In a context of global efforts to reduce dependence on fossil fuels, battery electric buses for public transport are a promising solution to decrease cities carbon footprint. Supported by the progress of energy storage and of ultra-fast charging technologies, full electrification of public buses fleet has become nowadays feasible and realistic. However, an optimised system is essential to ensure an economically viable transition, while maintaining high service reliability. Worldwide, transport agencies are testing electrified bus lines while some mega-cities have already succeeded their full transition. This master thesis report describes the modelling of an agent-based, city-scale public bus transport system implemented in partnership with TUMCREATE Ltd. The developed simulation enables analysing the electrification, then the operation of a public bus fleet, including charging stations, termini, and depots. With 98 % of bus routes under 45 km, and 2 hours driving time, the city-state Singapore seems an ideal place to study large-scale bus networks electrification. The models were calibrated and validated using a historical real-world dataset, covering the entire bus fleet of this south-east Asian island. More than 25,000 buses journeys, operated by 5700 buses on 355 bus routes were simulated. The results show that a full
electrification of the current public bus fleet in Singapore would require around 350 chargers and induces a daily charging power demand reaching 120 MW during peak hours.

Übersetzter Abstract:
In a context of global efforts to reduce dependence on fossil fuels, battery electric buses for public transport are a promising solution to decrease cities carbon footprint. Supported by the progress of energy storage and of ultra-fast charging technologies, full electrification of public buses fleet has become nowadays feasible and realistic. However, an optimised system is essential to ensure an economically viable transition, while maintaining high service reliability. Worldwide, transport agencies are testing electrified bus lines while some mega-cities have already succeeded their full transition. This master thesis report describes the modelling of an agent-based, city-scale public bus transport system implemented in partnership with TUMCREATE Ltd. The developed simulation enables analysing the electrification, then the operation of a public bus fleet, including charging stations, termini, and depots. With 98% of bus routes under 45 km, and 2 hours driving time, the city-state Singapore seems an ideal place to study large-scale bus networks electrification. The models were calibrated and validated using a historical real-world dataset, covering the entire bus fleet of this south-east Asian island. More than 25,000 buses journeys, operated by 5700 buses on 355 bus routes were simulated. The results show that a full electrification of the current public bus fleet in Singapore would require around 350 chargers and induces a daily charging power demand reaching 120 MW during peak hours.

Stichworte:
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Entries: