Chapter 1
Overview

In the context of a new round of technological revolution and industrial transformation, the electrification, connection and intelligence of vehicles have become the mainstream development trend of the automobile industry. The high-quality development of the new energy vehicle (NEV) industry is very critical to the improvement of the international competitiveness of the automobile industry and the efficient coordinated development of urban transportation, energy resources and the environment. This report, based on the big data of millions of new energy vehicles on the National Monitoring and Management Platform for NEVs (hereinafter referred to as the "National Monitoring and Management Platform"), makes an objective and in-depth analysis of the NEV market characteristics, the NEV operation characteristics, the NEV charging characteristics and other industry concerns, providing a significant reference for relevant governments, scientific research institutes, universities and enterprises in China's automobile industry. The NEVs referred to in this report mainly include battery electric vehicles (BEVs), plug-in hybrid electric vehicles (FCEVs) (including extended-range electric vehicles (E-REVs)) and fuel cell electric vehicles (FCEVs).

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1.1 Overview of the Development of New Energy Vehicle (NEV) Industry in 2020

1.1.1 General Development Situation of Global New Energy Vehicle (NEV) Market

The global new energy vehicle (NEV) market is growing rapidly, especially in China.

At the beginning of 2020, the NEV market showed a sluggish growth due to the COVID-19 outbreak. With the adoption of the subsidy policies in Europe and the rapid control of the epidemic in China, the NEV markets in both Europe and China showed a rapid growth trend, and in 2020, the global NEV sales were up to 3.28 million, increasing by 43.7% compared with 2019. Especially in China, the NEV sales in 2020 have reached 1.367 million, accounting for 41.7% (Fig. 1.1) of the global NEV sales of that year.

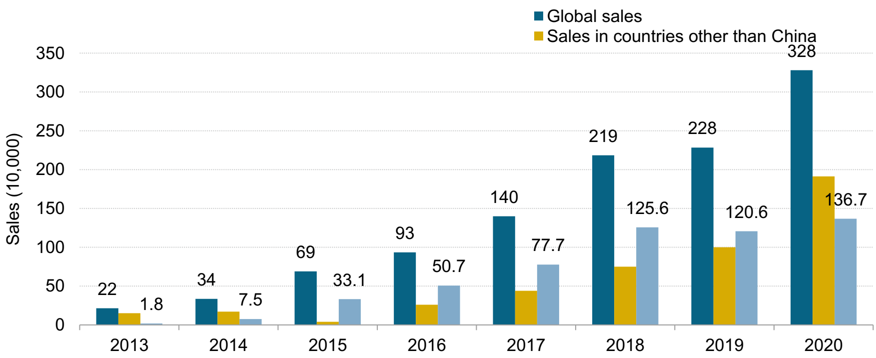

Fig. 1.1 Global sales of NEVs over the years. *Source* China Association of Automobile Manufacturers (CAAM) for sales data of NEVs in China; EV-volumes for sales data of NEVs in countries other than China

1.1.2 General Development Situation of New Energy Vehicle (NEV) Industry in China

(1) China has made remarkable achievements in automobile electrification, and the market penetration rate of NEVs has steadily increased

The scale of the NEV industry is expanding, with the development in 2020 better than expected.

In 2019, due to cyclic fluctuations in the automobile industry, the reduction of subsidies, and the sales promotion of conventional fuel vehicles, the NEV market declined for the first time and developed not as well as expected. In the first half of 2020, the NEV market was severely hit by the COVID-19 outbreak, but it was recovered and showed a strong growth in the second half of the year. Throughout 2020, the sales of NEVs reached 1,367,000, with a YoY growth rate of 10.9% (Fig. 1.2). As of December 31, 2020, the cumulative access of NEVs in China was more than 5,500,000, exceeding the target of 5,000,000 NEVs in the *Energy Conservation and New Energy Vehicle Industry Development Plan (2012–2020).*

The automobile electrification process is accelerating, with the market penetration rate of NEVs exceeding 5% in 2020.

Since 2014, the electrification of China's automobile market has accelerated significantly. By 2020, China's NEV penetration rate has increased to 5.10% from 0.33% in 2014 (Fig. 1.3), indicating that China has made remarkable achievements in the marketization and scale development of NEVs. As expected in the *Notice on Issuing the New Energy Vehicle Industry Development Plan (2021–2035)* (GBF [2020] No. 39) issued by the General Office of the State Council on November 2, 2020 (hereinafter referred to as the "2021–2035 Plan"), the sales of NEVs will account for about

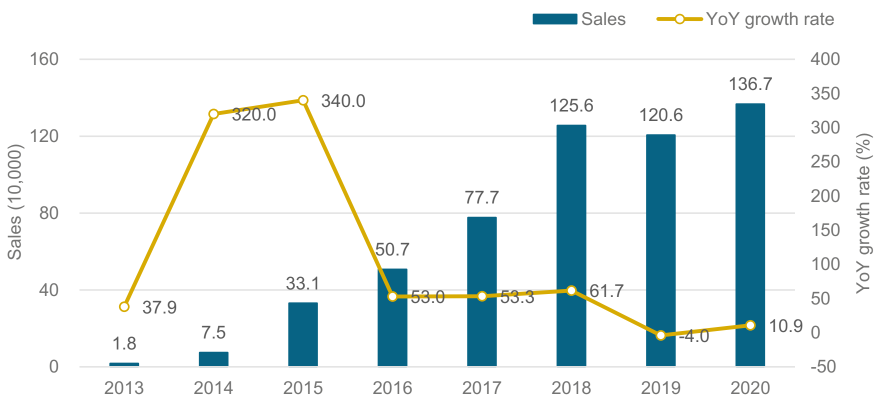

Fig. 1.2 Sales of NEVs in China over the years. *Source* China Association of Automobile Manufacturers (CAAM)

20% of the total sales of new vehicles by 2025. It is also expected that in the next five years, with the gradual maturity of the industrial chain and the further optimization of the operating environment, the market demand for NEVs will further expand, and the electrification process of the vehicle will be further accelerated.

