■ 연구논문 요약문

논문제목	Optimal Scheduling for Electric Vehicle Charging under Variable Maximum Charging Power
게재정보	Energies, 10 (7), 2017.07.
개요	- The main focus of this study is to schedule a large number of single-aggregator-subscribing EVs in such a way that minimizes the total charging cost from the aggregator perspective. Accordingly, the charging control considered in this paper can be classified as aggregator-based centralized charging control. - As for the charging scenario, we focus on realistic charging schemes that take into account variable maximum charging power. Most work in the literature assumes that the maximum charging power is fixed over time. In reality, the typical lithium-ion-battery charging profile that most EVs employ has variable maximum charging power that normally is dependent on the current SOC. To be specific, the maximum charging power usually decreases as the battery level approaches full charge. Therefore, consideration of variable maximum charging power is necessary so as to reflect current practice. - Under the assumption of variable maximum charging power, we consider two charging schemes: non-preemptive and preemptive charging. Under both schemes, the EV is charged according to a pre-determined profile, but the difference between the two is that preemptive charging allows interruptions during the charging process, whereas non-preemptive charging does not. For both charging schemes, we propose mathematical formulations of the EV charging-scheduling problem. Our formulations can deal with any charging profiles provided that the charging power can be represented as a function of the SOC.
연구결과	- We propose mathematical formulations for two different charging schemes: non-preemptive and preemptive charging. - We also introduce an adaptation of the proposed formulation as a way of preventing frequent interruptions in the charging process. - Our numerical simulations compare the different charging schemes and demonstrate that preemptive charging with limited interruptions is an attractive alternative in terms of both cost and practicality. - We also show that our formulation is computationally efficient in solving practical, large-scale charging-scheduling problems.
활용분야 및 기대효과	- Our computational simulation demonstrated that the proposed extended formulation is solved quickly for large-scale instances and therefore can be used for practical purposes. - As for the cost comparison between the charging schemes, it was shown

	that preemptive charging can reduce the total charging cost of non-preemptive charging by 1.5-3.7% for the tested instances, and that the total charging cost also can be reduced by decreasing the duration of each time interval. - Finally, we showed that the number of total interruptions in the charging schedule can be reduced considerably with only a small increase of total charging cost, which can be achieved by adding penalty terms to the formulation. - Therefore, our major finding is that the preemptive charging schedule with limited interruptions can be an attractive choice in terms of both cost and practicality.