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Research on Impacts of the Electric Vehicles Charging and Discharging on Power Grid

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ABSTRACT

At present, more and more concerns are being paid for world energy conservation and environmental protection, therefore, the development of electric vehicles (EVs) is gaining momentum. Electric vehicles have good environmental protection performance and can carry many types of energy as the main feature and electric vehicles are considered as green transportation for the 21st century. Automotive manufacturers, governments and environmental organizations are increasingly concerned about the electric vehicle. As zeroemission vehicles, electric vehicles can radically reduce exhaust vehicles to improve the air atmosphere and adjust the energy structure. Therefore, the author believes that electric vehicles should be developed vigorously in our country, but charging EVs on a large scale has become a practical problem in the planning of grid management and distribution network. This can seriously affect system performance, such as overloading, reduced efficiency, poor power quality, and increased losses in the power system. Opportunities are opening up as passenger vehicles move toward electric power (hybrid, battery and fuel cell vehicles). Electric "vehicle network" (V2G). V2G only makes sense when the automotive and power markets match. This article briefly discusses how charging affects your distribution system, the factors that cause this effect, and how to control charging. This minimizes the impact on the distribution chain and V2G technology. Electric vehicle trends are discussed based on the current situation and development challenges. At present, more and more concerns are being paid for world energy conservation and environmental protection, therefore, the development of electric vehicles (EVs) is gaining momentum. Electric vehicles have good environmental protection performance and can carry many types of energy as the main feature and electric vehicles are considered as green transportation for the 21st century. Automotive manufacturers, governments and environmental organizations are increasingly concerned about the electric vehicle. As zero emission vehicles, electric vehicles can radically reduce exhaust vehicles to improve the air atmosphere and adjust the energy structure. Therefore, the author believes that electric vehicles should be developed vigorously in our country, but charging EVs on a large scale has become a practical problem in the planning of grid management and distribution network. This can seriously affect system performance, such as overloading, reduced efficiency, poor power quality, and increased losses in the power system. Opportunities are opening up as passenger vehicles move toward electric power (hybrid, battery and fuel cell vehicles). Electric "vehicle network" (V2G). V2G only makes sense when the automotive and power markets match. This article briefly discusses how charging affects your distribution system, the factors that cause this effect, and how to control charging. This minimizes the impact on the distribution network and V2G technology. Electric vehicle trends are discussed based on the current situation and development challenges.

Keywords: Electric vehicles (EVs), Development, Environment, vehicle-to-grid (V2G).

INTRODUCTION

Due to the rapid development of the automobile industry and the increase of car owners, environmental pollution, energy source shortage, resource exhaustion and other problems caused by the automobile industry are attracting more and more attention worldwide. To protect the human environment and ensure energy supply, governments are investing a lot of effort and material resources to find ways to solve these problems.[1] Electric vehicles (EVs) have outstanding advantages such as high efficiency, low power, low noise, and no pollution, and have become a source of energy for humans and the environment to solve the most efficient tasks..

All or part of the EV are driven by the electric motor as a dynamic system of vehicles, in accordance with the current development orientation or the vehicles driving principle, EV can be divided into pure battery electric vehicle(BEV), hybrid electric vehicle(HEV) and fuel cell electric vehicle (FCEV).[2] With the number of EV and charging stations rapid increase, EV will become a new load of power grid in the future, taking into account a large number of EV charging behavior, the impact of EV access to the grid is gradually highlighted, such as load balance, power supply capacity, power quality and so on. So we must depth study of the impact of EV charging on the power grid. The emerging EVs will not only be the main form of the automobiles, but also be the future development of the main direction of the smart grid. Currently, the plugin

Hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs) have the ability to access the pervasive power grid. With the rapid growth of electric vehicles and charging stations, electric vehicles will become a new load on the power grid in the future. Given the large number of electric vehicle charging modes, the impact of electric vehicles approaching the grid is becoming increasingly evident. . The large-scale integration of electric vehicles will lead to deterioration of the power system, especially the power distribution system. Therefore, the study of the effect of electric vehicle charging on the distribution network is of great importance both theoretically and practically.

THEDEVELOPMENTHISTORYOFEV

Currently, worldfamous automakers are paying more attention to the development of electric vehicles. To facilitate the development of electric vehicles, mature companies tend to invest more in research and development. This is because the performance and appearance of pure EV batteries did not make major breakthroughs and did not achieve their intended purpose. HEVs are widely recognized for their low cost and confidence in better driving performance. In the field of fuel cell electric vehicles, foreign business communities have formed transnational strategic alliances. Our electric vehicle industry is booming. During the ninth fiveyear plan, the Ministry of Science and Technology incorporated the program into a "major scientific and industrial project" with an investment of nearly $1 billion. In 2001, a national "863 program" was established with major MA projects in which nearly $9 billion was invested. .The "Eleventh FiveYear Plan" pepiod, Ministry of Science and Technology listed program in saving and new energy automotive toriss, energy conservation, редусе dependence on imerted he mesrot ol emorted ol asovat om asonat om asonat of andeson of andosa m om andosan of andosame Om Aresan Andosame Oh Aresat Andosame. The development of new energy vehicles is one of the directions for energy saving of electric vehicles.and feasible ways to reduce environmental pollution and solve the petroleum crisis.3]