(2) New energy passenger cars dominate the NEV market, with the market share increasing year by year

Considering the model construction, the new energy passenger cars dominate the NEV market, and in 2020, the market share of new energy passenger cars in China's NEV market has reached 86.3%, with an increase of 9.2% compared with 2018 and an increase of 4.6% compared with 2019; the driver of NEV development has gradually changed from policy to market (Fig. 1.4). In the segment of new energy passenger cars, the BEV passenger cars take a lion's share of 71.5% in 2020, showing a year by year increasing trend.

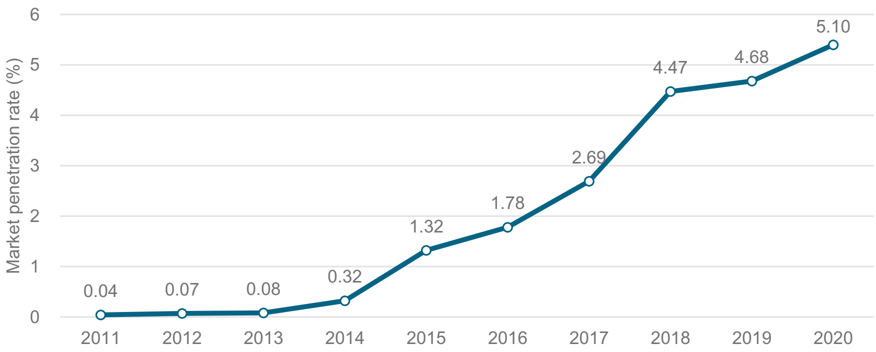

Fig. 1.3 Market penetration rate of NEVs in China over the years. *Source* China Association of Automobile Manufacturers (CAAM)

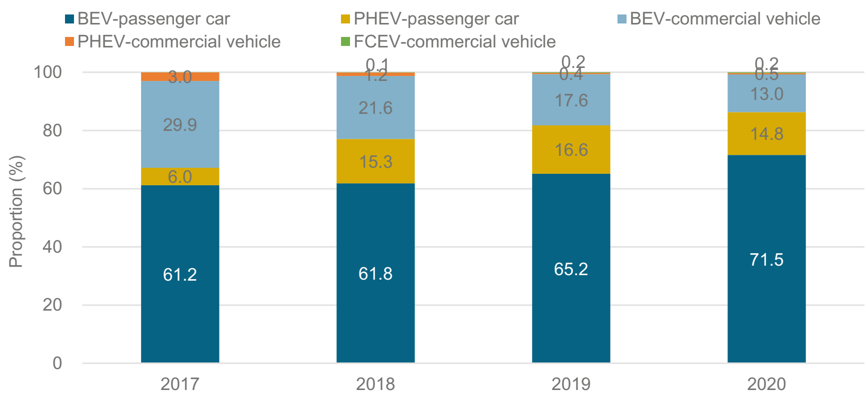

Fig. 1.4 Proportion of access of NEVs of different types over the years

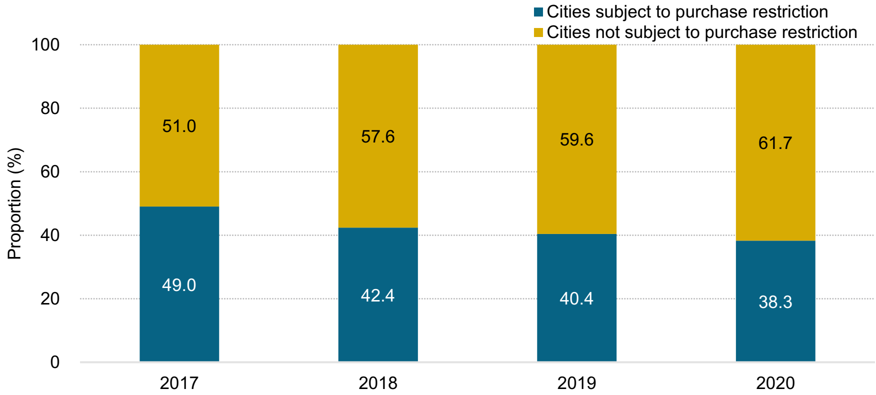

Fig. 1.5 Changes in the proportion of new energy passenger cars in cities subject to purchase restriction and cities not subject to purchase restriction

(3) The new energy passenger car has become more and more market oriented, and private purchase has become an important driving force

Consumer demand in cities not subject to purchase restrictions is strong, and the market share of new energy passenger cars is increasing year by year.

Under the stimulation of consumption promotion policies and the countryside NEV promotion activities, the awareness and recognition of NEVs by users in cities not subject to purchase restrictions have gradually increased, contributing to the surge of consumer demand in these cities. Specifically, in 2020, the market share of new energy passenger cars in these cities was 61.7%, showing a year by year growth trend compared with 2017 and 2018 (Fig. 1.5).

Private purchase has become an important driving force for the growth of new energy private cars in the NEV market.

In 2020, the adoption of the countryside NEV promotion policy and the launch of economic products promoted the rapid release of private consumer demand for new energy passenger cars, with the proportion of private purchases in total sales increasing to 71.1%, indicating that the private purchase has become the important driving force of the growth of new energy private cars in the NEV market (Fig. 1.6).

