CHINA'S NEV INDUSTRY: CHANGING BUSINESS ENVIRONMENT EXPECTED TO BRING BUSINESS OPPORTUNITIES ALONG WITH CHALLENGES

Jian Zhao
Technology & Innovation Studies Div., Consumer Innovation Dept.
Mitsui & Co. Global Strategic Studies Institute

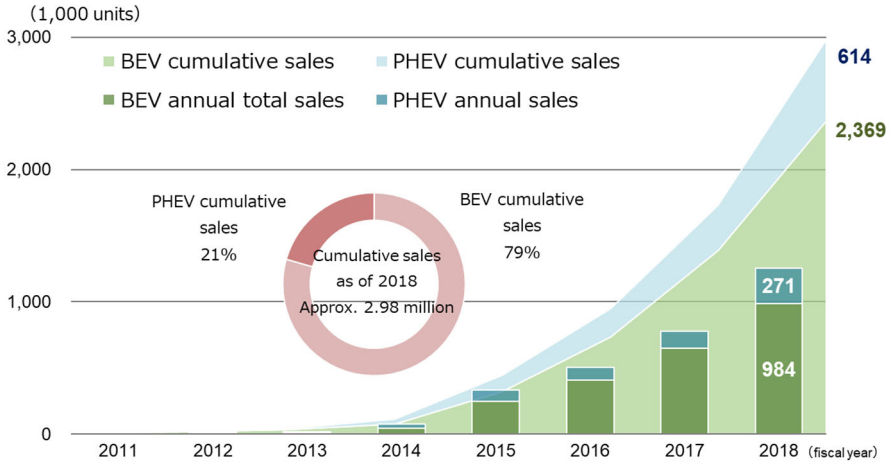
SUMMARY

- The business environment is about to change dramatically in China's market for new energy vehicles (NEVs), which has become the No. 1 market in the world for such vehicles, now that the country has officially enacted NEV regulations and is facing the scheduled elimination of subsidies by 2020.
- As the focus of the subsidy system in 2019 is shifting to the expansion of charging infrastructure and an emphasis on safety, the growth driver behind the NEV industry is expected to shift gradually from government subsidies to competition among NEV manufacturers.
- For Japanese companies as well, business opportunities exist in the areas of improving battery performance, expanding charging infrastructure, improving battery safety, and establishing reuse and recycling schemes, which are all needed for the sustained development of China's NEV industry.

INTRODUCTION

In 2012, the Chinese government announced the "Energy Saving and New Energy Vehicle (NEV)[1] Industry Development Plan (2012-2020)," in which it set the goals of introducing a cumulative total of 5 million NEVs, centered on battery-powered electric vehicles (BEVs), and 4.8 million charging stations by 2020. The introduction of generous subsidies in 2013 has fueled a rapid increase in the number of NEVs on the road, with 2018 sales of BEVs and plug-in hybrid electric vehicles (PHEVs) both marking record highs of 984,000 and 271,000 units, respectively. In just five years since 2014, the annual sales volume of NEVs has ballooned by 20 times (Fig. 1), underpinning expectations that the Chinese government will achieve its target to introduce a total of 5 million NEVs by 2020.

Figure 1: Total NEV Cumulative Sales Volume and Annual Sales Trends in China



Source: Compiled by MGSSI based on annual data released by the China Association of

