

Charging Station Location Selection considering Charging

Scheduling, Energy Pricing, and Travel Time and Energy Consumption Uncertainties

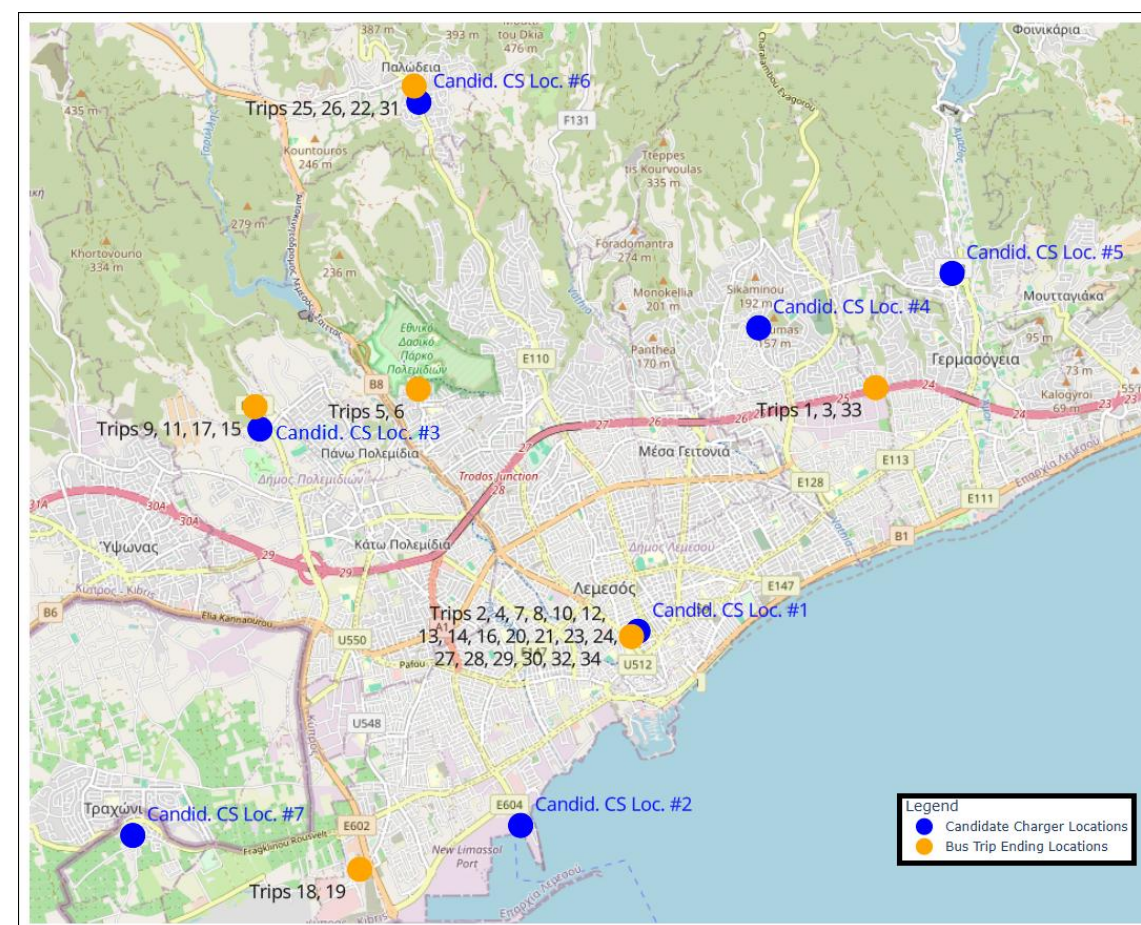


This metaInnovation can help **electric bus fleet operators** to optimally plan their charging infrastructure by minimizing **charger installation costs**, as well as buses' **daily charging costs**, and **deadhead and queue waiting times**. It considers real-world buses with charger specifications, energy pricing schemes, and bus charging scheduling under continuous charging regimes. It also accounts for inter-station travel time and energy consumption uncertainties for a more resilient charging network.