(4) The overall technological level has been significantly improved, and the industry is moving towards a new stage of high-quality development

In the field of complete vehicles, the range of NEVs has increased year by year, with the ranges of new energy passenger cars, new energy buses, and new energy logistics vehicles increasing more or less, and the range of BEVs of different types enjoying a rapid growth. Specifically, the average range of BEV passenger cars increased by 34.9% over 2018 to 394 km in 2020, and the proportion of BEV passenger cars with a range of more than 400 km has increased quickly from the 2.6% in 2018 to the 58.7%

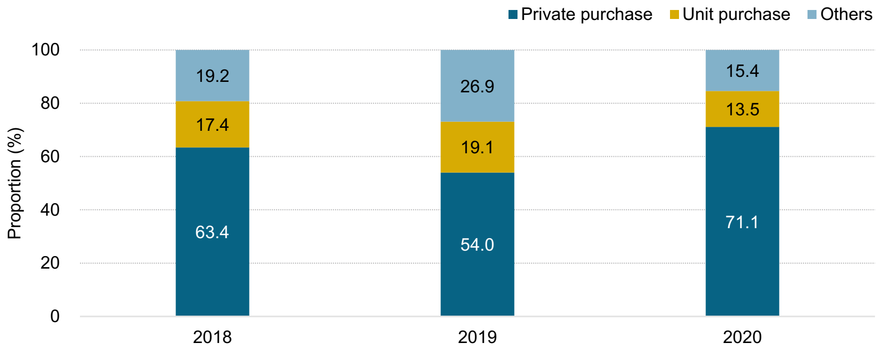

Fig. 1.6 Changes in the proportion of new energy passenger vehicles by nature of use

in 2020; the proportion of BEV buses with a range of more than 300 km increased from 44.7% in 2018 to 77.7% in 2020; and the proportion of BEV logistics vehicles with a range of 200–300 km has increased year by year.

Along with the fast increase of vehicle range, the body lightweight technology has also achieved a significant breakthrough, which, as an important part of the automobile technology system, is not only a common choice for China to cope with energy and environmental challenges, but also the only way for the sustainable development of the NEV industry. As a common key technology, lightweight is expected to coexist with the carbon neutrality target of the automobile industry for a long time. Talking from different types of vehicles, the curb weight of new energy passenger cars and buses has reduced significantly, and the lightweight technology for BEV passenger cars has progressed a lot. In recent years, with the substantial improvement of lightweight technology and the application of lightweight materials such as carbon fiber and aluminum alloy, lightweight technology has become an important means for NEVs to reduce energy consumption and carbon emission.

As for the key components of NEVs, taking the battery as an example for explanation, the ternary battery is the main type of battery used on the NEVs, but the application of lithium iron phosphate battery is gradually increasing, showing a market return trend. Talking from different types of vehicles, the ternary battery is mainly used by passenger cars, but the proportion of passengers with lithium iron phosphate battery increased in 2020, indicating that the lithium iron phosphate battery has gradually returned to the market. For BEV buses and logistics vehicles, a vehicle construction based on lithium iron phosphate battery is gradually into shape; the energy storage systems of NEVs are developing towards higher voltage, and specifically, the voltage of energy storage systems for new energy passenger cars and new energy buses are increasing significantly, and the energy storage systems for BEV passenger cars of different classes show obvious high-voltage development trend.

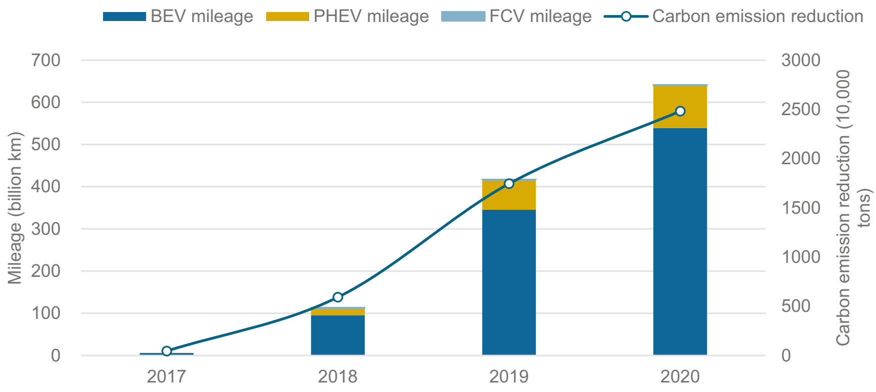

Fig. 1.7 Contribution of NEVs to carbon emission reduction in China-by year

(5) The NEVs demonstrate good energy saving and carbon emission reduction effects

In China, the mileage covered by NEVs has reached 117,690,000,000 km, which is equivalent to a cumulative carbon emission reduction of 48,641,000 tons.

As of December 31, 2020, the NEVs accessed to the National Monitoring and Management Platform have been up to 3,923,000, and the mileage covered by them has reached 117,690,000,000 km, which is equivalent to a cumulative carbon emission reduction of 48,641,000 million tons. According to the data over the years, the annual contribution of NEVs to carbon emission reduction has increased significantly since 2019, and in 2019 and 2020, it was 17,449,000 tons and 24,811,000 tons respectively (Fig. 1.7).

The electricity consumption per 100 km of BEV passenger cars has dropped significantly, and that of commercial vehicles has only increased slightly.

