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# China Charging / Battery Swapping Infrastructure Market Research Report, 2022

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## Research of charging / battery swapping: More than 20 OEMs layout charging business, new charging station construction accelerated

From January to September 2022, the sales volume of new energy vehicles in China was 4.567 million, with a market share of 23.5%, Thus ownership of new energy vehicles in China has exceeded 10 million units. In terms of charging infrastructure, according to statistics of Charging Alliance, as of September 2022, the ownership of charging infrastructure in China was 4.488 million sets, with a year-on-year increase of 101.9%; Based on this calculation, the overall car-to-pile ratio is close to 2.2:1, which has basically reached the national expected development goals.

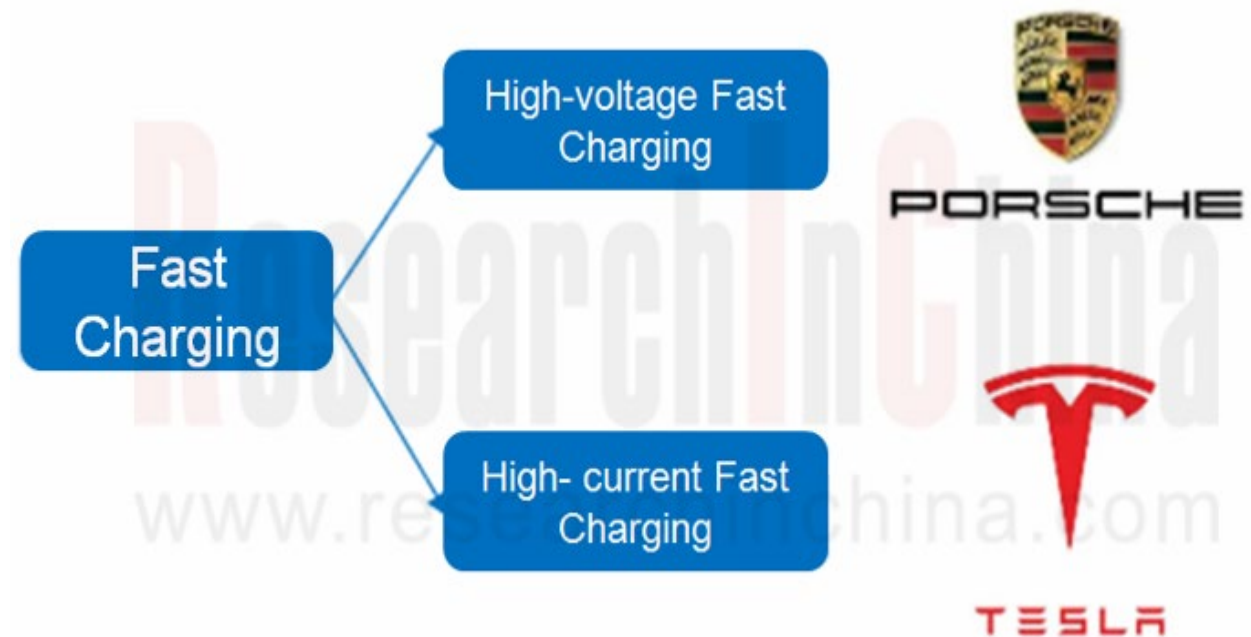
In January 2022, National Development and Reform Commission and other 10 departments jointly issued "Fourteenth Five Year Plan" for Public Service, which specifies that by 2025, China will form a charging infrastructure system to meet the needs of more than 20 million electric vehicles. According to the 14th Five Year Development Plan of the State Council, by 2025, the car-to-pile ratio will increase to 2:1, which is equivalent to two cars equipped with one charging pile.

# Market and technology trends of charging / battery swapping infrastructure:

In 2022, China's charging/battery swapping infrastructure industry ushers in further development and expansion, and the market pattern of 7-11kW AC charging piles is basically stable; The leading enterprise in 80-240kW DC charging pile market has begun to take shape. **At the same time, new charging technologies/stations are developing rapidly, including high-voltage fast charging, battery swapping, orderly charging, PV-storage-charging integration, hydrogen-PV-storage-charging integration, mobile charging robot, etc.**

## Trend 1: High-voltage fast charging

In terms of charging power, there are two main solutions to improve fast charging power: high-voltage fast charging and high-current fast charging. Judging from the current development, high-voltage fast charging is popular, mainly because high-current fast charging has a huge challenge to thermal management system, and there is a ceiling for single vehicle charging power, which cannot reach 480KW charging efficiency.



