Global EV Outlook
Momentum or Bottlenecks?

Introduction to the EV Market

The global electric vehicle (EV) market has been growing in 2022 amid the increasing roll-out of policies designed to cut emissions. With attention to meeting the global net-zero emission target, developing and developed countries are raising their investment in electrification programs and related charging infrastructure. **Simultaneously, the global automotive industry is expected to face one of the most significant changes, replacing internal combustion engine (ICE) vehicles with electric vehicles (EVs).**

Growth in EVs, especially in battery electric vehicles (BEVs), will likely lead to material changes in the automotive value chain and pose significant challenges to existing automotive players. We believe that suppliers with a diverse range of product offerings and customer base, and those focusing on the EV must-have components, including batteries and traction motors, are more resilient than some original equipment manufacturers (OEMs). Last year, most raw materials essential for battery cathodes and anodes saw prices increase. **Lithium hit an all-time high, and cobalt, graphite, and nickel saw their prices spike. With demand outstripping supply for most key metals, prices could likely continue to pressure overall battery costs.**

The recent Russia-Ukraine war may catalyze the EV market. The traditional automobile market is vulnerable to the global energy supply chain. The skyrocketed crude price can erode the customers' sentiment and further lead to demand destruction in the long term. This could come as a significant expansion opportunity for the EV market.

In the past two years, the growth of the EV market has been significant. However, compared to the overall car market, it accounts for only 4.1% of total car sales in 2022. The shortage of the semiconductors and the raw materials for batteries restrict the major global manufacturer from delivering cars to the market. Thus, the companies that can integrate their EV supply chain and increase production regardless of the constraint of the commodities market are going to seize and grow the market share soon. How the transition to EVs plays out over the coming decades is being determined by today's actions by the government and industry shortly.

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Highlight of companies

XPeng
XPeng aspires to balance domestic and international deliveries, encompassing the ambition of global expansion by 2022. It is expected to break even in 2 years, notwithstanding losses in previous years of operations. The company is negatively affected by the chip shortage, but XPeng Motors also faced fines from regulators in Shanghai for collecting customers' information without prior consent, indicating the prevalence of industry-wide compliance and regulatory risks. Meanwhile, XPeng has targeted to be the pioneer in mass-produced 800V high-voltage platform equipped with silicon carbide chips, which supports 200 kilometers traveling with only 5-minute charging.

BYD (Covered by GETA – Edward Choy)
BYD's overall revenue soared by 36.77% as the overseas revenue contribution increased from 16% to 39% dated 2020. The company specializes in new energy vehicle (NEV) sales. Due to the reliance on subsidies for sellers, the transaction price of NEVs is generally lower than the cost of production, resulting in a loss, which is experienced among industry players. BYD outperforms other EV players with a long-standing layout in the semiconductor field. While their counterparts, automotive MCUs, and automotive-grade IGBTs, are exploring self-development, mass production, and self-supply of semiconductors stimulated by its core shortage. Therefore, we believe BYD is in a relatively advantageous position.

Li Auto
The revenue of Li Auto increased by 37%, yet suffered a net loss increased by four times last year. The unsatisfying result is mainly attributed to the subsidies reduction of REEVs (range-extended electric vehicles) and escalated R&D cost of new model development. Currently, Li Auto was adversely impacted by chip shortage and may also be placed at the lower hand by only offering one model for sale. Its competitors have been marketing 2-3 models to target different customers and market segments, particularly amid solid competition in the SUV market with the existence of the Tesla Model Y.

Geely
Geely has sold 1.32 million new vehicles, accounting for a 6.6% market share of China's passenger vehicle market. The manufacturer retails four distinctive sub-brands covering the gasoline vehicle and NEV mid-to-high-end market segments. They have been confident in their overseas delivery, expecting export volume to reach 115,000 in 28 countries, implying a YOY increase of 58%. Geely has outcompeted its counterparts in sales volume by maintaining a solid new model pipeline, with budgets to launch over 20 new models in the next five years. However, new models are often sold at lower-than-expected profit margins, aggravating the intense competition in the EV market. Geely is also expected to incur substantially higher raw materials and R&D costs.