According to the operation data of vehicles of different types on the National Monitoring and Management Platform, the electricity consumption per 100 km of BEV passenger cars is decreasing year by year. Specifically, in 2020, the electricity consumption of BEV passenger cars of Class A0 and below was down to 12.4 kWh/100 km, and that of BEV passenger cars of Class A was 14 kWh/100 km. It is planned in the *Technology Roadmap for Energy Saving and New Energy Vehicles 2.0* (hereinafter referred to as the "*Technology Roadmap 2.0*") to reduce the combined electricity consumption of technically-leading Class A BEVs to below 11 kWh/100 km (CLTC[1]) by 2025. According to the combined electricity consumption of BEV passenger cars of different classes on the National Monitoring and Management Platform, there is still a certain gap from the planned target of the *Technology Roadmap 2.0*.

[1] China light-duty vehicle test cycle (CLTC), representing the driving cycle of vehicles in China.

In 2020, the electricity consumption of BEV buses was 73.6 kWh/100 km, and that of BEV logistics vehicles was 33.8 kWh/100 km, both of which increased slightly compared with last year. In the future, the commercial vehicle still embraces large potential for the application of lightweight technology.

1.2 NEV Operation Characteristics of China in 2020

For the purpose of this report, an overall assessment is made from such dimensions as the operation characteristics, charging characteristics, battery swap characteristics and fuel cell electric vehicles (FCEV).

1.2.1 NEV Operation Characteristics

(1) Due to the COVID-19 outbreak, the operation characteristics of some vehicles in 2020 were different from those of previous years

At the beginning of 2020, COVID-19 broke out, and in order to effectively control the epidemic, people around China have established a consensus of "No Gathering and Minimum Mobility", restaurants and entertainment venues are closed, and the vehicle movement is restrained due to such factors as regional isolation, restricted population mobility and extended holidays, and under this situation, some NEVs showed different operation characteristics from the previous years.

Specifically, at the beginning of 2020 when the epidemic prevention and control was in its most tough stage, the average single-trip speed of vehicles of different types was significantly higher than that of the same period in 2019, but after the epidemic was quickly brought under control and the population mobility was recovered, the average single-trip speed was gradually reduced to the level in 2019. For example, in February 2020, the average single-trip speed of private cars was 33.23 km/h, and after June, it was dropped to and maintained at about 28 km/h.

The logistics vehicles performed outstandingly in 2020, with the average daily mileage in each month significantly higher than that of the same period in 2019, and logistics vehicles played an important role in fighting the epidemic and ensuring the smooth operation of transportation. Taking Wuhan as an example, at the beginning of 2020 when the epidemic situation was extremely severe, the number of new energy logistics vehicles participated in the transportation of medical materials in Wuhan accounted for 55.8% of the new energy logistics vehicles put into operation at that time, greatly alleviating the pressure arising from the lack of medical materials in medical institutions.

From February to March 2020 when the epidemic was severe, residents were less willing to go outside, the operation of e-taxis and taxis were significantly restrained, and the average monthly travel duration and mileage of vehicles decreased compared with 2019. But then, with the rapid control of the epidemic, the operation of e-taxis and taxis gradually recovered.

The effect of the epidemic on the cars for sharing was limited, and the average monthly mileage was far greater than the expectation. But during the first half of 2020, the operation of cars for sharing was somehow affected, and since April when the epidemic was controlled, the daily mileage of cars for sharing has increased quickly to a level far more than that of the same period in 2019. To sum up, the average monthly mileage of cars for sharing throughout 2020 was 2613 km with a YoY increase of 65.06% year over year, and the proportion of cars for sharing with a daily mileage of more than 200 km increased from 13.81% in 2019 to 15.89% in 2020, indicating that demand for car sharing in long-distance travel is gradually increasing. Such an increase was out of our expectation, which is partly due to the stop of cross-province and cross-border tourism and the rapid development of suburban tourism under the repeated outbreaks of the epidemic in 2020.

(2) Vehicle mileage characteristics

As of December 31, 2020, the cumulative mileage covered by NEVs was up to 117,690,000,000 km.

According to data on the National Monitoring and Management Platform, the cumulative mileage covered by NEVs as of December 31, 2020, was up to **117,690,000,000** km, including 98,500,000,000 km (83.7%) covered by BEVs, 19,000,000,000 km (16.2%) covered by plug-in hybrid vehicles (FCEVs), and more than 100,000,000 km covered by FCEVs. Now, the NEVs have stepped into the large-scale demonstration and promotion stage (Fig. 1.8).

The average daily mileages in segments other than e-taxis and taxis have somehow increased.

In 2020, the average daily mileage of e-taxis and taxis decreased compared with 2019 (Fig. 1.9), while the average daily mileage in other segments including private cars, cars for sharing, logistics vehicles, buses and heavy-duty trucks increased.

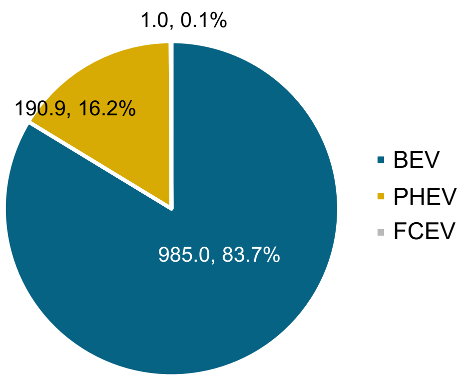

Fig. 1.8 Distribution of cumulative mileage of vehicles of different types (100,000,000 km, %)