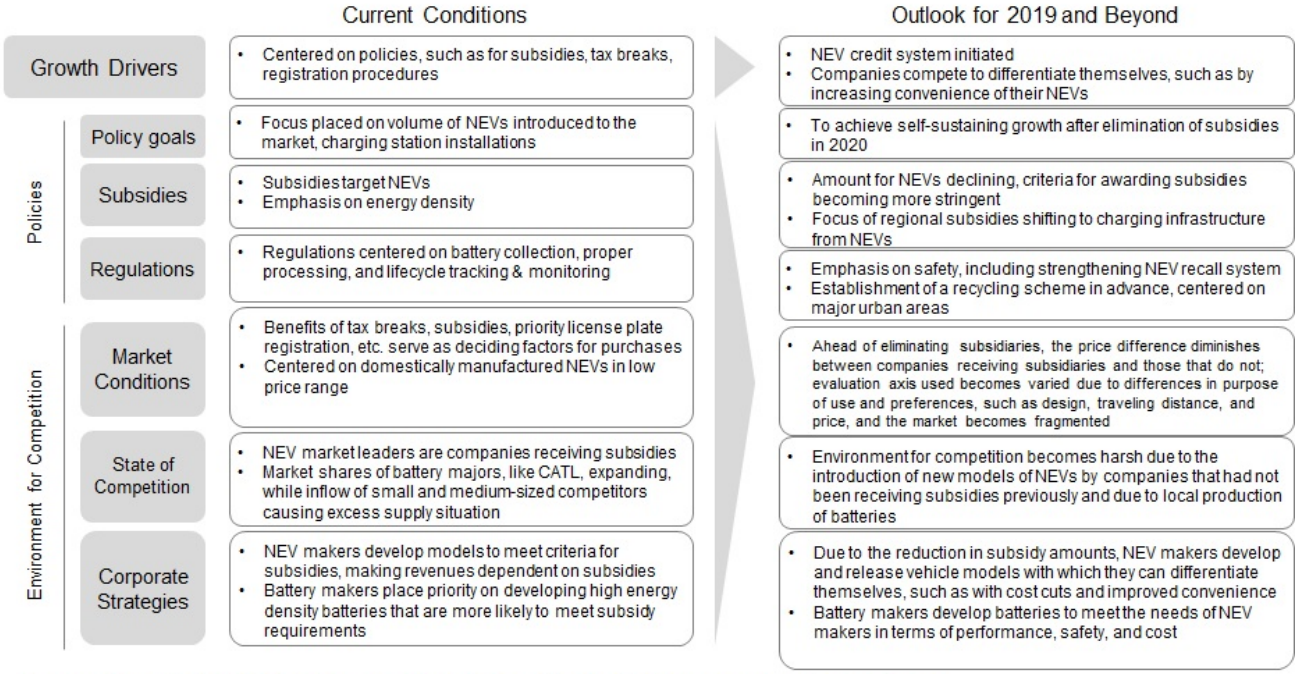
[1] New energy vehicles refer to battery-powered electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), and hydrogen fuel cell electric vehicles (FCEVs).

However, the business environment surrounding China's new energy vehicle market and automotive battery manufacturers is on the verge of changing dramatically with the scheduled end to government subsidies in 2020 and the arrival of competition based on the principles of a free market. This report identifies business opportunities for Japanese companies based on our review of changes in the Chinese government's policies, the focus of which is shifting toward the expansion of charging infrastructure and an emphasis on safety; the trends among companies as they shed their reliance on subsidies and prepare for competition; and the business environment surrounding automotive battery manufacturers as they concentrate on the establishment of schemes for improving battery safety and battery reuse/recycling.

CHANGES IN NEV INDUSTRY-RELATED POLICIES

Looking ahead at the scheduled elimination of government subsidies by 2020, we expect the growth driver of China's NEV industry from 2019 onwards to shift from subsidy support to competition based on free market principles (Fig 2). In order to accurately decipher the trends, it is essential to get a handle on the Chinese government's policies.

Figure 2: Current State of China's EV Industry and Outlook for 2019 and Beyond



Source: Compiled by MGSSI based on data released by the Chinese government and others

To understand China's policies, we need to look at various systems from a composite perspective. Under the NEV subsidy system for fiscal 2019 that was officially announced on March 26, 2019, China will continue to calculate subsidies based on battery performance,[2] but the announcement also revealed a shift in focus to safety and expansion of charging infrastructure.

With regard to safety, which is one of the issues moving to center stage due to the policy shift, a problem has been the frequent occurrence of fires caused by overheating batteries, an upshot of an overemphasis on trying to achieve higher battery energy density in order to obtain subsidies. Just before the announcement of the NEV subsidy system, the Chinese government issued a notice on March 18, 2019 to further strengthen the management of NEV product recalls, directing manufacturers of NEVs that have had fire-related accidents since January 1, 2018 to investigate and analyze the causes of those incidents and report their findings to the government.

[2] BEV passenger car subsidy = (subsidy based on driving distance or battery capacity x 550 yuan/kWh, whichever is less) x battery energy density adjustment coefficient x energy consumption adjustment factor for traveling 100 km.

