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Truck Production Index

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

2021 Truck Production Index (PSR-TPI) Loses 37%

Chris Fisher

Jim Downey

St. Paul, MN — **The Q4 2021 Power Systems Research Truck Production Index (PSR-TPI)** increased from 116 to 120, or 3.4%, for the three-month period ended December 31,2021, from Q3 2021. The year-over-year (Q4 2020 to Q4 2021) loss for the PSR-TPI was, 190 to 120, or -37%.

The PSR-TPI measures truck production globally and across six regions: North America, China, Europe, South America, Japan and Korea and Emerging Markets.

This data comes from OE Link™, the proprietary database maintained by Power Systems Research.

GLOBAL INDEX: We expect global production volumes in 2022 to gain 3.7% vs 2021, with a positive trend in all regions, except for China, where we expect production volumes to be down -3.6% in 2022 vs 2021. China experienced a surge in demand during 2020 due to the change in emissions regulations, so 2021 was down significantly, about 20%.

Power Systems Research TPI *Truck Production Index*

ALL REGIONS: Global demand for Medium and Heavy Commercial Vehicles (MHV) rebounded in 2021 but overall growth in the segment was flat. Going forward, we expect the growth to accelerate in 2022 and 2023. The exceptions to this rebound trend are in China and India, which continue to decline and sharply drive overall global production numbers into negative territory.

NORTH AMERICA: While supply chain disruptions continue to negatively impact the commercial vehicle market, medium and heavy commercial vehicle production is expected to finish 2021 15.8% higher than 2020. The forecasted production growth rate is expected to continue to show improvement through 2023 as supply chain disruptions ease and truck capacity in the market begins to align with demand. The disruption in the supply chain and on-going issues with COVID will continue to impact the market in 2022. **PSR**

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North America Economy

By Yosyf Sheremeta, PhD, Director of Product Management and Customer Experience

2022: Economy Will Grow, But at Slower Pace

2021 was a year of big hopes for economic recovery and pandemic management, and, overall, the economic rebound was strong.

Yosyf Sheremeta

SUMMARY. 2021 was a year of big hopes for economic recovery and pandemic management, and, overall, the economic rebound was strong. Looking at the state of the economy in general, and the key economic indicators such as GDP, interest rates, employment levels, etc., the North America market finished the year on a very high note. At the same time, development of new pandemic variants as well as ongoing issues with supply chains have led to manufacturing issues.

The second half of 2021 brought steady economic activities and strong economic recovery. Despite this strong performance, many existing and new challenges were seen. Problems from pandemic-related supply chain disruptions, logistics backlogs, and semiconductor shortages to new virus variations and labor market issues have contributed to slower growth in Q4 2021 than during the first half of last year.

Let's break it down. The "Great Resignation" means companies must make themselves more attractive to new hires, and it provides those workers who remain more leverage to change corporate cultures from the inside.

With help of government support and targeted fiscal policies, the US economy showed a strong comeback in 2021. Furthermore, the growth trajectory is well positioned to continue to expand into the next few years, however, at much slower pace, than in 2021.

At the same time, there are many reasons for us to be optimistic about this trend. Our positive outlook is based on the reviews of key economic indicators, including GDP, unemployment, and inflation. In our previous forecasts, we discussed recovery trends for the post-pandemic period, and called for a return of demand for most markets in 2021.

Power Systems Research remains optimistic in our projections. Many factors contribute to such an upbeat outlook. Current strong macro-economic data provides a solid basis for future growth. The level of economic activities remains strong. Low interest rates and positive trends in employment help support the economic rebound. The Infrastructure bill will also serve as a catalyst to generate new demand for the next few years and will continue to help drive the economic expansion.

At the same time, the economic expansion in 2022 will be challenged by ongoing issues such as the employment situation and inflation. Low unemployment, coupled with rising inflation, provide prime conditions for the Federal Reserve bank to increase interest rates, which have been at near zero levels.

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North America Economy

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We believe the current challenges and setbacks to the recovery efforts carried over from last year will be present at least during the first half of 2022. While the latest spikes of COVID variants are expected to go down by the spring of 2022, we also expect the logistics and supply chain challenges to improve significantly, and employment shortages present serious potential disruptions to the recovery trend.

Vaccine mandates, that are being challenged in courts, have also added to the workforce shortages. Service-oriented industries have been severely impacted, and industrial and manufacturing sectors face the same phenomena, where factories cannot meet current demand levels. Strong demand is linked with healthy consumer and business balance sheets, helped by generous monetary and fiscal policies.

We believe inflation is likely to keep rising globally through Q1 2022, as demand remained high throughout the holiday period, and ongoing disruptions to supply chains maintains pressure on input and output prices. At the same time, we expect inflation to peak in H1 2022 as economic growth normalizes, demand eases off, and supply issues begin to dissipate. There is already evidence of this in lower backlogs of work and a gradual increase in finished goods inventories. Furthermore, inflation will most likely stabilize at higher levels than we experienced before the pandemic.

The era of near zero interest rates is about to be finished. Given the outlook for the economy, the labor market, and inflation, it may become necessary to increase the federal funds rate sooner or at a faster pace than anticipated earlier. The Federal Reserve has put the wheels in motion for balance sheet reduction.

In minutes from its December meeting, the Federal Reserve Bank revealed discussions about a balance sheet reduction in addition to signaling rate increases and confirming an accelerating tapering. Market expectations currently are for the Fed to start raising its benchmark interest rate in March 2022, which would mean that balance sheet reduction could start before summer.

We expect to see four interest rate hikes in 2022 and an additional 2-3 increases in 2023-24 until we reach the levels of 2-2.5%. Despite higher interest rates in 2022-2023, we believe fiscal policies will still provide a favorable and healthy environment to continue economic expansion, while keeping inflation levels at healthy levels. Current conditions provide a solid outlook and reassurance for future recovery and growth at least for another 12-18 months.

The energy market will play a significant role in 2022-2023, both globally and in North America. Energy demand, production, and investment will remain out of sync this year as the transition to a global economy powered by renewable energy sources gains traction. It's an especially disruptive time in the global transition from fossil fuels to renewables.

