

Development Direction of New Energy Vehicle Charging Technology based on Electronic Power Technology

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ABSTRACT

The improvement of charging technology is necessary. By listing the charging characteristics of the three charging modes, this paper gives the methods to improve the charging efficiency of new energy vehicles in each mode, the advantages and disadvantages of the mode to improve the charging efficiency, and what kind of technology is expected to be used in the future. By summarizing the development prospects of various charging methods, providing the direction of building a more energy-efficient charging system in the future, and looking forward to the possible vigorous development of charging modes in the future.

KEYWORDS

New Energy Vehicles; Charging Mode.

1. INTRODUCTION

With the country's attention to environmental protection and energy conservation in recent years, various laws have been promulgated to encourage society, enterprises and individuals to protect the earth's environment and make it sustainable. All sectors of society have responded positively to the call, among which new energy vehicles have developed rapidly in recent years. Due to the well-known advantages of energy conservation and high economic benefits of new energy vehicles, the public is increasingly favoring new energy vehicles, which also promotes the improvement of enterprises in various technologies. By improving the charging technology of new energy vehicles, it can improve the utilization rate of electric energy, improve charging efficiency and save time and cost, facilitate public life and better protect the environment. How to improve charging efficiency and charging speed to bring users a better user experience is particularly important. This article will list the advantages and disadvantages of the three types of charging modes and the prospects for their future development direction.

2. THREE CHARGING MODES

2.1. Conductive Charging

Conductive charging, also known as contact charging or wired charging, uses wires to import electrical energy into the car's battery pack for charging. Conductive charging is divided into two modes: AC charging and DC charging, which is expressed in the form of "charging pile". [1] After the charging pile is connected to the car charger through the charging wire harness, it passes through the high-voltage control box, and then transmits it to the power battery. The high-voltage control box needs to store the electrical energy in the battery through an AC DC converter. The charging time depends on the size of the charging current. There is a traditional mode of constant voltage and

constant current for charging. This charging method takes a long time and cannot meet the demand for emergency power replenishment. The charging efficiency is lower than that of wireless charging, and cables need to be connected. Sometimes improper cable connection will lead to energy waste, and there are hidden dangers of electric shock, wear and fire. The advantage is that it is not affected by weather factors and is relatively stable; the charging is fast; the cost of wired charging equipment and wires is low. The optimization schemes include: improving the performance of the power battery, using DC fast charging and AC slow charging.

2.2. Wireless Charging

Wireless charging, also known as induction charging, non-contact induction charging, uses electromagnetic induction (CT induction) of alternating electromagnetic field to achieve wireless transmission of energy. [2] Wireless charging is divided into electromagnetic induction and magnetic resonance. Electromagnetic induction uses a changing magnetic field to generate current, and magnetic resonance uses the resonance principle to make the transmitter and receiver resonate at the same frequency. Through this technology, users do not need to connect the charging pile, but only need to park in the wireless charging area, so that the wireless charging equipment and the car can charge by themselves. This method has high charging efficiency and convenient operation. It does not require charging cables, charging interfaces, and charging hardware standards. However, there is a problem of high cost of wireless charging equipment, and most importantly, there is an inevitable air gap between cars and wireless charging devices. The optimization schemes include: WPT magnetic coupling structure and composite compensation network technology. The former is optimized by improving energy transmission efficiency and non-contact transmission, while the compensation network mainly solves problems such as power loss and limited transmission distance in computer transmission. Another solution is the "double receiving coil". The purpose is to further improve the wireless charging distance and charging efficiency. Based on the magnetically coupled induction static non-contact charging technology, the "double receiving coil" charging scheme is proposed. [3]

2.3. Power Exchange Mode

At present, the fastest charging method to achieve effective battery life on the market is to replace the battery pack. When the battery runs out, the fully charged battery pack is used to replace the depleted battery pack. [1] This method requires low charging performance of the battery, but it is necessary to ensure its capacity and stability to maintain the battery life. The replaced battery can be used for centralized detection, maintenance and charging, improve the service life of the battery, and reduce the impact of the charging process on the power system. This mode greatly saves charging time and has low requirements for charging equipment and infrastructure. It only needs to install the battery correctly and ensure the safety and reliability of the battery. However, there are also corresponding problems such as the daily maintenance of the battery, the reliability of the circuit interface, the immature system layout of the power exchange station, and the imperfect resource allocation. At present, China's application of this model is not extensive enough, and it will take some time, capital and manpower to establish a perfect power exchange supply system. However, compared with other models, this model has great development potential, and the capital cost to be invested is lower than that of other models, which saves the time of waiting for charging. In order to develop this model in the future, the most important thing to solve is the capacity and stability of the battery.

