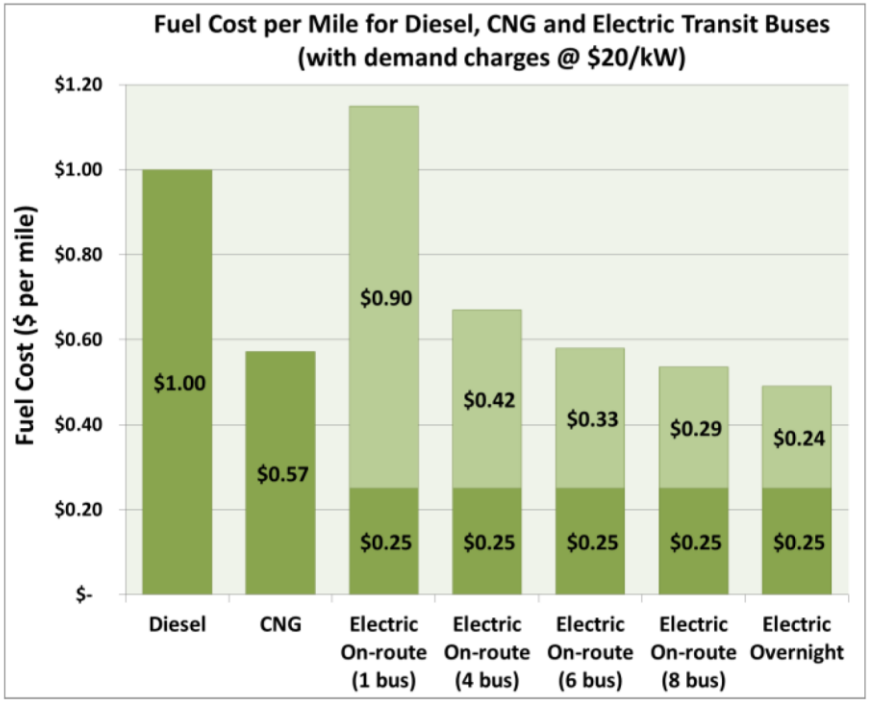
Optimal charging schedule and management for a fast-charging battery electric bus system

Dr. Ziqi Song
Assistant Professor, Transportation Division Head
Department of Civil and Environmental Engineering
Utah State University