In the short term, global economies are trying to squeeze fossil fuels out of their energy mixes without generating enough investment in renewable replacements or backup solutions. The economic impact will already be felt this year.

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The housing market remains strong. Housing starts in the US surged 11.8% to an annualized rate of 1.679 million in November 2021, the highest level since March and well above the consensus market of 1.568 million.

In North America, we are likely to experience continued high natural gas prices as investment in the unconventional sector is stymied by a combination of bearish investor sentiment and unclear current policy signals from the administration. The result will be both higher energy prices for consumers and a near-term policy collision with climate goals. The energy transition is already happening, but it certainly will not be smooth.

The housing market remains strong. Housing starts in the US surged 11.8% to an annualized rate of 1.679 million in November 2021, the highest level since March and well above the consensus market of 1.568 million. This number is also much improved (+64K units) from the previous report in August 2021.

The building materials market continued to experience pricing pressure as well as supply chain issues which impacted growth. Nevertheless, given the strong outlook for the economy, we expect the housing market to remain strong, which will directly help drive growth in segments like Construction, Industrial and L&G. The latest numbers on housing starts were much better than expected and we project the demand for housing to remain strong during H1 2022.

Across all market segments, we have seen overall total OEM equipment production numbers rebound in 2021 from 2020 losses. Cumulatively, OEM production within the 13 market segments we track in North America experienced a gain of 3.7% in 2021 vs. 2020. We expect the growth to continue to accelerate in 2022 at 12.3% vs 2021. This estimate is higher by 4.2% than the previous estimates in Q3 2021, mainly due to the much slower recover pace in H2 2021, employment challenges and supply chain issues.

The key drivers of the growth in 2022 will be the strong economy with healthy fiscal policy as well as high demand from consumers and business. We also expect employment levels to normalize along with significant improvements to the supply chains challenges we have experienced in 2020-2021.

While strong economic expansion was impacted by supply chain issues, manufacturing, and employment challenges, we continue to see strong demand across all sectors. However, the recovery and growth will vary considerably among market segments. Currently, we expect double digit growth in all segments except Agricultural equipment, which we estimate will gain 8.4% in 2022 vs 2021. Furthermore, the growth will continue into 2023-2024, however at slower pace than in 2022.

AGRICULTURAL. As the post-pandemic recovery continues, we expect the Ag segment to follow other industrial and heavy equipment industries. In 2022, we project the growth of agricultural equipment and machinery in North America to be at 8.4% vs 2021.

The Agricultural segment has weathered the pandemic better than other industrial sectors and is well positioned to continue its growth pattern in the next few years. The recovery will be steady, and we expect levels of production in 2022 to reach those of 2018.

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CONSTRUCTION EQUIPMENT. We expect the Construction machinery segment to follow strong economic recovery patterns. As housing starts regained ground in H2 2021 (after a temporary slowdown in Q2 2021), the demand remains very strong, mainly due to lack of inventory. Such conditions will drive the demand for new equipment. Given high levels of current and ongoing infrastructure spending, growth projections for the segment are favorable.

Our most recent overall projection on construction equipment and machinery production is positive at 10% in 2022 vs 2021, which is slightly higher than Q3 2021 estimates. Furthermore, we expect additional growth of 11.2% in 2023 vs 2022.

INDUSTRIAL. This segment typically follows the general economy, and the construction industry trends, with some minor equipment exceptions, such as forklifts. Currently, we expect an overall growth in production numbers at 10.3% in 2022 vs 2021 with additional growth of 12.8% in 2023.

Furthermore, industrial segment applications, especially material handling and smaller types of equipment stand ready to benefit from the trend to electric drive type power trains. This creates tremendous market opportunities, especially for new players and electric components suppliers. At the same time, existing OEMs and component suppliers have also been emphasizing innovation and new product development.

Consumer sectors, including **LAWN AND GARDEN**, **PASSENGER CARS**, **MINIVANS AND SUVs** as well as **RECREATIONAL PRODUCTS**, look very promising for the next few years. Not only have these segments entered a new cyclical uptrend, but they will also benefit from favorable fiscal policy (still low interest rates) and increased demand driven by the electrification trend within these segments.

LAWN AND GARDEN. The L&G segment continued its strong performance in 2021, driven by healthy demand and we estimate this trend will carry over into 2022-2023. Currently, we project 13.5% growth in 2022 vs. 2021 with additional growth of 6.6% in 2023. Despite many challenges, the Lawn and Garden market is set to establish one of the strongest adoption rates among all segments in the introduction of battery-powered models and technologies. In addition to the consumer side, we also see this trend sparking a significant interest among commercial buyers for Lawn & Garden equipment.

During the past few quarters, Power Systems Research has been gathering intelligence on these electric models, and we will complete data collection and release this information to our client databases over the next few quarters. Given current market circumstances and the trend in the industry, we believe electric models will follow similar growth rates to its ICE units and will greatly gain market share at the expense of ICE-powered equipment. Government regulations towards zero emissions in smaller equipment certainly helps drive the electrification trend and improve adoption rates.

PASSENGER CARS and MINIVAN/SUVs. Strong demand supported by low interest rates and a re-opening of the economy will help these segments regain

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We have already started to witness introduction of EV technology across all major OEMs, and we expect this trend to significantly accelerate in the next few years.

ground in 2022. At the moment, we expect the segment to post a solid year, mainly due to very strong demand for personal transportation.

However, given the current trend, specifically the market transitioning to SUVs and consumer preferences, the production volumes of passenger cars will likely never fully come back to the levels of 2016-2017. Not only has the segment been severely impacted by the pandemic and lockdowns, but ongoing supply chain issues and semiconductor shortages slowed recovery efforts. Currently, we estimate production for passenger cars in 2022 to be up 10.1%. This is a good rebound after the double digit decline the past two years. Furthermore, we expect the market to continue to grow at 5.5-6.8% in 2023-2024, respectively.

2022 promises to be great year as the strong demand carried over from last year and supply chain issues have started to ease. We project the Minivan/SUVs segment will gain 12.7% in 2022 vs. 2021 and 8.2% in 2023, respectively.

