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Load peak minimization on electric bus depots using stationary battery storage

Description:

The city of Hamburg has decided to electrify its bus fleets. The two public transportation companies in this city expect to operate up to 1500 electric buses by 2030. They have both decided to implement the centralized depot-charging concept. The load profile of such bus depot is highly dependent on the charging schedule of buses. Without an intelligent scheduling system, the buses charge on demand, as soon as they arrive to the depot. This can lead to an unevenly distributed load profile with high load peaks. One of the solutions is the implementation of an intelligent management system with charging schedule, organizing the charging events with the goal to minimize the peak, as shown in Figure 1.

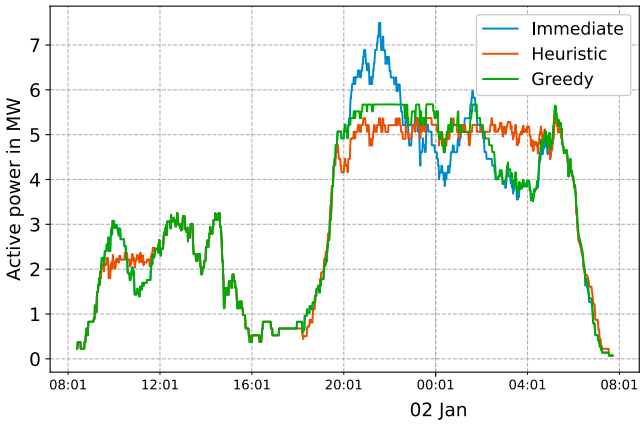

Figure 1. Load profile of the bus depot Alsterdorf showing the "Immediate" charging without any intelligent scheduling and two scheduling algorithms "Heuristic" and "Greedy"

An additional solution for the problem of high load peaks is the usage of stationary battery storages, which will be investigated in this thesis. A real bus depot in Bergedorf, operated by the company VHH (Verkehrsbetriebe Hamburg-Holstein GmbH) will be used as an example. The thesis can be written in English or German.

Tasks:

- Research on the state of the art technologies/techniques for electric vehicles, battery energy storages and load peak minimization
- Initial training / familiarization with the Bus Depot Simulator (co-simulation platform for the analysis of electric bus depots based on DigSilent and Python)
- Development of algorithm for load peak minimization using the battery storage
- Implementation of the algorithm in the Bus Depot Simulator
- (Optional) Testing the algorithm for several worst case scenarios (extreme weather conditions, big bus delays)
- Analysis of the results

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