

Fast Charging of Electric Buses in Distribution System

Background and Aim

Electric buses are getting more attention due to improved energy efficiency and reduced local pollutions. Since the buses are using electricity for propulsion they will have an impact on the distribution system. This project aims to develop a model to estimate the impact of fast charging of electric buses on the distribution system, and to develop strategies to reduce the influences. The strategies investigated includes:

- Reactive power compensation
- Energy storage at charger location
- Demand response of flexible customers

Modelling approach

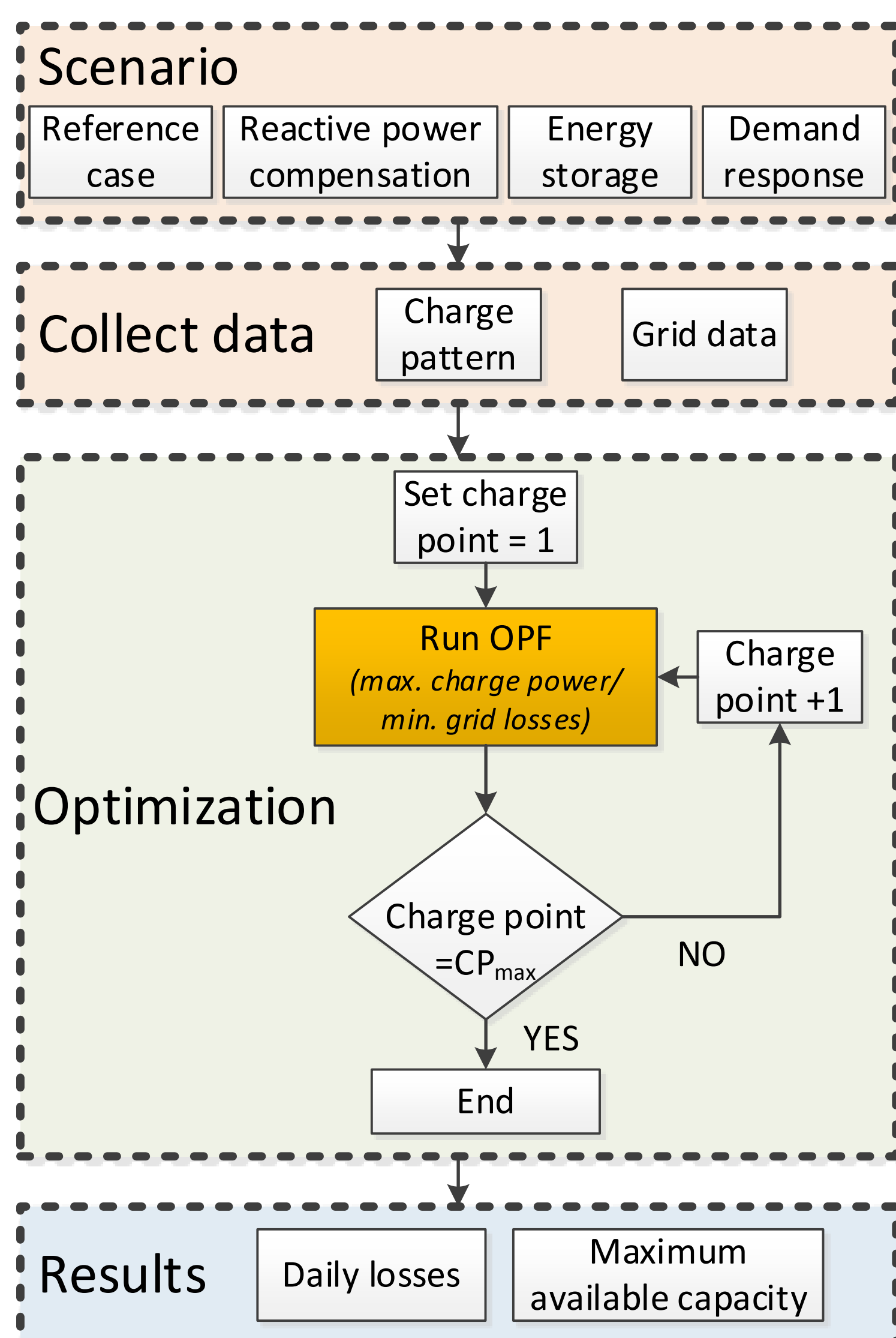


Fig. 1 Flow chart of the modelling approach

Local energy storage

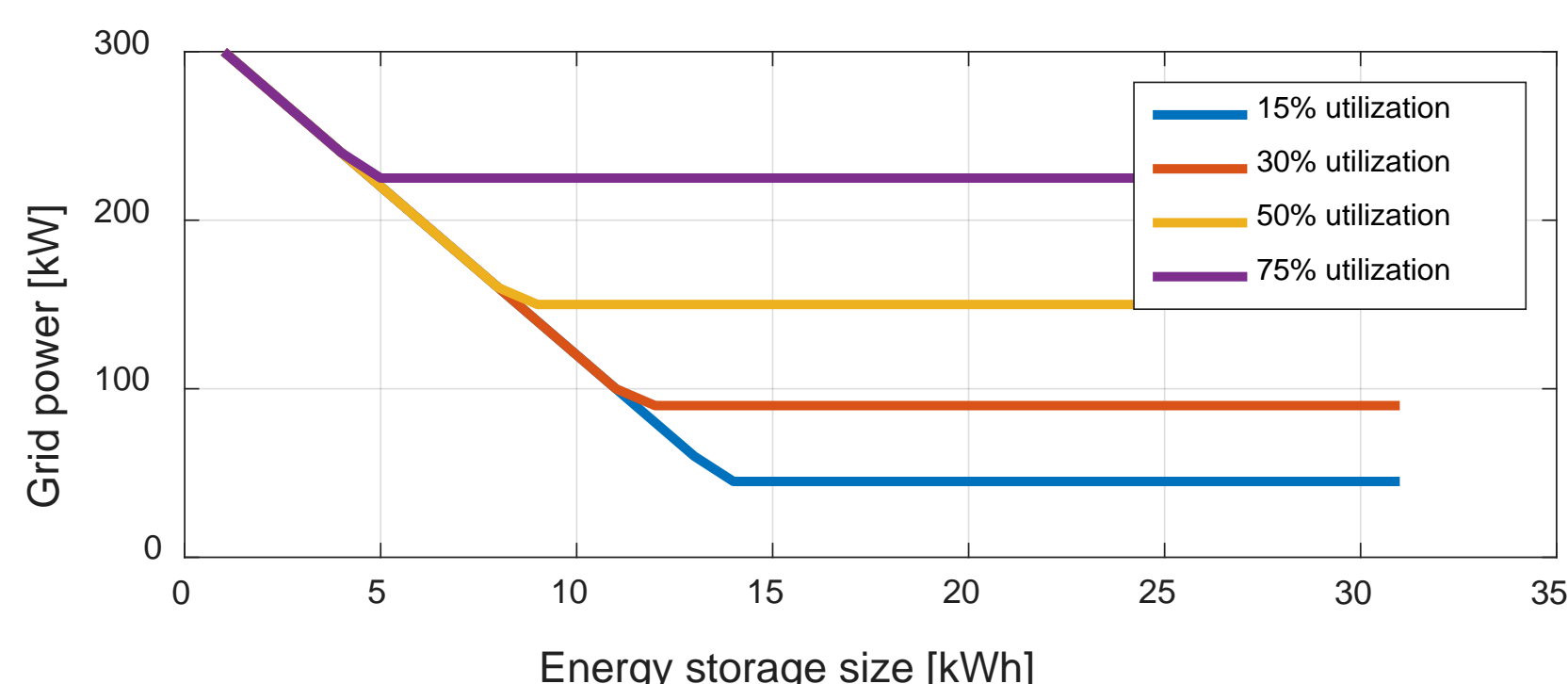


Fig. 3 Influence of local energy storage on power drawn from the grid (based on data for line 55 in Gothenburg).

- Even small energy storages could have a great influence on the power drawn from the grid.
- Limited by the utilization of the charger.
- Many cycles and high charge/discharge power.

