

Research on Problems and Countermeasures of Charging Pile Construction

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Abstract: Electric vehicles can effectively reduce carbon emissions in the transportation sector, making them a globally promoted mode of transport. With the rise and widespread application of electric vehicles, charging stations have become essential supporting infrastructure for electric vehicles. Electric vehicle manufacturers and charging station operators are investing in the construction of charging stations, and many countries have implemented various subsidy policies for charging station construction, which also places higher demands on the development of charging stations. This article briefly introduces the issues facing charging station construction and coping strategies against the backdrop of achieving carbon neutrality goals, providing references for promoting the development of charging stations.

Keywords: Government Subsidies, Charging Station Construction, Coping Strategies.

1. Introduction

With the increasing number of electric vehicles, electric vehicle manufacturers and charging pile operators are utilizing their respective advantages to seize some of the high-quality sites for the construction of charging piles to seize new opportunities for green development. The government also attaches great importance to the development of charging pile infrastructure, and to promote the construction of charging piles, the government also subsidizes enterprises related to the construction of charging piles [1]. However, due to regional factors, the development of charging pile construction has been limited to a certain extent, so the article explores and discusses the problems and deficiencies of charging pile construction and puts forward targeted suggestions to promote the development of charging pile construction.

2. Literature Review

The government subsidy policy has a positive effect on the proliferation of the electric vehicle market [2], while the construction and deployment of charging supporting facilities are also important factors affecting the promotion of electric vehicles [3]. Therefore, some scholars have discussed the issues related to charging infrastructure and put forward valuable suggestions for the expansion of charging networks. Yang sorts out the characteristics of different charging models [4]. Yue studied theoretically summarize the cost-benefit structure of charging pile investment [5]. Li analyzed the three kinds of subsidies related to charging facilities mainly used by local governments in China, i.e., the total investment subsidy, the electric power subsidy, and the mixed subsidy of construction and operation subsidies [6]. Hu suggested that the government should adopt operation subsidies as much as possible for charging pile subsidies [7]. Yue take the EV charging infrastructure subsidy as an entry point, describe the system consisting of the interactions among the government, charging service providers, and consumers, and calculate the optimal investment amount and construction quantity of the operators under the operation subsidy of charging piles and the investment subsidy of power exchange stations [8]. Li pointed out that the government must improve its

management efficiency to achieve a higher effect of the subsidy [9]. Lim concluded that the higher the degree of cooperation between the two parties, the greater the overall profit of the charging pile industry [10]. Wang built a shared car service chain alliance formed by charging pile service providers and time-sharing car operators and draw a conclusion that a reasonable reward and punishment mechanism for alliance cooperation is a necessary condition to maintain the stability of the alliance [11]. Tian studied the mixed operation mode and shared charging pile operation mode of joint car companies and charging pile manufacturers are proposed, and a charging operation mode, operation strategy and typical scheme design for residential areas are proposed [12].

Although the research on charging pile construction has been rich, it is mainly concentrated in the construction mode of government and car companies, and the research on the problems and countermeasures of charging pile construction at the macro level is not perfect. This paper further studies the construction of charging piles at the macro level.

3. Problems in Charging Pile Construction

3.1. Low Number of Charging Piles, Unreasonable Layout

Along with the continuous growth of new energy models, the charging pile layout and the number of electric vehicle owners cannot meet the requirements of the relevant requirements of the owners of electric vehicles, car owners in the use of charging piles, the convenience needs to be further improved, charging cosmetic number is not much, coupled with the existence of irregular use of parking spaces, will be the owners of normal use of charging piles to bring obstacles, and charging inconvenience will reduce the owner of the purchase of electric vehicles will be. The lack of convenient charging will also reduce the willingness of car owners to purchase electric vehicles. Currently, some local governments are implementing the energy supply form of “public rapid replenishment, self-use slow charging” as the theme, and want to build various charging pile infrastructures on a large scale, however, until now, the charging pile construction has

not been able to reach the original expected goal because the program is not rich enough and will encounter many obstacles in the implementation. The mismatch between vehicles and charging piles has become one of the obstacles to the implementation of electric vehicles.