We have already started to witness introduction of EV technology across all major OEMs, and we expect this trend to significantly accelerate in the next few years. With the introduction of new and improved technologies, including fast charging, extended range, and infrastructure development, we estimate significant improvements to adoption rates of these technologies, which will increase the transition rate from ICE powered models to non-fossil fuels.

POWER GENERATION. This segment will mainly follow other industrial segments and will gain 12.9% in 2022 vs. 2021 which also performed well at 10% last year vs 2020. The recovery is supported by healthy demand and a strong level of economic activities. We expect the segment to continue to improve in 2023 at 6.5% vs. 2022. Key demand drivers for the segment come from data centers, healthcare, and infrastructure development.

In line with the electrification trend in other segments, we expect the market of stored energy to rapidly accelerate in the coming years, which will significantly impact established product lines powered by ICE units. This transition will start to disturb the current market preferences; at the same time, it will help create new products and new opportunities in the markets of backup power and portable power as well.

RECREATIONAL VEHICLES. Recreational Products follow similar patterns to other consumer products; however, the pandemic provided a solid growth boost for the segment. We project another strong year at 15.3% growth in 2022 vs 2021, and 11.6% in 2023 vs 2022.

We believe the strong demand for recreational vehicles (motorcycles) will fall in the next few years and the industry will mainly focus on the recreational end use and purpose. Furthermore, we expect continuous redistribution of power and balance among industry OEMs as demand for products changes with demographics. We will see new OEMs entering the market with new products and electric powertrain technologies, as they hunt for increased market share. **PSR**

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NA Commercial Electric Vehicle Update

By Chris Fisher, Senior Commercial Vehicle Analyst

NA Medium and Heavy EV Market In Early Testing

Chris Fisher

Q. What is the current state of electric vehicle technology globally as well as the U.S.?

A. From a medium and heavy truck perspective, electric trucks are still in the early stages of testing, and it will still be a few years before we know if the current technology will be effective. Transit or city buses are much further along in the process since these are largely not for profit vehicles and have more dedicated routes that allow for more consistent recharge.

China is probably the furthest along with electric bus adoption with almost half of all medium and heavy buses produced being electric. While electrified bus adoption in North America and Europe is not nearly as strong as China, demand is increasing. In North America, natural gas buses (CNG and Propane) are currently the alternative fuel of choice. However, government mandates will likely force bus electrification over the next decade or so.

Q. What type of growth does PSR project and in which segments?

A. At this point, we believe the growth will be in the transit bus and pickup/delivery segments where charging infrastructure is more readily available. Since transit bus purchases are typically controlled by local and state governments, this will be a prime segment for electrification.

Many of the large cities in the United States have committed to 100% adoption of electric transit buses. For example, Los Angeles plans to be all electric by 2030 while Seattle, New York and the state of California plan to have all electric transit buses by 2040. For the regional and long-haul segments, the lack of charging infrastructure will be the most significant barrier to mass truck adoption. Until battery range issues and an adequate charging infrastructure is developed, there is no business case to implement battery electric long-haul trucks. This segment will be relegated to testing and showcasing.

Q. What are PSR's thoughts on the future of medium and heavy commercial EVs?

A. We think the majority of the transit bus segment will ultimately be electrified as various government mandates will require the cities to be zero emission compliant.

The future of medium and heavy commercial trucks largely remains uncertain since they are still relatively early in the testing phase, and it will be a few years before the testing is complete. For medium and heavy trucks, significant barriers to mass adoption will need to be overcome, including an adequate nationwide charging infrastructure and increased battery range.

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NA Commercial Electric Vehicle Update

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Advantages of electric vehicles include elimination of fuel cost and reduced maintenance cost since EV's have significantly fewer moving parts than the traditional ICE powered commercial vehicle.

Since the trucking industry is for-profit, government regulation and incentives will likely be needed to encourage large scale truck adoption. Even with the recently passed infrastructure legislation, I don't see large scale adoption in the regional or long-haul segment for at least a decade primarily due to the lack of a robust infrastructure grid nationwide.

Hydrogen fuel cell vehicles may be the best solution to achieving zero-emissions for regional and long-haul trucks over the longer term. However, fuel cell technology is in the very early stages of testing and will require the creation of a significant re-fueling infrastructure.

Q. What are the benefits and challenges of EV technology?

A. Advantages of electric vehicles include elimination of fuel cost and reduced maintenance cost since EV's have significantly fewer moving parts than the traditional ICE powered commercial vehicle. However, electric commercial vehicles will continue to compete with other technologies such as natural gas and possibly hydrogen fuel cells.

Fuel economy improvements to the traditional engines could also impact electric vehicle adoption rates. One of the biggest challenges is the lack of a nationwide charging infrastructure. This will greatly limit adoption rates in the regional and long-haul truck segments. Other challenges for electric trucks include high up-front costs, battery weight, range anxiety and range reduction in cold weather.

DATAPOINT: *North American Harvesters* 460

By Carol Turner, Senior Analyst, Global Operations

460 units is the estimate by Power Systems Research of the number of agricultural harvesters to be produced in the U.S. during 2022.

This 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 48.5% of total units produced, Deere leads in production of Harvesters in the U.S. In second position is Oxbo International's combined plant totals of 24%; third, is Flory with 10.5%.

Export: Collectively, up to 1% worldwide.

Trends: In 2021, production of Harvesters in NA increased 13% to 449 units. Production is expected to gain another 3% in 2022. The Ag industry has fluctuated in recent years and demand for new products declined a few years

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Datapoint

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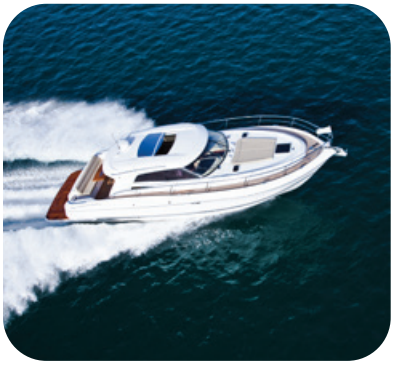

ago due to falling commodity prices. Farmers couldn't afford new equipment and spent years refurbishing existing units.

