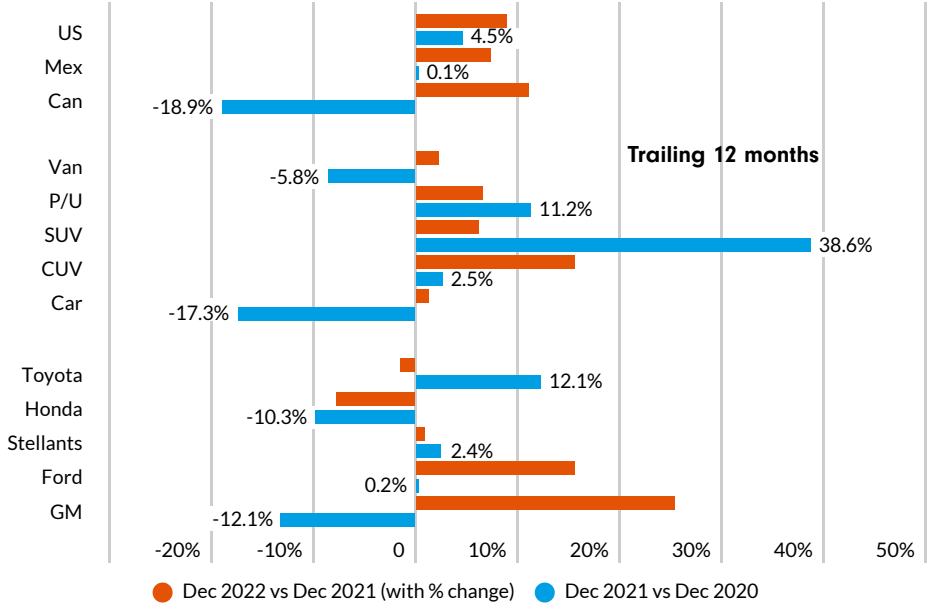
Source: AutoForecast Solutions

Selected Manufacturers

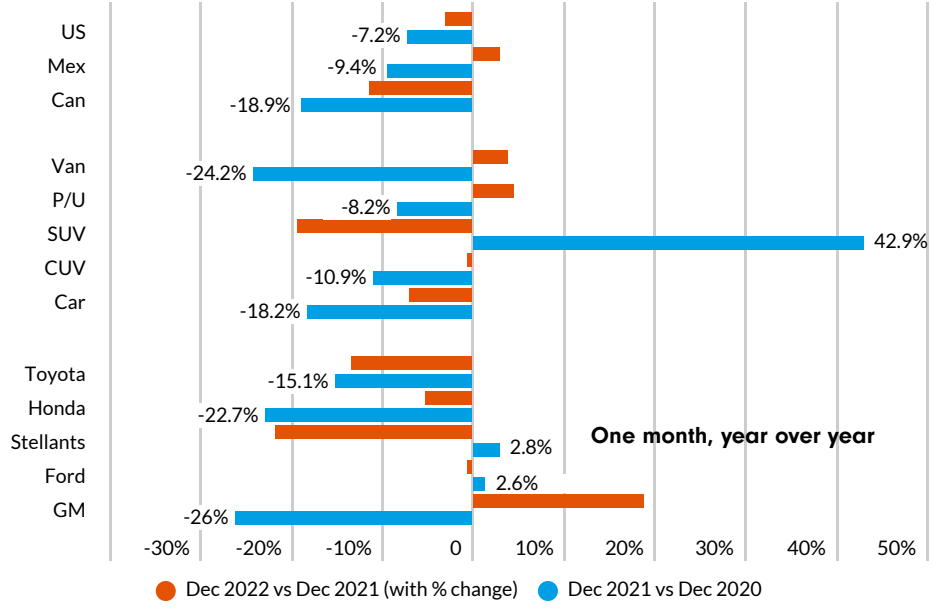


NORTH AMERICAN PRODUCTION CHANGES

Source: AutoForecast Solutions



Trailing 12 months represents 12-month period vs the year-prior period



One month represents single month over prior single-month change

GLOBAL LIGHT VEHICLE SALES OUTLOOK

BY SAM FIORANI

Despite a run on vehicles in December, sales in Russia were expectedly soft in 2022. Following the country's invasion of Ukraine, local sales crashed, with March plummeting 63%, April losing 78.5% and May cratered with an 83.5% loss. The traditional year-end push was 43.5% behind last December's peak of 227,735 units sold. The first two months of the year were off by only 13.7% but the invasion turned the market and sales were off 58.8% for the calendar year. A slow recovery will continue into 2023 as local buyers are turning back toward Russian and Chinese brands as the rest of the industry has retreated.

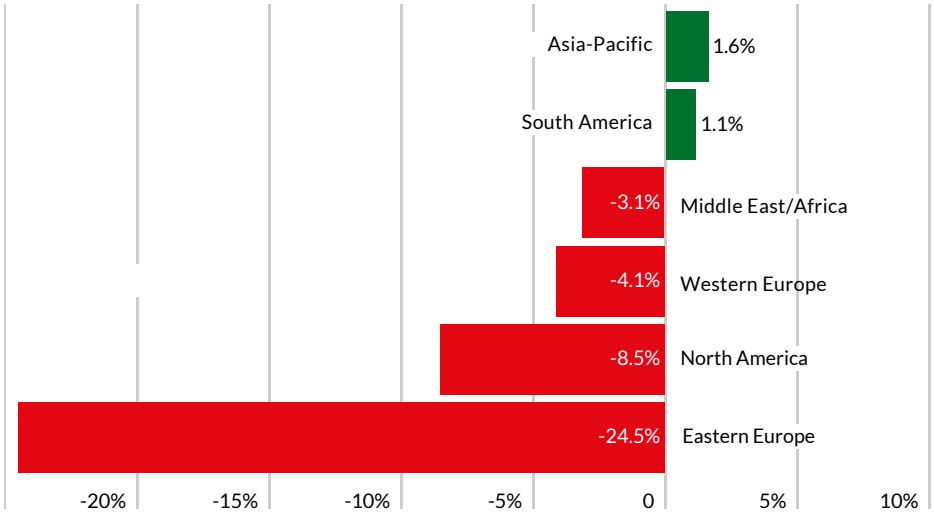
Inflation in Japan was just under 4% as of the end of 2022. While this is low compared with much of the rest of the world, it marks a height not seen in two generations. The Bank of Japan is keeping its interest levels steady in hopes that the economy does not slow further. With light vehicle sales off by 5.3% in 2022, keeping a close eye on the market is expected to allow a sales rebound in 2023. A slow recovery will push light vehicles up just 2% this year, but getting back to the five-million-unit level, last seen in 2019, is unlikely in the near term.