3. WAYS TO IMPROVE CHARGING EFFICIENCY

3.1. Choose the Right Charging System

Through the optimization and analysis of the intelligent charging control system, we know that the charging system is an important part of the new energy vehicle. The main task is to convert the electrical energy provided by the power grid and store it in the battery of the electric vehicle to provide the necessary energy for the operation of the car, which is mainly composed of charging equipment and battery management system. [4]

Improving the charging rate can be started from three aspects. First, optimize the charging equipment and charging architecture. Second, it adopts advanced charging technology and equipment, such as fast charging piles, high-power chargers, etc. At the same time, through the optimization of power management, current control and battery charging management of the charging system. Third, apply the intelligent charging control strategy to optimize the charging process.

The purpose of optimization is to protect the battery, balance the battery pack, green charging, and ensure the safety of charging. At present, the system optimization strategy schemes include: temperature control curve charging, optimization of charging curve. [5]

3.2. Improve the Energy Efficiency of Charging Piles

The performance of charging pile equipment is particularly important. High-performance new energy charging piles can fully charge the battery in a shorter time, thus reducing the waste of electricity. In addition, the power conversion efficiency of charging equipment will also affect the energy efficiency of charging piles. The energy efficiency of charging piles is mainly affected by three aspects. First of all, the operation status of the power system will have an impact on the energy efficiency of the charging pile. For example, during the peak period of power demand, the load of the power system is large, the power quality is low, and the energy efficiency of the charging pile will be reduced accordingly. Therefore, the power system conditions are one of the main reasons affecting the energy efficiency of charging piles. Secondly, the charging efficiency of the battery is also one of the main reasons affecting the energy efficiency of the charging pile. At present, lithium batteries are widely used. Due to the quality of the lithium battery itself, the performance of the charging equipment, the ambient temperature and other factors, the charging efficiency of the battery is different. Improving the charging efficiency of lithium batteries can be achieved in a variety of methods, such as the use of specific chemical additives, the adoption of multi-stage charging strategies, pulse charging and variable current/voltage intermittent charging methods. [6]

In addition, the type and status of the battery will also affect the charging efficiency. In the future, charging efficiency can be improved by selecting different types of batteries and improving their performance. Finally, the choice of charging methods (such as constant voltage charging and constant current charging) will also affect the energy efficiency of the charging pile. Constant current charging can reduce charging time and improve charging efficiency, while constant voltage charging can make full use of the battery capacity under the premise of ensuring battery safety.

Suggested measures: the transformation of the new power system. Promote the application of intelligent new energy charging technology, such as automatic adjustment system, wireless charging technology, etc. to optimize the energy efficiency control of the charging pile itself.

3.3. Vigorously Build the Development of the Power Exchange Mode

The early stage of the power exchange mode requires less investment and low requirements for infrastructure, but a complete power exchange system is needed to mobilize the efficient operation of various departments to improve charging efficiency and shorten the waiting time, and additional

power exchange stations are needed to prevent battery failure and damage. If possible, an automatic power exchange system can be built in the future to reduce the waste of manpower and reduce the risk of manual installation. In addition, to ensure the long-term and continuous charging of the battery, it is necessary to improve the performance of the battery and improve the capacity of the battery.

Generally speaking, the development prospect of the power exchange mode is good, there is great room for development, and the difficulty of realization is low, but the corresponding problems also need to be solved in the process of specific construction. For example, how to efficiently cooperate with various departments to improve efficiency, how to reduce the cost of daily battery maintenance, etc.

4. SUMMARY

At present, conductive charging is widely used in China, and there is a relatively mature conductive charging infrastructure and maintenance system. Due to the high cost of new infrastructure construction and technical research and development required for wireless charging, it is not a key consideration. It is also optional to make new technological breakthroughs to reduce costs in the future. At present, the large development space is the power exchange mode, which only needs to replace the battery. The technical requirements are low, and the requirements for infrastructure construction are also low. Therefore, in the future, if we vigorously build the development of the power exchange mode, it is the most cost-effective choice, but each method has problems that need to be solved urgently, and it is still necessary to improve the charging efficiency in a targeted way. To meet the needs of customers, reduce the cost of waiting time, and facilitate public life.

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