Countermeasures for Developing New Energy Bus Standards in China

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Abstract. With the rapid development of new energy vehicle technology, new energy bus has become more and more popular in China, and the relevant standards and policy are urgently needed to guide the market. According to the assessment of the development situation on new energy vehicle technology and new energy bus, combining with traffic policy guidance and the development trend of new energy vehicles, this paper aims to put forward the countermeasures of the new energy bus standard in China, including standard system, key standards and relevant recommendations. Research result is expected to provide decision support for the wide application of new energy bus in China.

Keywords: New energy bus; Standards; Countermeasures.

1. Introduction
From the perspective of society development, the enormous, which challenges faced by energy and environmental systems, have become a serious problem for all countries in the world and also a prominent problem of building harmonious human relations. More specifically, as automobile industry develops, a growing number of cars have caused unprecedented consequences on the ecological environment and non-renewable resources, such as petroleum. For these reasons, the development of new energy vehicles has become a global consensus.

Because of rapid development of urbanization in China, it is the time to develop new energy vehicles. Nowadays, China's auto industry is facing the challenges from energy, environment and transportation perspectives. In terms of energy, China's oil dependence reached 65%, of which the automobile industry consumption accounted for about one-third of the total consumption; in terms of environment, more than 90% of the major cities in the country experienced excessive air quality, and many major cities experienced bad weather such as fog and haze. In addition, traffic jams constantly happen in many cities. Data shows that in 2016, automobile production and sales were 28.119 million and 28.028 million and ranked first in the world for eight consecutive years. China's private car ownership is more than 160 million. Compared to developed countries, China’s automobile development still has a long way to go. In recent years, China's government introduced a series of policies to support the development of new energy vehicles, urban public transport industry has become an important application area, However, there are still many problems in the aspects of the safety, endurance and other aspects, it is urgent to speed up the standardization construction, and guide the healthy development of the new energy bus industry with science, and support the implementation of national bus priority development strategy better.
2. Development of New Energy Vehicles and Buses

2.1. The Characteristics of New Energy Vehicles Development
Since 2007, lots of initiatives had been introduced to promote the development of new energy vehicles. To June 2016, about 30 policies to new energy vehicles have been established, including 7 promotional policies, 8 industry specification policies, 4 Charging infrastructure policies, 5 enterprise directory of the relevant policies, 6 industry management related policies. The new energy automotive industry has been rapidly developed under national support. Also, the sales of new energy vehicles are 50.7 thousand, accounting for 1.81% of the car market in 2016. Sales of new energy vehicles in China (2011-2016) are shown in Fig.1. By the end of 2016, the number of construction and operation of public charging piles has achieved to 150 thousand, indicated that the construction of charging infrastructure increased steadily. Sales' composition of new energy vehicles in China is shown in Fig.2.

![Figure 1. Sales of new energy vehicles in China (2011-2016)](image)

![Figure 2. Sales' composition of new energy vehicles in China](image)

2.2. The Characteristics of New Energy Buses Development
Urban public transport is the key field of new energy vehicles promotion and application in China. The Ministry of Transport attaches great importance to the promotion and application of new energy vehicles in the transportation industry, especially in the urban public transport sector, The Ministry has issued "The Ministry of transport on accelerating the promotion and application of new energy vehicles in the bus assessment methods to implement the views of the popularization and application of the transportation industry and the "new energy" (Trial) and other documents, in recent years in order to carry out the "Ten City 1000" project for the beginning of the promotion of new energy vehicles has
achieved a certain effect. And the ownership of new energy vehicles in the public transport sector grows consistently.

