WTA ZEB TRANSITION STUDY – DRAFT REPORT

03/21/2023 WTA PRESENTATION

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WHAT TRANSPORTATION CAN BE.

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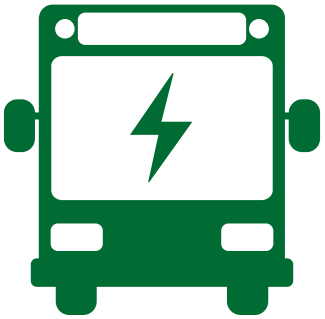
MEETING AGENDA – STUDY OVERVIEW

1. Zero-emission technology overview
2. Policy & Funding
3. Operations Analysis

ZERO EMISSIONS TECHNOLOGY OVERVIEW

BATTERY ELECTRIC BUSES (BEB)

- 5 manufacturers producing BEBs
- 40’ BEB ~ $1.15 million
  - 40’ Diesel ~ $520,000
- Range (125-180 miles)
- Requires Charging Infrastructure
  - Costs $150,000 - $700,000 per bus depending on type and configuration
- Cheaper to fuel than diesel



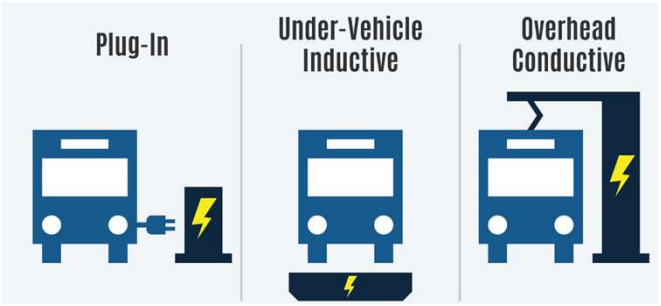
GILLIG

PROTERRA

NEW FLYER

NOVA BUS

BYD



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FUEL CELL ELECTRIC BUSES (FCEB)

- 2 manufacturers producing FCEBs
- 40’ FCEB ~ $1.25 million
  - 40’ Diesel ~ $520,000
- Range (260+ miles)
- Requires Fueling Infrastructure
  - Costs $2.0 M - $5.0 M, depending on fleet size to support
  - Assumes $4.5 M / 50 buses for this report
- Hydrogen availability is limited

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NEW FLYER

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TECHNOLOGY PROBLEM IDENTIFICATION

Challenges to Adoption and Operation	Battery Electric Buses	Fuel Cell Electric Buses
Vehicle Cost	~ 2X diesel bus	More than 2X diesel bus
Infrastructure Cost	Very High	Very High
Range	Less than ½ of diesel bus	¾ of diesel bus range
Fueling Logistics	Hours to Charge	Minutes to Fuel
Available Fuel Source	Electricity not constrained	Lack of Available H2

Limited to no impact to WTA funding or operation

Large impact on WTA funding or operation

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POLICY AND FUNDING

POLICY DRIVING ZEB ADOPTION

Federal

(50% GHG emissions reductions by 2030, net zero in 2050)

- Infrastructure Investment and Jobs Act ($105 B for public transit, $15 B for EV adoption)
- Inflation Reduction Act

State

(95% GHG reductions by 2050)

- Clean Fuel Standard
- WA State Climate Commitment Act
- Clean Energy Transformation Act
- ZEV Infrastructure Partnership Program
- SB 5910 (Renewable Hydrogen Generation)

Local

- Whatcom County Climate Action Plan
- Bellingham Climate Protection Action Plan
- WTA 2040

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POTENTIAL FUNDING SOURCES

Federal

- **USDOT** *(RAISE Grants)*
- **FTA** *(Bus and Bus Facilities Discretionary Grant, Low/No Vehicle Grant, Urban Area Formula Grant, State of Good Repair, Flexible Funding Program – Surface Transportation Block Grant Program)*
- **EPA** *(Environmental Justice Collaborative Problem-Solving Cooperative Agreement Program)*