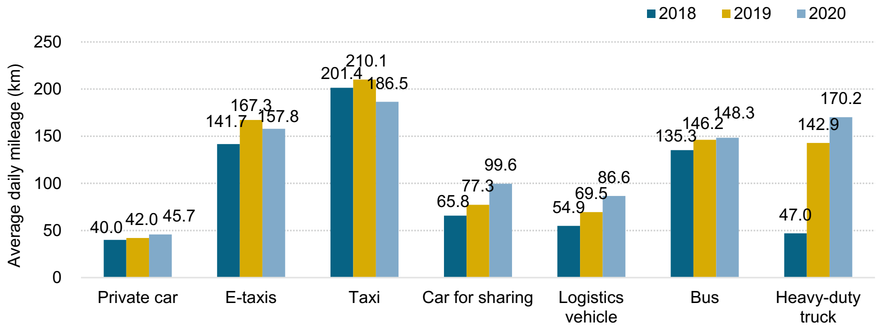

Fig. 1.9 average daily mileage of vehicles in key segments

Specifically, in 2020, the average daily mileage of cars for sharing and logistics vehicles increased by 28.9% and 24.6% respectively compared with 2019, indicating that the operation intensity of these two vehicles increased; the average daily mileage of heavy-duty trucks was 170.2 km, increasing by 19.1% compared with last year.

The average monthly mileages of vehicles other than e-taxis and taxis have somehow increased.

In 2020, the average monthly mileage of private cars, cars for sharing, logistics vehicles, buses, and heavy-duty trucks increased (Fig. 1.10). Specifically, the average monthly mileage of cars for sharing and logistics vehicles was 2613 km and 2169 km respectively, increasing by 65.1% and 52.2% respectively compared with last year; the average monthly mileage of heavy-duty trucks was 3294.54 km with an increase of 38.3% compared with last year, and the proportion of heavy-duty trucks with an average monthly mileage of more than 5000 km was up to 30.6%.

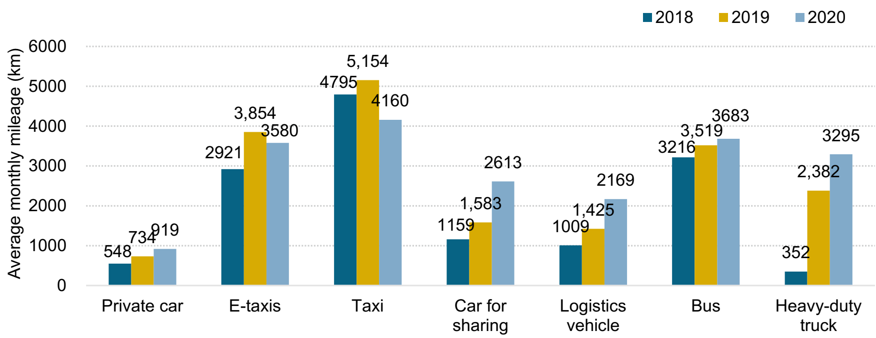

Fig. 1.10 Average monthly mileage of vehicles in key segments

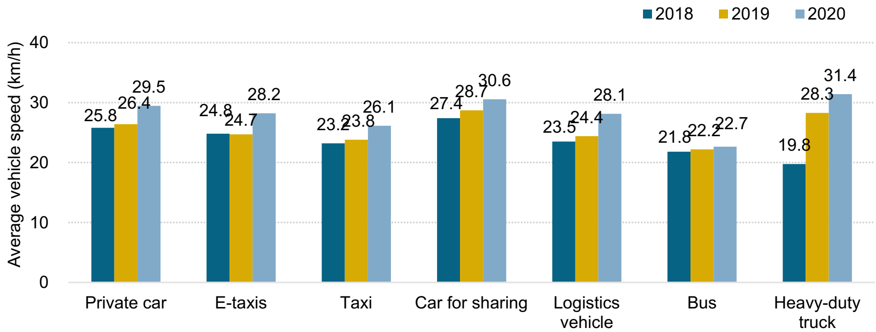

Fig. 1.11 Average speed of vehicles in key segments

(3) Vehicle speed characteristics

In 2020, the average single-trip speed of all types of vehicles increased compared with last year, and the traffic efficiency was improved significantly.

In 2020, the average single-trip speed of vehicles in key segments increased, the traffic efficiency was significantly improved, and user satisfaction was higher (Fig. 1.11). Specifically, in 2020, the average speed of private cars, e-taxis, taxis, cars for sharing, logistics vehicles, and heavy-duty trucks were all above 25 km/h, and among them, the average speed of heavy-duty trucks was up to 31.4 km/h, but the average speed of buses was relatively slow, i.e., only 22.7 km/h.

1.2.2 NEV Charging Characteristics

(1) Characteristics of changes in vehicle charging methods

The proportion of fast charging times in each segment is increasing year by year.

As shown in Fig. 1.12, the proportion of fast charging times in each segment is increasing year by year. As the distribution shows, the proportion of fast charging times of private cars is generally low, which was 15.4% in 2020, with an increase of 3.1% compared with last year; the proportion of fast charging times of e-taxis and taxis is the highest, and that of cars for sharing has increased quickly.

(2) Characteristics of charging duration

The average single-time charging duration of vehicles in each segment decreased compared with last year.

In 2020, the average single-time charging duration of each key segment decreased compared with 2019. Specifically, the average single-time charging duration of

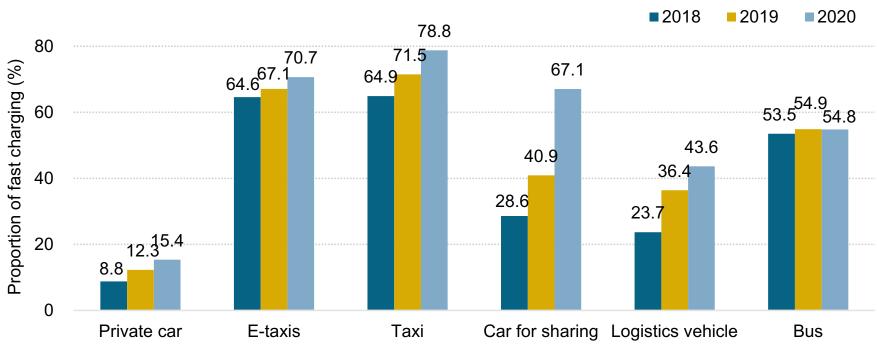

Fig. 1.12 Proportion of fast charging times in key segments

private cars was the highest with a value of 3.2 h, which is 0.8 h shorter than that in 2019 (Fig. 1.13).