Measurement from a 300 kVA charging station

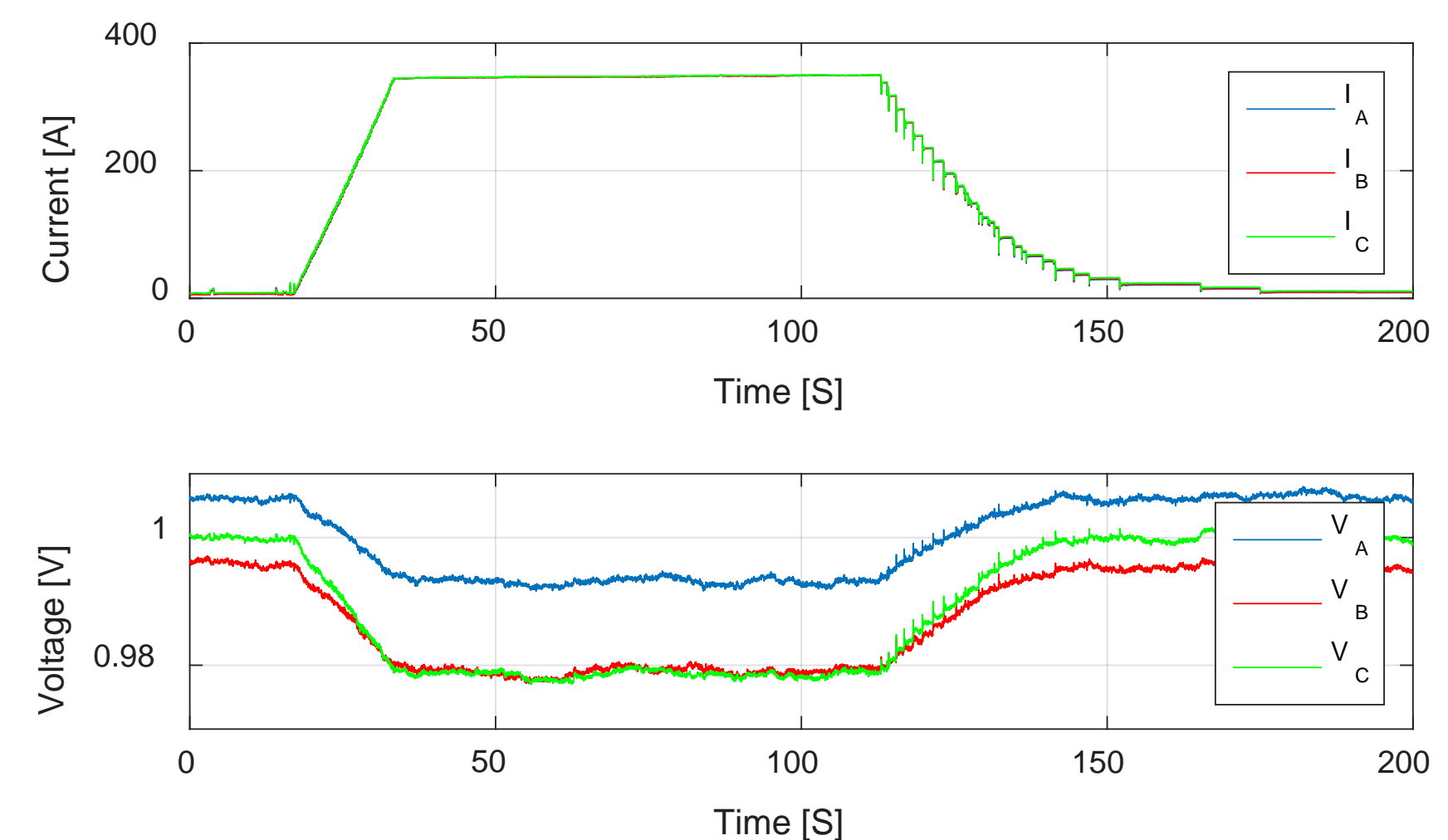


Fig. 2 Current and voltage during charging of an electric bus at Lindholmen science park.

- 2% voltage drop due to the charging of the electric bus.