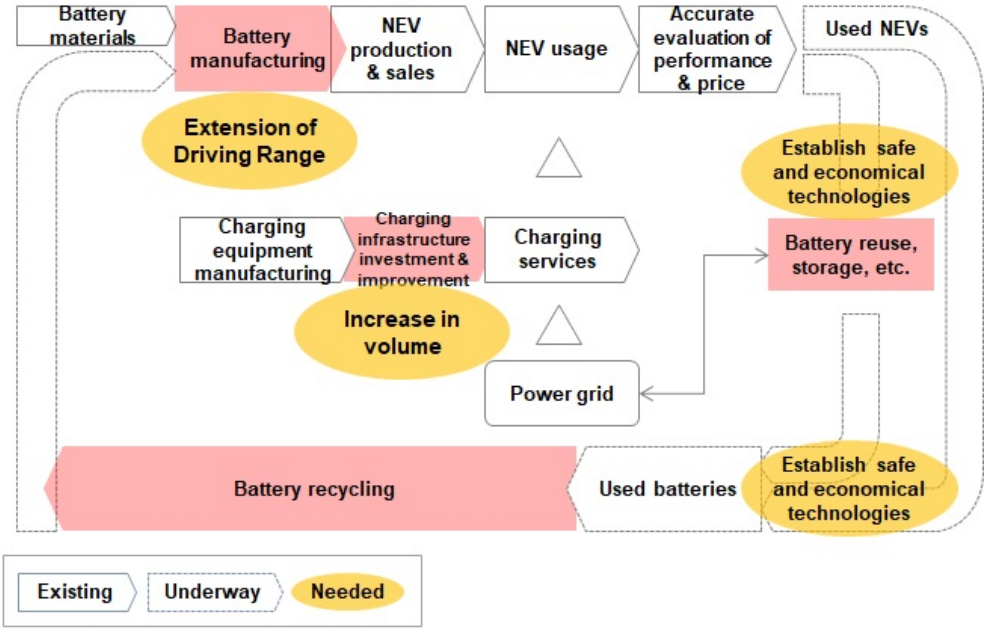
Regarding the expansion of charging infrastructure, the Chinese government announced in November 2018 an action plan to improve charging infrastructure accessibility and reliability for NEVs, revealing its intention to have the subsidies provided by regional governments allocated for infrastructure improvements. The plan's objectives include optimization of charging station distribution, technology advancements, and network flexibility improvements over the next three years. In an official government report issued on March 5, 2019, Prime Minister Li Keqiang also made reference to the acceleration of construction of charging infrastructure and hydrogen stations.

Meanwhile, criteria for calculating battery performance are becoming more stringent. The standard used to grant subsidies for BEV (battery electric vehicle) passenger cars is the minimum of the driving range, and it was raised from 150 km to 250 km, while the subsidy amount was reduced to 18,000 yuan, from 34,000 yuan.[3] The move to completely phase out subsidies is progressing, such as with a tightening of criteria used in the subsidy calculation formula, which include the energy density adjustment factor and energy consumption adjustment factor for a vehicle traveling 100km.

REQUIREMENTS AND CHALLENGES FOR SUSTAINABLE DEVELOPMENT OF NEV INDUSTRY

Once the subsidies are eliminated, not only will China's NEV industry face competition with gasoline- and diesel-powered vehicles equipped with internal combustion engines without the aid of the subsidies it has enjoyed thus far, but market entry by foreign battery material manufacturers, such as Japanese and South Korean companies, will likely pick up and that will mean even tougher competition. Under these circumstances, in order to realize the sustained development of the NEV industry in China, the industry will need to increase consumer motivation for purchasing NEVs by narrowing the gap in convenience compared with internal combustion engine vehicles (ICEVs) by means of the following: 1) improving battery performance, 2) expanding charging infrastructure, and 3) promoting the development of a reuse and recycling system for used batteries (Fig. 3). In the following paragraphs, the current situations for the above 1-3 will be described in detail along with the challenges going forward.

Figure 3: Factors Needed to Build NEV Value Chain



Source: Compiled by MGSSI

[3] The amount of 34,000 yuan is the fiscal 2018 driving range-based subsidy for a BEV passenger vehicle with a range of 250 km or more.

1. Extension of driving range by improving battery performance

The first requirement to close the gap with ICEVs is to extend the driving range by improving battery performance. The industry's battery development goal by 2025 is to achieve an energy density of approximately 350 Wh/kg that would enable an NEV to be driven more than 400 km on a single charge. This target serves as a guide for extending the driving range. However, even BEVs capable of traveling 250 km that are eligible for subsidies in fiscal 2019 are still inadequate in terms of satisfying this standard of convenience, and as such, the situation calls for further improvement.