CATL (Covered by CET – Yolanda Qian)
CATL has been dominating the EV battery market by serving a wide spectrum of EV manufacturers, namely NIO, XPeng, Li Auto, and Tesla, with a market share of 58%. The firm has a favorable prospect upon their announcement of the R&D plan. They plan to add products that use sodium instead of the more expensive lithium. As sodium-ion batteries could be about 30%-50% cheaper than the existing options, CATL may expect an even larger market share domestically and internationally with the successful development.

Renault
In 2021, Renault completed its rapid shift into the electrified market, strengthening its position in Europe, especially France. Renault ZOE became the second best-selling electric vehicle in Europe. Although its vehicle sales recorded a 5.3% YoY decrease, electric cars sales increased by 52%, which accounted for 31% of the total passenger cars sales in Europe.

Volkswagen
Volkswagen has doubled its BEV deliveries over the year. In Europe, electric vehicles accounted for 19.3% of Volkswagen's deliveries in 2021. Volkswagen has also recorded a significant increase in deliveries of electric cars in the United States, China, and Germany. A total of 77,100 BEVs (+437%) were delivered in China, making Volkswagen one of the five biggest BEV providers in China, while the sales of BEVs in the U.S. were almost twenty times more than that in the previous year.

Tesla (Covered by GETA – Angela Lo)
Tesla has postponed the launch of its Roadster, Semi, and Cybertruck models to 2023 while focusing on the production of its existing models and the new 4680 battery. In January 2022, Tesla accomplished its production goal of one million 4680 cells in its Fremont factory, which could be used to supply around 1000 Model Y. The new 4680 battery adopts lithium-iron-phosphate (LFP) chemistry and increases silicon content which enables faster-charging speed while reducing production costs for Tesla. The new battery can produce six times the power and five times the energy capacity, implying a 16% increase in range.

Rivian (Covered by GETA – Dabby Ip)
Rivian's operation in 2021 was primarily research and development activities related to EV. In 2019, Amazon ordered 10,000 electric delivery vans (EDV) from Rivian to address existential carbon dioxide emissions. Rivian will launch three models, R1T, R1S, and EDV, simultaneously, resulting in an expectation of a 33% revenue CAGR in 2025-2030. With the construction of the second manufacturer in Georgia, Rivian plans to invest in international operations and grow business outside existing operations.

(Source: Online Research, Company Report, Bloomberg, CUIRS)

Honda

Honda has recorded strong earnings results, beating 3Q 2021 operating profit expectations by 152.9b yen. The company is confident that it will be able to procure semiconductors, recovering from its previous reliance on mega suppliers, intending to produce 4.6 million vehicles in 2022, up from 4.2 million in 2021 forecasts. In December 2021, Honda also signed an agreement with battery R&D company SES AI for the joint development of lithium-metal batteries. Additionally, on March 4, 2022, Honda announced a partnership with Sony to engage in joint development and sales of EVs. The objective is to begin the New Company within 2022 and sell its first EV in 2025. Being the frontrunner of Japanese carmakers in the EV industry, Honda aims to boost EVs sales to take up 40% of their total sales in 2030, 80% in 2035, and 100% in 2040.

Nissan

Nissan recorded an operating profit of 191.3 billion yen in 3Q 2021, a significant YoY improvement. Favorable market conditions in the US and progress in the quality of sales increased net revenue per unit, offsetting supply shortages. The alliance between Renault, Nissan, and Mitsubishi has led to more than 10 billion euros invested in EVs, with over 1 million EVs sold. The Alliance plans to continue by investing 23 billion euros in further EV development, leading to 35 new EV models by 2030. Additionally, they are working towards reducing battery costs by 50% in 2026 and 65% by 2028. The joint venture between these three companies seems to be well-rounded in many aspects.