Simulation results

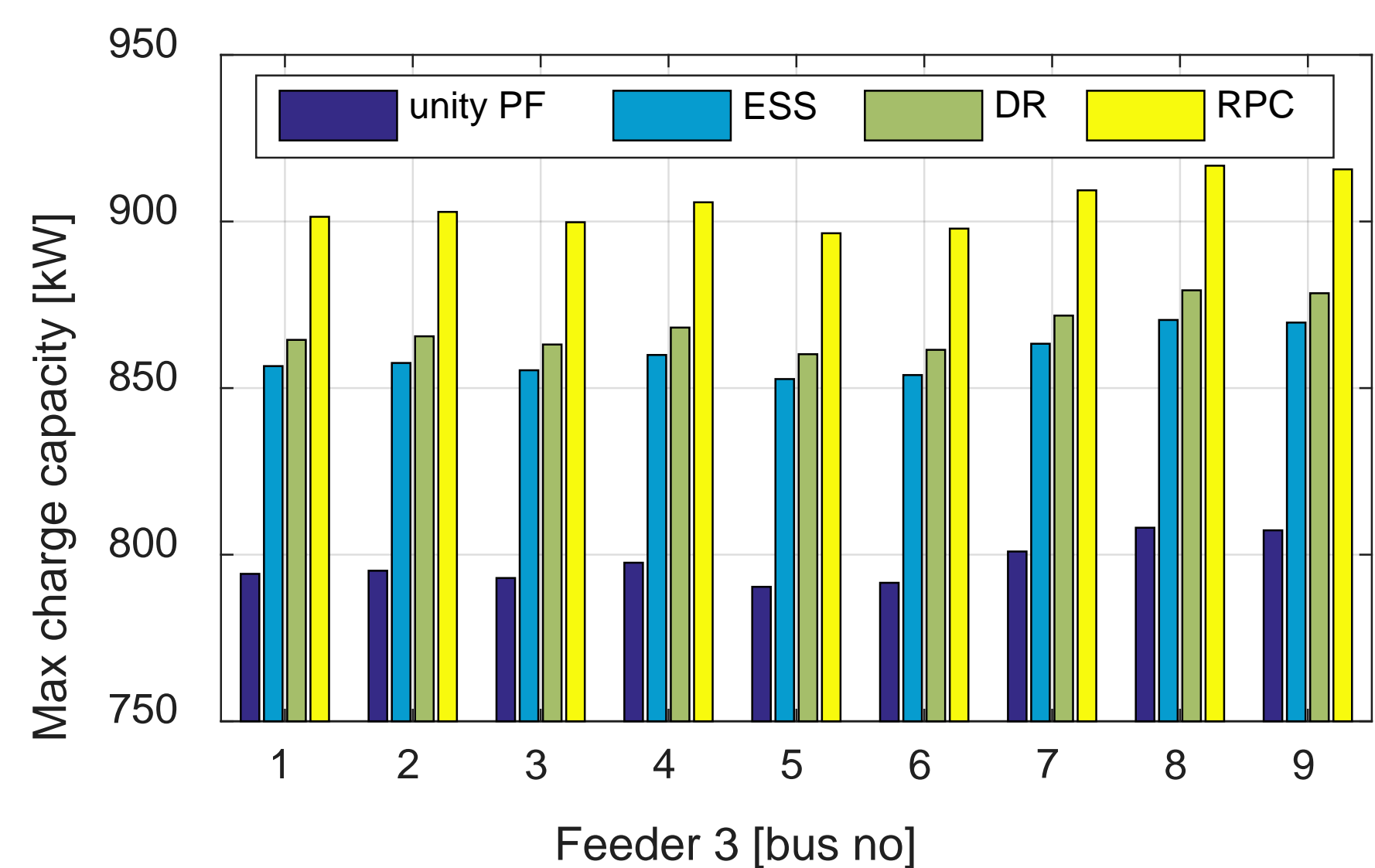


Fig. 4 Available capacity for charging at the different buses in the distribution system when utilizing alternative strategies.

- In the simulated distribution systems no major issue caused by implementing charge stations with a capacity of about 800 kW.
- By utilizing alternatives approaches the maximum charger size increases with about 60-100 kW.

Conclusions

- Local energy storage system can be used to reduce the impact of fast charging station for electric buses but the influence depends on the utilization rate of the charger.
- Demand response could be beneficial but requires incentives for and coordination of the customers that will participate.
- The possibility to use the charger for reactive power compensation could reduce the voltage variations within the distribution system but the influence on the voltage level is limited on the simulated 10kV grid.

Acknowledgement