Currently, it appears that growers are moving from hand to machine harvesting. They are increasingly using over-the-row mechanical harvesters to pick produce and like commodities. Especially during COVID times, this type of machinery reduces the need for manual labor during labor shortages. The increase in harvester production is also attributed to the desire for new machinery that increases productivity and profitability.

Expect production to fluctuate over the next 3-5 years with an increase of 5% by 2025. **PSR**

Europe Report

By Natasa Mulahalilovic, Finance and Administration Manager – Europe

Hybrid Electric-Hydrogen Maritime Propulsion System

Natasa Mulahalilovic

Germany-based Torqeedo GmbH and Proton Motor Fuel Cell GmbH are jointly developing a hydrogen hybrid propulsion system for the marine industry. The ambitious and innovative project is provisionally named "Ma-Hy-Hy" (Marine Hydrogen Hybrid) and is funded by the Bavarian federal government until 2024.

Proton Motor Fuel Cell GmbH specializes in a high-tech innovative, climate neutral energy solutions, especially in CO2-neutral and emission-free hydrogen fuel cells and electric hybrid systems for stationary, automotive, rail and maritime applications. Development and production sites are located in the Munich area.

Torqeedo GmbH, as a part of the Deutz group, is a market leader in development and production of lithium batteries, solar charging equipment, electric and hybrid drives. It offers outboards and inboards, electric motors and hybrid drive systems ranging from 0,5 to 100 kW on motor level (up to 200 kW on system level).

The Marine Hydrogen Hybrid project complements Torqeedo's Deep Blue Hybrid range with the Proton fuel cell system to get a carbon-free hybrid electric-hydrogen kit adaptable to different categories of commercial ships and recreational boats.

The system specifications include:

- fuel cell with a power between 30 and 120 kW
- battery pack between 40 and 160 kWh
- electric motor offering 50 and 200 kW of power
- variable hydrogen storage capacity

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Europe Report

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Partners will mutually work on industrialization, marketing, and sales solutions of the output after its validation.

The Bavarian government selected the project for funding as the new propulsion system can be implemented in both, inland and offshore maritime sectors, globally contributing to sustainable and "zero-emission" maritime energy transition.

Read Proton-Motor, **Read Torqeedo**, **Read ElectricHybrid**, **Read Proton-Motor**

PSR Analysis. Germany and its states work hard to develop and implement an advanced hydrogen strategy, investing €8 billion in hydrogen projects. The country is working to become an international leader in production and exportation of a green energy technologies, focusing on green hydrogen. **PSR**

Brazil/South America Report

By Fabio Ferraresi, Director Business Development-South America

Embraer/Eve Formalizes Flying Car Registration

Fabio Ferraresi

Eve Urban Air Mobility, the branch of aircraft giant Embraer, says it has started the process to register its eVTOL, Electric Vertical Take Off and Landing, vehicle at ANAC, the Brazilian bureau for aircraft certification and tied to international bureaus. Getting this documentation is the most important step for starting its commercial operation programmed for 2026. With this certification Eve will meet international standards of air navigation and safety.

Source: *Automotive Business* **Read The Article**

PSR Analysis: Although the aircraft business is not exactly at the scope of products we currently cover, this launch will impact the mobility industry and we are monitoring it closely. Eve has already set 17 partnerships and has a booking of 1700 units, more than many EV makers making a lot of noise in the industry and media. **PSR**

Scania Tests Euro VI Engine in Brazil

The 13 liters with Scania Twin SCR aftertreatment developed in Sweden is tested in Brazil for the new Proconve P8 products, already in place for new models and mandatory for all models by January 2023. The homologation process at IBAMA is already advanced but may show adaption needs to Brazilian environment. This engine is part of a completely new powertrain and brakes system with higher efficiency and lower emission. The power range vary from 420 to 560 hp and it is prepared for HVO use.

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Brazi/South America Report

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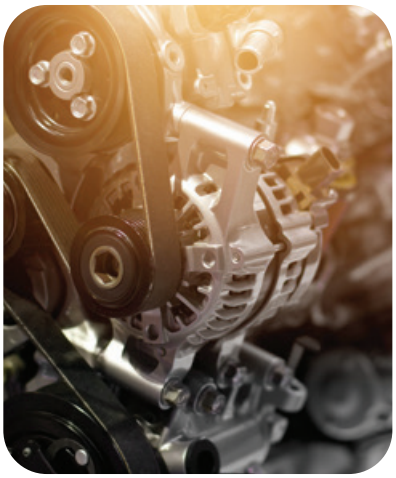

Source: *Automotive Business* **Read The Article**

PSR Analysis: The use of edge technology at Scania Trucks in Brazil is in line with the amount of exports Scania makes to Europe and to lower emission regions. The higher efficiency will bring increased sales to South America as fleet owners seek lower fuel consumption. **PSR**.

Low Interest Funding Set for Low Emission Machines

The program called Low Carbon FINAME is dedicated to the acquisition of new machines that contribute to carbon emission reduction, with a focus on EV Buses, EV Trucks and Off-Highway Machines electric and Hybrid. OEMs have to register their products before December 2024 to access lower interest rates.

Source: *M&T* **Read The Article**

PSR Analysis: The incentives for funding are an important driver to make an EV competitive when compared to an ICE in Brazil, a country with high interest rates and high cost of capital. Historically, lower interest rates caused high sales and bubbles in key segments as CE and MHV. We are closely monitoring the funding conditions and the impact it will bring to key market segments. **PSR**

China Report

By Jack Hao, Senior Research Manager - China

Bosch Qingling Builds Hydrogen Fuel Cell Plant

Jack Hao

Bosch Qingling has begun construction on Bosch's first R & D Center for hydrogen fuel production in the world, a national hydrogen fuel cell engine production base and a national hydrogen energy commercial vehicle production base.

The hydrogen fuel cell engine project is being built jointly by Bosch (China) Investment Co., Ltd. and Qingling Group, with a total investment of about US$ 470 million (2.98 billion yuan).

