



Electric Buses Overview

Board Transportation Committee Meeting
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Electric Vehicles are Not Revolutionary

- Electric-powered transit vehicles in use since 1880s
- Internal combustion engine prevailed in cars/buses
- 1990s to Present: Advances in battery storage & electric drives
- First hybrid cars/buses, now all-electric cars/buses
- Recognized as a technology to help meet environmental goals



Increasing Interest

- Electric buses types: Battery & Fuel Cell
- 2,800 electric buses produced in North America since 2010
- Electric pilots at regional transit systems
- Fairfax County:
 - Relay at Mosaic autonomous vehicle
 - Joint Environmental Task Force recommends converting buses by 2030
- More cities/states are buying electric and/or pledging to have full electric fleets by 2050 or sooner



Considering Electric Buses

*“The Zero Emission Bus (ZEB) industry is still maturing; therefore, your transit agency should begin each deployment by researching the current technology options and any available Federal, State and Local resources.” **

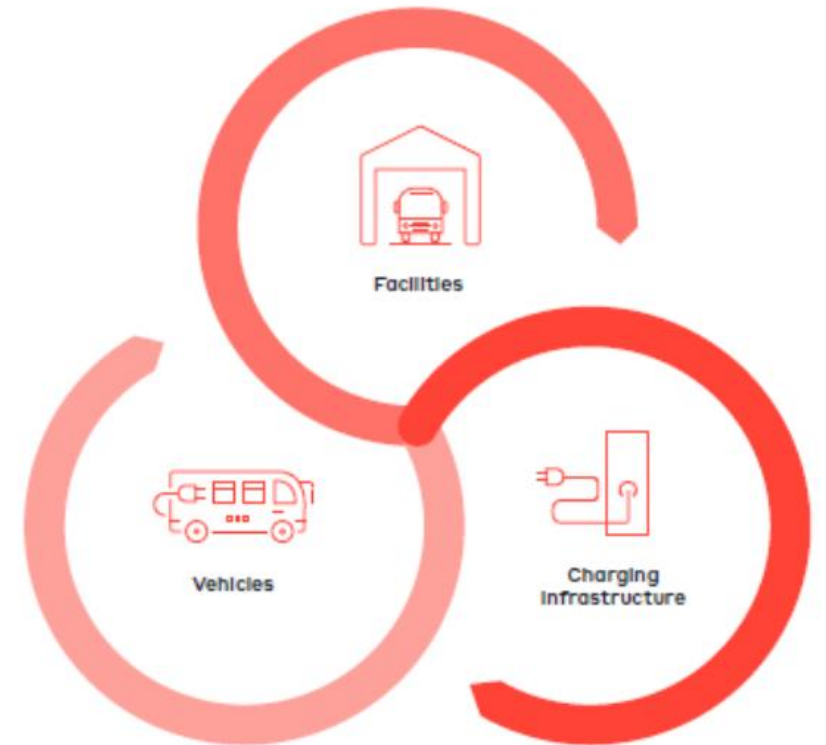
- Before you buy...
- Guidelines for evaluating future use
 - Define commitment and timeline
 - Collect data/information from current users
 - Determine how electric buses fit service needs
 - Identify grants & assistance (government/utilities)
 - Build relationships (utilities/manufacturers)



* Final Guidebook for Developing Zero-Emission Transit Buses, Transit Cooperative Research Program, April 2020

Adapting to a New Vehicle Technology

- Four major areas to look at when adopting a new vehicle technology
- Understand how the technology fits
 - Vehicles: Life-cycle costs, range
 - Facilities: Storage requirements, safety
 - Fueling: Service time, infrastructure costs, environment impacts
 - Operational: Required changes to service or current practices, training requirements, personnel safety



Advantages



- Zero vehicle emissions
- Lower dependency on fossil fuels
- Lower maintenance costs

- Hi-tech appeal
- Smoother & quieter ride
- Addresses global climate change & national energy independence



Challenges

- Limited range (miles/hours)
- Fueling infrastructure
 - Cost of new delivery systems
 - Charging times
- Vehicle cost
- New practices/procedures
 - Changes required to operations, maintenance and training

Bus Type	Cost	Range	Fueling
Diesel	\$0.5M - \$0.6M	475 – 525 miles	6 minutes
Diesel Electric Hybrid	\$0.7M - \$0.8M	525 – 600 miles	6 minutes
Battery Electric	\$0.8M - \$0.9M	125 – 225 miles	5 – 7 hours

How to Make It Work

- Funding
 - State/Federal subsidies
 - Partner w/utilities (assistance and/or negotiated rates)
- Improving range
 - Efficiencies/Lighter vehicles
 - Better Batteries
 - In-service charging
 - Regenerative braking
- Operational Changes
 - Changing duty-cycles
 - Recruiting qualified technicians



Charging Infrastructure

- Primary charging (parked buses)
 - Easy plug-in by Operator
- In-service charging
 - Short boosts for extended range
 - Strategic placement



- Main infrastructure issues
 - Transformers/Chargers
 - Back-up power
 - Plan for scalability

Electric Buses for Fairfax County

- Current efforts:
 - In-house staff experience with electric buses
 - Ongoing partnership with Dominion Energy with autonomous vehicle pilot
 - Richmond Highway Bus Rapid Transit Team looking at using electric buses
- FC DOT looking forward:
 - Electric buses have a place in the future
 - Looking into funding opportunities for buses and infrastructure at the federal and state levels



Electric Bus Demonstration

- Four bus pilot + support infrastructure - cost estimate: \$3.8M - \$4.2M
- Objectives to learn more about:
 - Range and charging
 - Service and seasonal performance
 - Performance on local and express routes
 - Begin development of training programs
- Staff recommendation/request:
 - Board direction to develop formal pilot proposal
 - Seek funding from state and federal sources





Questions and Discussion