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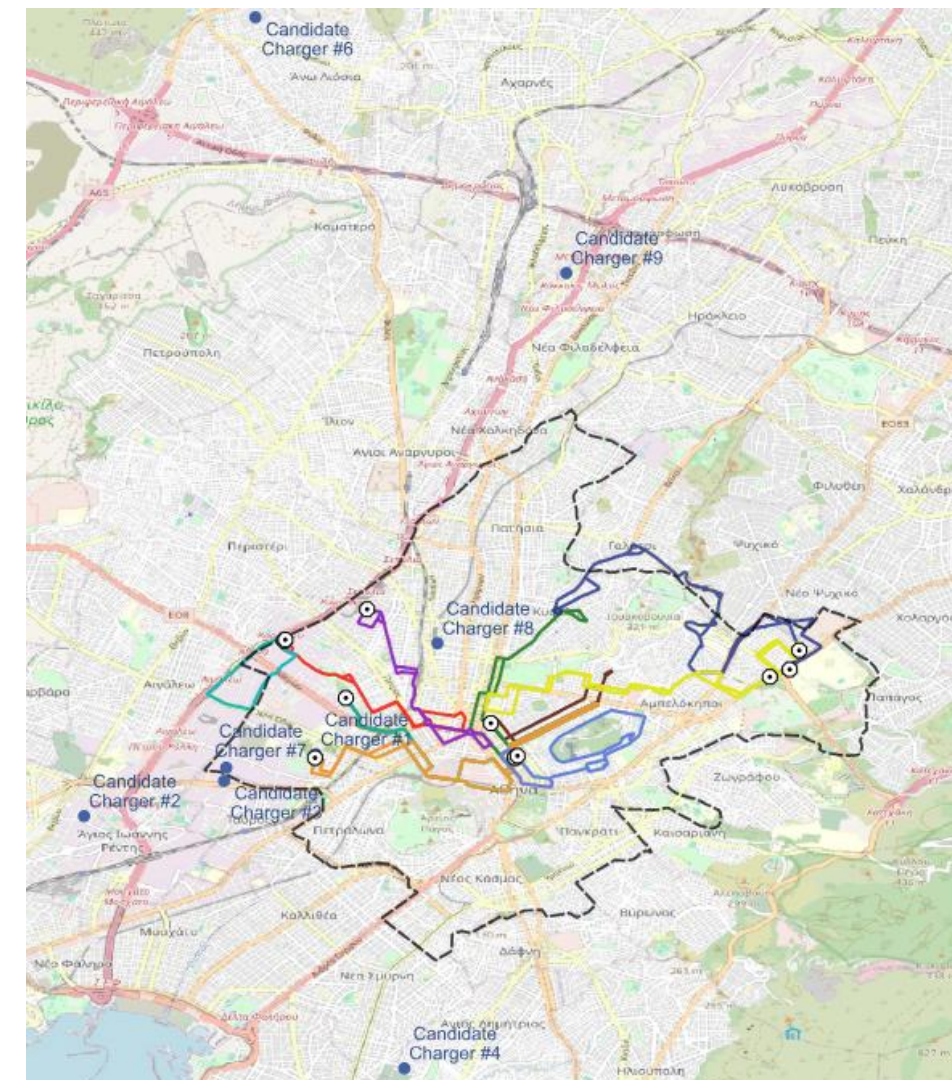
Data Requirements

- Electric bus trip schedules and routes.
- Time-of-Use electricity tariffs.
- Peak demand charge rates.
- Charger types and technical specs.
- Candidate charger installation locations.
- Energy consumption and Battery State of Charge.