Bosch predicts that by 2030, about 12.5% of new commercial vehicles in the world will be powered by fuel cell vehicles. In order to further promote the industrialization of hydrogen power in China, Bosch began to lay out the construction of a new plant in. At present, it has completed the preparations such as overall planning and design, and officially started construction today.

The site covers a total area of about 240,000 square meters. In the first phase, about 99,900 square meters of R & D and testing center, production and manufacturing center and office area will be built. It is expected to be operational by the end of May 2023.

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China Report

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At present, hydrogen fuel cell vehicles are in the initial stage. Today, hydrogen fuel cell commercial vehicles, and hydrogen fuel cell passenger vehicles account for less than 0.1% of the global population of these vehicles.

Source: *Sohu* **Read The Article**

PSR Analysis: According to the forecast data previously released by the international Hydrogen Energy Commission, hydrogen energy will provide 18% of the global energy demand in 2050, which is expected to create a market of more than US $2.5 trillion, and fuel cell vehicles will account for 20-25% of global vehicles.

At present, hydrogen fuel cell vehicles are in the initial stage. Today, hydrogen fuel cell commercial vehicles, and hydrogen fuel cell passenger vehicles account for less than 0.1% of the global population of these vehicles. It is expected that the number of hydrogen fuel cell vehicles population in China will increase from 7,352 units in 2020 to 100,000 units in 2025.

The compound annual growth rate is expected to reach 68%, and the market scale is expected to reach 80 billion yuan. The balance between the total life cycle cost (TCO) of hydrogen fuel cell vehicles and the cost of competitive products such as pure electric vehicles in the future is an important turning point for the improvement of market penetration of hydrogen fuel cell vehicles in various segments. The development of subsidies will play an important role in the development of the vehicle market. **PSR**

Far East: Japan Report

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

Yamaha Motor To Launch Electric Motorcycles in Europe

Akihiro Komuro

Yamaha plans to launch a series of electric motorcycles in Japan and overseas this spring. Electric motorcycles with an engine displacement equivalent to 125cc will be leased and sold on a trial basis in Europe, Japan and other countries. In response to the global trend of decarbonization, Yamaha has set a goal of reducing CO2 emissions to virtually zero by 2050. The 125cc equivalent electric motorcycle has been on the market in Taiwan, but this is the first time it has been offered in Europe and Japan.

The new motorcycle has been developed based on the E01 concept vehicle, which was unveiled at the 2019 Tokyo Motor Show. The company avoided mentioning specifics about the range and other specifications but said that the E01 would be equipped with a high-powered fixed battery that can run at high speed while meeting the range requirements for daily use, and that it would support quick charging as well as normal charging.

Like the E01, the 50cc equivalent electric motorcycle, developed based on the E02 unveiled at the Tokyo Motor Show, is planned to go on sale in Europe this spring. President Hidaka said that the 125cc equivalent will be "marketed

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Far East Report

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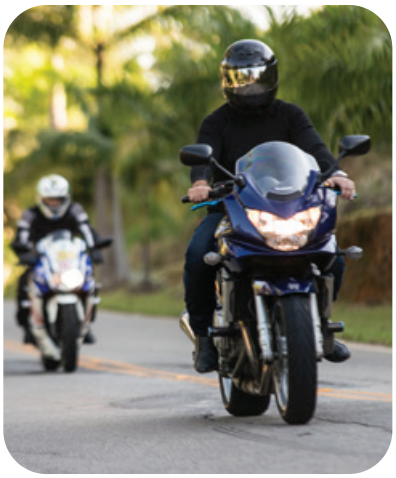

as widely as possible (in Asia and other regions) in the future," but the 50cc equivalent has yet to be launched outside of Europe, where there is demand for city driving.

The "E01" is a 125cc equivalent (rated output of 1 kW or less) urban commuter that can also be quickly recharged, while the "E02" is a 50cc equivalent (rated output of 0.6 kW or less) that can be easily used with a removable battery.

Of the 86,000 motorcycles sold in Japan in 2020, 9,000 of the Beano engine models were sold annually, but only 500 of the electric models were sold.

The company will compete with Chinese companies, which have an advantage in terms of price, safety and other factors. It is essential to reduce costs, especially for batteries, to shift to electric vehicles.

Source: The Nikkei

PSR Analysis: There is no doubt that the electric motorcycle market will grow significantly in the global, eroding the traditional gasoline model market. However, if we look only at the Japanese market, the trend may be on a much smaller scale.

One of the main reasons for this is the small acceptance of motorcycles in Japan. In the 1980s, when the driving manners of young riders and traffic accidents became a social problem, there was a belief that motorcycles were not good for the world and were dangerous vehicles. Some people may laugh at the idea that this was a long time ago, 30 to 40 years ago, but for those who were adolescents back then, this kind of social imprinting has had a surprisingly large impact on them.

A web search on the word "motorcycle image" shows that not a few people have a negative impression of motorcycles. Even though high school students are old enough to obtain a motorcycle license, in reality, they could not ride a motorcycle even if they were interested due to school rules or parental decisions at home. There was a time when it was considered socially acceptable to forbid it. As a result of this situation that has lasted for a long time, the number of parking spaces for motorcycles remains infinitely small, even in urban areas.