The typical surge in sales in December was greater than usual in China. Even with this bump, the calendar year ended down 1.4%, with the positive inertia leading into expected growth of 9.5% in 2023. Most significant is the rise of the domestic brands and EVs. Along with hybrids, EVs have experienced strong growth in recent years, with EVs improved by 82% in 2022. Largely on the growth of EVs and higher-quality models, domestic brands made up almost half of the market in 2022, placing the squeeze on market leaders such as Volkswagen. Reaching globally competitive volumes on a local scale will make these models increasingly competitive when exports make their mark on the sales charts across developed countries like the UK, EU, South Korea and Japan. Moving into the US will require improved relations between the two countries but will eventually happen.

December numbers came in strong for the US, but it still wasn't good enough to keep the year from bottoming out. Sales of 13.76 million light vehicles marks the lowest total since 2011, back when the market was still recovering from the "Great Recession" of 2008-2009. Considerably lower than in 2021, sales in 2022 will mark a low point as the market improves in 2023 to 14.5 million units. Getting back to the 17-million range previously seen from 2015 through 2019 will take time and is not expected before 2034, with the conversion to EVs raising prices and keeping many buyers out of the new vehicle market.

Sales in Russia will improve gently in 2023 as buyers turn to Chinese brands and domestic ones such as Lada

DECEMBER 2022 YOY LIGHT VEHICLE SALES CHANGE

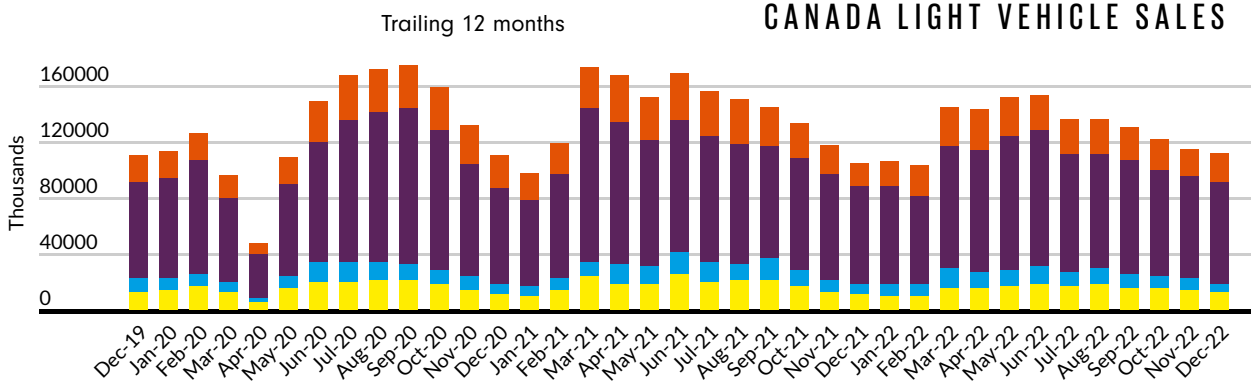


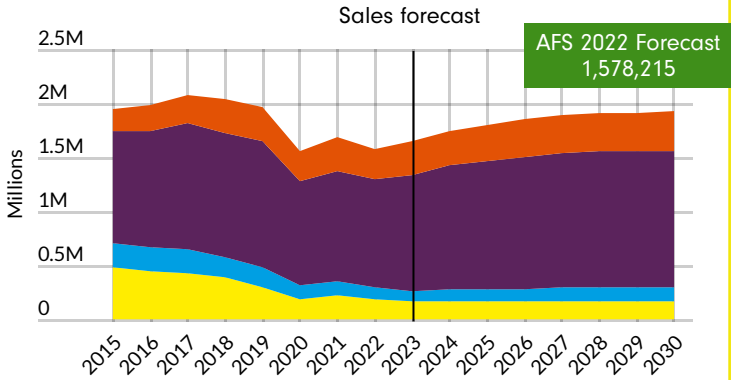
Source: AutoForecast Solutions

> 'THE TYPICAL SALES SURGE IN DECEMBER WAS GREATER THAN USUAL IN CHINA'