The batteries installed in China's NEVs can be broadly classified into two types: lithium iron phosphate (LiFePO4, or LFP)[4] batteries and lithium nickel manganese cobalt oxide (Li(Ni-Mn-Co)O2, or NCM)[5] batteries. In the past, LFP had been the mainstay battery, but NCM has become predominant in recent years due to its advantages for extending driving range and qualifying for subsidies.

R&D activities aimed at improving the energy density of NCM batteries are being pursued in a bid to achieve an energy density target of 350 Wh/kg or higher by 2025. In particular, a practical option is said to be the high nickel-content Li(Ni-Mn-Co)O2 battery employing NCM811 (the numerical figure indicates the composition ratio of nickel, cobalt, and manganese in the cathode material).

However, to improve the energy density of NCM811, the thermal stability and safety of the material need to be improved as well. In addition, a problem cited for procuring a stable supply of high-quality materials needed for manufacturing Li(Ni-Mn-Co)O2 batteries using NCM811 has been inadequate material manufacturing technologies, such as for high purity lithium hydroxide and high quality electrolytic solutions. However, in April 2019, China's CATL, the largest maker of batteries for NEVs, succeeded in producing a prototype of a battery cell with energy density of 304 Wh/kg, and some industry watchers speculate that the company will begin supplying the cell to some NEV manufacturers who will install it in certain vehicle models by the end of the year. China's Envision Group, which acquired Nissan Motor's vehicle battery business and NEC's electrode materials business in 2018, is constructing a plant in Wuxi, Jiangsu Province, and reports say that a system for mass production of NCM811 will be ready by the end of the year. Major battery manufacturers are thus stepping up the pace of their efforts to achieve commercialization and mass production of NCM811 Li(Ni-Mn-Co)O2 batteries.

Aside from NCM811, the development of next-generation batteries (all-solid-state batteries)[6] is also an effective approach, but at present, China is being overshadowed by the advanced countries that are at the forefront in this area.

2. Quantitative expansion and quality improvement of charging infrastructure

In order to minimize the difference in convenience between NEVs and ICEVs, charging stations must be made available to NEV drivers in locations where they want them. As of the end of 2018, a total of 777,000 charging stations had been introduced for public and personal use in China. However, the number is far below that needed to achieve the Chinese government's targeted ratio of charging stations to NEVs of 1:1, which the government deems as sufficient for satisfying a given standard of convenience.

For private-use charging stations, it is said that many property management companies are uncooperative about installing the equipment in their residential districts. Moreover, there are also problems with the manners of some drivers, such as in the case of an ordinary vehicle parked in the space designated for NEV charging, and the slower-than-expected progress of installation work.