In key segments, the average single-time charging duration is closely related with the proportion of fast charging times. That is, the lower the proportion of fast charging times, the longer the average single-time charging duration (Fig. 1.14).

(3) Characteristics of vehicle charging times

The average monthly charging times of vehicles in main segments other than logistics vehicles decreased compared with last year.

In 2020, the average monthly charging times of vehicles in other segments than logistics vehicles decreased compared with last year (Fig. 1.15), and among those vehicles, the decreases in average monthly charging times of e-taxis and taxis were the highest, which were 3.3% and 5.5% respectively; the monthly charging times is closely related to the monthly mileage (Fig. 1.16), and in view of this, the monthly charging times of taxis, buses and e-taxis are the highest, as their monthly mileages are longer.

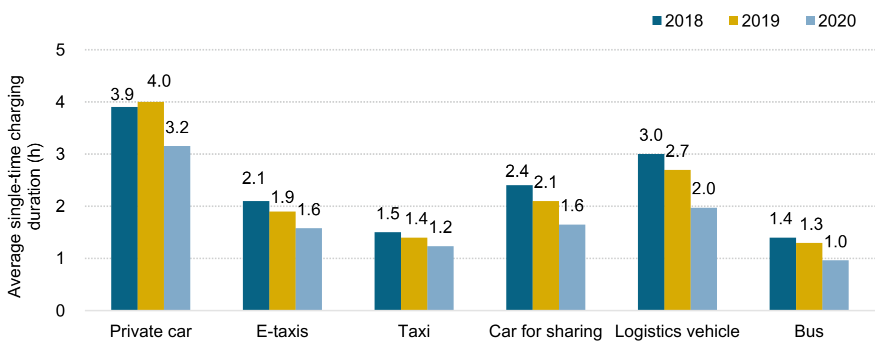

Fig. 1.13 Average single-time charging duration in key segments

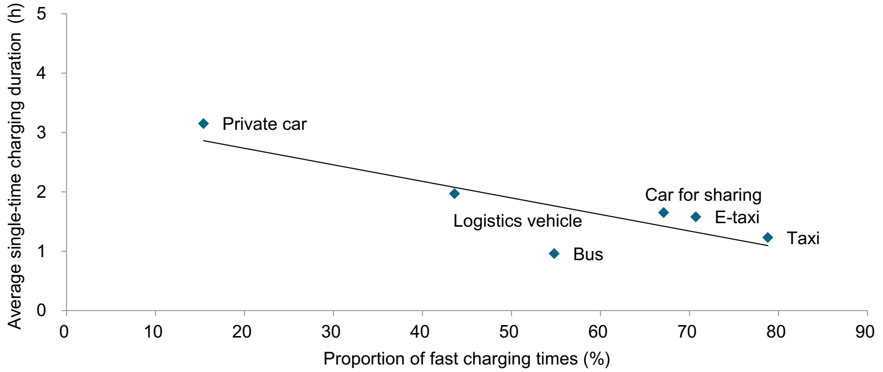

Fig. 1.14 Relationship between the average single-time charging duration and the proportion of fast charging times

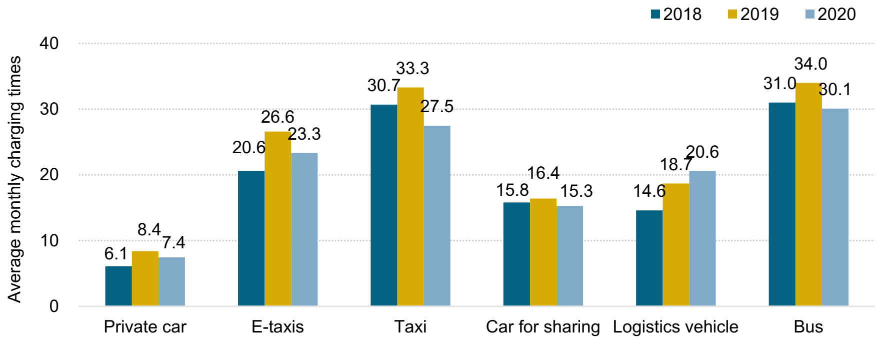

Fig. 1.15 Average monthly charging times in key segments

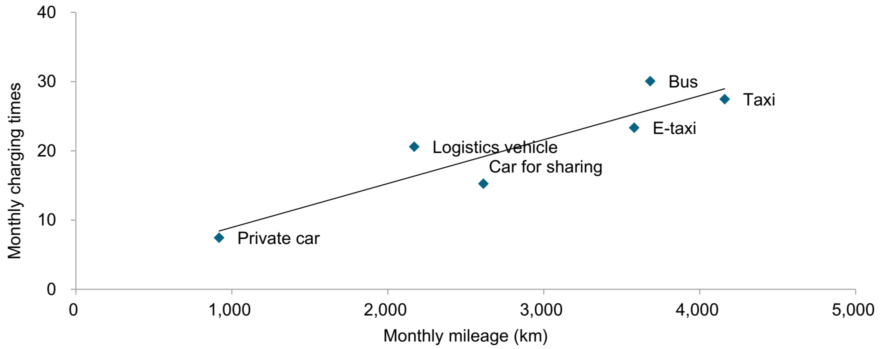

Fig. 1.16 Relationship between monthly charging times and monthly mileage in 2020