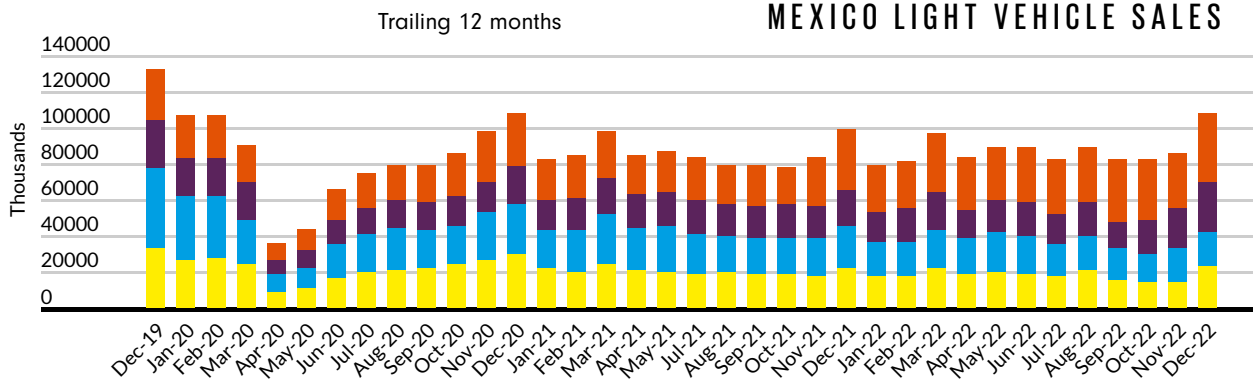
Source: AutoForecast Solutions

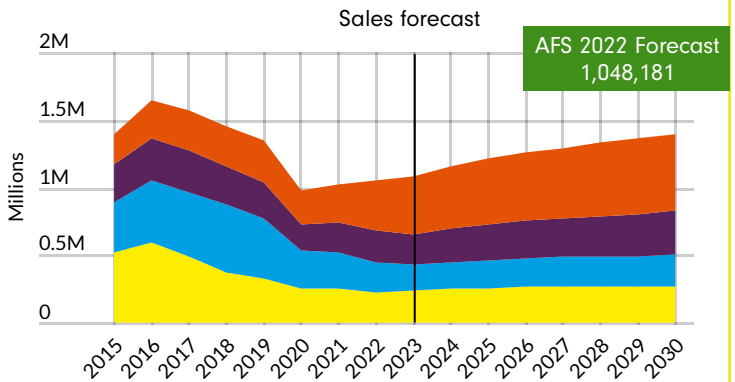
CANADA LIGHT VEHICLE SALES



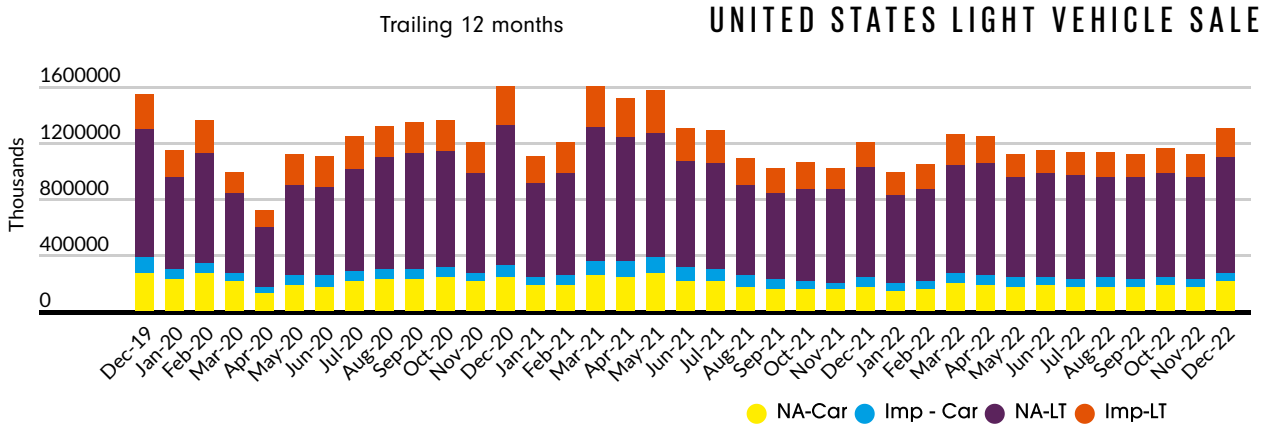


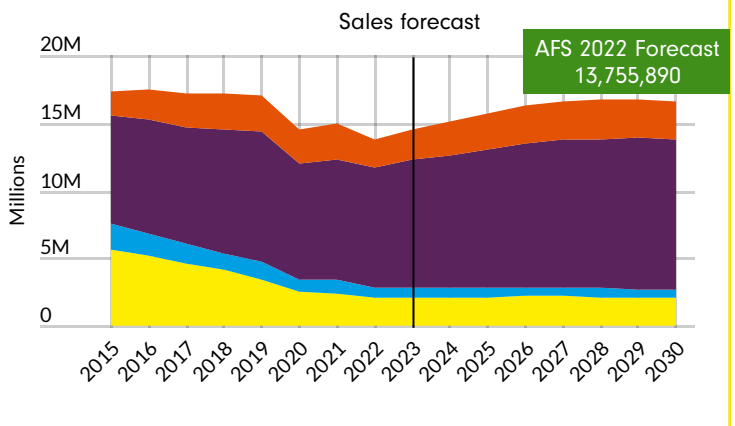
MEXICO LIGHT VEHICLE SALES





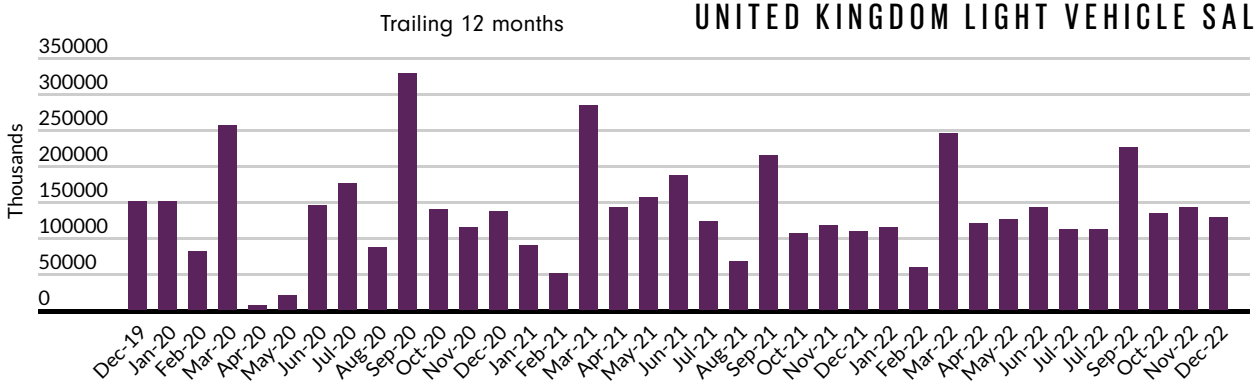
UNITED STATES LIGHT VEHICLE SALES

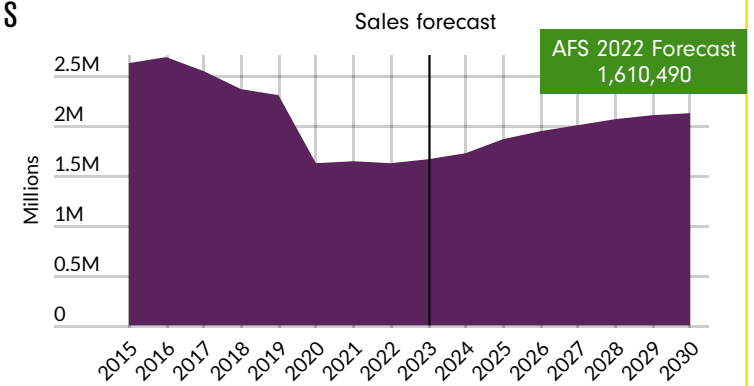




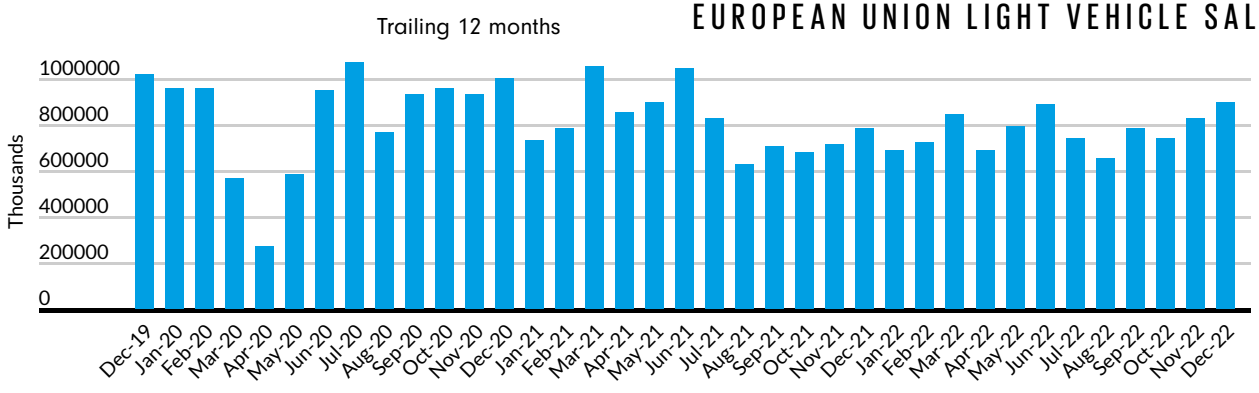
Source AutoForecast Solutions

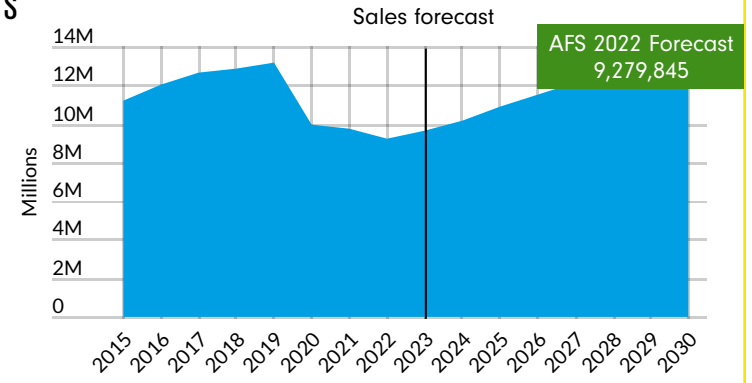
UNITED KINGDOM LIGHT VEHICLE SALES



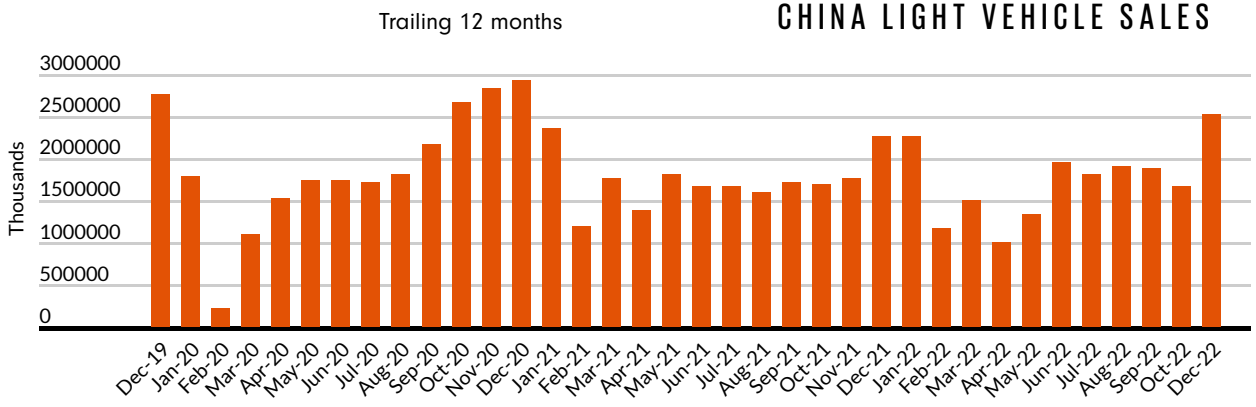


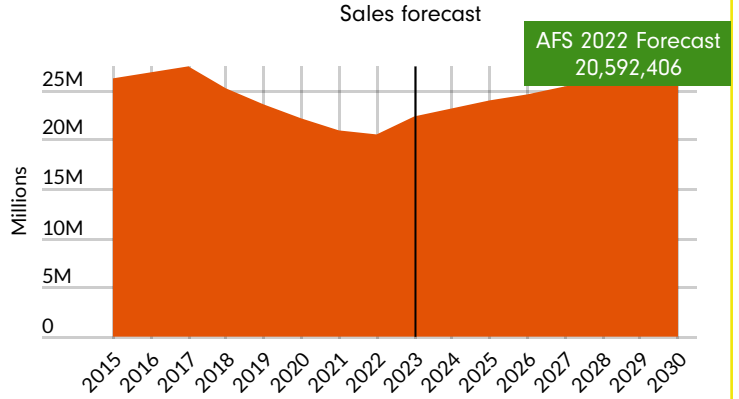
EUROPEAN UNION LIGHT VEHICLE SALES



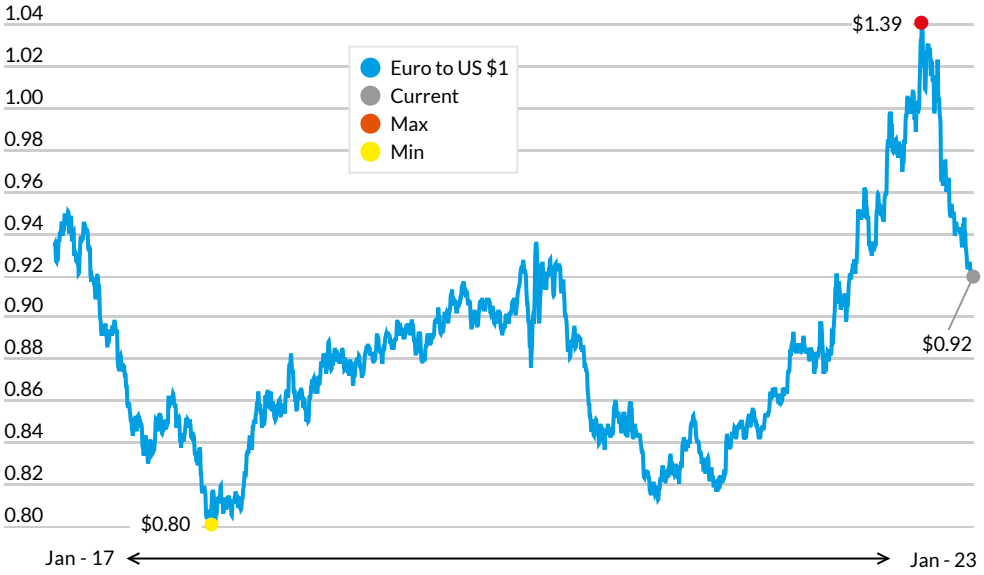


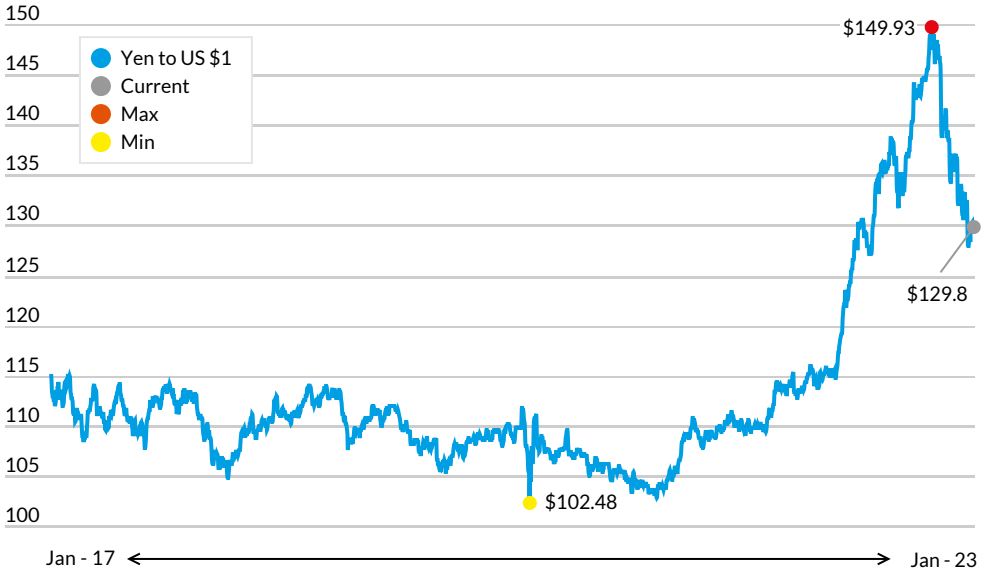
CHINA LIGHT VEHICLE SALES

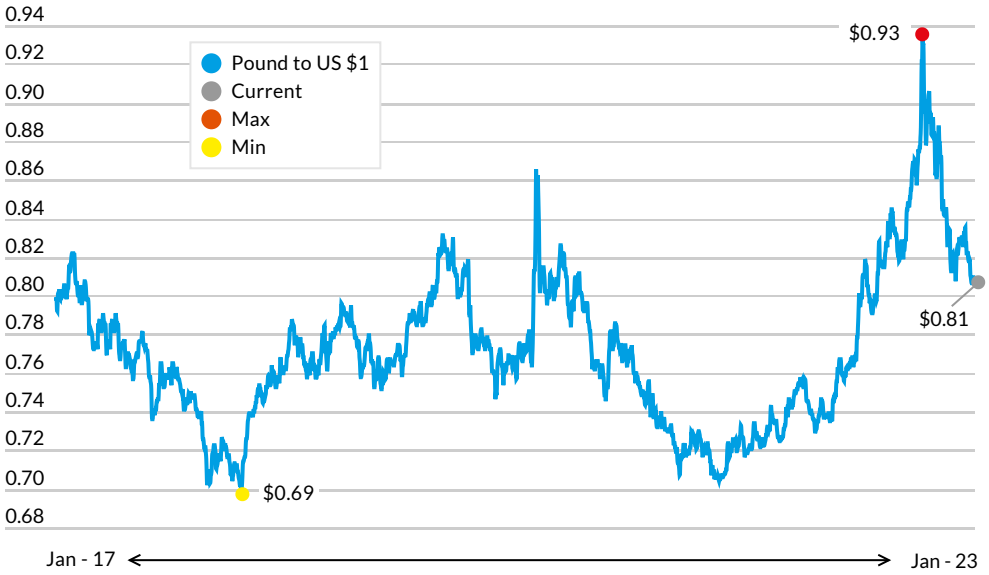


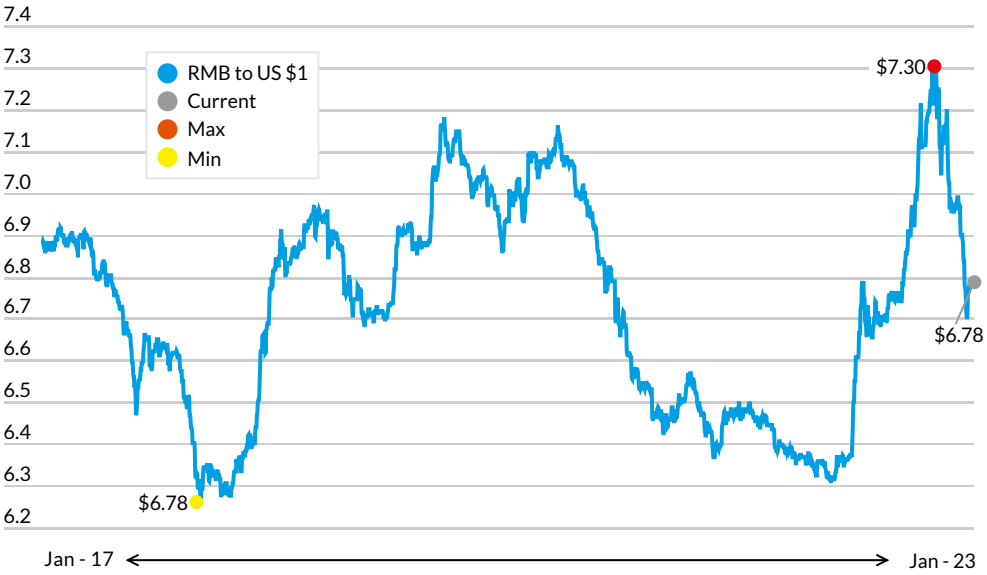