Fast-charging for BEBs

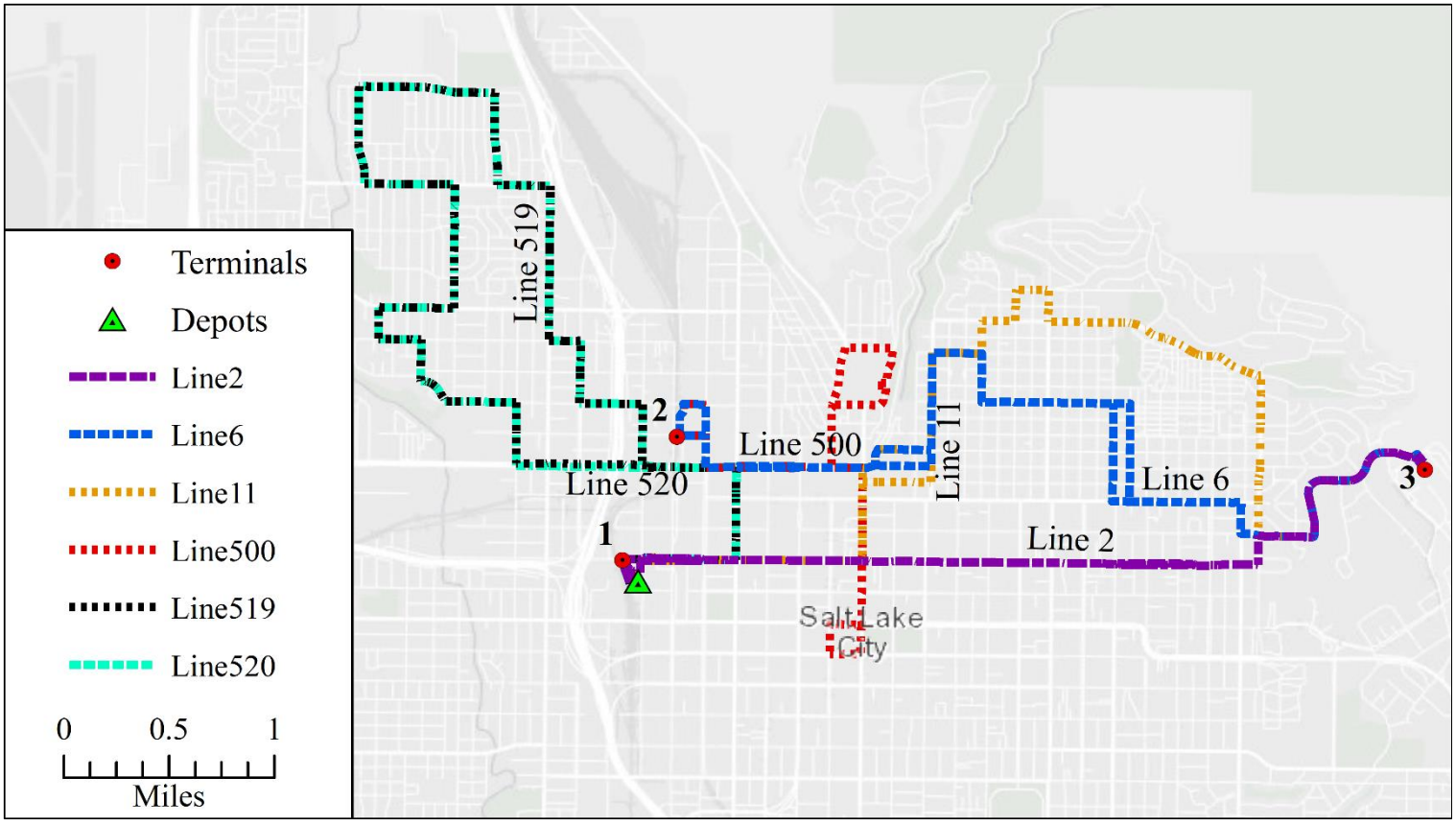
The impacts of demand charges

- CALSTART (2014) reviewed electric rate schedules of 26 major electric utilities in Arizona, California, Colorado, Florida, Georgia, Illinois, New York, Oregon, Texas and Washington
  - 21 out of the 26 electric utilities levy demand charges on their commercial and industrial customers.
  - Three utilities indirectly include peak demand to calculate the total customer charge.
- Demand charges accounted for 75.2%±8.6% of the total electricity bill for a fleet of five electric buses in Tallahassee, Florida (Qin et al., 2016)