Both Yamaha and Honda are aware that the development of electric motorcycles is the key to their survival, and they are working hard to improve the performance and safety of their bikes and release them at internationally competitive prices. However, one of the main reasons why such models have to be leased is that the market is not ready for them to become popular in the domestic general market. Have you ever heard of the anime movie "AKIRA" that depicts the fictional year 2019? The main character was riding an extremely stylish EV bike. The movie was released 30 years ago, but the reality is not quite like the movie. Just like the shocking launch of the iPhone and the instantaneous development of the 5G environment, the motorcycle market may need a shocking product launch. **PSR**

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極東 > 日本レポート:

小室 明大 – 極東及び東南アジア リサーチアナリスト

ヤマハ発動機、新電動バイクを今春以降投入　欧州などで

ヤマハは今春以降、国内外で新たな電動バイクを順次投入する。エンジン排気量125cc相当の電動バイクを欧州や日本などで試験的にリース販売する。世界的な脱炭素の流れを受け、2050年にCO2排出量を実質ゼロにする新たな目標を掲げた。

125cc相当の電動バイクは台湾では展開しているが、欧州や日本向けの投入は初めて。2019年の東京モーターショーで披露したコンセプト車「E01」をベースに開発してきた。航続距離などの仕様について具体的な言及を避けたが、E01は日常的な利用で航続距離を満たしつつ、高速走行できる高出力な固定式の電池を搭載し、通常の充電だけでなく急速充電にも対応するとしていた。

E01と同様、東京モーターショーでお披露目した「E02」をもとに開発した50cc相当の電動バイクは今春、欧州で市販する計画だ。着脱式の電池を採り入れ、街中での移動向けとなる。125cc相当は「今後（アジアなどで）なるべく広く展開する」（日高社長）が、50cc相当は街乗り需要がある欧州以外への投入は未定という。

「E01」は急速充電にも対応した125cc相当(定格出力1kW以下)の都市型コミューターで、「E02」は着脱式バッテリーにより手軽に使える50cc相当(定格出力0.6kW以下)となる。

2020年の国内の二輪車販売8万6000台のうち「ビーノ」のエンジン車は年9000台売ったが、電動車は500台に限られる。「それが現時点の顧客の評価」（日高社長）という。

価格面で優位な中国勢などには安全性などで対抗するが、電動化シフトに向けて電池を中心としたコスト引き下げは不可欠だ。

出典: 日経（一部筆者により元記事内容を改編しました）

PSR 分析: 電動バイク市場は従来のガソリンモデル市場を侵食するかたちで大きな成長を遂げていく。それがグローバル市場の分析であることに間違いは無いが、こと日本国内の市場に限って見た場合、その潮流はだいぶ小規模なものになってしまうのかもしれない。ひとつの大きな理由は、社会がバイクを許容する受け皿の小ささが挙げられる。

若年層ライダーの運転マナーと交通事故が社会問題になった1980年代に、バイクは世の中にとって良いものではない、危険な乗り物である。という考え方があった。30～40年前の遠い昔のことだ、と笑う人もいるかもしれないが、そのころに思春期だった人たちにはこうした社会の刷り込みは案外大きな影響を与えているものだ。「バイク　イメージ」というワードでWeb検索をすると、ネガティブな印象を持っている人が決して少なくないことが分かる。高校生が年齢的に

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The T7X is the world's first fully electric construction equipment that eliminates all hydraulic components. It is comparable in performance to existing internal combustion engine equipment and emits no harmful substances.

はバイクの免許を取得可能でも、実際には学校の校則や家庭の親の判断によって興味はあっても乗れなかった。禁じるのが社会通念的にも正しい、とされていた時代があったのだ。こうした状況が長く続いた結果、都市部でも二輪の駐車場は限りなく少ないままである。ヤマハもホンダも、電動バイク開発が生き残りの鍵と自覚しており、高性能と安全性を高め、さらに国際的な競争力がある価格でリリースしたいと、懸命の努力を続けている。だが、そうしたモデルであっても、リース販売のかたちをとらざるを得ないのは、国内一般市場に普及するための環境が、市場側に整っていないことが大きな一因である。

架空の2019年を描いたアニメ映画「AKIRA」をご存じだろうか？主人公が乗っていたバイクは、極めてスタイリッシュなEVバイクだった。この映画が公開されたのは30年も前だが、果たして現実は映画のようにはなっていない。もはや従来のガソリンモデルをEV化したところで市場に与えるインパクトはほぼ無い。iPhoneが衝撃的に発表され、瞬く間に5G環境が整備されつつあるように、バイク市場にとっても、衝撃的な製品投入が求められているのかもしれない。**PSR**

Far East: South Korea Report

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

Doosan Bobcat Aims at NA Market with Fully Electric T7X

Doosan Bobcat unveiled the world's first fully electric construction equipment to the global market through CES 2022, the world's largest technology exhibition.

Doosan Bobcat held a media day event at the Mandalay Bay Convention Center in Las Vegas to introduce the T7X, which won two CES 2022 Innovation Awards.

The T7X is the world's first fully electric construction equipment that eliminates all hydraulic components. It is comparable in performance to existing internal combustion engine equipment and emits no harmful substances. Noise has been greatly reduced to one-tenth the level, and energy efficiency has been maximized.

The Doosan Bobcat also has achieved a strategic partnership with Sunbelt Rentals, a rental company in the North American region.

Source: The Aju News

PSR Analysis: Many companies have been actively working on the development of electric construction equipment. Among them, this loader announced by Bobcat is worthy of attention.

It uses an actuator instead of a hydraulic system, eliminating the need for up to 57 gallons of hydraulic oil used in previous models, and only requiring one quart of coolant. This means that the loader requires virtually no fluid, which contributes lower maintenance costs, which will be a big advantage for users.

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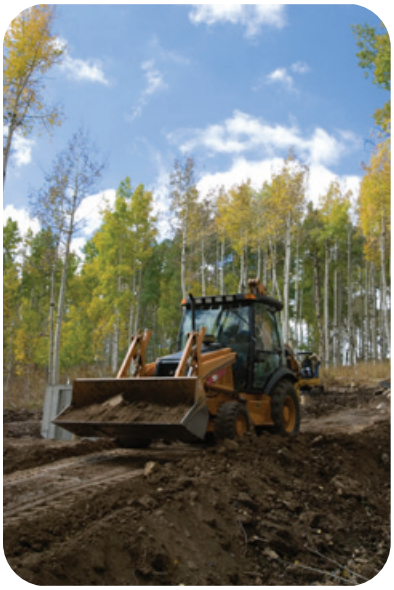

The power source is a 62kW lithium-ion battery, and the system recognizes the load at the time of operation and automatically reduces the power for light loads to extend the runtime. The system also enables performance analysis through two-way telematics communication.