Toyota

Toyota beat earnings estimates with an operating profit of 784.4 billion yen in 3Q 2021 and an operating profit margin of 10.1% due to North American price hikes, curbing incentives, and reductions in COGS. However, Toyota revised its 2021 production volume from 9 million to 8.5 million units, which is quite a conservative estimate. Previously not so confident in EVs, Toyota suddenly shifted directions, announcing that they aim to produce 3.5 million EV's a year (roughly a third of global sales) by 2030–up from the previous 2 million. Additionally, the company will be investing 2 trillion yen in battery research and production, aiming to lower battery costs by 50% per EV. Their goal is to reduce capital investment costs and improve efficiency at battery factories.

Highlight of companies (cont'd)

Region	Company	Logo	Main Business	Major Model	Current Market Cap	Revenue (Total for 2021Y)	PE Ratio	EV/EBITDA
China	**XPeng**		Design, develop, manufacture and market Smart EVs	SUVs (G3 model), four-door sports sedan (P7 model)	26.51B	3,293.50 (US$ million)	-31.60	-4.42
China	**BYD**		Develop, manufacture and sales of vehicles (both gasoline and new energy vehicles)	Qin Plus, Song, Tang, Han	785.71B	33.94 (US$ billion)	227.60	33.67
China	**Li Auto**		Design, develop, manufacture and market Premium Smart EV (family type)	Li One	29.81B	4.24 (US$ billion)	-556.00	-3.47
China	**Geely**		Automobile manufacturer focusing on development, manufacturing and sales of passenger vehicles	Volvo Cars, Daimler AG	15.91B	15.96 (US$ billion)	21.20	1.97
China	**CATL**		Automotive Li-ion batteries, energy storage systems, battery recycling	Lithium battery (EV batteries)	186.00B	14.17 (US$ billion)	118.50	111.65
EU	**Renault**		Designs, develops, manufactures, and sells electric vehicles	Renault Zoe	6.48B	46,21 (€ million)	6.90	1.22
EU	**Volkswagen**		Designs, develops, manufactures, and sells electric vehicles	I.D. models, e-up!, e-Golf	94.15B	250,200 (€ million)	7.25	4.38
US	**Rivian**		Designs, develops, manufactures, and sells electric vehicles and accessories	R1T, R1S, EDV	37.99B	55 (US$ million)	N/A	-4.79
US	**Tesla**		Develops, manufactures, and sells electric vehicles, energy generation and storage systems internationally	Model S, Model X, Model 3, Model Y	1.18T	53.82 (US$ billion)	233.80	122.08
JP	**Honda**		Automobile manufacturer focusing on development, manufacturing and sales of passenger vehicles	Honda e	6.09T	106.40B (US$ billion)	7.30	0.05
JP	**Nissan**		Automobile manufacturer focusing on development, manufacturing and sales of passenger vehicles	Nissan Leaf	2.18T	63.50 (US$ billion)	16.40	0.06
JP	**Toyota**		Automobile manufacturer focusing on development, manufacturing and sales of passenger vehicles	bZ4X (BEV) (coming mid-2022), 2022 Mirai (FCEV)	34.19T	219.90 (US$ billion)	10.10	0.07

(Source: Online Research, Company Report, Bloomberg, CUIRS)

Macro Analysis

Demand-Side

China

Government stimulus and incentives to individual and public transportation providers

In general, EV sales in China skyrocketed 154% last year, with sales volume scaling new heights and hitting 3.3 million units in China (dated 2021).

With government stimulus and incentives, the demand for EVs remains high in China, from both individual users and public transportation usage.

For instance, there has been sufficient support for fuel cell electric vehicles purchases by offering subsidies of up to USD29,000 for fuel cell electric cars and USD72,500 for fuel cell electric trucks and buses. There are no plans for subsidy contraction in the year ahead, implying the surge in demand is expected to continue. Furthermore, many municipalities and regional governments promote EV purchases by individual drivers, boosting household purchases of EVs at the same time. The demand rise is expected to continue to stimulate the growth of the EV industry in China.

US

Policy to build a network of high-voltage chargers along interstate highways

The Biden administration announced its requirement for all states to submit proposals to line highways with electric vehicle chargers as part of a $5 billion plan to improve the infrastructure needed to support the thriving sales of electric vehicles and the administration's ambition to make half of the new cars sold electric by 2030.