2.3. New Energy Bus has Become the Main Part of New Energy Vehicle Applications

From 2011 to 2012, demonstration based on public transport and new energy vehicle had been carried out in 25 cities, the total reached 14682, accounting for 53% of the total energy vehicles, among them, hybrid buses accounted for 83% of new energy bus, the depth of independent research and development of hybrid bus technical breakthrough. Between 2014 and 2015, new energy vehicles had been promoted in 39 cities (city group), pure electric and plug-in hybrid are the main types, new energy bus accounted for 20% of total sales. New energy bus holdings accounted for 5% of the total buses. As of the end of 2016, China's new energy bus ownership reached 165 thousand, standing 27.1% of the total number of urban public cars, 78 thousand new energy buses added, and increase of 56% over the previous year. Situation of new energy bus in China (2011-2016) is shown in Table.1.

| Years | Quantity | Accounting for the proportion of the national bus | Pure electric car | Accounting for the proportion of new energy bus | Hybrid car | Accounting for the proportion of new energy bus |
|-------|----------|--------------------------------------------------|-------------------|------------------------------------------------|-----------|-----------------------------------------------|
| 2011  | 7831     | 1.70%                                            | 1218              | 15.60%                                         | 6613      | 84.40%                                        |
| 2012  | 13426    | 2.80%                                            | 1722              | 12.80%                                         | 11704     | 87.20%                                        |
| 2013  | 22236    | 4.40%                                            | 3050              | 13.70%                                         | 19186     | 86.30%                                        |
| 2014  | 36617    | 6.90%                                            | 7297              | 19.90%                                         | 29320     | 80.10%                                        |
| 2015  | 86659    | 15.40%                                           | 36262             | 41.80%                                         | 50397     | 58.20%                                        |
| 2016  | 16.46    | 27.10%                                           |                    |                                                |           |                                               |

2.4. New Energy Bus Development Support Policies Gradually Improved

During the 2011-2015 periods, the state has issued some policy documents such as "General Office of the State Council on the promotion of new energy vehicles to promote the use of guidance" and "New Energy Vehicle Subsidy Policy Details (2014-2015)". The state has established a new energy bus operation subsidy mechanism to increase the new energy bus operating subsidy, reduce the total price of refined oil subsidies year by year, refined oil price subsidies and new energy bus operating subsidies to promote the use of new energy bus. At the same time, ensuring assessment methods regards to promoting the use of new energy bus in the province (district, city), subsidies for funding applications are improved. At the same time, a clear assessment of promoting the use of new energy buses for the provinces (regions, cities) specificities the subsidy funds of application, the reliant assessment responsibilities of quality and safety of new energy vehicles. It further clarified the development path of new energy, quantified the evaluated standards, initially established the statistics and management system, and offered an institutional guarantee for the development of new energy buses. Meanwhile, in order to break through the bottleneck of the basic infrastructure of new energy bus promotion, the State Council has published "Guiding Opinions of Accelerating the Construction of Electric Vehicle Charging Infrastructure", which asked for regarding the special charging facilities such as public transportation and taxi depots as the main body, to enhance planning, design and guidance. According to the needs of the line-operation, charging facilities are constructed in the parking lot at priority, fast charging station and substations are constructed along the line with reasonable needs.

2.5. Increase the Intensity of New Energy Development

During the "thirteenth five-year" plan, the state will further increase the development of new energy bus. According to the "urban public transport development plan of the thirteenth five-year plan", new energy
vehicles will reach 200,000 in the field of urban public transport by 2020. In addition, there are some gas vehicles using clean energy such as LNG, CNG, and some hybrid buses will also be actively promoted, to improve the bus structure better. These measures meet the needs of urban people travel, the urban transport structure and urban air quality can be further improved. According to the "Notice on the Promotion and Application of Financial Support Policies for New Energy Vehicles in 2016-2020", the state will implement the subsidy reduction policy for new energy vehicles, reduce the subsidy year by year to further stimulate new energy vehicle technology and promote the factories to reduce production cost.

2.6. Problems of New Energy Bus
Over the past ten years, China's new energy vehicles have developed like a raging fire, especially the pure electric vehicles and hybrid vehicles, and have spawned in many manufacturers. As important application areas of new energy vehicles, the urban public electric car industry also reflects the shortcomings of new energy buses.

2.7. Safe Operation of Vehicles
Pure electric buses, especially those length of 10 meters or more, with lithium iron phosphate battery or ternary battery, have security issues during driving process caused by increased temperature of the battery or over discharge. Pure electric cars have been spontaneously combusting in many cities, which bring a huge risk to the safe operation.

2.8. Less Mileage Results in Poor Flexibility
Battery life has always been a major factor hindering the development of electric vehicles, which is also one of the major concerns of consumers. Survey shows that the new energy buses can run 100 kilometers after a charge. According to bus operating mileage of first-tier cities and second-tier cities, it cannot reach the theoretical value in complicated road conditions.