RESEARCH STATUS ON EV

Research on the charge of the coordinating network has already been carried out in the 1980s. As electric vehicles grow in popularity, inconsistent charging will have a profound impact on the flexibility, safety and affordability of distribution networks. The integrated evaluation of electric vehicles is the basis for charging station planning and charging and discharging management. Current research on grid-connected electric vehicles can be divided into three aspects:

Electric Vehicle Charging Load Modeling and Simulation

This study is the basis for studying the effect of electric vehicles on the grid and controlling charging and discharging. EV charging load simulation includes battery charging characteristics, user behavior, charging mode, and more. As the EVs has not been largescale access, we usually analysis the size and characteristics of the charging load by the simulation.The mathematical model of charging and discharging behavior of electric vehicle is established, and the optimal scheduling scheme of charging and discharging of electric vehicle suggest.

Research on Effect of EVs to Distribution Network

The immediate effect of integrating an electric vehicle into a propulsion system is to increase the load. At the same time, based on various scenarios of electric vehicle use, the impact of electric vehicles on the network economy, transportation quality adjustment, distribution equipment, etc. were analyzed. On the other hand, the supplier side or the network side can analyze the reliability of the distribution chain and withstand the integration of electric vehicles.

Research on EVs Charging and Discharging Control and Utilization

Research on grid-connected electric vehicles is not only related to increasing loads on the power grid, but batteries in electric vehicles can be used, controlled, and fed to the grid as a distributed energy storage device. Current research work includes harmonic control, regulated charging, vehicle-to-vehicle power grid (V2G) technology, and grid planning.

IMPACT ON THE DISTRIBUTIONNETWORK

Currently, the main research areas involved with grid power quality, economical operation and planning.

The open distribution net work simulation analysis platform (Electrical Power Research Institute) can be used to establish a distribution net work models, with the determine factors and random factors of time ands pace, to analysis the three aspects of influence.

Effect on Power Quality

Impact on power quality of the EVs integration includes harmonic pollution, voltage drop and three-phase imbalance.

(1) Harmonic Pollution
EV access use increases the corresponding charging equipment, including a large number of highly non linear power electronic device, when the charger for EV charging, DC between he three-phase AC constant commutation will generate harmonic, harmonic current may pollution powergrid, electrical equipments, and influence the power quality of distribution system.

(2) Voltage Drop
EV technology gradually mature and large scale utilize, the application may cause the local load increase of the power distribution network, large scale EVs charging will affect the node voltage, especially end node voltage drop will seriously affect the demand of users.

(3) Three-Phase Imbalance
A small EV charge at a fixed location and for a period of time reduces charge diffusion, which can result in significant three-phase unbalanced currents. Conversely, when charging a large number of electric vehicles, a current imbalance occurs.

Effect on Distribution Network Planning
The implementation of chargers in the distribution network and the number of charging stations for electric vehicles will increase the structure and charity of the distribution network. Therefore, the location of electric vehicle charging stations and gas stations is very important. Mishandling can significantly increase rover consumption and result in a certain amount of voltage. It also affects the layout of road networks and users, hindering the development of electric vehicles.

Effect on Operation
From the point of view of the economic operation of the distribution network, this mainly reflects the magnitude of the net losses of the distribution transformer, the cable and the service life.

(1) NetLoss
The loss rate is surprisingly unrealistic because the electric vehicle's charge loss rate increases at high permeability.

(2) Cables
Harmonic currents also negatively affect cables. These effects cause load losses and shorten service life.

(3) Transformer
Network transformer distribution is a relatively relevant link. Charging large electric vehicles can overload them, shorten their lifespan, and even cause them to fail. With the advent of lodd, the load on rower generations, transmission and distribution systems was endless, and rover generators and transmission units were tuned.

KEYTECHNOLOGYANDCHALLENGEINVOLVEDOFEV

Vehicle-to-grid(V2G)Technology

The electric power grid and light vehicle fleet are exceptionally complementary as systems for managing energy and power. The power grid has essentially no storage (other than its 2.2% capacity in pumped storage), so generation and transmission must be continuously managed to match fluctuating customer load. Our comparison of the electric system with the light vehicle fleet becomes of practical interest as society contemplates electricdrive vehicles (EDVs), that is, vehicles with an electric drive motor powered by batteries, a fuel cell, or a hybrid drivetrain. Electricdrive vehicles(EDVs) can generate or store electricity when parked, and with appropriate connections can feed power to the grid—we call this vehicletogrid power or V2G power. [4]As we'll describe shortly, these power markets include regulation, spinning reserves, and peak power.