State

Green Transportation Capital Grants

Local

Bellingham Transportation Levy Fund

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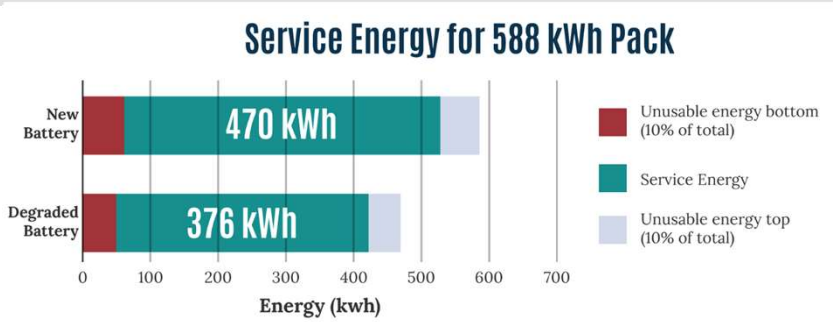
OPERATIONS ANALYSIS

OPERATIONS MODEL ANALYSIS (PEER)

- Detailed route models for all fixed-route service
- Assumes 40’ Gillig BEB with degraded battery
- Routes combined to blocks
  - Included deadhead (MOAB to route to MOAB)
- Blocks Combined into Schedule (what bus does during the day)



Season	% Completable (Blocks)
Winter (without DFH)	57%
Winter (with DFH)	69%
Spring/Fall	79%
Summer	75%

Existing Blocks (How the schedule is composed)	
# of Blocks	72 (50/22)
Completability	69%

Block Combinations (What the buses do during the day)	
Combinations	49 (27/22)
Completability	55%

OPERATIONS MODEL ANALYSIS (PEER)

Block Combinations (588kWh Battery, 367kWh of Service Energy)	
Combinations	49 (27/22)
Completability	55%

Future Block Combinations (800kWh Battery, 640kWh of Service Energy)	
Combinations	49 (47/2)
Completability	96%

Analysis also done for 40’ Gillig BEB with assumed 800 kWh nominal battery (+36% from existing) to test for future battery improvements

2 block combinations not completable with future battery

- Requires on-route charging, FCEBs or changes to block schedule
- Model results suggest schedule could be easily tweaked to get to 100% completability