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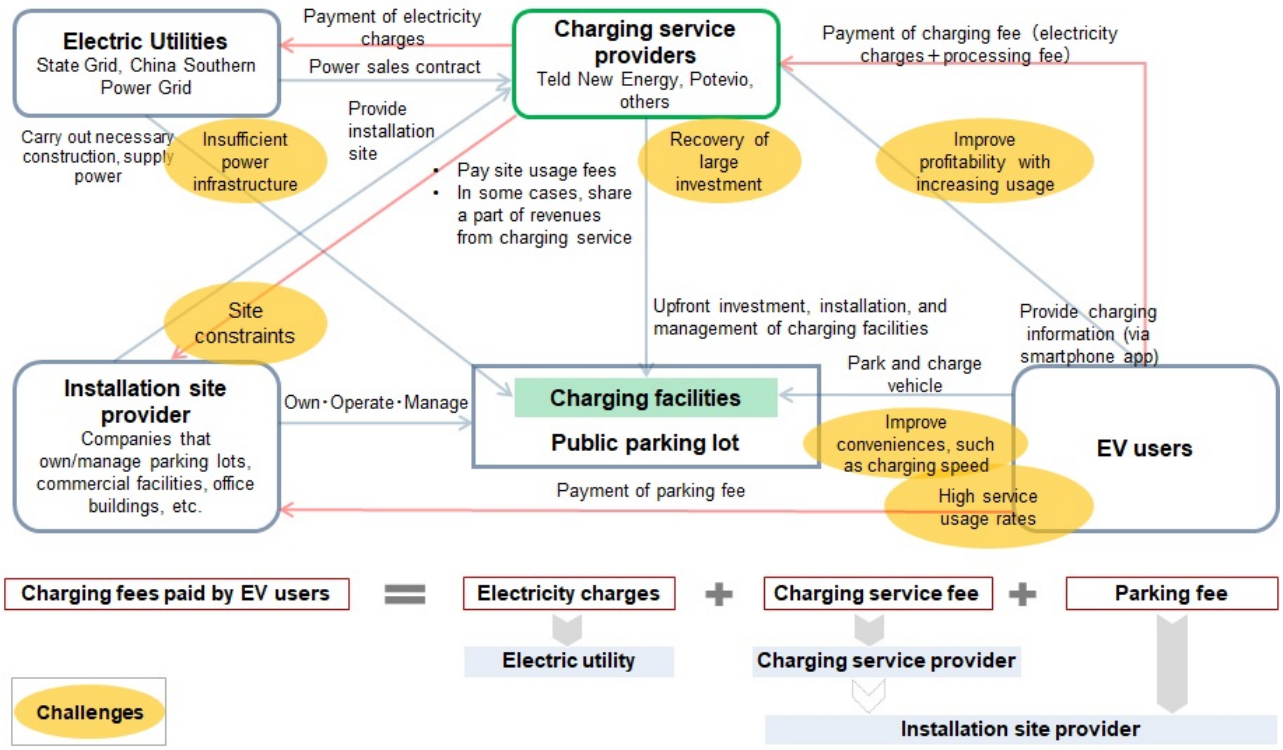
4 Lithium ion battery using lithium iron phosphate (LiFePO4) as the positive electrode. The battery's energy density is lower than that of the Li(Ni-Mn-Co)O2 battery, but it is low in cost and excellent in terms of safety.

5 The (Li (Ni-Mn-Co) O2) battery is a lithium ion battery in which a portion of the cobalt in the lithium cobaltate positive electrode material is replaced with nickel and manganese, making it a battery using three types of raw materials -- nickel, manganese, and cobalt.

6 Lithium ion battery that uses a solid electrolyte instead of electrolyte solution.

The popularity of public charging facilities is not spreading very much due to cost. The business model for the public charging service is as shown in Fig. 4. It remains difficult for companies providing the service to achieve profitability because of an imbalance in demand for charging services in proportion to costs for land, parking facilities, and installation in urban areas. As the development of the charging infrastructure involves large upfront investments, there is a possibility that new investment may stagnate if the period needed to recoup investment is drawn out. Improving profitability is therefore also a major requirement for ensuring the continuous provision of charging services.

Figure 4: Basic Business Model and Challenges of China's Public Charging Service



Source: Compiled by MGSSI

In addition to the above, while there is demand for an increase in installations of fast charging equipment, there are also many challenges, such as the additional cost of new investment in related power infrastructure development.

3. Optimization of reuse and recycling throughout the NEV industry

Systems that have yet to be established for NEVs, compared with frameworks already in place for ICEVs, are reuse and recycling schemes, centered on vehicle batteries. The establishment of reuse and recycling schemes is needed not only from the perspective of solving social problems, but also from the perspective of creating a fair market for used NEV vehicles.

As the service life of a vehicle-installed battery is generally 5 to 8 years, although this depends on usage conditions such as the number of charging and discharging cycles, the need to dispose of used batteries in volume is expected to emerge in the near future. According to a report released by the Chinese government in February 2019,[7] the volume of batteries expected to be retired in 2020 will exceed 20 GWh on a storage capacity basis. Because the improper processing of the batteries could result in serious societal problems, the early establishment of a reuse and recycling scheme is necessary.

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[7] Report on NEV battery recycling & utilization (summary version) issued by China's Ministry of Industry and Information Technology.

The Chinese government itself has not been standing by idly. In August 2018, it introduced regulations focusing on the collection and proper handling of used batteries, and for tracking and monitoring batteries throughout their lifecycles. The government guidelines urge battery reuse to ensure safety, clearly defining the roles and responsibilities of NEV makers and battery makers, with the former expected to establish a battery collection scheme and the latter to provide technical support. However, in order to fulfill these roles and responsibilities while giving consideration to technology and cost issues, businesses will need to not only enhance their own capabilities, including technologies and know-how, but also secure resources from partners.