# Trend 1: High-voltage fast charging

At present, high-voltage fast charging has become the most popular choice in the industry. In 2019, Porsche Taycan launched the first 800V high-voltage electrical architecture in the world, equipped with an 800V DC fast charging system and supporting 350kW high-power fast charging; In 2022, XPeng Motor launched its G9 model based on 800V SiC platform in mass production, while Geely and Mercedes Benz launched the SEA architecture and MMA architecture supporting 800V.

At the same time, OEMs, charging operators and energy enterprises have laid out high-voltage fast charging stations successively. GAC Aion, XPeng, AVATR, ZEEKR, NIO and Tesla all have layout plans for high-voltage fast charging stations. The maximum current of a single XPeng S4 ultrafast charging pile is 670A, and the peak charging power is 400kW; GAC Aion super-charging station (A480 super-charging pile) has a peak power of 1000V, a current of 600A and a liquid cooled charging system; In 2020, the State Grid began to invite bids for 480KW high-voltage fast charging piles, presenting a trend of continuous growth.

Operation Progress of Partial High-voltage Fast Charging Stations

Company	Construction & Planning
XPeng	<b>XPeng S4 Super Fast Charging Station:</b> In September 2022, the first batch of S4 super fast charging stations of XPeng Motor were launched in Beijing, Shanghai, Guangzhou, Shenzhen and Wuhan;
AVATR	<b>AVATR &amp; High-voltage Fast Charging Station:</b> In October 2022, the first customized high-voltage fast charging station jointly built by AVATR and BP was officially launched;
GAC Aion	<b>GAC Aion Super Charging Station (A480 Super Charging Pile):</b> In April 2022, the world's first smart super charging station of GAC Aion has been put into operation, located in Donghong International Plaza, Tianhe District, Guangzhou;
ZEEKR	<b>ZEEKR Super Charging Station:</b> In September 2021, ZEEKR super charging station was officially put into operation in Hangzhou;
Tesla	<b>Tesla V4 Super Charging Station:</b> In September 2022, Tesla built the first V4 charging station in Arizona, USA, which will have 40 charging parking spaces;
NIO	<b>500kW Super Charging Pile:</b> NIO plans to launch new power supply facilities such as 500kW super fast charging pile with peak power and the third generation battery swapping station from the end of 2022 to the beginning of 2023. NIO third generation battery swapping station has also entered the sample station testing stage, and is expected to support 800V high-voltage platform.
Star Charge	<b>Star Charge 480kW Liquid Cooling Super Charging Pile:</b> In January 2022, the first 480kW super charging pile of Star Charge has appeared in Hangzhou Zijingang Super Charging Station
ABB	<b>ABB 480kW High-power Liquid Cooling Super Charging Equipment:</b> In August 2022, the first ABB 480kW high-power liquid cooling super charging equipment in China was officially delivered in Xilihu International Science & Education City;
Zhiguang Research Institute	<b>8760 PV-Storage-Charging Super Charging Station:</b> In September 2022, the 480kW super storage and charging demonstration station--8760 PV-storage super charging station, developed and constructed by Zhiguang Research Institute (Guangzhou) Co., Ltd., was successfully operated in Guangzhou Science City.

Source: ResearchInChina



## Trend 2: Battery swapping

The battery swapping mode is a fast power supplement mode for new energy vehicles. The battery is stored and charged through a centralized battery swapping station, and then the battery swapping service is provided for the car owners to achieve the same speed of battery supplement and refueling. According to the statistics of Charging Alliance, as of September 2022, China has 1762 battery swapping stations (excluding heavy truck battery swapping). In terms of provinces and cities, the top ten charging stations are Beijing, Guangdong, Zhejiang, Jiangsu, Shanghai, Shandong, Sichuan, Hebei, Hubei and Jilin, and top three provinces account for 39.9% of the total.

According to the different battery installation position, size and endurance mileage, the battery swapping methods are divided into passenger car and commercial vehicle, in which passenger car battery swapping is divided into module-in-box and integrated chassis; the commercial vehicle battery swapping can be divided into top-hanging type, overall one-sided type and overall two-sided type.

### Classification of Battery Swapping Methods



Source: ResearchInChina











## Trend 2: Battery swapping

In the passenger car market, the main battery swapping operators in China at present include NIO, Aulton New Energy, Blue Park Smart Energy, First Technology, etc., of which NIO and Aulton New Energy are far ahead in the number of covered battery swapping stations.

