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Achieving sustainable transport through resource scheduling: A case study for electric vehicle charging stations

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ABSTRACT

Electric vehicles support low-carbon emissions to revitalize sustainable transportation, and more charging stations are being built to meet the daily charging demand. Charging piles and service workers are the most important resources for electric vehicle charging stations, and the scheduling of these resources is an important factor affecting the charging stations' profits and sustainable industrial development. In this paper, we simulate the charging piles and service workers in charging station resource scheduling and analyze the impacts of the number of service workers, the charging pile replacement policy and the charging pile maintenance times on an electric vehicle charging station's profits. An orthogonal test can achieve the following optimal resource scheduling results when their range is known: (1) In the lifetime of the charging pile, seven maintenance times are needed; (2) Even if the charging pile is still in normal condition, it needs to be replaced in order to achieve the maximum profits for the charging station; (3) a comprehensive analysis of service efficiency and service costs indicates that 8 service workers are needed to achieve the optimal profits for the charging station. Therefore, the scientific contribution of this research is to establish one resource scheduling simulation model that can assess the effects of the number of service workers, the charging pile replacement policy and the charging pile maintenance times on charging station revenues and to obtain the optimal results. In addition, if the model parameters change, we can still obtain the optimal results.

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Izvirni znanstveni članek

Doseganje trajnostnega prometa z razporejanjem virov: Študija primera za polnilne postaje za električna vozila

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POVZETEK

Električna vozila podpirajo nizkoogljične emisije za oživitev trajnostnega prometa, za zadovoljevanje dnevnih potreb po polnjenju pa se gradi več polnilnih postaj. Polnilna mesta in servisni delavci so najpomembnejši viri polnilnih postaj za električna vozila, razporeditev teh virov pa je pomemben dejavnik, ki vpliva na dobiček polnilnih postaj in trajnostni industrijski razvoj. V tem prispevku simuliramo razporejanje virov polnilnih postaj in analiziramo vpliv števila servisnih delavcev, pravilnika o zamenjavi polnilnih mest in vzdrževalnih ciklov polnilnih mest na dobiček polnilne postaje. Pravokotni eksperiment lahko doseže naslednje optimalne rezultate razporejanja virov, ko je njihov obseg znan: (1) v življenjski dobi polnilnega mesta je potrebnih sedem vzdrževalnih ciklov; (2) tudi če je polnilno mesto še vedno v normalnem stanju, ga je treba zamenjati, da dosežemo največji dobiček polnilne postaje; (3) celovita analiza učinkovitosti storitev in stroškov storitev kaže, da je za doseganje optimalnih dobičkov za polnilno postajo potrebnih osem uslužbencev. Zato je znanstveni prispevek te raziskave vzpostavitev enotnega simulacijskega modela razporejanja virov, ki lahko oceni učinke števila uslužbencev, politike zamenjave polnilnih mest in vzdrževalnih ciklov polnilnih mest na prihodke polnilnih postaj in doseže optimalne rezultate. Poleg tega lahko dobimo optimalne rezultate tudi, če se parametri modela spremenijo.

PODATKI O ČLANKU

Ključne besede:
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Razpored virov;
Električno vozilo;
Polnilna postaja;
Simulacija;
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