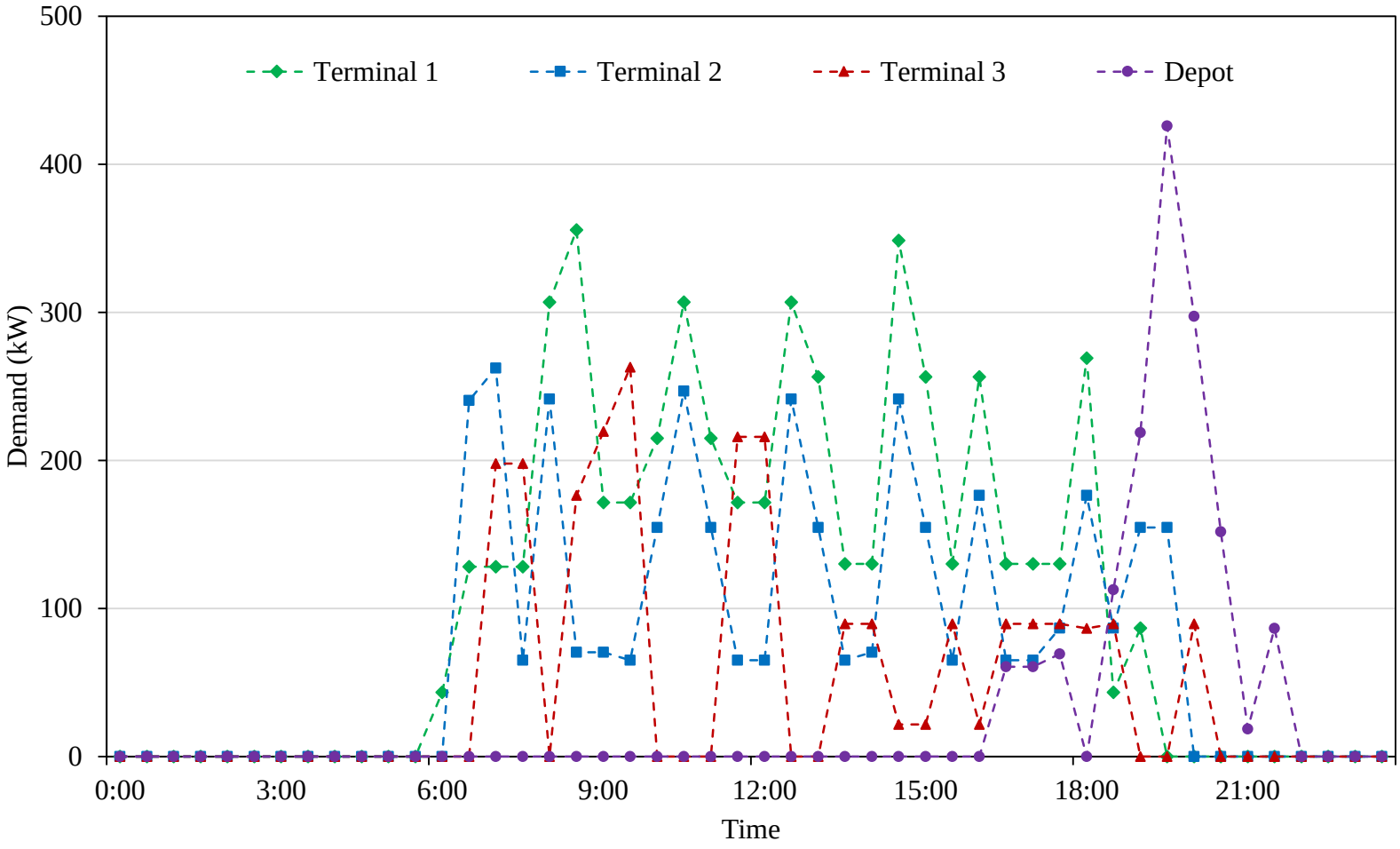
Fuel cost for diesel, CNG and electric buses with demand charges
Source: CALSTART (2014)