There are a number of other technical issues that need to be resolved in order to make such schemes work. Achieving battery reuse requires the technology to efficiently determine the performance of used batteries made by different manufacturers and with varying performance efficiencies, as well as the technology for safe use, but China's technologies in these areas are still immature. Furthermore, in order to realize recycling that is, in the end, economical, it is necessary to establish advanced automated dismantling technology and efficient technology for the recovery of metal resources, such as lithium.

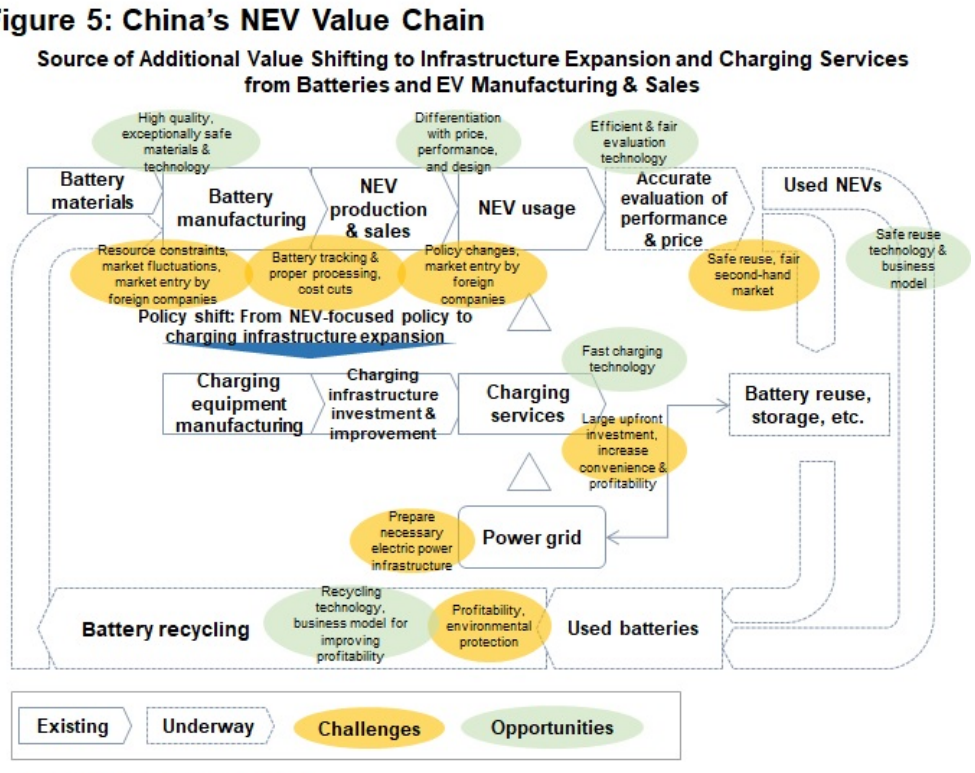
In China, the prices of used EVs have decline sharply. Illustrating this phenomenon, the price of a three-and-a-half-year-old EV160 (a model released in 2015 by Beijing Automobile Works) with 46,000km on the odometer is currently one-fourth that of a new car.[8] Developing the ability to accurately determine the battery life and its value should thus help establish a fair market for used NEVs.

BUSINESS OPPORTUNITIES IN THE NEV MARKET

Overview of the NEV Value Chain and the Expected Role of a General Trading Company

As competition in business brings changes to the NEV market by becoming the growth driver, a BEV value chain is taking shape in China. This value chain and the associated challenges and opportunities are illustrated in Fig. 5.

Figure 5: China's NEV Value Chain



Source: Compiled by MGSSI

[8] The actual amount paid by the purchaser, excluding the subsidy. Based on the author's survey of data on Chinese used car trading websites (as of March 2019).

The formation of the BEV value chain cycle in China is opening up business opportunities in specific fields, especially for Japanese companies with technological capabilities in battery manufacturing and recycling. In addition, there are cases where cooperation between companies positioned at the front end and back end of the value chain can generate additional value, such as battery recycling companies cooperating with battery material manufacturers. As a general trading company involved in various parts of the NEV value chain, including the areas for metal resources, materials, core parts, MaaS,[9] through to vehicle-installed battery reuse and recycling technologies, we are in a position to offer various solutions to various companies. While supporting Japanese companies that are making advances into China, we can identify sources of additional value and thereby help promote businesses.

