The Influence of New Energy Electric Vehicle Charging on Distribution Network

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Absrtact: at this stage, the society and people are increasing their efforts to protect the environment, and begin to pay more and more attention to low-carbon life and energy saving and emission reduction. For low-carbon life and energy saving and emission reduction, an important means to promote its realization is the development of new energy electric vehicles, but it is worth noting that in the case of the wide application of new energy electric vehicles, the impact of large-scale access to power grid charging can not be ignored. As a direct access to the distribution network, it can directly affect the smooth operation of the grid and power quality. Driven by the widespread promotion of new energy electric vehicles, the important factors affecting the stability of power grid operation are charging practice and spatial matching degree. It is necessary to interpret the influence of new energy electric vehicle charging on distribution network.

1. Introduction

As an important clean energy power, electric vehicles have received great attention and large-scale investment from various countries. It has become a national strategy in China, the United States, Japan, the European Union and other countries and regions, and the market scale is growing rapidly. In the past five years, China's new energy vehicle sales and ownership have both achieved a hundredfold increase. The charging network is also in a period of rapid development, and China has become the world's largest charging pile market. The operation of large-scale charging infrastructure has brought new opportunities and challenges to the development of the distribution network.

2. Forecast of Future Development Trend of 1. Electric Vehicles

Smart grid construction and development have attracted great attention in every country, and electric vehicles as an important part of smart grid services, the development trend is very wide. With the global environmental pollution becoming more and more serious, automobile enterprises began to gradually transform to energy development in an all-round way, and the unlimited potential for the development of new energy automobile industry has been understood by many countries. It can be expected that in the context of the widespread promotion and use of new energy electric vehicles, it will greatly promote the future good development of the city. In the process of the development of new energy electric vehicles, its supporting facilities, namely electric vehicle charging stations, are indispensable.

There is no denying that electric vehicles will be introduced quickly in the automotive market, in the context of the continuous acceleration of the development of electric vehicles, but also greatly promoted the worldwide electric vehicle market changes. Research has shown that global electric vehicle production is increasing gradually. From the national point of view, the government and the financial sector must not be able to subsidize and invest in the public system for a long time, so it is necessary to actively break the calm that restricts the private use of electric vehicles, so it is necessary to increase the mileage of electric vehicles with a single charge, to ensure that the cost of car purchase is reduced to a certain extent, and to ensure simple and convenient use. With the

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development of light materials for electric vehicles, the energy density of charge and discharge batteries has been significantly increased, and the matching degree between charging equipment and other equipment has been improved, and the electric vehicle selection index has been continuously increased. In the long run, more and more car owners will be more inclined to choose electric vehicles.

3. new energy electric vehicle charging on distribution network

3.1 Impact on load supply and balance

The whole car whole charge and replacement battery charge these two are the current main electric vehicle form. In contrast, in the charging station, the time is more flexible and the aspect adjustment is to replace the battery charging electric vehicle, which can use the electric trough time concentration in the battery charging process, and can effectively adjust the grid peak and valley conformity difference. Electric vehicle is one of the mobile decentralized energy storage units, and its coordination with other renewable energy sources can be well realized, and then the load characteristic curve of power system can be adjusted effectively. As a controllable load of electric power, connected to the distribution network can choose the appropriate time, can ensure that the load curve of the power system can be effectively changed, while effectively reducing the peak-valley load difference, the corresponding peak-cutting and valley filling effect is also very effective, but it is worth noting that the set power and load characteristics have a direct impact on its regulation effect.

Driven by the increasing sales of electric vehicles, it has also continuously increased the influence of electric vehicles on the load characteristics of distribution networks. When the electric vehicle can reasonably arrange and adjust the charging load, it can promote the power plant and the power grid cooperation degree to increase effectively, and promote the continuous improvement of economic efficiency.[1]However, once the electric vehicle can not reasonably arrange and adjust the charging load, it is easy to have a larger load peak and valley difference in the distribution network. At this time, it will undoubtedly increase the power system load regulation pressure, but also make the power grid load burden gradually increase, which has a serious impact on the efficiency of power grid operation, but also difficult to ensure adequate supply under high load demand.

