Layout design and research of new energy vehicle charging pile in Anhui Province

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Abstract. Based on the investigation of the layout of charging piles for new energy vehicles in Anhui Province, this paper analyzes and studies the main problems existing in the development of charging piles in an urban area of Anhui Province, and puts forward the reasonable layout and suitable sites of charging piles. It also puts forward the types of charging piles suitable for the application of the city and the planning of relevant details, as well as the prospect of future charging piles.

1 Introduction

With the trend of global warming getting worse, the global goal is to establish a low-carbon economy and society by 2050. In the development of electric vehicles, the charging system is an important way for electric vehicles to commercialize. The charging system of electric vehicles mainly refers to the multi-mode converter device which transforms the electric energy in the power generation device and the public power grid into the electrochemical energy in the battery (see Figure 1), which covers the vehicle charger, charging station, ground charger, etc. Electric vehicle charging station is one of the urban service facilities, which mainly provides power battery power for all kinds of electric vehicles.

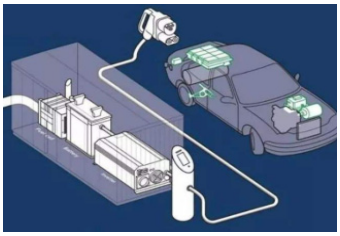

Fig1. Charging structure diagram of new energy vehicle charging pile

On June 11, 2020, Premier Li Keqiang and German Chancellor Angela Merkel held a cloud meeting and signed a cloud agreement. Anhui provincial Party committee and provincial government regard the Jianghuai Volkswagen new energy vehicle project as the "No. 1 project" for the development of advanced manufacturing industry. The headquarters of new energy vehicle research and development center of Volkswagen Group is located in Hefei. Therefore, in order to protect the charging rights of electric vehicle owners, major cities have stepped up the construction of AC charging piles for electric vehicles to ensure that the proportion of electric vehicle charging piles and new energy vehicles is no less than 1:1. [1] According to the calculation of relevant experts, the ratio of electric vehicle charging pile and new energy vehicle needs to reach 4:1, in order to solve the pressure of electric vehicle charging.

At present, in July 2018, Bengbu Municipal government decided to respond to the call of Anhui provincial government to start the "construction of supporting facilities for new energy vehicles". According to the actual municipal road condition planning of the city, we carried out the layout design of new energy vehicle charging facilities.

2 At present, Current development of new energy vehicles in China

According to our investigation and research, we have successively carried out the promotion and application demonstration work of new energy vehicles in major and medium-sized cities, nine cities in the Pearl River Delta, Shantou, Zhanjiang, Shaoguan, Meizhou, Chaozhou and Maoming; Guangzhou and Shenzhen have become national pilot cities for demonstration and promotion of energy-saving and new energy vehicles. The large-scale application of new energy vehicles has become a highlight during the Guangzhou Asian Games and Shenzhen Universiade. The demonstration and application fields of new energy vehicles continue to expand, from buses to taxis and official vehicles. Accordingly, the layout and construction of charging piles are following closely.

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3 Layout of existing charging piles in Bengbu City

3.1 Charging mode of new energy vehicle charging pile

The function of charging pile is similar to the fuel dispenser in gas station. It can be fixed on the ground or wall, installed in public buildings (public buildings, shopping malls, public parking lots, etc.) and residential parking lots or charging stations. It can charge various types of electric vehicles according to different voltage levels. The input end of the charging pile is directly connected with the AC power grid, and the charging plug at the output end charges the new energy vehicles. The charging point generally provides two charging methods, conventional charging and fast charging. Users can swipe cards on the man-machine interactive interface of the charging point with a specific charging card, which can display and print the data of charging capacity, charging mode, charging time and cost [2].

3.2. The existing charging pile layout in Bengbu City

According to our investigation, there are 10 charging pile facilities in Bengbu, and the distribution is shown in Figure 2.