The basic concept of a multi-grid rover is that the EDV rover moves towards the grid while stationary. The EDV may be a battery electric vehicle, a fuel cell vehicle or a hybrid vehicle. The EDV battery can be charged during periods of low battery and discharged when the rover needs it. Fuel cell EDVs create propulsion boats powered by liquid or gaseous fuel. The plug-in hybrid EDV can operate in both modes.

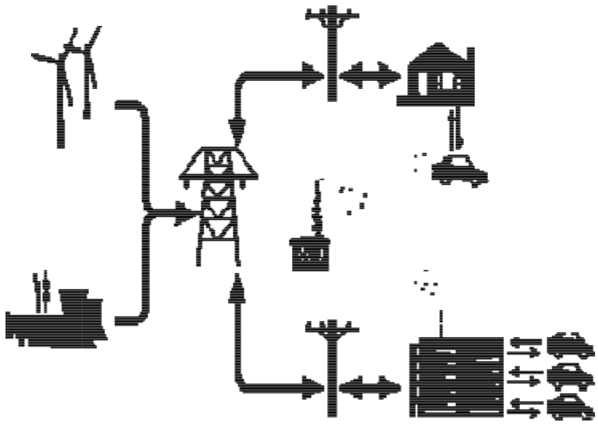

Fig.2: Illustrative schematic of proposed power line and wireless control connections between vehicles and the electric power grid

Fig.2 shows an illustration of possible connections between EVs and the power grid.

Electricity flows oneway from generators through the grid to electricity users. Electricity flows back to the grid from EDVs, or with battery EDVs, the flow is two ways.The control signal from the grid operator (labeled ISO, for Independent System Operator) could be a broadcast radio signal, or through a cell phone network, direct Internet connection, or power line carrier. It can achieve increase stability and reliability of the grid and lower the system operating costs. Moreover, in the long run, V2G could reduce investment in new power generation infrastructure. In the future, V2G will be combined with the smart grid and develop towards more intelligent trend.

Charging Control

(1) Harmonic Control
The following actions can be taken for harmonics issues: Transducers are one of the main devices that generate high level harmonics, so you can increase the number of pulses or use RWM transducers. Increasing the number of pulses from 6 to 12 can significantly reduce the RMS value of harmonic currents. Reactive power compensators can be installed to improve the system's ability to withstand harmonics. You can also build a power quality monitoring system to monitor real-time data and respond in a timely manner to unexpected situations.

(2) Coordinated Charging
Coordinated charging is electric vehicles that involve regulating the grid in the form of controlled charging, and it is a way to prevent large electric vehicles from being unduly concentrated. In general, for the purpose of optimal savings or minimal impact on the network, it is based on the state of the network and takes into account battery performance limits and user requirements for controllability. At the same time, take advantage of low-lying areas to charge electric vehicles to stabilize load fluctuations and avoid new peak production. So it can improve the power quality, economy and reliability of the distribution network.

Coordinated charging needs to schedule and coordinate distributed EVs for charging, but it is difficult for the network to directly control the charging of individual EVs. Therefore, some studies refer to the concept of "middlemen". Others believe that coordinated pricing will use multi-agent technology. Electric vehicles combine with smart grid technology, so they can automatically avoid peak hours to recharge.

TREND

From the technical development strategy, EV will be the direction of future development, and EV hybrid as a long-term network area has not been built before the technology transition. [10] Hybrid EV system combined and dub. Its progressive point is to retain the key characteristics of a gasoline car in lifestyle, matching the combination of gasoline engine and electric motor in gearshift, tratane and fan. need reprogramming. Movement distance is not limited. Pure EV saves gas, engine, transmission, cooling device and exhaust tool, compapink to the electrical system of a conventional internal combustion gasoline engine, reducing the cost of the engine and control unit, and even as improving the internet power conversion efficiency of electric vehicles. because of the truth the tractor is derived from the car's rowing machine and the big generator, it is not feasible to evaluate the performance of a gasoline engine or a hybrid engine. therefore, using herbal electric vehicles will lessen expenses. in the future, producers will want to cope with important EV technologies, dramatize EV acquisition skills reduction, accumulate battery achievement, and enlarge transmission line continuity.

CONCLUSION

The integration of EVs is inevitable trend in the development of distribution network. Large deployment of EVs is expected to lead to potential problems for distribution network. The traditional criteria of the distribution network may not be suitable for largescale EVs integration.

However, the distribution grid load impacts could be reduced effectively through the appropriate configuration of EVs proportion with different charging methods. And the energy storage characteristics of EVs will also provide new opportunities for safe and economic operation of the system.

In the future, the development of electric vehicles and its wide range will trigger a revolution in modern transportation and have a profound impact on the electronics industry.

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