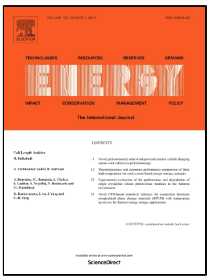
Accepted Manuscript



A cooperative game theoretic analysis of electric vehicles parking lot in smart grid

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PII:	S0360-5442(17)31180-5
DOI:	10.1016/j.energy.2017.07.006
Reference:	EGY 11193
To appear in:	*Energy*
Received Date:	12 November 2016
Revised Date:	28 June 2017
Accepted Date:	01 July 2017

Please cite this article as: Saemeh Aghajani, Mohsen Kalantar, A cooperative game theoretic analysis of electric vehicles parking lot in smart grid, *Energy* (2017), doi: 10.1016/j.energy.2017.07.006

A cooperative game theoretic analysis of electric vehicles parking lot in smart grid

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Plug-in Hybrid Electric Vehicles (PHEVs) play a major role in decreasing amount of fossil fuels led by transportation system. PHEVs in both Grid-to-Vehicle (G2V) and Vehicle-to-Grid (V2G) modes can effect on the power market. In order to diminish potential challenges related to these effects, various methods like developing optimal charging strategies for the connected PHEVs and managing energy exchange between the PHEVs` parking lots can be taken into consideration. In this paper, a cooperative game model has been proposed in order to determine charging/discharging price adaptively. Simulation results show how this model leads to the maximization of utilities' profit and minimization of the parking lots' cost. Furthermore, a stochastic analysis has been done over the proposed model in order to well understand how much the deviation of profit and expected value of profit are in different levels of uncertainty. The numerical results prove that higher deviation over spot market price leads to both higher mean and deviation over profit for utilities, and the owner of utilities should consider the effect of price's uncertainty whenever it is considerable.

Keywords: Parking lot, Cooperative game model, Electric vehicle, Smart grid, Utility.

Nomenclature

Indices

t index of hours $t = 1,2,...,T$

v index of vehicles in parking lots $v = 1,2,...,N_v$