Figure 1. Crowded EV charging stations

3.2 Impact on power quality

Harmonic pollution is the most important factor that electric vehicle charging affects the power quality of distribution network. For the electric vehicle charging station with access system, harmonic pollution will inevitably affect the distribution network, which will mainly reflect the adverse effects brought by it in the following aspects. First, the consumption of electric energy also increases the actual payment of electricity, the main reason for this problem is that the watt-hour meter regards harmonics as active power. Second, when the harmonic current increases, the active power loss of the transformer will also be increased, and the corresponding transformer noise will

be increased with the harmonic injection, and the harmonic will also increase the active power loss and reactive power of the power supply and distribution line. In the power system, the transmission will also make the harmonics seriously affect the distribution network line equipment, which will seriously threaten the power quality of the power grid, and the harm intensity will cause adverse effects on the daily operation of many kinds of equipment. Therefore, in order to ensure the harmonic effect is reduced effectively, it is necessary to apply the effective filtering method actively.

3.3 Impact on grid economy

Transformer loss is a concentrated embodiment of the economic impact on power grid, which also includes the impact on power grid lines and other power equipment. In the electric vehicle charging process, often will affect the transformer loss, when the charging strength is small scale access, it can be ignored, but it is worth noting that in the case of the increasing number of electric vehicles, the transformer loss will gradually increase, so the energy saving loss is more difficult.

3.4 Impact on grid planning and trading patterns

Under the background of continuous development and extensive use of smart charging technology, the power grid load and frequency fluctuation on both sides of the distribution network have also been effectively balanced, and the corresponding peak-valley load difference has been reduced to a certain extent, and the power grid load has gradually increased. In the case of continuous promotion of time-sharing peak-valley electricity prices, different access modes can make electric vehicles in different periods of time through the distribution network charging to supplement their own power, this phenomenon will gradually complicate the power grid and electric vehicle power exchange mode, the past simple mode will be complicated development, the past single charging mode will also change to a variety of aspects, so that the power market support more open requirements.[2].

Figure 2. Impacts on grid planning

4. Improving Orderly Charging Constraint System for Influencing Problems

Because the electric vehicle charging load often affects the distribution network, in order to ensure the effective improvement of this impact problem, we need to actively formulate the orderly charging access system, based on the different levels and different regions of the orderly control system, coupled with the rational use of effective incentive system, to ensure that the overall orderly restraint system can be gradually formed.

In general, the overlap of charging equipment is easy to occur when the type of vehicle and the content of the service are different, so in the process of making the orderly restraint system, the coordination between each other should be considered centrally to ensure that the charging equipment can not only adapt to the various kinds of electric vehicle charging devices, but also achieve the purpose of charging each other.

One of the key development directions of electric vehicles in the future is private use. Compared with traditional power supply, the charging mode of private use is relatively unfamiliar, so we need to actively guide the public's recognition and acceptance. In order to ensure the effective time of acceptance and recognition by the public, it is necessary to actively adapt to the combination of popularity and response. Based on the characteristics of electric vehicles and the organic integration of the applicable population, the private electric vehicle customers should be actively explored, guided and encouraged to join the orderly charging service, and the orderly restraint system should

be established actively and soundly, so as to ensure that the implementation and implementation of the regulation and restraint system at different levels provide important impetus to effectively improve the impact of electric vehicle charging on the distribution network.

In power network planning and operation, it is necessary to regulate and supervise the charging load of electric vehicles reasonably, to compile the corresponding emergency plan and response mode on the basis of the simultaneous charging load change of power grid in different regions, and to ensure the feedback of constraint information to each charging device based on the application of effective communication mode, and then to use it together with other levels to better deal with the charging load of electric vehicles[3]. In the process of planning the power grid, it is necessary to effectively upgrade the weak link of the power grid caused by the charging of electric vehicles, and to supervise the charging piles of the station level charging service unit or substation in real time during the overall restraint process of each restricted area. With the help of the orderly charging restraint system of service units, the overall cooperation of charging piles in the area can be effectively managed, and the key links of orderly charging constraints can be effectively realized. For an orderly charging guidance system, the main purpose is to instruct and guide the charging demand to meet and the charging behavior to be carried out smoothly, such as providing the navigation load of the vehicle navigation to the vehicle with the charging requirement, so as to guide the navigation to inform and guide the charging period of the electric vehicle in the form of short message to ensure the staggered charging peak time as far as possible.

Figure 3. Strengthening the construction of intelligent charging stations

5. Conclusion

With the rapid development of electric vehicle industry in China at the present stage, in order to ensure that the charging situation of electric vehicles can meet the needs of people, help electric vehicle users to recognize electric vehicles more, and then effectively promote the popularization and wide application of electric vehicles, it is necessary to consider the charging situation of electric vehicles. The influence of electric vehicle charging on distribution network is fully considered, and then the corresponding charging constraint mechanism is actively formulated around the actual situation, and then the influence is improved, while the power supply quality of electric vehicle is improved, which lays a good foundation for the wide development and application of electric vehicle.

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