A case study in Utah



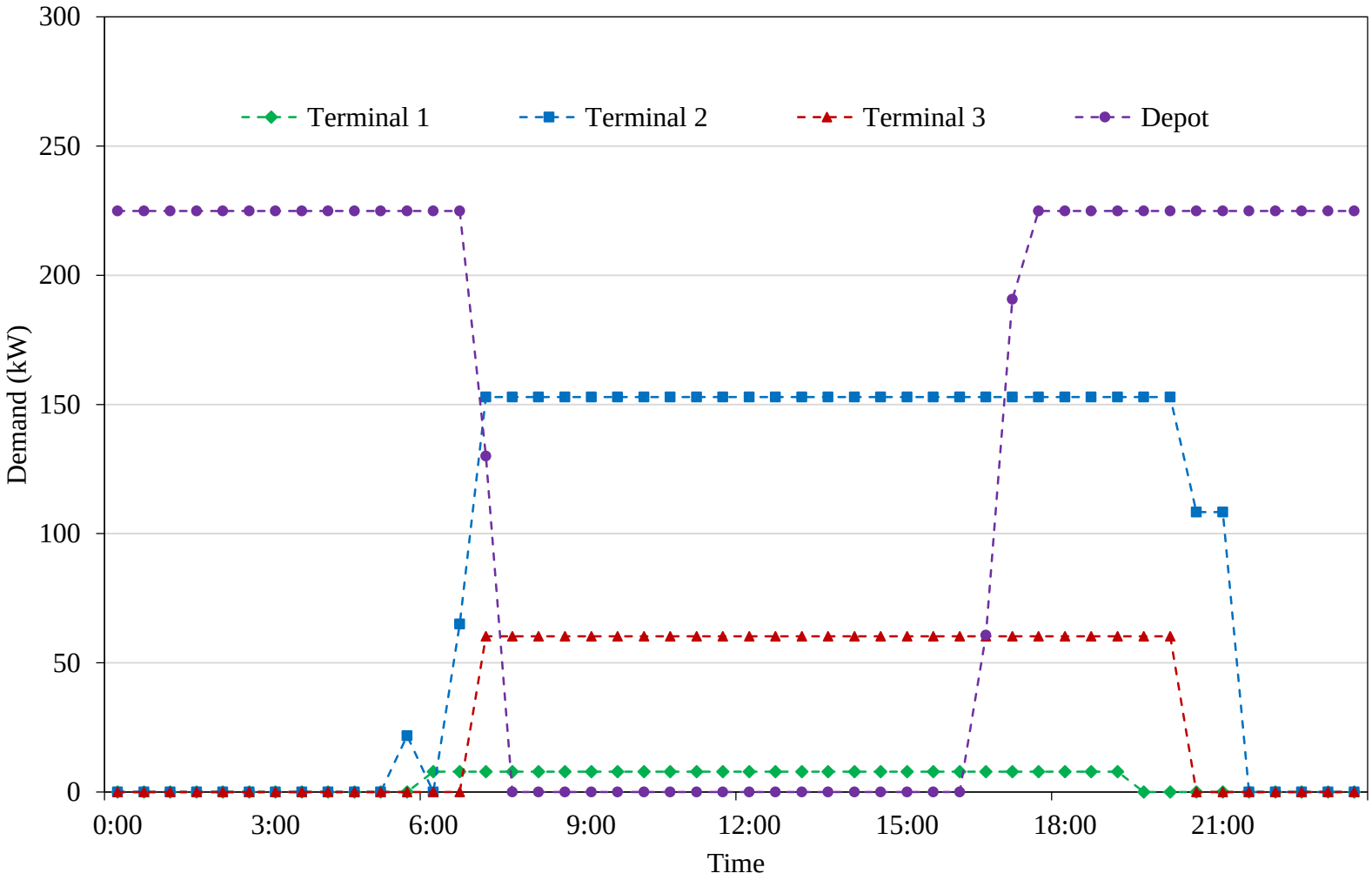
Selected UTA Bus Lines

Demand profiles for uncontrolled charging



(a)

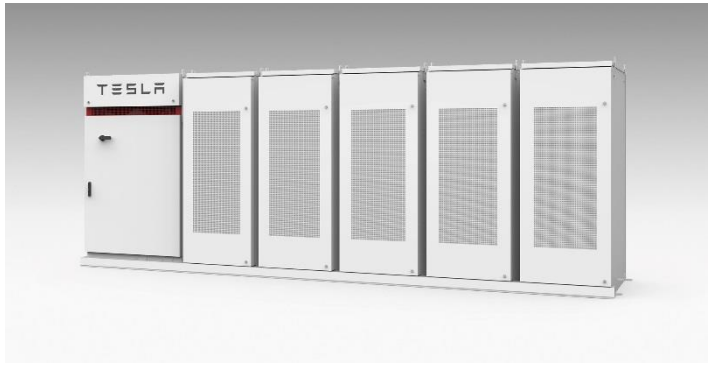
Optimal demand profiles



(b)