The promotion and application of battery swapping mode need not only technical support of enterprises, but also cooperation of national standards, battery standards, vehicle manufacturers and energy enterprises. The "national team" in the field of battery swapping was established in 2022. On September 22, 2022, Shanghai Jieneng Intelligent Power New Energy Technology Co., Ltd. jointly invested by Sinopec, CNPC, SAIC, CATL and Shanghai International Automobile City Group was officially established, The registered capital is RMB 4 billion, and the business scope covers power battery leasing, energy supplement technology R&D and promotion, battery operation management, big data services, etc.

With establishment of "National Team" for battery swapping, 2022 will become the first year of China's battery swapping mode development. In the future, improvement of standardization of battery swapping vehicle model, BaaS mode and cascade utilization of batteries will become three major development trends of battery swapping technology.

Type and Operation Mode of Battery Swapping Operators

Operator Type	Operation Mode	Representative Enterprises
Independent battery swapping operators	The core positioning of independent battery swapping operators is to <b>cooperate with automakers</b> to develop the battery swapping vehicle models and focus on serving taxi users.	Aulton New Energy and First Technology  
New energy automakers	As a core role in the field of battery swapping, new energy automakers are intended to <b>build their own platforms and ecosystems</b> .	NIO, Geely and BAIC   
Battery enterprises	The core of battery enterprises' incoming battery swapping is to <b>promote battery standardization</b> and realize battery full-life cycle service.	CATL 
Energy suppliers	State owned energy suppliers enter the battery swapping business mainly to <b>promote the standardization of battery swapping, energy transformation</b> , and achieve the energy goal of carbon peak and carbon neutral.	State Grid, CNPC, Sinopec    

Source: ResearchInChina

## Trend 3: PV-storage-charging integrated smart energy station

PV-storage-charging integrated smart energy station takes the electric vehicle charging station as carrier, based on the design concept of energy Internet, integrates photovoltaic, energy storage and other distributed energy systems, realizes the coordinated operation of energy, grid, load and storage, and on this basis, carries out practical demonstration of multiple commercial operation modes of electric vehicle charging and discharging facilities.

At present, the PV-storage-charging integrated station market has accommodated vehicle companies, battery companies, charging operators, energy companies and others, mainly through cooperative construction and operation of various enterprises, and most of them are demonstration stations and new energy practice stations.

China has small proportion of PV-storage-charging integrated stations, and the large-scale promotion is late, mainly because the construction of PV-storage-charging integrated stations needs large investment, and many enterprises are still waiting for the policy trend; as well as low technology maturity. With the launch of super-charged vehicles by OEMs, the cost efficiency improvement of energy storage batteries and the support of national policies, 2025 will be the first year of PV-storage-charging industry development.

### Partial PV-storage-charging integrated smart energy station construction projects in China

Project	Project Planning
State Grid highway service area "PV-Storage-Charging" Integrated Demonstration Project	The total designed PV capacity is 292.1kW, the capacity of energy storage battery is 500Ah, and the total investment is 3.143 million yuan. The designed PV power generation in the first year is 385,000 kWh, and each charge and discharge of energy storage battery is 205 kWh. <b>Charging equipment:</b> 4x60kW fast charging station <b>Energy storage equipment:</b> roof PV module capacity 287.1kW, thin film module 5.0kW, 500Ah energy storage battery pack, time limit switch, grid-tied metering device
Tesla's first PV-Storage-Charging integrated super charging station	<b>Energy storage /charging equipment:</b> the integrated super charging station is equipped with commercial Powerpack of Powerwall, and has V3 super charging piles and destination charging piles. Up to now, Tesla China official website has a Powerwall interface, with energy reserves of 13.5kWh, charging/discharging cycle efficiency of 90%, and continuous output power of 5kW. At present, the product has not been officially released in Chinese market.
Star Charge- PV-Storage-Charging-Discharging Integrated Charging Station at Changzhou Administrative Center	<b>Energy storage /charging equipment:</b> the reconstruction area of charging station is 1300 square meters, and 1227kW charging piles are built, which can meet simultaneously charging requirements of 43 vehicles. The construction of photovoltaic canopy is 142kW, and the daily power generation is 350kW, saving 160 tons of carbon emissions every year.
The world's first PV-Storage-Charging integrated super charging station of GWM	At the end of 2021, the world's first PV-Storage-Charging integrated super charging station of GWM was located in Bangkok, Thailand. <b>Charging equipment:</b> There are six charging parking spaces, which adopt DC fast charging mode to meet the fast charging of six pure electric vehicles at the same time.