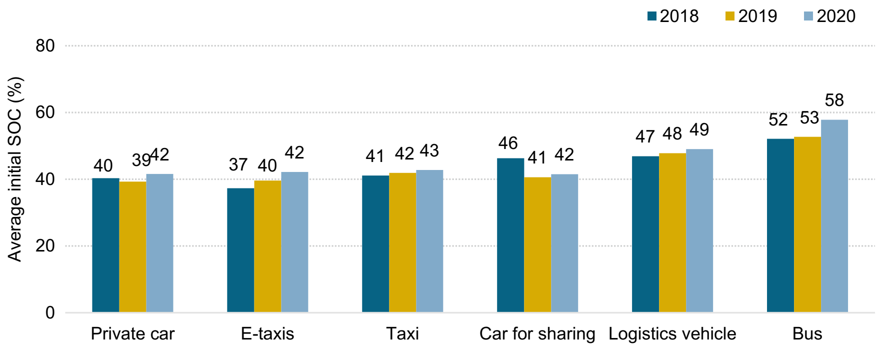

Fig. 1.17 Average start-of-charge SOC in key segments

(4) Start-of-charge SOC characteristics

The average start-of-charge SOC of vehicles in main segments increased compared with last year.

As shown in Fig. 1.17, the average start-of-charge SOC of vehicles in all key segments increased compared with 2019. Specifically, the average start-of-charge SOC of buses is the highest, and is increasing year by year. The average start-of-charge SOC of vehicles is closely related to the increase of range and the maturity of charging facilities.

1.2.3 NEV Battery Swapping Characteristics

The combination of "battery charging + battery swapping" has become the mainstream power supplement configuration for electric vehicles (EVs). According to the proportion of battery swapping times, the EVs of battery swap type are generally power supplemented by both charging and battery swapping, and for taxis/e-taxis and private cars, the battery swapping times are generally lower than the charging times; the battery swapping stations and their commercial innovation mode need to be improved. The average monthly battery swapping times of heavy-duty trucks is 24.9, which is significantly higher than the average monthly charging times (i.e., 15.7), and indicates that the heavy-duty trucks of battery swap type have higher operation intensity and better operation effect. From the perspective of power supplement method, the heavy-duty trucks of battery swap type can realize power supplement quickly, addressing the technical difficulty of slow charging speed of rechargeable heavy-duty trucks and thus improving the operational efficiency; from the perspective of economy, the heavy-duty trucks of battery swap type have the battery separated from the vehicle, and thus the battery can be rented, greatly reducing the purchase cost, and enabling an economy significantly higher than that of the fueled heavy-duty trucks of the same class. Therefore, the heavy-duty truck of battery swap type is of great value to be popularized in specific fields such as urban transportation, mines and ports, and will help to promote the application of BEV heavy-duty trucks.

1.2.4 Fuel Cell Electric Vehicles (FCEVs)

Fuel cell electric vehicles are still in the scale demonstration and promotion stage. According to the data on the National Monitoring and Management Platform, the cumulative access of fuel cell electric vehicles (FCEVs) to the Platform as of December 31, 2020, mainly including FCEV buses and FCEV logistics vehicles, has exceeded 6000.

Then, based on the operation characteristics of FCEVs, as of December 31, 2020, FCEVs have achieved a cumulative mileage of 106,420,000 km and a cumulative travel duration of 3,880,000 h; their overall online rate is growing steadily year by year, and in 2020, it was 2020 is 75%, which is higher than that in 2019, but is still lower than the overall online rate of NEVs. This gap is closely related to factors such as the maturity of infrastructures and the convenience of use of vehicles in the initial stage of industrial development.

1.3 Suggestions for the Sound and Sustainable Development of China's New Energy Vehicle Industry

In the next five years, we will embrace the accelerated technological revolution and industrial transformation around the world, as well as the critical period of complete NEV marketization under the construction of a new development pattern of domestic-international dual circulation. To grasp the new development opportunities of the NEV industry, implement the new concept of green development, and empower the strategic transformation of China from a big automobile country into a powerful automobile country, concerted efforts of many forces in the industry are required. This report, according to the development and operation characteristics of the NEV industry on the National Monitoring and Management Platform, concludes the relevant suggestions for the development of the NEV industry to provide decision-making reference for policy-making departments and related enterprises.

(1) Implement the new concept of green development, and take multiple measures to achieve the goals of carbon peak and carbon neutrality in the automobile industry as scheduled

At the general debate of the 75th Session of the United Nations General Assembly on September 22, 2020, President Xi Jinping announced that China would scale up its nationally determined contributions (NDCs) by adopting more vigorous policies and

measures, striving to peak CO_2 emissions before 2030, and achieve carbon neutrality before 2060. The Central Economic Work Conference clearly listed "carbon peak and carbon neutrality" as one of the key tasks in 2021, and required to develop an action plan for peaking carbon emissions by 2030 to support places with conditions to take the lead in peaking carbon emissions. It is promised in the *Technology Roadmap for Energy Saving and New Energy Vehicles 2.0* that the automobile industry will peak carbon emissions ahead of the national carbon emission reduction commitment in 2028, and by 2035, the total carbon emissions will drop by more than 20% from the carbon peak.
According to the evaluation of the energy conservation and carbon emission reduction effect of NEVs on the National Monitoring and Management Platform, the top-level design, as well as the promotion and application of energy conservation and carbon emission reduction technologies in various dimensions such as the upstream energy link and production link of the NEV industry shall be strengthened, so as to improve the overall energy conservation and carbon emission reduction efforts of the automobile industry. The specific measures are as follows:

