Research on the Construction and Operation Mode of Electric Vehicle Charging Station in China

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Abstract. Chinese government is promoting the electric vehicles to replace the role of cars ran on patrol. It can be imagined that the construction and operation of charging station will have an insignificant impact on the development of electric vehicle industry. This paper based on connotation and characteristics of electricity charging station, described the electric charging facility development policy in China, promoted three basic construction and operation mode and the advantages and disadvantages are analyzed separately, finally obtained the optimized mode.

Introduction

The increasing number of motor vehicles caused by rapid development of economy and urbanization lead the increase eases travel in urban area. However, at the same time, tremendous amount of cars takes some new environment problems. Compared with vehicles run on fossil fuels, electric vehicles have advantages in energy conservation and emission reduction, which have been promoted by many countries to ease pressure on urban environment.

Energy supply, as an important link in the chain of electric vehicle industry, will play a decisive role in the development of electric vehicle. In June 2016, Chinese National Energy Administration issued the government program of electric vehicle charging facility construction, planning that there will be 5 million electric cars in China in 2020. It also requires that the ratio of electric cars to charging point should exceed 1.2, which means Eighty-five billion will be invested to construct over 6 million charging points and 12 thousand charging stations[1]. Thus it can be seen that, in the following years, it would be particularly important for us to explore the efficient mode of the construction and operation of electric vehicle charging station.

![Figure 1. The number of electric vehicle charging station in last five years.](image)

Government-led Mode

In this mode, government, as investment subject, is responsible for the construction and operation of electric vehicle charging station. This mode including two different kinds of specific operation[2]. Firstly, government provide the land, finance construction, and own the majority stake of all the charging station. Secondly, government pay for the construction of charging station and transfer the management right to the state-owned enterprises or entrust operation agency to run and manage the capital, which is an indirect way different with the first one.
The Reason of Government-led Construction

The electric vehicle charging station is an important kind of public basic facility, which can become a driving force for electric vehicle industry advance, leading the city future development. Therefore, it is an obligation for government to construct electric power vehicle charging station.

For the reason that the development of electric cars is just in the initial stage and it will spend a long time in promotion stage, there will be a greater risk in investment and operation in charging station industry. Private running for profit is difficult of unwilling to take the risk.

The Advantages of Government-led Mode

Leading the Development Orderly. The main reason of government for the public basic charing station construction is promoting electric vehicle industry, but not gain profit, which will provide his two industries with powerful and stable support[3]. At the same time, government-led charging station construction will give positive sign to market mainstay and so lead it into a healthy direction.

Achieving the Integrated Planning and Intensive Development. The government-led mode will benefit the synchronous development of electric vehicle industry and electric vehicle charging industry and avoid inadequate or overheated investment. At the same time, government can find the balance among charging station construction, urban land planning and urban electricity power network planning, which help the electric vehicle industry develop orderly.

The Shortages of Government-led Mode

Increasing the Pressure on Government Finance. Government-led mode require government to not only put into a great amount of money, but also increase the fiscal expenditure to maintain the operation because of the long profitless time after the construction of charging station. As the increasing number of electric vehicles and expanding of movement region, government need to put into more money, which may cause serious financial pressure.

Low-efficiency Operation. Government usually pay a close attention on political goal instead of financial goal. What's more, charging station operator is unwilling to promote corresponding management ability for lack of pressure to achieve maximum profit. Low-efficiency operation would be a common problem under the influence of these two parts, in government-led mode.

Impeding Fair Competition. For the reason that electric vehicle charging stations constructed and operated by government are protected by government, the other stations invested by private capita will have difficulty in fair competence and valid competence with them, which may impede the pace of marketization and commercialization in charging station industry.

Enterprise-led Mode

The Reason of Enterprise-led Mode Construction

Positive Economic Outlook. Electric vehicles, as a developed utilization method of new energy, represent a develop direction of strategic emerging industry. It can be imagined that electric vehicles charging station industry will gain corresponding social benefit and enterprise benefit accordingly.