Source: ResearchInChina

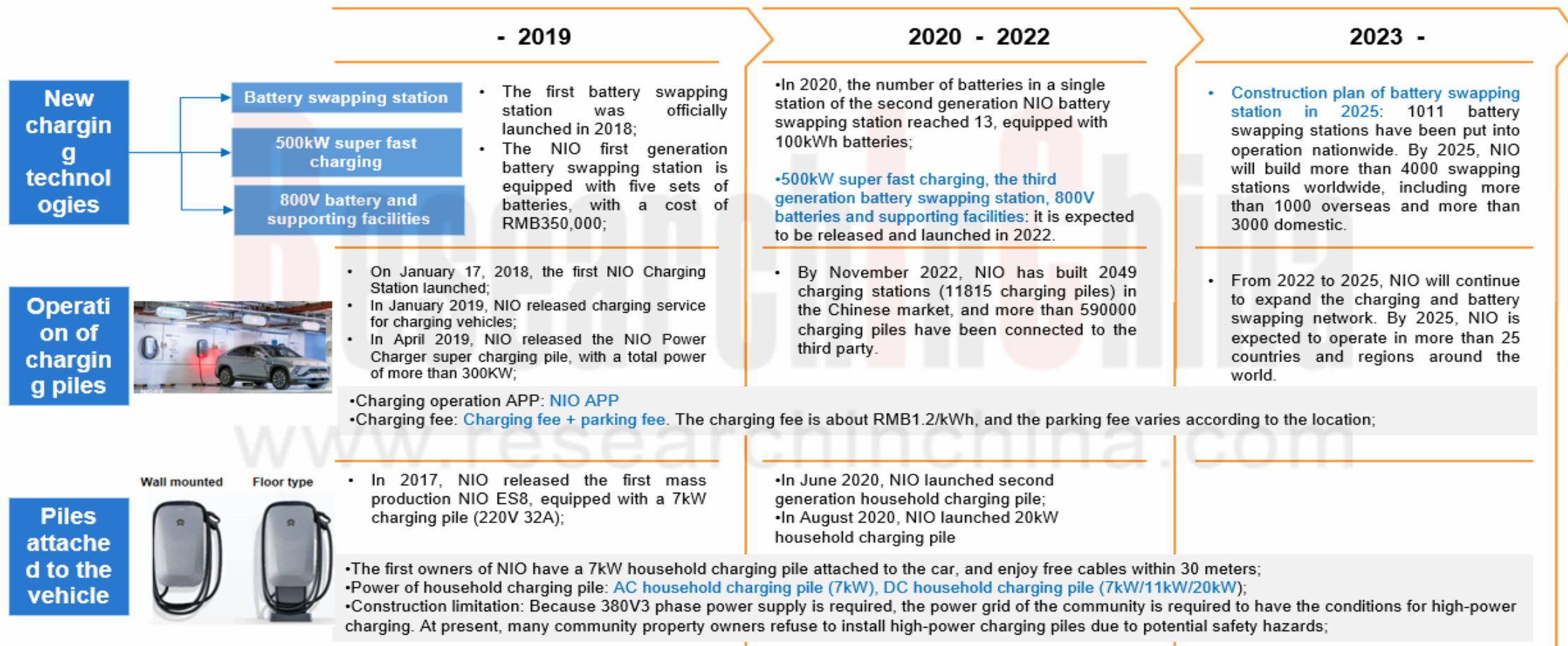
Taking NIO as an example, NIO has already layout in battery swapping station and ultrafast charging: the second generation of NIO battery swapping station has been put into use, introducing the BaaS mode. NIO also leads the establishment of Wuhan Weineng Battery Assets Co., Ltd. which is responsible for battery management and operation. According to the plan, the third generation battery swapping station and 500kW ultrafast charging station will be released at the end of 2022.

NIO automotive super-charge network: 500kW ultrafast charging is expected to achieve a peak current of 650A, and adopts liquid-cooling gun line design. In addition, NIO also announced 800V high-voltage platform battery pack and supporting battery swapping system, and which will be open to the whole industry in the future.

NIO battery swapping station: the second generation of NIO battery swapping station is the first in the world to realize autonomous parking in mass production. It is a software-defined and end-cloud combined intelligent battery swapping system. A total of 239 sensors and 4 cloud systems are arranged in the second generation battery swapping station to work together, comprehensively deepening the application of visual recognition technology. With the help of science and technology, users can start self-service battery swapping with one button in the car without getting off.



## NIO-Layout of Charging/Battery Swapping Infrastructure



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## Beijing Headquarters

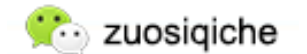
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