2.9. Charging Slow Leads to High Operating Costs
Charging slow is a common problem for new energy vehicles, for example, in Kunming ordinary buses run 200 km daily, while the pure electric bus can only run up to 100 km per day, which means the car can only run half a day. If there is congestion, the car can only run 70-80 kilometers after a charge, and workers must be on duty to avoid the occurrence of explosion, fire and other accidents, which greatly increased the operating costs of enterprises.

2.10. Development State of New Energy Bus Standard Specification
In order to standardize the development of new energy vehicles and buses, the Ministry of Industry and Ministry of Transport have speeded up the revision work of industry standard, to regulate the use of new energy bus operations.

Since 2001, China has gradually developed and updated a series of new energy vehicle access standards. According to the regulations, application for access to new energy automotive products should comply with relevant laws and regulations conditions and, also in line with "new energy automotive products Special inspection items and the same type of conventional car-related standards. At the same time, there are 39 inspection standards in the "new energy automotive products special inspection projects and according to the standard", which defined production access conditions clearly.

In February 2016, the Ministry of transport issued "general technical conditions of pure electric city bus" (JT/T 1026-2016), which have stipulated the technical requirements, test methods, inspection rules, transportation and storage of pure electric city bus. In February 2016, the Ministry of transport issued the technical specifications for hybrid urban buses (JT/T 1025-2016), which stipulated the technical requirements, test methods and inspection rules of hybrid city buses.

In order to strengthen the application and safety supervision of new energy vehicles, information technology has been used to achieve real-time monitoring of the operation of new energy vehicles. In October 2016, the National Automotive Standardization Technical Committee issued "the technical
specifications for electric vehicle remote service and management system "(GB/T 32960-2016), which stipulated the overall structure and function requirements of the electric vehicle remote service and management system, and defined the public platform, enterprise platform and vehicle terminal.

3. Proposals for Standardization of New Energy Buses
With the development of electric vehicles, automobile manufacturing enterprises have come to realize that "standard" is the key factor in the development of electric vehicles. From the present point of view, the global standardization of new energy vehicles is developing from "diversification" to "centralization". In the future, the standardization construction of China's new energy buses will focus on the following three aspects.

3.1. Construction of a New Energy Bus Standard System
Top-level design for promoting new energy vehicles should be done well. Research and development of new energy vehicles and charging facilities, maintenance, operation and management, safety emergency and elimination of recycling should be made. New energy vehicle standards should be joining into the urban passenger standard system. Improving the standardization of new energy buses should be improved to create a favorable policy environment for the promotion and application.

3.2. Carry Out Standardization in Key Areas
Combined with the existing problems in the development of new energy buses and the trend of future development, research and implementation of standards in major areas should be increased, and the lessons should be summarized in time. Charging slow and poor security problems should be solved. At present, the standard specifications of charging device interface, charging technology and safe use should be focused on. In addition, launching access to other types of new energy vehicles such as the hydrogen fuel cell car is necessary. Interface, charge, and security standard should be considered, to force new energy bus technology upgrading.

3.3. Increase Standard Training
The standard system and key areas’ standards should be constructed vigorously. According to the standard release time, the annual publicity plan should be formulated with various strengths, such as training, communication learning, exhibition display, and online information platform to carry out key standard publicity and training. The new energy automobile products forum and demonstration projects of the relevant ministries and commissions should be relied on, and cities with good basic conditions and new energy vehicle manufacturers should be selected as standardized pilot projects to provide reference and repeatable experience for the whole country.

4. Conclusions
With the promotion of ecological civilization construction, the development trend and space of new energy bus will be further enhanced. There are many problems, such as vehicle, facilities and interface technology, existing in the process of promoting new energy bus, but that is starting point and foothold of industry standardization. The next step of the work is to promote the construction of China's new energy bus standard vigorously by the following path: set up a new energy bus standard system (top-level design) - revision of standards in key areas (resolving urgent problems) - practice standard (standard to strengthen the vitality) - training publicizing path (expand propaganda), and vigorously promote the construction of new energy vehicles standardization in China.

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