3.2. High Charging Costs

The high cost of charging is the shortcomings that often exist in various regions of China. According to Evergrande Research Institute research report data show that at present, China's charging pile daily average make 1 hour, the utilization rate is only 4%; Beijing, Shanghai charging pile daily average charging only 20 minutes, the utilization rate is only 1.3%. And about 20% of China's charging pile dedicated to buses, sanitation and logistics vehicles and other public areas of the corner car charging, charging speed, demand fluctuations are less, and the power supply is also very large, to further enhance the utilization rate of the charging pile. Therefore, excluding dedicated piles, the utilization rate of charging piles is even lower. Explore the influencing factors behind, basically is due to charging high cost and reduce the willingness of car owners for the use of charging piles, charging costs including parking fees, electricity prices and power supply service costs, per kilometer cost of about 0.4-0.5 yuan, charging costs as high as the cost of traditional fuel car fuel costs, and there are charging time-consuming, security risks and other issues, resulting in poor user experience, satisfaction is low.

3.3. Immature Operation Mode

Charging pile industry, because in the early time the capital investment is relatively large, the income is relatively small, the return cycle is long, can't produce the brand effect, can't find the right way to make profits, make the whole industry in a long time are in the situation of loss, and there are all kinds of charging guidelines in the market, can't reach a consensus, all these will jeopardize the growth of the charging equipment. Lack of high-level business approach, so that the upstream and downstream industries cannot carry out high-quality exchanges, the expansion of the electric vehicle market and the charging makeup of the construction pace is not consistent, the main parties concerned cannot reach the effect of communication with each other, all of these reasons are hindering the charging piles to move forward. In some areas, the growth of charging piles is relatively late, in the first half of the stage of some operators to build too fast, one-dimensional investment, and too much reliance on the site and power resources, without fully considering the needs of the market, want to get subsidies will put a lot of money into the charging speed of slower, lower-cost AC piles and the owners of the preferences contradictory to the overall utilization of the low rate, the payback cycle is longer. At the level of product quality, the standardized construction is even later than the market growth, in the first half of the stage of investment in the construction of charging piles do not comply with the relevant guidelines, there are defects in the quality, and the operators basically only rely on the collection of service fees to obtain income, although there is a series of marketing methods such as recharge discounts, which can enhance the degree of bonding with the owners, but the cost of a single recharge is not high, and there is not a great deal of value.

4. Response Strategies for Charging Pile Construction

4.1. Improve Local Financial Subsidy Policy

According to the characteristics of each region, formulate a detailed policy with local characteristics. Referring to the existing situation of automobile marketing and expansion, and knowing the direction, try to utilize the financial leverage to reach the scientific matching of vehicle expansion. For example, some small and medium-sized cities, due to their smaller scale and narrower scope, the utilization of electric vehicles should focus on specialized vehicles and establish development demonstration lines with their own characteristics. Transformation of purchase and construction subsidies to operation subsidies. As far as the construction of charging piles is concerned, the construction subsidy can be transformed into the charging subsidy, and the charging pile operators are subsidized in accordance with the charging volume, and the centralized charging piles with a large charging volume can be provided with additional subsidies, and the power supply department can be provided with subsidies for some charging piles with certain usage environments, so as to reduce the cost of charging piles' electricity consumption, enhance the economic benefits of charging pile operators, and also play a certain degree of Incentive effect.

4.2. Improve Charging Pile Operation Efficiency

Optimize the charging pile planning layout. The energy sector should exert its own performance, reach a reconciliation of interests with each subject, ensure that the construction progress of charging piles and the layout of the region are scientific enough, explore the existing number of electric vehicles in a certain region, the location of parking, charging rules, etc., and ensure that the number of electric vehicles and the number of charging piles can be equipped together. Promote the interconnection of charging piles. With the help of scientific information means to reach the interconnection between each charging pile, thus making it easier for electric vehicle owners to find charging piles, and facilitating the settlement of bills, after which the owners will be able to enjoy higher-quality charging services, which will also help the industry to grow in a sustainable manner. Improve the standardization system of charging facilities. Design consistent guidelines for charging piles, use these guidelines to help improve the level of science and technology, stabilize the market order, so that the relevant requirements of the electric vehicle industry and the charging pile industry can be combined.

4.3. Increase Funding to Create a Favorable External Environment

Reduce the cost of electricity. Various places in China have gradually promulgated some measures to cope with the problem of charging pile construction funding level, each region should all aspects of the charging pile construction and the existing situation of power supply, according to the actual situation to study and formulate financial incentives. Establish an infrastructure investment fund. Ensure that the government, enterprises, power grid institutions and other relevant development stage to give full play to their own practical utility, to reach the electric vehicle charging pile

industry in all aspects of the arrangement, in order to promote the popularization of electric vehicles to bring excellent environmental conditions.

