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Locating charging stations for battery-electric heavy-duty vehicles

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We study the problem of locating charging stations for battery-electric heavy-duty vehicles (BEHDV) under uncertainty in both demand and available power grid capacity. The problem can be formulated as a two-stage stochastic problem where the first-stage decision is to determine the future locations of the charging stations. After the locations have been determined, information about demand and available power grid capacity is revealed and the second-stage decision is to install the chargers and satisfy demand.
The problem is formulated as a stochastic multi-period facility location problem with flow-based demand and a budget constraint. The objective of the model is to maximize expected demand coverage, i.e. maximizing the expected number of BEHDVs that can drive from their starting points to their destinations using the charging network. It does so within a set budget and while respecting limits on driving times and rest periods, available grid capacity, and spatial constraints for placing chargers. The model factors in vehicle types with varying battery capacities, as well as the route choices available to drivers. We use a multi-period approach to account for changes over time, such as variations in charging demand and fleet composition. We apply our model to a real-world case study based on a Norwegian operator of charging stations.

Authors: SCHÜTZ, Peter (Norwegian University of Science and Technology); M. HAUGEN DE LANGE, Thomas (Norwegian University of Science and Technology); M. HOLEN, Tord Gunnar (Norwegian University of Science and Technology); M. LEVIN, Patrick (Norwegian University of Science and Technology); Mlle PAGNIER, Celine (Norwegian University of Science and Technology)

Orateur: SCHÜTZ, Peter (Norwegian University of Science and Technology)

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