The plan is to tackle the state's deficit in the number of chargers to relieve people's concerns about the lack of chargers when purchasing EVs. The chargers must be built no more than 50 miles apart in rest areas for easy access.

Although the money may not be sufficient to erect the required number of charging stations to the growing demand for EVs, the administration hopes the plan can act as a catalyst motivating utility and private operators to build additional chargers.

Later on, the administration plans to spend an additional $2.5 billion on upgrading the charging infrastructures in rural areas where private investors may have little incentive to touch.

EU

Generous incentives and other enabling factors spur the purchase of EV

Electric vehicle sales are set to rise strongly in the short term to meet the upcoming CO2 emissions target in Europe. Strong policy support and more charging infrastructures in different European countries spur the purchase of electric cars. Electric vehicle prices may decrease considerably in the next few years if the supply chain crisis can be solved. Thus, there may be an increase in EV adoption.

The "France 2030" and the stimulus plan announced in May 2021 support the French automotive industry. Renault, the largest car manufacturer in France, received a state loan worth €5 billion. With a €100 million funding program to expand charging infrastructure, France has a favorable environment for EVs.

Germany is the largest market for battery-electric cars in Europe now. The German government provides generous subsidies to EV buyers, continuously boosting EV sales to a record high.

Japan

Japan's EV sales results are mixed

Japan's EV sales were discouraging in 2020, with EV sales dropping 28% to 31,000 vehicles (BEV/PHEV sales) and EV market share (% share of BEVs/PHEVs in the total market) dropping by 20% to 0.69%.

In 2021, though overall EV sales barely increased, the amount of imported EVs tripled to 8,610 – with Tesla responsible for a significant portion. The common opinion is that Japanese consumers are accustomed to the trademark hybrid vehicles of domestic firms and are concerned about cruising range, long charging time, and high vehicle prices. However, the recent spike in EV imports might signal the market's newfound current interest in EVs.

The problem is that this statistic is made up of imported EVs and not domestic-produced ones. The Nissan Leaf only sold 10,843, as opposed to its all-time high of 25,722 in 2018. In the case of other types of vehicles, typically, nine out of ten Japanese consumers will purchase domestic products. Still, Japanese consumers can also feel that domestic firms lag behind the flashy competition. 2022 will be a crucial year to see whether Honda, Toyota or Nissan convince their divided customers or let foreign competitors capitalize on this opportunity.

Supply-Side

China

Adequate metal reserves can meet rising demand

China EV sales surged 154% in 2021, while production growth is 166%. As a result, the rising demand for lithium-ion batteries will likely continue. Currently, 80% of raw lithium is imported, and dependence on foreign cobalt is even higher, with 90% being imported. But on the one hand, China dominates 50-70% of these metals' refining; Chinese companies are also predominant in the production of battery chemicals and cells, controlling the critical supply chain. Research has shown that China has enough domestic metal reserves to meet its demand.

The recent war has disrupted the supply chain. For example, Nickel, a critical upstream raw material for the manufacture of power batteries for new energy vehicles, will also be affected by the situation in Russia and Ukraine in the short term.

Research has shown that China has enough domestic metal reserves to meet its demand. The nation's mining companies acquired 6.4 million tonnes of lithium last year. It also held 80.5% of lithium-ion battery capacity. Therefore, the market growth of EVs in China will remain strong.

But once the situation becomes clear, the pre-market premium on geopolitics will quickly subside, which may cause the price of raw materials to fall from a high level. Moderate speed up in developing domestic lithium and nickel resources and enriching the source of imported raw materials will further optimize raw material supply channels. The development of key players can thrive, bringing their price level to an upward trend.

Faster-charging sodium-ion batteries

CATL has begun the industrialization of sodium-ion batteries and plans to form an essential industrial chain in 2023.

With the advent of new material sodium-ion batteries, dependence on lithium batteries can be relieved. They have unique advantages in low-temperature performance, fast charging, and environmental adaptability and are compatible and complementary with lithium-ion batteries. At present, the energy density of the first-generation sodium-ion battery cell has reached 160Wh/kg, which is currently the highest level in the world. After 15 minutes of charging at room temperature, the power can reach 80%. This exceptional property is expected to popularize the use of EVs further.