Individual Demand and Business Opportunities Identified from Analyzing the Challenges

The above analyses of the challenges suggest that there are many business opportunities in the solution process. Among them, the areas in which Japanese companies are especially strong are shown in Fig. 6.

Figure 6: Business Opportunities Identified from Analyses of Challenges

Main Area	Business Opportunities for Japanese Companies (provider role)	Promising Industries
Batteries	• High quality battery materials, such as electrode material, electrolyte solution, and separator for NCM811 batteries • Solid electrolytes, all-solid state batteries and related manufacturing technologies	Chemical materials, battery materials, battery control, battery manufacturing
Charging Infrastructure	•Fast charging equipment	Charging equipment, charger control devices
Reuse	• Efficient battery performance diagnostic tools and techniques •Used battery safety control technologies	Automotive, power, battery control (used)
Recycling	•Advanced recycling technologies, such as for automation and attaining high recovery rates	Automobiles, metals, materials, refining and metal recycling

Source: Compiled by MGSSI

With regard to batteries, although Chinese manufacturers command a large share of the market, Japanese manufacturers have the upper hand when it comes to development and manufacturing capabilities for high-quality battery materials. Accompanying the expected growth in use of NCM811 Li(Ni-Mn-Co)O2 batteries in the future and together with efforts to ensure the safety of the batteries, demand is projected to increase for high quality battery materials that support good performance and that are necessary for the production of NCM811 cathode materials, such as lithium hydroxide, Si/C anode materials, separators, and electrolytes. Japanese companies with prominence in this field are expected to be able to advance into China and expand their operations, such as by supplying Chinese manufacturers and also cooperating with Japanese automakers that plan to increase their offerings of NEV models.

A memorandum of understanding was signed between Japan and China concerning joint development in the area of charging infrastructure expansion, which was instigated when the Chinese side approached the CHAdeMO Association[10] in 2018 regarding joint development of a next-generation high-power standard. The CHAdeMO Association hopes that consolidation with China on a standard for fast charging will facilitate entry into the Chinese charging equipment market, and that it will be able to derive other benefits from having the same standard as China in view of the country's large NEV market. In addition, because charging infrastructure provides access to data on usage of NEVs and vehicle-installed batteries, and because such data can be leveraged to create additional value, charging infrastructure is also attracting attention as a launching off point for new business, such as for used NEV sales/purchases and reuse of used batteries.

9 MaaS：Mobility as a Service

10 CHAdeMO Association, which includes Japanese automakers among its members, aims to standardize fast charging under the CHAdeMO protocol and increase installations.

Meanwhile, the charging infrastructure market in China is currently monopolized by the State Grid Corporation of China and leading charging service providers. However, Japanese companies cannot merely limit themselves to cooperation on establishing a unified standard for fast charging. Taking a medium- to long-term perspective, they are expected to formulate strategies involving companies that have BEV charging infrastructure, and thereby create new business opportunities.

With regard to the reuse and recycling of used batteries in Japan, lithium ion batteries and nickel-metal hydride batteries were included among parts that must be removed from a vehicle by auto dismantling companies under a 2012 revision to the End-of-Life Vehicle Recycling Law. Furthermore, if the batteries cannot be sold as second-hand goods, the vehicle manufacturer is required to assume the responsibility of the producer to collect and process the batteries as industrial waste at its own expense. Against this background, Japanese automakers are working with power companies and chemical material makers to repurpose used batteries for stationary applications at mega-solar power plants and develop low-cost recycling technologies. In 2017, China introduced a policy similar in form to Japan's End-of-Life Vehicle Recycling Law that mandates NEV manufacturers to collect and process used batteries. As a result, demand for efficient and low-cost reuse and recycling technologies is increasing. The complementary relationship between Japan, which leads in establishing the necessary schemes and in technology development, and China, where the benefits of economies of scale are readily attainable, could have significant implications. If Japan and China cooperate to find the optimal solution for used battery processing, not only could we expect synergistic effects of the economic and environmental benefits, but we can also expect it to lead to the improved soundness of China's NEV industry and the completion of its value chain.