4.4. Establish a Market-Oriented Mechanism to Attract Social Capital Investment

Government and social capital cooperation, with the introduction of government incentives at all levels, social capital participation in the construction of charging piles continues to increase, China's state-owned enterprises, private enterprises and collective enterprises will be a variety of characteristics of the social capital, are able to use the PPP model, to participate in the charging piles in the construction and operation. Finding quality intermediaries to build a third-party platform, in order to alleviate the information asymmetry between the government and social capital in the process of cooperation, and open up a multi-win situation, the construction of a third-party platform can play an intermediate connecting effect, cope with the information asymmetry problem of the subjects with equality and independence, reduce the risk, improve the efficiency of cooperation, and then promote the optimal operation of the project. Establish "Internet + charging pile mode", build a power supply network suitable for the development needs of each region, due to the current stage of charging pile layout is more dispersed, charging time is longer, can synchronize the construction of charging pile intelligent network service platform, the social capital and the government in a timely manner to grasp the supply and demand of charging piles, and comprehensively improve the charging service level.

5. Conclusion

In recent years, in order to reduce energy consumption and alleviate the pressure of environmental pollution, countries around the world have been vigorously promoting the electric vehicle industry with electric vehicles as the mainstream. With the rise and wide application of electric vehicles, charging piles have become the necessary supporting charging infrastructure for electric vehicles and an important guarantee for the development of urban electric vehicle industry. At this stage, the charging pile industry is in a high-speed development stage, individual areas due to the late start, the layout of the lack of integrated planning, imperfect policies, the government to promote the lack of efforts and other reasons, resulting in the charging pile number is small, the layout is unreasonable, the charging cost is higher, the operation mode is immature and other issues. In view of the problems in the development of charging pile construction, we put forward countermeasures to clarify the role of the government in the development of charging pile construction, further improve the local financial subsidy policy, make full use of the policy to guide the advantages of the introduction of social capital to promote the healthy competition in the charging pile market, so as to improve the vehicle-to-pile ratio,

optimize the regional coverage of charging piles, and increase the effective utilization rate of charging piles. Accelerating the promotion of electric vehicles and the construction of charging pile infrastructure is not only creating benefits for the public, but also promoting the green development of the economy and society.

References

- [1] 2023.U.S. Announces \$2.5 Billion for Electric Vehicle Charging Stations, Alternative Fuel Vehicle Supply Stations. CNN. URL: <https://interview.chinanews.com/gj/2023/03-15/9971694.shtml>
- [2] State Grid. 2020.State Grid Comprehensive Construction of New Energy Vehicle Charging Facilities Project Centralized Linkage Start. URL <http://www.sgcc.com.cn/>
- [3] Quddus M A, Kabli M, Marufuzzaman M. Modeling electric vehicle charging station expansion with an integration of renewable energy and Vehicle-to-Grid sources [J]. Transportation Research, 2019, 128(8):251- 279.
- [4] Yang M, Zhang L H, Dong W J. Economic benefit analysis of charging models based on differential electric vehicle charging infrastructure subsidy policy in China [J]. Sustainable Cities and Society, 2020, 59.
- [5] Yue W, Liu Y, Tong Y, et al. Role of government subsidies in the new energy vehicle charging facility industry: a three-party game perspective [J]. China population, resources and environment, 2020, 30(11) : 119-126.
- [6] Li D, Shang C, LV H, et al. Adoption of New Energy Vehicle in the Post-Subsidy Era with Heterogeneous Consumer Demand [J]. Chinese Journal of Management Science, 2024, 32(04):141-152.
- [7] Hu Y, Jin Y, Zhang S. Climate, Health Impacts, and Social Costs of Electric Vehicles in China: A Cost-Benefit Analysis [J]. Acta Scientiarum Naturalium Universitatis Pekinensis, 2021, 57 (05): 916-926.
- [8] Liu H C, You X Y, Xue Y X, et al. Exploring critical factors influencing the diffusion of electric vehicles in China: A multi-stakeholder perspective [J] Research in Transportation Economics. 2017, 66:46-58.
- [9] Li G, Luo R, Gu Y. Government's Promotion Policies and the Demand of New-Energy Vehicles: Evidence from Shanghai [J]. China Industrial Economics, 2019, (04): 42-61.
- [10] Lim M K, Mak H Y, Rong Y. Toward mass adoption of electric vehicles: Impact of the range and resale anxieties [J]. Manufacturing & Service Operations Management, 2015, 17(1): 101-119.
- [11] Wang T, Deng S. Optimal building policies of charging stations with automobile supply chain analysis [J]. Chinese Journal of Management Science, 2018, 26(10): 152-163.
- [12] Tian W, Shiming D. Supply chain leading models of building charging stations: Leaders, subsidy policies, and cost sharing [J]. International Journal of Sustainable Transportation, 2019, 13(3): 155-169.