EXCHANGE RATES VS US DOLLAR



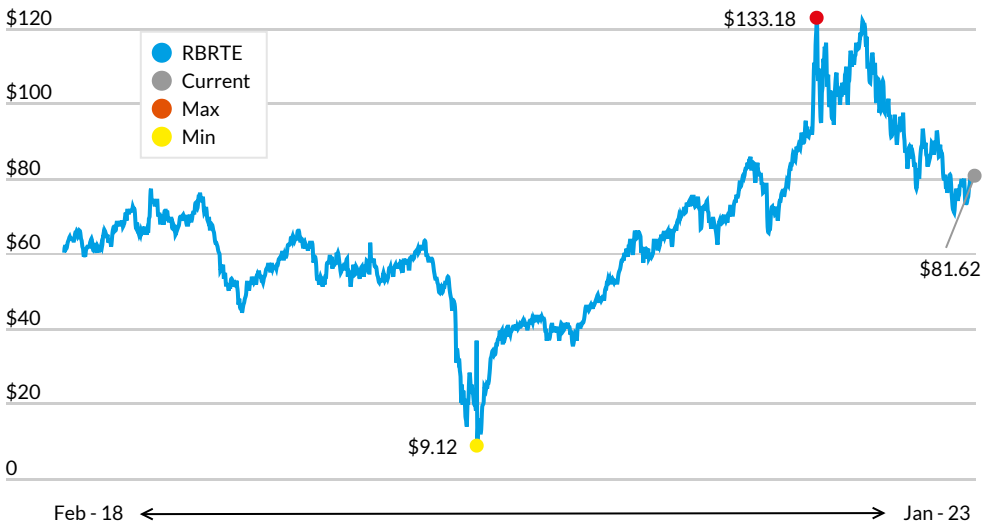






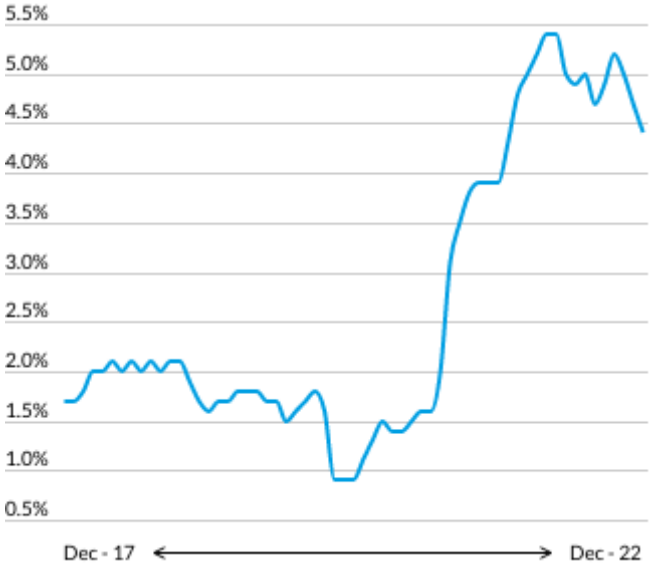
OIL PRICES

Europe Brent Crude



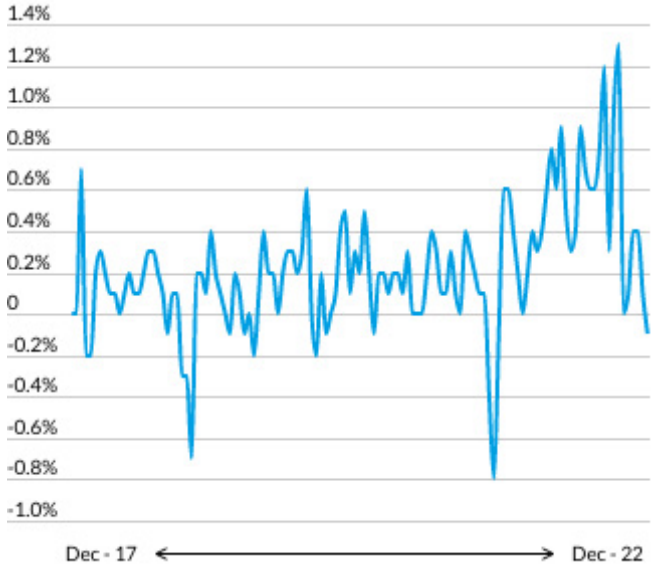
West Texas Intermediate

Change in Personal Consumption Expenditures



Federal Reserve Bank of St. Louis

United States Consumer Price Index



US Bureau of Labor Statistics

Consumer Confidence

University of Michigan

SPECIAL REPORT

JOSH SHASTAL

Highlights from the influential CES

The Consumer Electronics Show, or CES, is the world's most influential technology event, where the biggest brands showcase the latest breakthrough technologies. CES has become increasingly important for automakers to attend as the industry is shifting to software-defined vehicles. The switch to battery-electric vehicles creates an opportunity for automakers to