Performance is comparable to engine models, with zero harmful substances. Noise is 10% of the engine model, vibration is almost zero, and energy efficiency has been maximized. This release is a milestone for electrification in the loader world and may be just what the market needs. I feel that this is a product could be a benchmark for other manufacturers. **PSR**

極東 > 韓国レポート:

小室 明大 – 極東及び東南アジア リサーチアナリスト

斗山ボブキャット、完全電動式「T7X」掲げて北米市場攻略へ

斗山ボブキャットが世界最大の技術展示会「CES 2022」を通じ、世界初の完全電動式の建設装備をグローバル市場に披露した。

斗山ボブキャットは米ラスベガスのマンダレーベイコンベンションセンターでメディアデー行事を開催し、「CES 2022革新賞」2つを獲得した「T7X」を紹介した。

T7Xは油圧関連部品をすべて除去した世界初の完全電動式の建設装備だ。既存の内燃機関装備に匹敵する性能を備えるともに、有害物質はまったく排出しないのが特徴だ。騒音は10分の1水準に大きく減り、エネルギー効率は極大化された。 斗山ボブキャットはT7Xのこのような長所を前面に出し、北米地域のレンタル企業である「Sunbelt Rentals」と戦略的パートナーシップを締結する成果も収めた。

出典: 亜州経済 (一部筆者により元記事内容を改編しました)

PSR 分析: 建機の電動化についてはこれまでも多くのが積極的に開発に取り組んでいる。その中でも今回ボブキャットが発表したこのローダーは注目に値する。

油圧システムの代わりにアクチュエーターを使用しており、従来モデルで使用されていた最大57ガロンの油圧オイルは不要になり、1クォートのクーラントが必要になるだけだ。つまり実質的にこのローダーは液体を必要としていない。それによって維持コストも低く抑えられるというのは、ユーザーにとって大きなアドバンテージになるだろう。動力源としては62kWのリチウムイオン電池を搭載しており、システムが動作時の負荷を認識し、軽負荷の場合は自動的に電力を削減し、ランタイムを伸ばす。また、双方向テレマティクス通信によるパフォーマンス分析も可能にしている。

エンジンモデルに匹敵する性能、有害物質はゼロ。騒音はエンジンモデル比

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10%、振動もほとんど無く、エネルギー効率は極大化された。このリリースはローダーの世界でひとつの電動化の到達点であり、市場に求められているその者かもしれない。他メーカーにとっての指標になり得る製品のリリースだと私は感じる。**PSR**

Thailand's state-owned energy giant, PTT says it will start producing EVs in 2024 in a joint venture with Taiwan's Hon Hai Precision Industry.

SouthEast Asia: Thailand Report

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

PTT and Hon Hai To Produce 50,000 EVs in 2024

Thailand's state-owned energy giant, PTT says it will start producing EVs in 2024 in a joint venture with Taiwan's Hon Hai Precision Industry. They will build a plant in eastern Thailand with an annual production capacity of 50,000 units, which they plan to increase to 150,000 units by 2030.

PTT and Hon Hai have established a joint venture company, Horizon Plus, which is 60% owned by PTT and 40% by Hon Hai, to produce EVs. The two companies had signed a joint venture agreement in September 2009. The total investment is expected to be US$ 1 billion to US$ 2 billion.

Based on the platform for EVs developed by Hon Hai, the company will produce vehicles in cooperation with auto parts companies clustered in Thailand.

Thailand, the largest auto producer in Southeast Asia, has set a goal of having 30% of its domestic vehicles be EVs by 2030. However, Japanese automakers, which account for 90% of the domestic production, are prioritizing EV production in Europe, the US, and China.

The Thai government hopes to encourage local parts manufacturers and others to shift to EVs through PTT, the largest state-owned company in Thailand. To promote the use of EVs, PTT started a rental business for EVs sold by other manufacturers on April 4. The company is also installing EV chargers at its service stations throughout the country. In October 2009, Hon Hai unveiled its first EV prototype. The company plans to mass-produce it in Thailand, China, and the US.

Source: The Nikkei

PSR Analysis: Thailand is becoming the center of a new EV competition. China's Great Wall Motor (GWM) has also announced that it will launch five EV models locally within this year. Changan Automobile, Geely Automobile, and Chery Automobile are also planning to enter the Thai market. Mercedes-Benz will also start producing EVs by the end of this year, and Foxconn has already announced that it will set up an EV plant in Thailand.

In 2020, Thailand will have 40 million vehicle registrations, of which EVs will account for only about 0.5%, while EV registrations will grow at a compound

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SouthEast Asia Report

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annual growth rate of 24% between 2016 and 2020, increasing from about 81,000 to about 192,000.

Many companies are bringing EVs to market, driven by investment support from Thailand's Board of Investment (BOI). The ambitious forays by Chinese companies are particularly noteworthy, and it will be very important to see how Japanese companies, with their high market share, will compete in Southeast Asia. Toyota has announced 15 models of BEVs, many of which will be launched in Thailand. The competition will intensify. **PSR**

東南アジア > タイレポート:

タイ石油公社、鴻海と24年からEV生産　年産5万台

タイ国営のエネルギー大手、タイ石油公社（PTT）は台湾の鴻海精密工業と合弁で2024年からEVの生産を開始すると発表した。タイ東部に年産5万台の工場を建設する。30年までに同15万台に増強する計画だ。PTTが60%、鴻海が40%出資して、EV生産を手掛ける合弁会社「ホライゾン・プラス」を3日に設立した。両社は21年9月に合弁契約を結んでいた。総投資額は10億～20億ドルを見込む。鴻海が開発したEV向けのプラットホームを基に、タイに集積する自動車部品会社と連携して車両を生産する。

東南アジア最大の自動車生産国であるタイは、30年までに国産車の3割をEVにする目標を掲げる。しかし、国内で生産シェアの9割を占める日本車メーカーは、欧米や中国でのEV生産を優先している。タイ政府は最大の国営企業であるPTTを通じて、地場の部品メーカーなどにEVシフトを促したい考えだ。PTTはEV利用を推進するために、4日から他メーカーが市販するEVのレンタル事業を始めた。全土で展開する給油所にEV向け充電器の設置も進めている。鴻海は21年10月に同社初となるEVの試作車を公開した。タイのほか中国や米国で量産を計画している。