Yet, its prices and performance are still concerning. The current scale of the supply chain is still small. Also, its performance in warm and hot climates compared to low-temperature regions remains unknown.

As China already foresaw a 30% supply shortfall in lithium batteries, carmakers are delaying their delivery to customers. On the other hand, sodium-ion batteries have a big advantage in not using rare metals. This can help stabilize manufacturing costs, achieve the delivery target and realize positive profitability in the long run.

China's maturing technology can handle chip and gas shortage

The soaring prices of key raw materials catalyzed by the Russia-Ukraine conflict are hampering the cost-cutting efforts of electric vehicle manufacturers and the popularization of electric vehicles. Chip shortages have even forced smaller automakers to suspend production, and China's booming electric-car industry could be frozen to some extent.

On the other hand, the conflict between Russia and Ukraine has further affected the supply of neon gas, an essential raw material for the production of chips, and exacerbated concerns about the decline in the production capacity of the chip industry.

The domestic purification technology for these rare gasses has achieved a breakthrough in China, and the production process is relatively mature. Even if the relevant supply chain is interrupted, China can organize emergency production to ensure domestic supply. So, in the long run, China EV makers should be able to remain stable in production.

US

Faster-charging 4680 battery

Tesla has announced a new 4680 battery cell, which uses lithium-iron-phosphate (LFP) chemistry instead of traditional nickel-cobalt-aluminum as the main component. It is a new tab-less cylindrical cell that produces six times the power and five times the energy capacity. The current success rate in production is a satisfactory 92% as of Jan 15th, while Panasonic will be deploying a prototype production line for the new battery as early as 2023.

Elon Musk claimed that 4680 battery cells could pack higher energy density and allow farther 16% range reach in the same footprint. Increasing the silicon content and tab-less technology allows less heat during charging, hence shortening charging time by 10-80% in less than 15 minutes.

With its merits of low cost, fast charging capability, and high cycle life, the LFP battery is anticipated to be adopted by most automakers. Thus, LFP chemistry is expected to be the dominant battery chemistry over the traditional nickel manganese cobalt (NMC) chemistry by

2028, with global demand exceeding 3000 GWh by 2023.

Yet, as more players come into the market and the global EV sales surge, Tesla may see supply chain shortages as the demand for LFP chemistry may later skyrocket. Moreover, in the short term, the supply of LFP batteries may be affected mainly by the anti-Covid policy in China, for over 90% of the global LFP production capacity is based in China. Moreover, since Australia owns the world's largest lithium mine, the trade dispute between China and Australia may also cause issues in the global supply chain.

EU

Europe's EV supply chain revs up

The demand for electric vehicles is on the upswing in Europe; however, there is a battery supply chain gap between the manufacturer and the supplier. After the supply chain disruptions since the pandemic, Europe-based automakers are shifting their attention to developing a domestic supply chain for batteries and components. Renault inks Gigafactory deals with Chinese and French firms and plans to establish Gigafactories in France, while Volkswagen is planning to build six battery Gigafactories in Europe by 2030. Furthermore, the European Commission has started a $3.3 billion European Battery Innovation program to support research and innovation in the battery value chain.

If the supply chain gap is filled up, automakers can produce more EVs to meet the anticipated growth in EV sales with a more stable battery supply in Europe. This will also break the Asian dominance in the supply of materials and industrial recycling activities.

Japan

Japanese firms upgrade their supply chains with the risk of rapidly rising raw material prices

Honda, Nissan, and Toyota all have plans to create the best batteries and most efficient supply chains.

Honda has signed an agreement with battery developer SES AI and is proposing to utilize lithium-metal batteries; the energy density of this new technology is ten times the standard lithium-ion batteries, but previously proved challenging to manufacture. The goal is to construct a new factory (1GWh capacity in 2023), and mass produce these batteries in 2025.