reimagine what a vehicle should be and create a unique user experience for drivers and passengers. In this era of software-defined vehicles, CES is the new auto show.

There were a lot of automotive announcements from multiple brands at this year's show but the following highlights the most important.

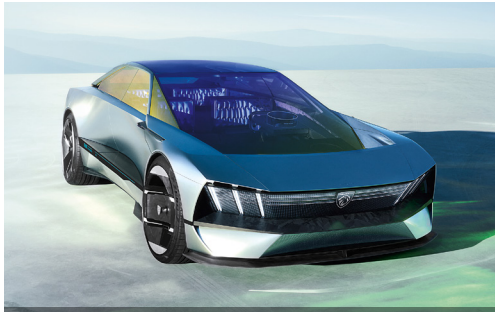
STELLANTIS

The increasing importance of CES to the automotive industry was demonstrated by Stellantis's decision to choose the event for the unveiling of the new Ram 1500 Revolution battery-electric concept. This truck is packed full of innovative new technologies, many of which will make their way into future Ram vehicles, and not only the BEVs. Ram will officially reveal the production version of its battery-electric truck in the next few months and production is expected to begin at the Warren assembly plant in late 2024.

This timeline puts Ram two years behind its biggest competitors, Ford and General Motors, in offering a fully electric truck. It also leaves the brand trailing startups like Rivian with its R1T and Lordstown with its Endurance BEV pickup, both of which are available today. Whether this timing will ultimately hurt Ram is debatable.

Peugeot's CEO, Linda Jackson, was at CES to show off the latest technology and unveil the new Inception concept, a battery-electric vehicle. A new tablet-like control center called Hypersquare is a new technology that lets the driver control the vehicle with a touch or swipe of a finger. Jackson described Hypersquare as "gaming in real life", which is either an exciting or terrifying thought depending on who you ask. Peugeot said Hypersquare will be available as soon as 2026.