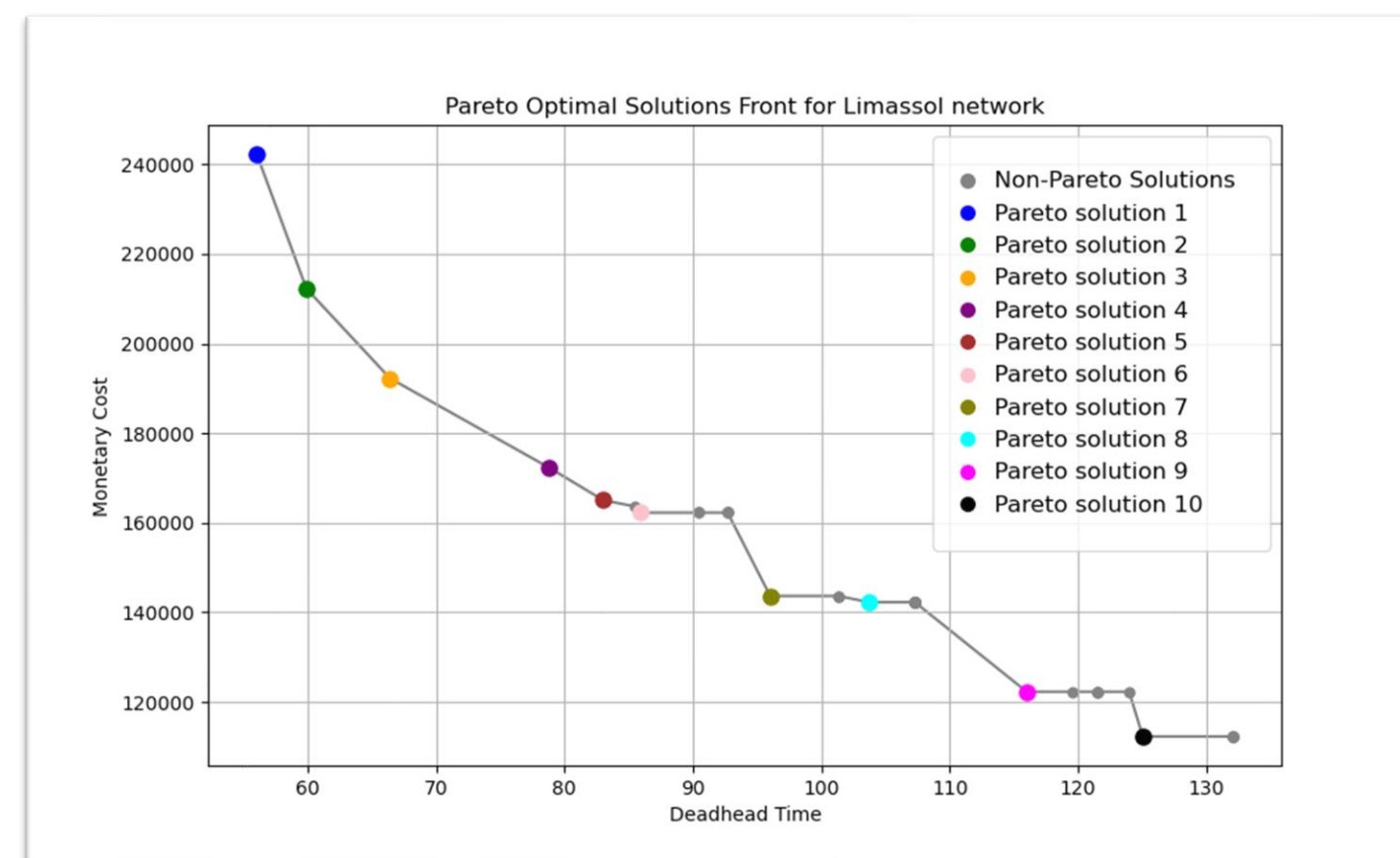
Methods

- The tool uses Mixed-Integer Linear Programming for the mathematical formulation and the ϵ -constrained method to generate a set of Pareto optimal solutions.
- The tool uses the Sample Average Approximation Method for the stochastic approach of the problem.



Decisions

- Selection of optimal locations and types for new charging stations.
- Charging scheduling within daily and/or night-time.
- Determination of charging duration and energy transferred per session.



Scalability

- Applicable to mid-sized urban transit networks. Tested for up to 480 bus trips and 108 candidate chargers. Also tested with 30 buses and 20 charging options under various travel time and energy scenarios.
- Supports multiple charger types (slow/fast).
- Adaptable to different energy pricing schemes.



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