Nissan's alliance with Renault and Mitsubishi allows for a cooperative battery developing strategy. The Alliance aims to reduce battery costs by 50% in 2026 and 65% by 2028, with 220GWh battery production capacity for their entire business. Additionally, the Alliance is set on using all-solid-state battery technology (ASSB), which has double the energy density of current lithium-ion

Batteries. They aim to mass-produce ASSB by mid-2028.

Finally, Toyota aims to lower battery cost by 30% and improve power consumption by 30%, reducing overall battery cost by 50% per EV. It plans to increase battery production capacity from 180GWh to 200 GWh and invest five billion yen per GWh of production capacity–40% lower than other major battery manufacturers. This is because Toyota wants to keep up the same production capacity while reducing capital investment costs. In short, Toyota's goal is to boost the energy efficiency of EVs and improve the efficiency of factories.

Though these firms all seem to have a solid plan to increase the production of batteries, the recent increase in raw material prices–especially lithium, cobalt, and nickel–does not bode well for e-mobility. If the world's raw material producers cannot keep up with demand, Japanese firms' plans to ramp up production may backfire.

Catalyst and Risk

Catalyst

China

Model for mid-market to capture the demand of the general public

Most well-known brands in China are all preempting the high-end market, such as NIO and BYD. The distribution of products in the domestic EV market can be roughly divided into two major price segments: below 100,000 yuan and above 300,000 yuan. The mid-market is being overlooked.

Due to the high cost of batteries, it is challenging to guarantee battery life and quality while maintaining a mid-market price for any model, as well as the product strength lacks advantages over fuel vehicles. Thus, the mid-market is not tempting at this stage.

When conditions become mature: lower battery cost, configuration design referencing the old high-end models, any company that rolls out a suitable model for the mid-market can seize the market in the first place and benefit from the first-mover advantage.

Policy support on charging stations

At the end of 2020, the number of domestic new energy vehicles and the number of charging piles were 4.92 million and 1.681 million, respectively, with a vehicle-to-station ratio of about 2.9:1. However, based on the public charging pile, the ratio becomes 6.5:1.

The initial investment for charging station companies is not high, but a smaller supply can lead to a higher utilization rate to achieve profitability. So operators in China have little enthusiasm to invest significantly ahead of time. This may discourage China's target from reaching its carbon goal by replacing the old with more EVs when battery life is not satisfactory.

From Plan 21-25, it is expected that the coverage rate of expressway charging stations in the eastern region will reach 80% in 2025, and the coverage rate in the central and western areas will reach 60%. To stabilize the growth of EVs ownership, an increasing number of charging stations are to be relied upon.

US

Proposal for a raise in the unit ceiling of EV tax credit

In 2009, former President Barack Obama announced a federal tax credit of up to $7,500 for all EVs and PHEVs purchased. However, the tax credit will phase out after selling 200,000 eligible EVs, which Tesla and General Motors Co already reached the cap. Besides, certain states and municipalities offer electric-vehicle incentives, such as a $2,000 cash rebate for fully electric vehicles in California.
Researchers estimated that electric vehicle purchases would have fallen by about 29% without tax subsidies. The plunge in consumption is mainly due to the shrink in low-income EV buyers, who are more price-sensitive than their high-income counterparts.

Recently, the Biden administration is proposing to raise the unit ceiling of the tax credit from 200,000 to 600,000. If the bill passes the legislative process, many automakers will remain eligible for tax credits into the foreseeable future. Although electric vehicles generally have higher price tags than gas-powered counterparts, the three-fold increase in unit ceiling significantly reduces the EV price. EVs may potentially become less costly. Consequently, the purchase incentives would substantially spur EV sales in the US.

EU

EU proposes to ban new fossil fuel cars from 2035

The European Commission has proposed to ban the sale of non-electric vehicles within the EU's 27 member states from 2035 to meet the "Fit for 55" plan. This plan aims to reduce carbon dioxide emissions from automobiles by 55% by 2030, increasing to 100% by 2035. In addition, the proposal includes legislation to boost the development of charging infrastructure needed for mass EV adoption.

The proposed policy and improved ancillary facilities promote the popularization of electric vehicles and increase the receptiveness to EVs in Europe.