The new battery-electric Inception concept is Peugeot's vision of the future and shows the new design approach that the brand is using in its next-generation BEVs.



Peugeot Inception is a design and tech manifesto

'IN THIS ERA OF SOFTWARE-DEFINED VEHICLES CES IS THE NEW AUTO SHOW'

The new design is called "Feline Future" and Jackson described the vehicle as a "new breed of cat" with a posture of a "big cat ready to spring". The next generation of battery-electric Peugeots, inspired by the Inception concept, will start to roll out in 2026.

Stellantis also announced the debut of the Chrysler Synthesis cockpit demonstrator, which combines Chrysler's new interior design with advanced technology from Stellantis. Chrysler will be the first brand in North America to feature applications of the new technologies being developed by Stellantis. Chrysler says it is on track to launch its first BEV in 2025 and will go to an electric-only portfolio in 2028.

SONY HONDA MOBILITY

The new joint venture between Sony and Honda, named Sony Honda Mobility or SHM, unveiled its new brand AFEELA along with a prototype vehicle that, SHM says, "expresses its vision of creating a new relationship between people and mobility". The AFEELA name is intended to convey how people should "feel" mobility and how intelligent mobility systems should "feel" their environment.

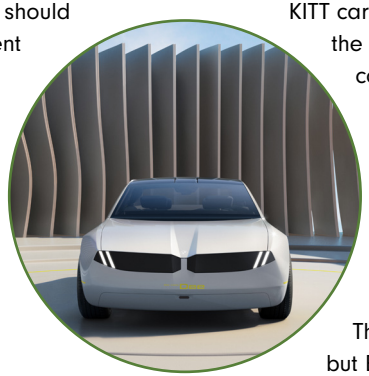
SHM said that pre-orders will start in 2025 and it expects US deliveries to begin in the first half of 2026, followed by Japan in the second half. Production will be carried out by Honda in its existing North American plants, which have plenty of excess capacity as Honda continues its years-long decline in market share.

Sony Honda Mobility's Afeela brand will sell cars from 2025

Although Honda is manufacturing the vehicle, customers won't be able to find one at a Honda dealership. That's because SHM will sell its models exclusively online and bypass the dealer network.

BMW

BMW Chairman Oliver Zipse was joined on stage by actor Arnold Schwarzenegger to introduce BMW's new concept car, called the iVision Dee. Through the use of artificial intelligence, the iVision Dee has its own personality and is able to talk with humans, like KITT from the 1980s hit TV show Knight Rider. In fact, BMW was able to bring the KITT car on stage to join Dee during the introduction. This intelligent concept car previewed future technologies being developed by BMW. The iVision Dee is the world's first full color-changing car using e-ink to showcase 32 different colors available to alter the vehicle's exterior appearance. The e-ink technology is amazing but BMW engineer Stella Clarke lowered expectations by saying it will be years, if ever, before it is actually used in production.



BMW iVision Dee uses artificial intelligence to talk with people

SPECIAL REPORT

BY SAM FIORANI

The over-capacity shake-up

There is a growing concern about excess capacity in vehicle production. Excess capacity has been the bane of the industry for decades as every vehicle manufacturer has competed to stay ahead of its rivals. With a focus on too many plants, manufacturers in Europe, North America and Japan leveled off in the early 2000s by maintaining an adequate production/sales balance to keep profits high. Additional competitors, first from South Korea and later China, have boosted global production capacity and put pressure on profits around the world.

Hyundai-Kia has developed into a global powerhouse and reached a level where production remains in the profitable range. The bigger problem came from China, where dozens of new manufacturers attempted to take their share of the quickly growing local market. Once local production volume satiated the Chinese market, exports would continue the growth. Larger manufacturers grew quickly, filled huge plants and are now looking at exports while many smaller manufacturers have disappeared.

Traditionally, targeting capacity utilization of more than 80% is the norm for profitable operation. Established plants in mature markets usually operate about that level except during model changeovers or labor issues. Rating a Ford or Volkswagen factory in the 70% range is rare. But this has changed in recent years with new plants by EV startups and expansion of the more successful Chinese manufacturers.

Now the market is shifting to EVs and manufacturers are finding it more efficient to build dedicated EV plants. Converting a plant designed to produced ICE vehicles misses the efficiencies gained from building a factory around the EV assembly processes. With this in mind, manufacturers are opening plants across the world to add EV production capacity.

These new plants are, for the most part, not replacing existing plants. And this list does not include planned expansions of existing plants such as the doubling of Stellantis's Kenitra plant in Morocco and expansion announced for Tesla plants around the world. Millions of units of added capacity can quickly be included if those plants were counted here.

Just from this sample group of new plants, planned capacity for light vehicle production is increasing by nearly three million units. Existing plants produced as many as 96 million units as recently as 2017 and the global market is not expected to top that output before 2028. What happens with all of this excess capacity? Obviously, plants will need to close.

During the current transition to EVs, manufacturers see their new products as adding incremental volume. Early adopters of these EVs are not necessarily displacing a sale of an ICE vehicle. Many early buyers of vehicles like the Tesla Model S or Lucid Air just want to be the first and have the money to add another vehicle to their personal fleet. Similar arguments can be made for vehicles like Ford's Mustang Mach-E and General Motors' GMC Hummer. As these models generate higher volumes of sales and more affordable offerings come to market, this incremental volume diminishes and new purchases will take away sales of legacy models, lowering the demand and, ultimately, reducing the need for legacy plants.

In North America, more than two million units of production will be added with new EV-only plants. GM is repurposing legacy plants for EV production and other manufacturers are expected to add EV production to existing plants in the short term, which should squeeze some volume capacity from ICE vehicle production, but there will be millions of units of additional capacity placing pressure on existing plants. If the startups – including Lucid, Faraday Future, Rivian and contract manufacturers Foxconn – are successful, Ford, GM, Stellantis, Toyota and Honda, as the largest manufacturers in the region, could need to take older plants offline in the next five to 10 years. This could displace tens of thousands of workers.