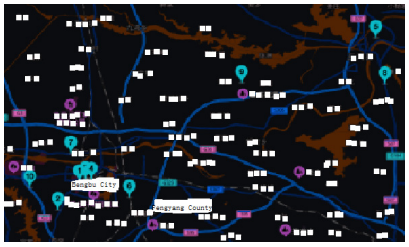

Fig2. Distribution diagram of charging pile facilities in Bengbu City

- New energy charging pile; address: 60m east of 1071 Chaoyang Road, bengshan District, Bengbu City, Anhui Province.
- Yi charging station (Fenghuang international underground parking lot); parking space b057-b062 of Fenghuang international parking lot, bengshan District, Bengbu City, Anhui Province.
- Post Charging Station (Government of Musang Mountainous Area); Address: No. 3858 donghai Avenue, Bangshan District, Bengbu City.
- Electric vehicle charging station of Bengbu Zhongyue Geely Automobile Sales & Service Co., LTD.; Address: Huhe Road, Yuhui District, Bengbu City, Anhui Province.
- Special call charging station (Wuhe County bus hub); Address: North of Wuhe County bus Station, Bengbu City, Anhui Province.
- Xing Xing Charging Station (Bengbu Mincheng Automobile Sales Co., LTD.); Address: Warehouse 1, No. 5028, Huaishang Avenue, Bengbu City, Anhui Province.
- Wuhe Yuanyao Charging Service Station; Address: 50 meters west of 104 National Road, Wuhe County, Bengbu City.
- State Grid Chong Power Station (Hefei direction, Beijing-Taipei High-speed Yuhui Service Area); Address: Yuhui Service Area, Yuhui District, Bengbu city, Anhui Province
- State Grid Charging Power Station (Beijing direction of Beijing-Taipei High-speed Yuhui Service Area); Address: Yuhui Service Area, Yuhui District, Bengbu City direction of Beijing.
- Oil, gas and electricity joint construction station of Bengbu Comprehensive Passenger Station; Address: Auxiliary Road, Xuehan Road, Longzihu District, Bengbu City, Anhui Province

4 Main problems and barriers existing in the layout of existing charging piles in Bengbu City

4.1 Main Problems of Current Charging Pile Development in Bengbu City

4.1.1 Quasi-construction difficulties

The construction of charging infrastructure is a complex social project, which needs to coordinate multiple departments. Support from all parties, such as property rights department, power grid company, fire department, superior management department of the established area, etc. Charging piles of new energy vehicles need large voltage and current, and safety guarantee is the biggest problem when they are installed in various areas [3].

4.1.2 Maintenance difficult

Many charging piles are idle after completion, and it is difficult to maintain due to scattered installation.

4.1.3 Profit difficult

At present, there is no reasonable profit model. The state subsidy policy for the industry encourages the expansion of the market, but also lowers the threshold of competition, making high-quality enterprises pay more costs. Poor quality enterprises cheat and damage the interests of consumers and other problems.

4.1.4 Charging interface standards are not uniform

Although the interface standard of AC slow charging has been set at the present stage, but dc charging, super charging and other fast charging methods, the standards of various manufacturers cannot be unified.

4.1.5 Long charging time

The charging time of 80% power of DC quick charging is about 20-30 minutes, which becomes the bottleneck. But it's also a business opportunity. Foreign construction and

commercial combination has been worth learning.

4.1.6 The utilization rate of charging pile is not high

Parking Spaces are often occupied by non-new energy vehicles. The public charging pile information released to the public is not perfect [4].

5 Suggestions on the construction layout of charging piles in Bengbu City

Based on the development experience and problems of charging pile construction in Bengbu city, we put forward the following Suggestions:

5.1 Countermeasures to the existing charging pile layout problem -- increase layout

5.1.1. Large shopping and commercial center

Charging piles are set up in large shopping malls.

Fig3. Distribution of large shopping and commercial centers in Bengbu City

5.1.2 Residential areas and civil building areas

A large number of small charging piles are built in residential areas and civil construction areas.