Japan

Government purchasing incentives and investment in charging infrastructure

Japan allocates 37.5 billion yen to provide EV purchase incentives and increase charging and hydrogen infrastructure to catch up with other economies worldwide.

Out of the total budget, 25 billion yen will be used to subsidize BEVs, plug-in hybrids, and FCEVs. The government increased the subsidies to up to 800,000 yen per BEV and 2.5 million yen per FCEV. Additionally, 6 million yen will be designated to build new hydrogen filling stations. However, these subsidies are not as achievable as they seem; to obtain the subsidy, a consumer's electricity at home and work must all come from renewable sources.

Japan's limited public charging infrastructure for BEVs is hindering market success, with only 15,000 EVs being sold in 2020. However, Tokyo's government aims to set aside 6.5 billion yen to expand the charging infrastructure network from the latest 30,000 to 150,000 by 2030.

Risk

China
Tightening of EV regulations

Accelerated regulation risk among Chinese EV manufacturers has catalyzed the need for improving data reporting and cybersecurity upgrading within the domestic market. To prevent system vulnerability and standardize software upgrades, the Personal Information Protection Law has stated that EV manufacturers are not only required to inform the Ministry of Industry and Information Technology (MIIT) of their vehicle functions and performance limitation, including tools that collect customer data for machine learning, but also pass the security assessments of EV products from 2021 onwards.

Moreover, EV manufacturers still rely on traditional car sales would be most impacted. China has imposed a mandate on automakers requiring EVs to make up 40% of all sales by 2030. They may have to increase their EV line marketing budget and re-allocate their production capacity, increasing the operating expenses during the decade.

Owing to the predicted intensifying of competition within the EV market due to more non-EV manufacturers entering the EV market to comply with the regulations, EV manufacturers must increase spending on R&D to differentiate themselves in the already-competitive market of China to maintain their position. However, simultaneously, the overall cost of EV manufacturers is expected to rise in the future out of compliance reasons and product differentiation, magnifying expenses. This may disrupt the original plans of development and innovation. For the industry, these changes may limit the potential of exploring mid-market models, slowing down the maturation of the EV industry.

THE US
The emission reduction goals are not legally binding, potential risk of hollow ambition

As President announced, the administration's ambition is to make half of all new vehicles sold in the country electric.

However, the goal is not legally binding, which means there is no guarantee of achieving the goal by 2030. The Safe Climate Transport Campaign, an environmental group, criticized the White House's action and automakers' commitment to a non-binding plan unreliable.

Although the action allows flexibility, it may not capture people's confidence. "Flexibility is essential… but at At the same token, you need to set ambitious goals." said Senator Gary Peters of Michigan.

EU
Russia-Ukraine crisis

Ukraine, the world's leading producer of raw materials (noble gases) for semiconductors, supplies more than 70% of the world's neon gas, 40% of krypton, and 30% of xenon. In the short term, the Russian-Ukrainian crisis could disrupt the production of rare gases and increase their prices, leading to higher costs for semiconductors. If the situation worsens, the supply of rare gases may be suspended in the longer term, and the global chip supply will be tightened.

Russia is also one of the largest metal suppliers, with high exports of precious metals, including palladium and Nickel. As Russia accounts for more than 15% of the world's pure nickel supply, and Nickel is a raw material for manufacturing electric vehicle power cells, the collection of high-end models that require higher battery performance will be affected. Due to the increasing adoption of LFP battery which does not use Nickel or Cobalt in the negative terminal, the impact on entry-level electric vehicles is relative miller. We predict that more EV manufacturers may adopt LFP battery cells for their standard-level battery packs.

JP
Recent weak performance has caused Japan to fall behind in the EV market

According to the E-mobility Index 2021, Japan slipped to an embarrassing last place compared to Germany, France, Italy, the USA, China, and South Korea. The E-mobility index takes competitive countries in the EV market, and 2 of its criteria are based on their EV technology and industry.

Japan placed fourth in terms of EV technology, losing its previous lead. This was due to its reliance on launching PHEVs, which are less efficient and have subpar charging technology.