出典: 日経（一部筆者により元記事内容を改編しました）

PSR 分析: タイが新たなEV競争の中心になりつつある。中国の長城汽車（GWM）も年内にEV5モデルを現地投入すると発表している。また、Changan（長安汽車）、Geely（吉利汽車）、Chery Automobile（奇瑞汽車）らも進出を計画。メルセデスベンツも年内でEVの生産を開始、FoxconnもEV工場をタイに設置することを発表済みだ。2020年のタイの自動車登録は4,000万台で、このうちEVが占める割合は約0.5%にすぎない。だがその一方で、EVの登録台数は2016年から2020年にかけて年平均成長率24%で推移して、約8万1,000台から約19万2,000台に増加している。タイ投資委員会（BOI）による投資支援を追い風にして多くの企業がEVを市場に投入している。

特に中国勢の野心的な進出が目を引くが、高いシェアを持っている日本勢が東南アジアでどう対抗するのかは非常に重要になる。トヨタは15車種のBEVを発表したが、多くはタイにも市場投入されるだろう。競争は激化する。**PSR**

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India Report

By Aditya Kondejkar, Research Analyst – South Asia Operations.

Union Budget Push To Expand Highways and EVs

Aditya Kondejkar

The 2022-2023 Budget is focused on building long-term strength using investment as the growth lever while maintaining policy stability and inclusivity. The 35% increased capex outlay, major infrastructure projects like 25,000 km road construction, 100 Cargo terminals, Project GatiShakti, 5G network, optic fiber cable laying and the recent PLI schemes are major positives.

Source: *Auto Guide India* **Read The Article**

"The blueprint of a digitally enabled, Aatmanirbhar Bharat, coupled with measures that will drive sustainable yet inclusive growth at a rapid pace for the next twenty-five years are the bedrock of the proposals announced in the Union Budget 2022-23, as we redefine our economy in a post-pandemic world. Setting the direction for creation of urban fossil fuel free zones, policy for battery swapping and energy as service and incentives for creating a vibrant start-up eco system, India could soon emerge as a fore-runner of green mobility solutions for the world" **- Sunjay J Kapur, President ACMA** (Automobile component manufacturers association of India)

PSR Analysis. The Union Budget 2022 seeks to lay the foundation for the next 25 years, from India@75 to India@100. With PM's 'Gati Shakti National Master Plan', a Rs 100-lakh crore project for building comprehensive infrastructure in India, it will be a significant step towards path to development. The Budget attempts to focus on each of the sectors and has also tried to stimulate the economy after the pandemic slowdown.

There is a clear emphasis on creative, sustainable and innovative business models. Battery Swapping and Energy as a Service (EAAS) will help accelerate the transition towards Clean Mobility. The development of special mobility zones for electric vehicles and promoting clean technology for public transport validate government's commitment to E-mobility, which would boost confidence in the EV industry in terms of manufacturing, sales, and it will create a sense of assurance among customers.

Further, the Government also revealed in the budget its plans for developing 25,000 kilometers of new highways in the next financial year. This will result in a push for infrastructure spending and in turn ensure an increase in Commercial Vehicle sales in the country.

Apart from this, the Finance Minister also announced that to promote the use of environment friendly blended fuels in the country, non-blended fuels will attract an additional excise duty of Rs. 2/liter starting in October 2022. This will also help in reducing the Petroleum imports into the country. **PSR**

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Russia Report

By Maxim Sakov, Market Consultant, Russia Operations

New Russian 653hp Engine for Grain Combines

Maxim Sakov

Tutaev Motor Plant has completed creation of 18.5 liter 8 cylinder Vee diesel engine TMZ-8807.10 with two turbochargers, electronic operation system and iron cast cylinder block heads. The powertrain pushes out 653 hp and is a part of new engine family, the TMZ-880. The development of the TMZ-880 family was started in 2016.

The new engine will be tested on the AG combine Palesse KVK-8060 made in the Belorussian Gomselmash plant in 2022. It will replace the German Mercedes OM-502LA. Decisions about mass production will be made, depending on test results. **Read The Article**

PSR Analysis: A few years ago, Tutaev Motor plant became part of the KAMAZ structure. Since then, it has received a good boost in development. Among the new projects of TMZ are a joint venture with Chinese Weichai, and a new HHP engine range. **PSR**

UAZ Supplies Components for Hyundai and Kia

The UAZ-Component company, part of the Ulyanovsk Automotive Plant, has started making crankshafts for engines Hyundai Gamma 1.6. The first serial lot of 3000 crankshafts was shipped in December 2021.

The UAZ crankshaft was designed according to Hyundai requirements, and the components made by UAZ are being installed in Hyundai Solaris, Creta, Kia Rio and other car models.

First castings were made according to computer models. Upon finishing this stage, Hyundai representatives conducted audits on the UAZ working site. Then, first lots were shipped to Hyundai plant in Sestroretsk for finishing works. All tests were successful. At the end of 2021 UAZ received the approval for use of its crankshafts.

In January, the supply volume reached 10,000 units, then volume is planned to increase to 20,000 units per month. **Read The Article**

PSR Analysis: It looks like a second stage of localization automotive components with Hyundai (first stage included local assembly of the engines themselves). **PSR**

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Russia Report

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With fast the growth of Chinese cars sales in Russia, we should look for the appearance of new local production plants for Chinese cars

Sollers and Chery Negotiating Joint Car Production in Russia

Russian Sollers Group and Chinese OEM Chery are negotiating joint car production and development of new technologies in electric transport, according to an announcement by the Sollers Group. Parameters of the project will be set by the middle of 2022.

The parties are negotiations about large-scale co-operation, which includes car production, development of new technologies in electric vehicles, new modules, and materials for automotive industry.

A government spokesman said, the co-operation of Chery and Sollers was also discussed between Russian and Chinese State heads. **Read The Article**

PSR Analysis: At the moment, the only large production site for Chinese cars in Russia is the Haval plant in the Tula region. With fast the growth of Chinese cars sales in Russia, we should look for the appearance of new local production plants for Chinese cars. **PSR**