5.1.3 Public parking lots, transfer parking lots, expressway service areas

Public parking lots, transfer parking lots, expressway service areas, transportation hubs, large station parking lots to build charging piles.

Fig4. Charging pile group at bus stop

5.1.4 Scenic spots and sightseeing places

Scenic spots and tourist attractions can be set up a large number of charging piles.

5.1.5 Schools, sports, hospitals, office places, etc

Schools, hospitals, offices and other places also need to establish new energy vehicle charging piles in a timely manner.

5.1.6 Special vehicle charging base station

Charging infrastructure for buses, sanitation vehicles, postal vehicles and other special new energy vehicles should be combined with the construction of parking lots for special stations.

The charging infrastructure of freight vehicles and logistics vehicles in industrial and logistics land can be combined with the construction of parking lots in their land according to their own development needs.

5.1.7 Other areas

Other areas can make full use of nearby power supply, flood prevention and other public facilities to set up charging infrastructure of new energy vehicles.

5.2 Reasonably determine the types of charging piles and make plans for relevant details

The proportion of allocation shall be clearly defined. The planning and land administration departments shall specify the charging pile configuration requirements for new public construction projects, residential communities and social public parking lots in the land transfer conditions.

Fig5. Yongqing AC charging pile in Bengbu, Anhui

The proportion of parking spaces for newly-built residential quarters (including affordable housing) should not be less than 10% of the total planning parking spaces.

Fig6. Charging pile of Bengbu community

New public parking lots, office buildings, shopping malls, hotels and other public construction projects should be set with charging piles, which should not be less than 20% of the total planned parking space.

Fig7. Charging pile layout should be early, fast and reasonable

The proportion of charging pile construction shall not be less than 5% of the planned total parking space when the old residential area is renovated.

Fig8. Public charging pile at the north side of Building 10, Jinding Huangzhuang Phase II, Huangzhuang Street, Bangshan District, Bengbu City

The proportion of Party and government organs, institutions, enterprises and institutions that meet the requirements shall not be less than 10% of the total number of parking spaces.

Fig9. Reasonably advanced construction, accompanied by vehicle piles, intelligently and efficiently optimized construction layout of EV charging facilities

In short, if the number of new energy vehicles exceeds the number of charging piles, the number of charging piles should be increased accordingly.

5.3 Promote the use of charging piles in combination with Internet +

5.3.1 Function of Charging pile Internet +

Cooperate with r&d companies to develop apps for users. Make the function reach:

- Users need real-name authentication before using the APP, and bind information such as mobile phone number, license plate number and vehicle type.
- The geographic cloud map of APP link shows the specific location of each charging pile.
- When the user opens the app, the app automatically searches for the user's location and pushes the nearby idle charging pile.
- For users who are using charging piles, the APP will automatically push travel information such as nearby bus stops/subway stations.
- A small router is deployed near the charging point to provide services for users waiting for charging, and to count the number of connected users to update the number of waiting for charging in real time.
- For long-distance driving users, the app can be used to reserve the charging point near their destination in advance.
- Users can set charging time or charging amount through app.

5.3.2 Charging pile charging method

Charging pile charging system is mainly controlled by charging control unit, and some other extended functions, such as LCD display, RS232 reading charging card, RS485 electricity meter interaction, 3G/4G network interaction with various vehicle networking, etc.

5.3.3 Operators manage in real time through Internet +APP

The operator can monitor the use of charging piles in real time through THE APP and evaluate users' feedback, so as to make correct management plans and make it more convenient for users.

6 conclusion

In China, the development of new energy vehicle charging station is inevitable, and preemption is also the way for enterprises to win. However, it will take some time for new energy vehicles to be popularized in ordinary families. The main reason is that the charging station network was not built in a day.In the future, with the state's strong support for the development of green industry, the combination of driverless vehicles and new energy vehicles, and the real-time map communication between unmanned vehicles and charging pile sites, will be able to realize automatic charging, unmanned charging, automatic payment and other functions, which will be a landmark scientific and technological innovation.

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