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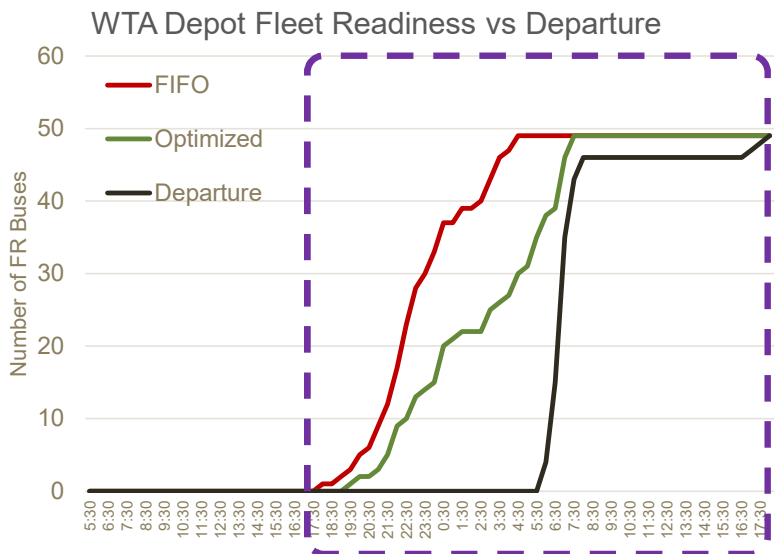
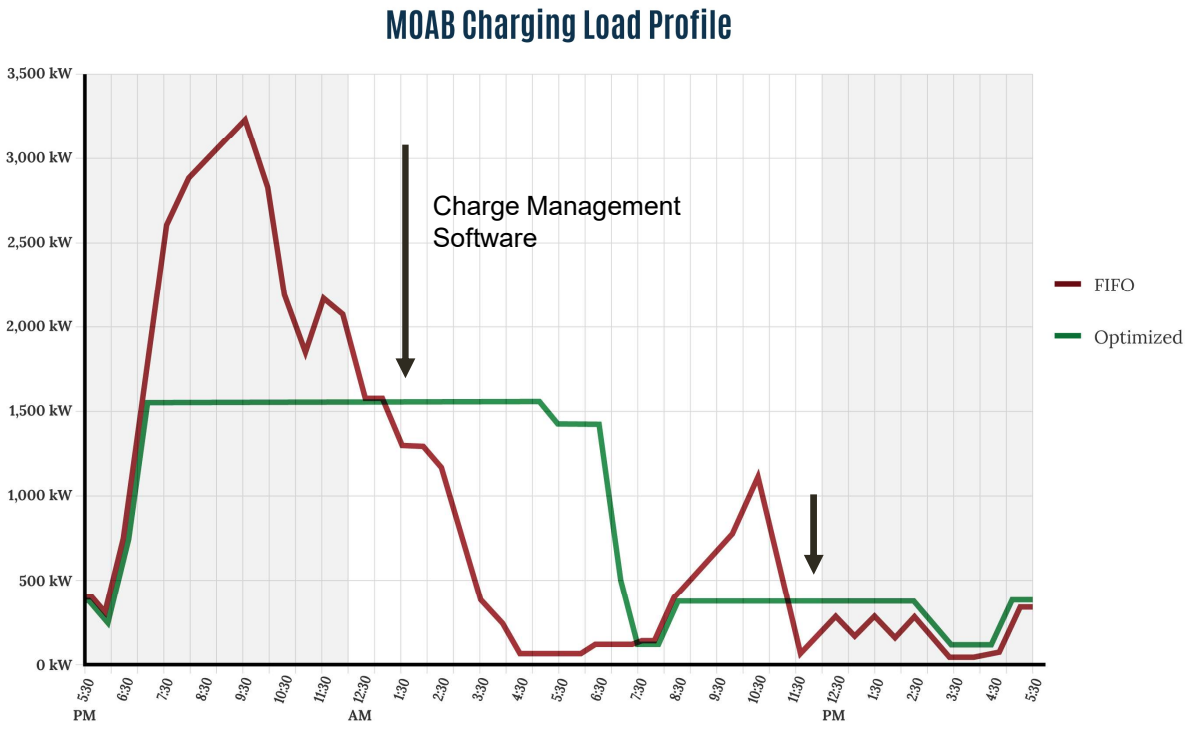
ELECTRICAL DEMAND

- **FIFO**: Charging buses on a first-in-first-out basis with no delays
- **Optimized**: Tries to reduce peak, and shift charging into the preferred window.





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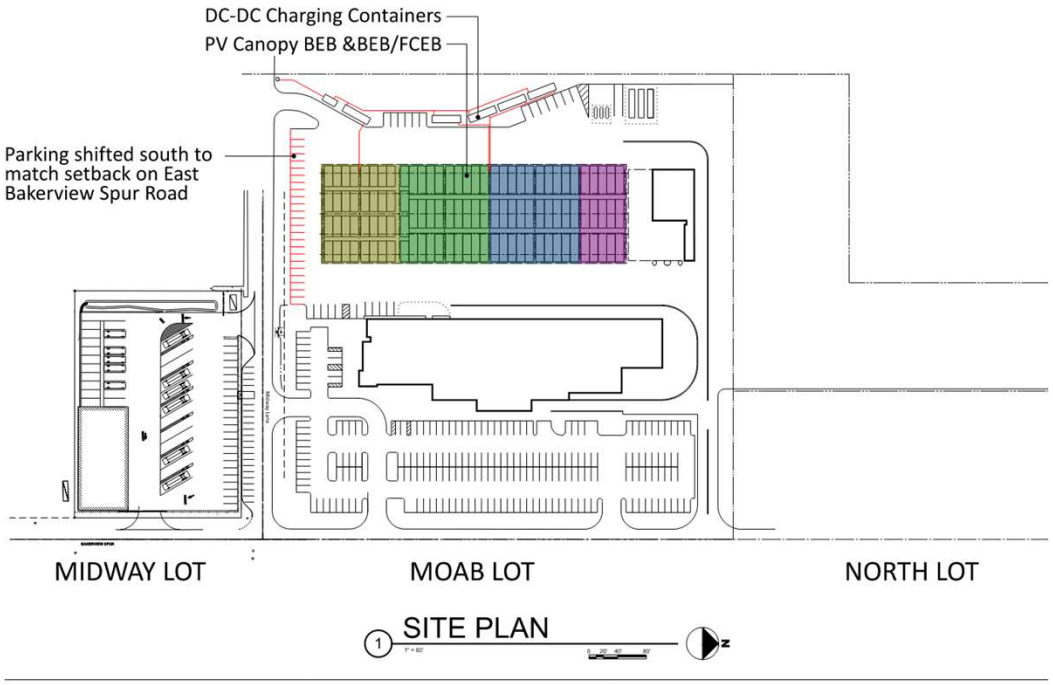
MOAB SITE UPGRADES