(1) Speed up the clean energy application for vehicles. The upstream energy link is the main contributor of carbon emissions of NEVs. It is recommended to actively promote coal abandoning in the power industry with clean electricity as the goal. Promotion of continuous deployment of clean energies is of great significance for accelerating the life-cycle carbon emission reduction of NEVs and promoting the achievement of long-term carbon neutrality goal of the automobile industry.
(2) Accelerate the deployment of green products and promote lightweight and downsizing as the main methods to promote carbon emission reduction in the automobile industry. The local governments shall accelerate the electrification in the public sector, speed up the application of electric vehicles for heavy emission vehicles such as muck trucks and mining vehicles; explore comprehensive electrification in the field of logistics; further, explore incentives for commercial innovation of electrification in the field of private cars, and accelerate electrification in the field of private consumption. The enterprises shall follow up and implement the national goals and paths of carbon emission reduction technology for the automobile industry, and accelerate the formulation and implementation of electrification strategies to promote the green transformation of automobile products.

(2) The NEV industry has a good long-term development potential, but a technological breakthrough is still necessary in the short term

Though remarkable achievements have been made, the NEV industry still faces many problems and contradictions in the course of development, such as long-term reliance on imports due to weak technical foundation of key core components and materials; inconvenient charging; low EV safety; and rapid deterioration of battery in winter and slow charging in low temperature environments. China's NEV industry is still in its critical stage where a series of difficulties are to be tackled and the quality is to be improved.

To solve those problems, the measures to be taken include: increasing the support for auto makers and parts manufacturers; establishing a common technology innovation model that combines production, education and research resources with key common technologies as focus; increasing collaboration in the research and development of key components such as heat pump and air conditioner, electronic brake and DC–DC converter to further improve the performance and economy of NEVs while ensuring the safety of the vehicle; and in addition, strengthening the joint innovation and research of comprehensive cross and basic cutting-edge technologies; strengthening international cooperation to enhance the innovation ability of the NEV industry chain and build a new industrial ecosystem.

(3) In the field of charging facilities, promote the deep integration of vehicles with grid, and accelerate the construction of a comprehensive charging system combining charging and battery swapping functions

Charging infrastructures, as the link between the automobile industry and the energy industry, will promote the low-carbon development and energy transformation of the automobile industry. With the large-scale market-based development, NEVs will play an important role in the adjustment of energy structure in the future, and as the largest mobile energy storage units, they will play an active role in the adjustment of energy structure and the construction of digital energy system. The specific recommendations are as follows.

Strengthen the top-level design, increase cross-sector coordination, promote the construction of NEV charging facilities, and optimize the operation environment of charging facilities. The application of NEVs is closely related to the convenience of the use of charging facilities. With the large-scale market-based promotion of NEVs, the popularization of charging infrastructures in cities of third tier or below and vast rural areas will become an important measure for the application satisfaction of NEVs.

Accelerate the two-way integration of vehicle and energy, and promote the deployment of mobile digital energy networks. The networking of charging facilities is of great significance for the balance of grid loads, peak-load shifting, and application of green energies. Charging facility operators are required to accelerate the deep integration of charging infrastructures and vehicles, speed up the realization of vehicle-grid interaction, and build an integrated "optical storage and charging/discharging" (integrated distributed PV power generation system-energy storage system-charging and discharging system) mobile energy network, and make comprehensive use of peak-valley price, NEV charging incentives and other preferential policies to realize the efficient energy interaction between the NEVs and the power grid, reduce the electricity cost of NEVs, and improve the peak shaving efficiency and emergency response capabilities of the power grid.

Specific fields are the focus for the development of battery swapping mode, and a comprehensive energy supply network combining charging and battery swapping functions should be established. According to the data on the National Monitoring and Management Platform, the application of fast charging has been increasing gradually, but as the scale development of the NEV industry proceeds, fast charging will exert a certain impact on the power grid. Therefore, in specific fields such as taxis and e-taxis, the application of battery swapping mode will help to alleviate the impact of high-voltage DC charging on the power grid and promote the high-quality development of charging facilities.

(4) Make full use of the National Monitoring and Management Platform for NEVs to provide operational support for the large-scale demonstration and promotion of fuel cell electric vehicles

With the increasing promotion of FCEVs in various demonstration cities, local governments are required to speed up the construction of a national monitoring and management platform for fuel cell electric vehicles (FCEVs), and link it with the National Monitoring and Management Platform to provide operational support for the large-scale demonstration and promotion of FCEVs. The specific recommendations are as follows:

(1) Comprehensively and systematically collect all the dynamic information in the process of "research, production, sale, service, repair and scraping" of FCEVs, so as to provide more credible data support for the formulation and implementation of FCEV's policies.
(2) Do a good job of data statistics through data interfaces by using information channels such as the National Monitoring and Management Platform to timely access to hydrogen charging characteristics, operating status and other data of FCEVs and build a data center with all-round technical analysis capability for FCEVs; build a simulation test platform for faults of hydrogen fuel cell systems and vehicles to carry out correlation analysis of the number of FCEV failures based on the faulty data and vehicle operation data, and establish an early warning model.
(3) Establish a national big data cloud center for FCEVs with the National Monitoring and Management Platform as the convergence point to provide data sharing services for FCEVs applied in various operating fields based on the principles of openness, sharing, win–win and mutual benefit.

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