New Energy Market Occupation. Charging stations will exist as an scarce source in specific period of time, that is, the number of charging station could not increasing without limit in a specific region. Therefore, enterprise which construct charging station ahead of time will possess sources and capture corresponding market.

Achieve Enterprise Transform. For example, Petroleum Enterprise which invest in charging station can achieve the transform from traditional energy enterprises to new energy enterprise. The electricity network enterprises take electricity vehicles charging station into power network as an organ part, which will breed energy storage technology and facilitate the development of clean energy.
The Advantages of Enterprise-led Mode

**Adequate Capital.** Enterprises with sources of human, capital, material and commercial operation experience invest in charging station can support the construction and operation.

**High-efficiency Operation.** Under the enterprise-led mode, the goal of charging station investment is maximize the economic effectiveness. Therefore, enterprise insist on market-orientation and service-aiming.

The Shortages of Enterprise-led Mode

**Causing the Disorderly Development.** As the market subject, enterprises conditioned by their inherent limitations and blindness, setting maximum economic benefit as their first goal, but not most optimum distribution of resources, which may cause the overheating or inadequate investment in charging station construction.

**Restricting the Development of Charging Station Industry.** In the initial stage, enterprises going after the economic benefit would make charging service's price according to actual operation cost, which is much too burdensome for most of consumers, and make restriction on the development of electricity cars and charging stations.

**Lack of Coordination.** It is difficult for enterprises to achieve the coordination of charging station construction, urban land planning, transmission and distribution network planning. And the relationship of charging station industry and electric vehicle would be another problem.

Consumer-led Mode

This mode is defined that electric vehicle consumers invest in charging station to meet the need of their cars. The investment motive can be regarding the charging station as supporting facility of electric cars, avoiding the inconvenience caused by External charging station.

The advantage of this mode is that consumers can achieve valid link between vehicles and charging facilities. At the same time, However, consumers have to bear high charging facilities construction and operation fees. What's other, it would lead to low utilization rate and repeated construction of charging facilities.

Mixed Mode

As we can see in the analysis above, each of three traditional modes has advantages and dias advantages. Therefore, it's unwise to choose a single plan, while "government-enterprise" mixed mode which means enterprise-led mode involved and supported by government could be a ideal choice. Because it has theoretical foundation, overing come the shortcomings of pure government-led mode and enterprise-led mode, meeting the need of construction and operation of charging stations at this stage.

Theoretical Foundation

PPP(Public—Private Partnerships), proposed by developed countries in 1990s and spread to all over the world, is the theoretical foundation of mixed mode. public–private partnership (PPP, 3P or P3) is a cooperative arrangement between one or more public and private sectors, typically of a long term nature Governments have used such a mix of public and private endeavors throughout history. "government-enterprise" mixed mode is an application of this theory in the construction and operation of electricity vehicle charging station.

Adaptation

Electric vehicle industry is rising up luxuriantly. Accordingly, the construction and operation of charging station usher in rapid development. At the first stage, enterprise will meet many problems including allocation plan, construction standard, service price which can only be solved under the support of government.
Prospects of Mixed Mode

Coordination of Charging Station and Distribution Electricity Network. Power grid enterprises invest in charging station can achieve the organic unity of power network and charging station. Correct unity of power network and charging station will optimize the power structure and reliability and avoid waste caused by discordance.

Promoting Smart Grid. A smart grid is an electrical grid which includes a variety of operational and energy measures including smart meters, smart appliances, renewable energy resources, and energy efficient resources[4]. Electronic power conditioning and control of the production and distribution of electricity are important aspects of the smart grid. The technology of charging station can rise up with the development of smart grid.

Professional Skill Development. For the reason that charging station is closely connected with electric system technology, power grid enterprise investing in charging station can take their technology advantages, improving the service level.

Optimal Use of Electricity Resource. Power grid enterprises can achieve the maximal use of electricity resource through peak load shifting by operating charging station, which is beneficial to energy conservation and emission reduction.

Maintenance of Power Grid Security and Stability. Harmonic phenomenon happened in the process of electric vehicle charging would have bad effects on quality of electric energy and grid security[5]. Compared with other enterprises, grid enterprises supported by government is more competent at harmonic suppression.

References