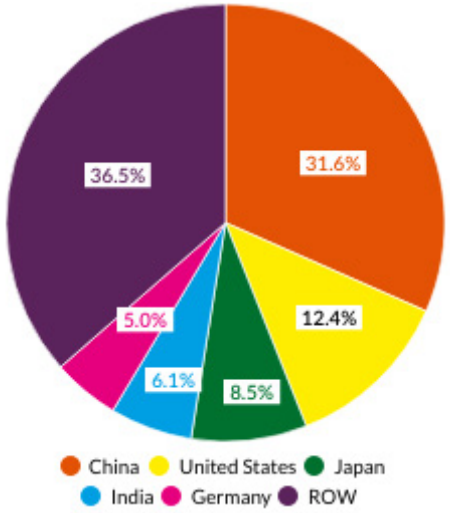
The simpler nature of the assembly of EVs will also reduce the workforce needed to build vehicles over the next 20 years, but much of that reduction will come from the closure of existing plants. Transitioning to EVs will progress slower than many in the industry believe, but there will be a transition. This will require plants to be closed and workers to be relocated to other plants or other industries. Yes, there is a growing concern for over-capacity in the industry. It will be addressed gradually and it will be divided between older ICE plants becoming redundant and EV startups failing to find a foothold in the market. This will, ultimately, be the biggest shake-up in the industry since the Great Depression, leaving only the best and luckiest to survive.

SAMPLE OF NEW PRODUCTION CAPACITY

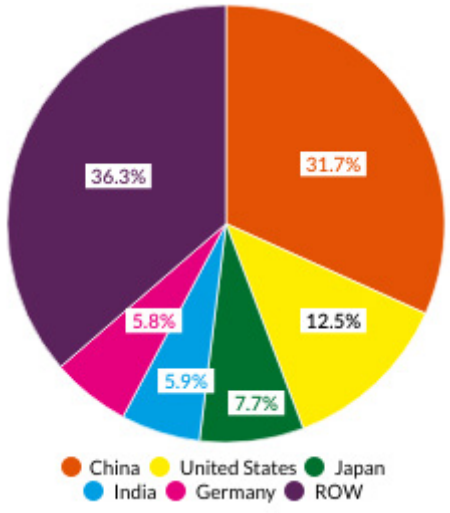
Manufacturer	Location	Scheduled Job 1	Planned Capacity
Foxconn	Lordstown, OH, USA	September 2022	250,000*
Faraday Future	Hanford, CA, USA	April 2023	60,000
CanoSo	Pryor, OK, USA	January 2024	50,000*
Via Motors	Detroit, MI, USA	July 2024	50,000*
VinFast	New Hill, NC, USA	July 2024	200,000
Hyundai Group	Ellabell, GA, USA	October 2024	300,000
Mahindra & Mahindra	Pune, India	December 2024	100,000
Lucid Motors	KAEC, Saudi Arabia	January 2025	155,000
Hyundai Group	Ulsan EV, South Korea	July 2025	200,000
Ceer Motors	Saudi Arabia	July 2025	150,000
Subaru	Oizumi EV, Japan	July 2025	50,000*
Rimac	Sveta Nedelja, Croatia	August 2025	30,000*
BMW	Debrecen, Hungary	August 2025	150,000
Ford Motor Company	Blue Oval City, USA	August 2025	400,000*
Foxconn	Rayong, Thailand	January 2026	50,000*
Rivian	Atlanta, GA, USA	July 2026	400,000*
Geely (Volvo)	Kosice, Slovakia	August 2026	250,000
Mercedes-Benz	Jawor, Poland	November 2026	100,000

*Estimated

2022 TOP 5 GLOBAL COUNTRIES



2029 TOP 5 GLOBAL COUNTRIES



TOP 5 BRAND OWNERS

Brand Owner	2022 Production	Brand Owner	2029 Production
Toyota Motor	10,665,866	Toyota Motor	11,089,749
Volkswagen	8,084,720	Volkswagen	9,259,737
Stellantis	7,180,837	Stellantis	8,452,452
Hyundai Motor	7,072,757	Hyundai Motor	8,034,864
Renault-Nissan-Mitsubishi	6,755,187	Renault-Nissan-Mitsubishi	7,528,203

TOP 5 GLOBAL PLATFORMS

CMF-B HS	2,754,235	CMF-B HS	2,888,386
NGA-C	2,248,783	KP2	2,220,669
MQB A1	2,109,880	NGA-C	2,199,776
NGA-K-SUV	2,056,337	NGA-K-SUV	2,154,744
N	1,881,780	Gen III	1,946,631

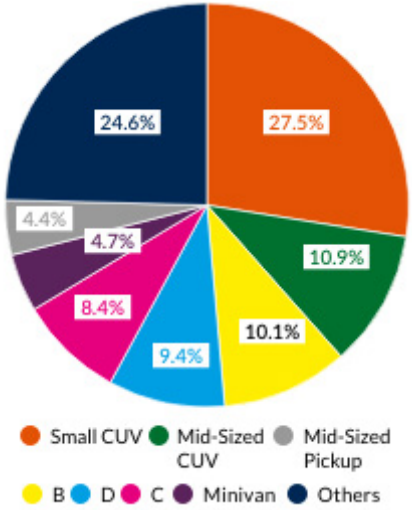
Renault-Nissan-Mitsubishi (CMF-B HS), **Toyota Motor** (NGA-C, NGA-K-SUV, NGA-C), **Tesla** (Gen III), **Volkswagen** (MQB A1), **Hyundai Motor** (KP2, N)

TOP 5 GLOBAL ASSEMBLY PLANTS

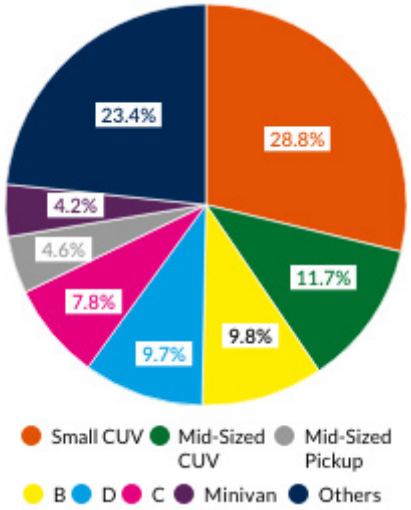
Manesar 1	1,067,306	Manesar 1	1,146,083
Chongqing Engine 1	1,048,865	Chongqing Engine 1	1,082,480
Liuzhou 2	780,826	Liuzhou 2	775,926
Gigafactory 3	756,941	Gigafactory 3	684,785
Xi`an 2	716,961	Beijing 1	670,810

Maruti Suzuki (Manesar 1) **Changan Auto** (Chongqing Engine 1) **SAIC-GM-Wuling** (Liuzhou 2) **BYD** (Xi`an 2) **Beijing Benz** (Beijing 1) **Tesla** (Gigafactory 3)

2022 TOP GLOBAL SEGMENTS



2029 TOP GLOBAL SEGMENTS



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