137 Method for Electric Vehicle Access to Distribution Network Based on Demand Side Management

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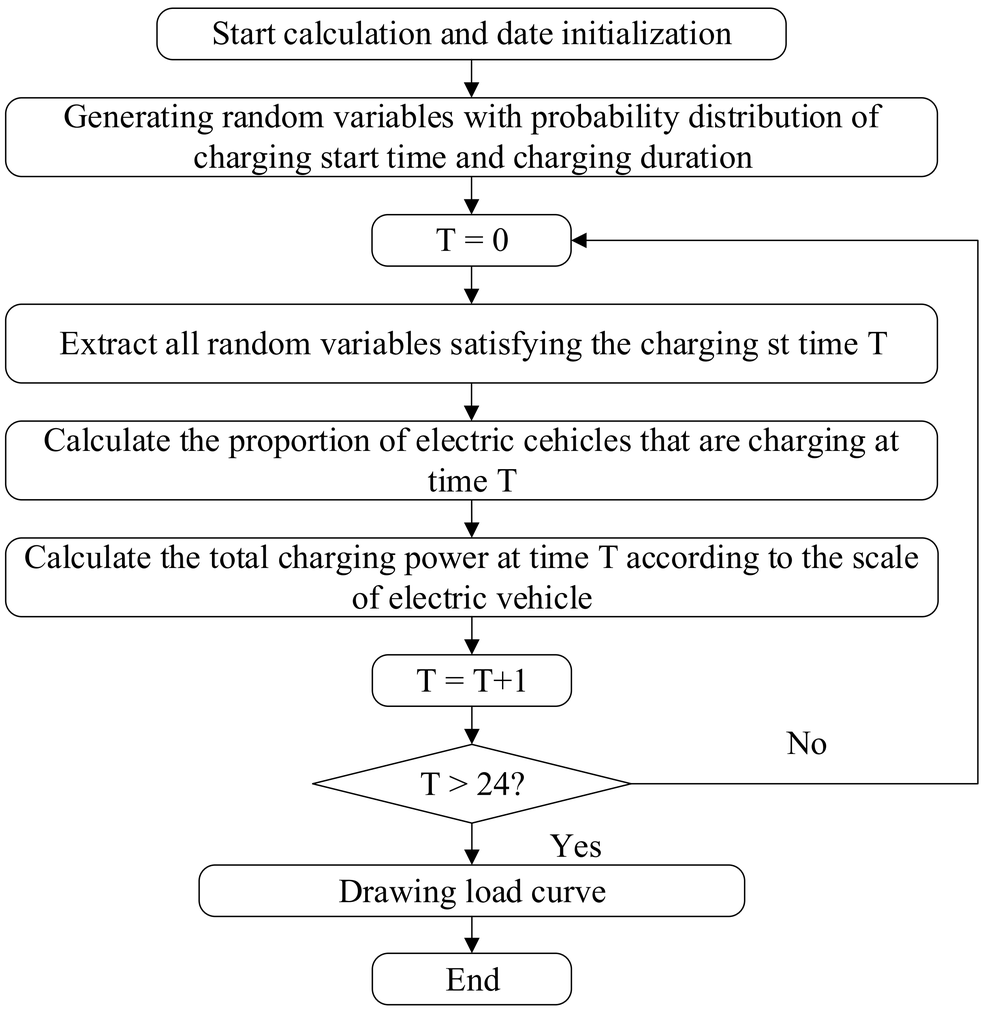
Introduction of your work

In this paper, a time-if-use price optimization scheme based on demand side management is proposed.

Methods of your work

Firstly, the load models of electric vehicles under different charging modes are established, and the charging load calculation flow of electric vehicles is established by combining Monte Carlo simulation method.



On this basis, the time of use price optimization model based on customer side response is established, and the peak valley time-of-use price optimization model is solved by NSGA-II algorithm, and the optimal solution is determined by TOPSIS comprehensive evaluation method, and the optimal time-of-use price scheme is obtained. Finally, the correctness and rationality of the scheme are verified by the analysis of an example.

Results of your work

Minimize the user cost

$$\min F_1 = C_0 + C_c + C_B - C_f$$

where F_1 is the total cost of the user; C_0 is the cost of the user to buy the car; C_C is the charging cost; C_B is the maintenance cost of the battery; C_f is the income from participating in the discharge;

Maximize revenue of power supply companies：

$$\max F_2 = P_2 = p_i \sum_{i=1}^{T} q(i)$$

Minimize the peak valley difference of the total

$$\min F_3 = \min E\left[\sum_{k=1}^{K}\left(\max_{1\ \ i\ \ 24}\left(q'_{ki}\right) - \min_{1\ \ i\ \ 24}\left(q'_{ki}\right)\right)\right]$$

where E is mathematical expectation, and q_{ki}' represents the load power at time i on the k_{th} day after the time-of-use price policy is implemented.

Conclusions of your work

Day	Type	Difference	Peak load /MW	Electricity consumption /MWh	Electricity cost	Responsiveness
1	before	45.97	513.3	3272.2	172.6	
	after	26.94	140.1	3289.4	178.4	0.64
2	before	68.84	180.5	3635.1	176.5	
	after	52.32	157.0	3670.9	179.2	0.59
3	before	76.21	198.5	4221.6	220.0	
	after	60.45	175.3	4246.0	239.3	0.66
4	before	63.68	216.6	4574.4	237.8	
	after	44.59	201.2	4519.8	235.7	0.63
Mean value	before	64.00	186.5	3958.3	205.2	
	after	46.22	171.1	3936.5	203.5	0.64

This paper establishes the load model of EV under different charging modes and the time-of-use price optimization model of customer response. The optimal solution is determined by NSGA-II algorithm and TOPSIS comprehensive evaluation method.The electric vehicle load is effectively guided to achieve the goal of peak load shifting and valley filling, and the purpose of orderly charging optimization control of electric vehicle is achieved, and the operation level and security of power grid are improved.