Previously in second place, Japan dropped to fifth place regarding its EV industry. This is mainly due to Japanese car suppliers being overtaken by suppliers worldwide; Japan is only projected to produce 1.5 million vehicles by 2023–a dismal amount. Additionally, Japanese battery producer Panasonic has been overtaken by CATL and LG Chem as the world's leading suppliers.

Though recent statistics do not bode well for the EV industry in Japan, hopefully, 2022 will be a turning point for the country as the Japanese government and firms seem to have realized the importance of the upcoming EV trend–as mentioned in the previous sections.

Summary

Endlessly consuming petrochemical materials since the first car came in the 1900s has caused irretrievable damages, which are no longer ignorable to humankind, to the environment. With fossil-fuel transportation accounting for 30% of the emission of carbon dioxide, switching to electric vehicles is necessary and urgent.

Despite the global pandemic effect and supply chain bottlenecks last year, the growth of the EV industry has been tremendous. In 2020, the sales of electric vehicles were merely 3 million and accounted for 4.1% of the market share. Within one year, its sales have grown to 6.6 million and reached 8.3% market share of the automobile market, a 108% YoY growth.

China, Europe, and the U.S are the biggest consumer of EVs, with over 91% of the sales in 2021 concentrated in these regions. **Government support and improving battery technology are the key factors that accelerate the transition to electric vehicles.** China plans to achieve carbon neutrality before 2060, while the EU and U.S have an aggressive target of reaching net-zero greenhouse gas emissions before 2050.

Currently, lacking enough charging infrastructure for long-distance travel is one major shortcoming of electric vehicles. Building up charging stations it's hard for companies because substantial capital expenditures in advance are required, and revenues can only be materialized after the demand picks up. That's why government support is vital to the future of electric vehicles. The Biden administration has rolled out the 5 billion program to states to construct a National EV charging network; China also plans that the coverage rate of charging stations in eastern will reach 80% by 2025.

Long charging time is another constraint for the popularization of EVs. For Tesla Model 3, it takes 7 hours to be fully charged. Even within the battery sweet spot, which is usually between 20% to 80% of a full charge, an hour is still needed to charge, and this problem is amplified in long-distance travel. CATL plan to form an essential supply chain for producing sodium-ion batteries, significantly lowering the charging time to 15 minutes. Meanwhile, Tesla's new 4680 battery vastly improves the charging efficiency and is anticipated to be widely adopted by most electric vehicles. **In CUIRS GETA EV Coverage team report that is going to publish by the end of April, there would be a discussion about EV charging issue across different models.**

Despite the above challenges for the industry in the short term, we believe that the future of the automobile will be electric vehicles, and the transition of transportation is inevitable. Stepping into the post-pandemic stage, the EV industry has strong potential to grow exponentially as it strengthens policy support, maturing technology, and progressive infrastructure.

At the Glasgow Climate change Conference, the Glasgow Climate Pact was signed, and Paris Rulebook was agreed upon by major economy. This is also the first time that "phase-down unabated coal power and end inefficient fossil fuel subsidies" was written in the final agreement, marking an end to the fossil-fuel era. Besides, the recent Russia-Ukraine crisis has brought enormous price pressure to the commodities market, where the price of crude oil has increased by 30% to 100.46 YTD. Russia, as the third-largest oil producer in the world, undoubtedly brings a headwind to the traditional automobile market. This reveals the risk that the conventional market is vulnerable to major oil suppliers. If the situation persists, then it is possible people are being afraid of the skyrocketed oil price or even scared away. This comes as a catalyst to speed up the transition to green energy and electric vehicles.

Tesla released the first electric vehicles in 2008. After ten years, it is the time when the technology and market finally mature. The current shortage of chips and raw materials might affect the short-term delivery of EVs. Nevertheless, stepping into the post-pandemic stage, the bottlenecks will likely ease as business and investment return to normality.

With strengthening policy support, maturing technology, and progressing infrastructure, we believe the electric vehicles market will grow exponentially and soon dominate the automobile market.

(Source: Online Research, Company Report, Bloomberg, CUIRS)

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