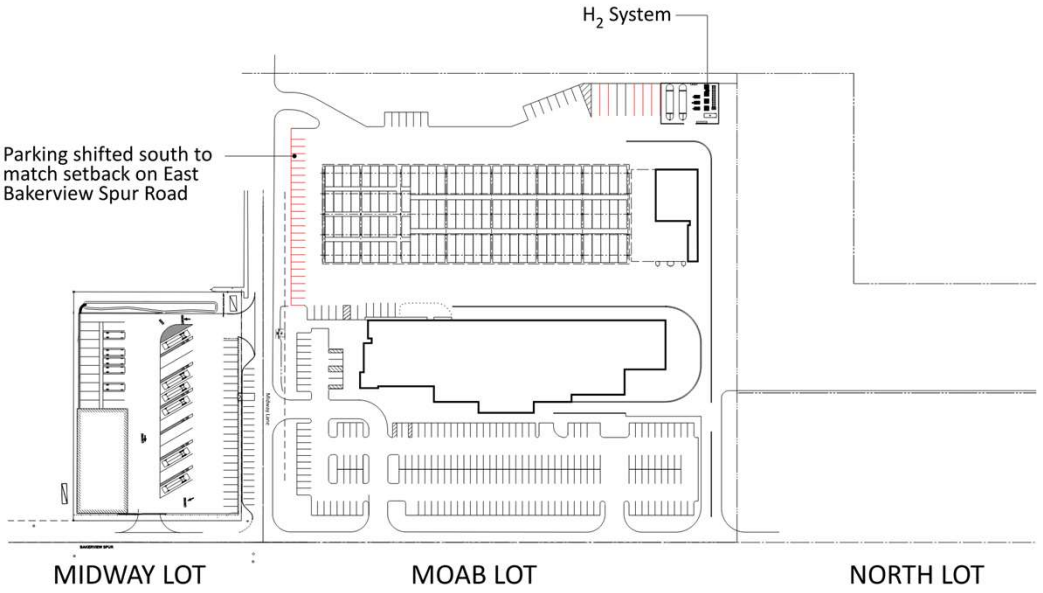
MOAB LAYOUT AND UPGRADES – BEB OPTION

- Room for ~84 X 40’ BEBs and chargers
- Deployed in stages
  - By colored groups if pantograph
  - As needed for plug-in
- ~2 MW additional electrical load capacity needed
- Backup Generator(s) (~2-3 MW)
- Increased fire suppression (coordination with fire dept.)
- Maintenance Bay Upgrades
- Staff safety training



MOAB LAYOUT AND UPGRADES – FCEB OPTION

- H_2 System would be a major one (or two) time investment
  - ~ $4.5 million for station for 50 FCEBs (scaled by size)
- May need additional electrical capacity (H_2 compression)
- H_2 Detector Alarms
- Increased Ventilation
- Increased Fire Suppression
- Maintenance Bay Upgrades
- Staff Safety Training



Q&A

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