MEASURUNG THE ECONOMIC IMPACT OF ELECTRIC VEHICLES ON POWER SYSTEM AND OPTIMAL STRATEGY FOR CHARGING ELECTRIC VEHICLES

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Overview

The number of vehicles that require electric charging, such as electric vechicles (EVs) and plug-in hybrid vehicles (PHEVs), is increasing as they are emerging as a solution to environmental problems. These electric vehicles need to be recharged at home or charging stations. Electric vehicles affect the power system because they require a large amount of electricity and this causes an increase in electricity usage. Therefore, the charging strategies for electric vehicles have a significant impact on the peak load for total amount of power system and electric charge for each household. The purpose of this paper is to predict the use of electric vehicles through simulation and to research the effect of charging electric vehicles on peak loads of power systems and the changes in personal electricity charges according to various charging strategies.

Methods

In this paper, policies on electricity charges will be considered both when connected to smart grids and not. The use of electric applications and electric vehicles is based on residential activity patterns simulation. First, the data are used to generate behavioral patterns for each household member and calculate the electricity consumption accordingly. After that, the use of electric cars is produced through stochastic simulations.

Charging strategies for electric vehicles are divided into two types: fixed strategies that do not take into account electricity charges and flexible strategies in which electricity charges are considered. We calculate and compare electricity usage and electricity usage rates for both strategies.

Results

Depending on each policy and each situation, we compare the total electricity usage of power system and the electricity bill of each household. The peak load of the entire power system can also be compared. Optimized charging strategies that consider electricity prices and usage can be seen to have lower peak loads and lower electricity bill than non-optimized strategies. Finally we evaluate the economic values of using home energy control box or smart charger.

Conclusions

The diffusion of electric vehicles can be seen to have a significant impact on existing electricity use systems. The increase in the peak load due to the increase in the electricity conusmtion has the risk of causing a lot of damage both socially and personally. We expect smart grid systems and electric vehicle charging strategies through them to be one way to solve these problems.

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