Battery Electric Buses - The Good, the Bad and the Ugly
Link Transit System Statistics

• 3,500 square mile service area
• 120,000 population
• 550 route miles - 600 bus stops
• 62 buses - 9 Park & Rides
• 2.2 million annual miles
• 1.1 million annual boardings (pre-covid)
Link Transit – Battery Electric Bus Setting

• 5 - 2010 22’ Ebus (Opportunity Charged)
• 4 - 2016 35’ BYD K9S -Plug-in charged
• 1 – 2016 35’ BYD K9S -Wireless charged
• 10 – 2020 35’ BYD K9S -Wireless charged
2016 BYD K9S
BYD 85KW Wired Chargers
MD Wireless Charger
The Good

- Batteries
- Reliability
- Cost
- Range
- Charging
Li-ion Battery Improvements

Kilowatts

- 2010
- 2014
- 2016
- 2017
- 2020

kw

Link Transit
connecting our communities
Current Performance

• Most reliable buses
• Cost -$0.15/mile vs $0.65/mile diesel
• Plug-in 175- 200 mile range
• With wireless charging – over 350 mile range
Lifetime Energy Cost

- Urban bus – averages 650,000 miles
- 650,000 miles = $287,083 lifetime diesel cost (@ $2.26 per gallon)
- 650,000 miles @ 1.9 kW/mile = 1.26 mil kW = $58,500 lifetime electric cost
- Energy cost savings $228,583
- Additional cost of electric bus $290,000
Maintenance/Energy Cost

- 650,000 miles x $0.65/mile diesel bus = $422,500 lifetime maint. & energy cost
- 650,000 miles x $0.15/mile electric bus = $97,500 lifetime maint. & energy cost
- Lifetime cost saving = $325,000
- Additional cost of electric bus $290,000
The Bad

- Inter-operability of charging
- Unstable component suppliers
- Demand Charges
- FTA
The Ugly

- Demand charges
- Utility capacity
- FTA
- Unstable component suppliers
Utility Concerns

• Demand Charges – two types
  – Peak energy use charge
  – Time of day charges

• Base rate $0.024 per kW
• Demand charge $2.40 per peak kW
• Average rate $0.046 per kW
Charging Infrastructure

• Utility Capacity At Scale
  – Three wireless chargers – 1,050 kW
    • $800,000 chargers, transformers, installation
  – 20 plug-in overnight chargers – 1,700 kW
    • $350,000 chargers, transformers, installation

• Cost for additional substation capacity
  – $8 to $20 million depending on location
FTA and New Technology

• FTA treats battery-electric as proven tech
  – 12 year useful life
  – No structure to recognize market & tech changes

• Component vendors unstable
  – No continuous parts supply due to changing tech
The Unanticipated

- Accounting Treatment (GASB)
- Energy Management
- Permitting
- Trade Wars