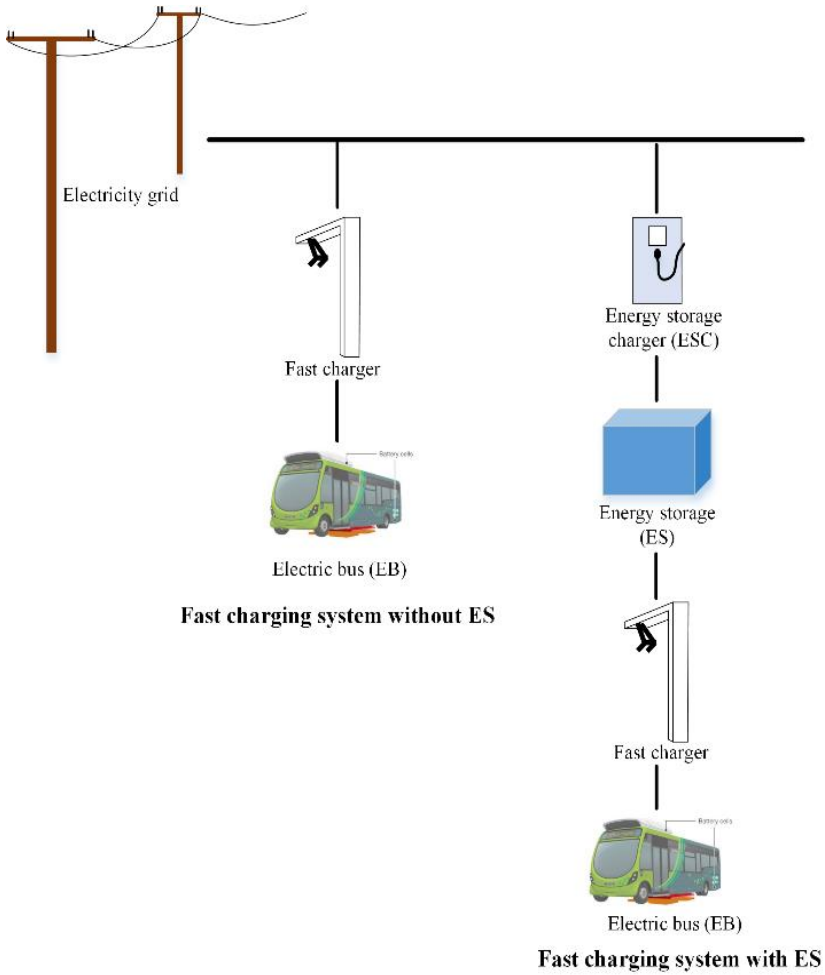
Other ways to reduce demand charges

- Energy storage system (ESS)

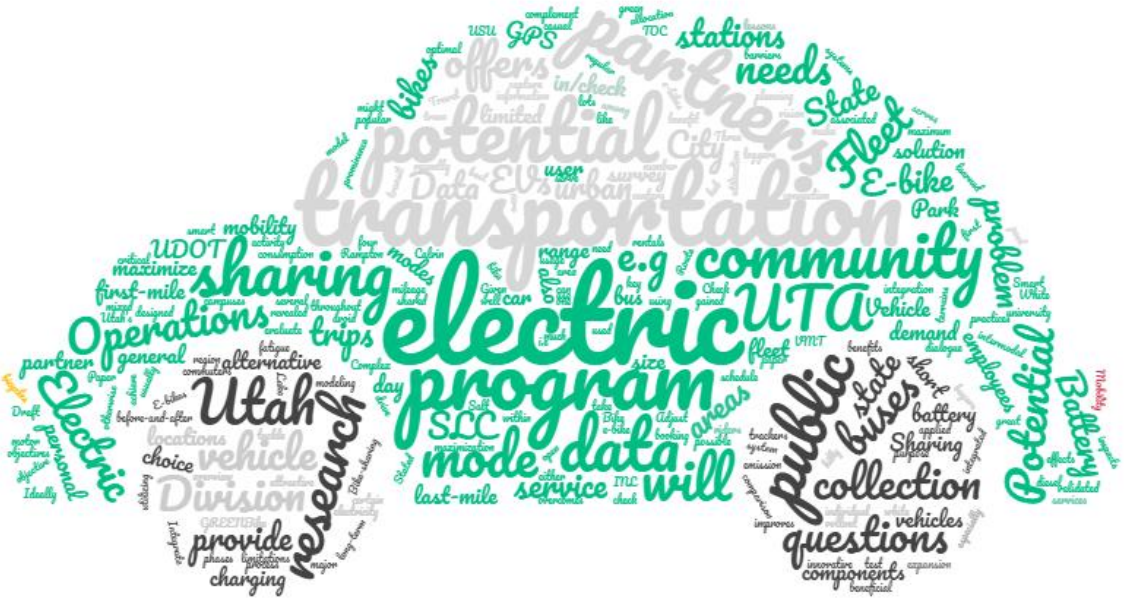


Source: Tesla.com

- Basic idea:
  - ESS can draw energy from the power grid using a low-power energy storage charger at any time.
  - At the charging station with an ESS, buses draw energy from the ESS through the high-power fast-charger within a short dwelling time



Questions and answers



Email: ziqi.song@usu.edu