Zero-emission Fleet Transition Recommendations

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January 17, 2024

Discussion Topics

- A Brief Look Back
- Analysis Results
- Looking forward

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A Brief Look Back

KEY CONSIDERATIONS (from October 2021):

- Focus on green and efficiency and cost
- Funding availability
- Infrastructure requirements and available site space
- Fuel/Energy availability
- Vehicle performance (primarily range)
- “Fit” into existing operations and our service to the community
- Resiliency for continuity of operations and emergency response

A Brief Look Back

	Battery Electric Bus	Fuel Cell Electric Bus
Reliable Range	130-190 miles on a single charge (or indefinite range with on-route charging)	200-320 miles before refueling
Fueling Technology	Depot or on-route charging • Plug-in charging • Wireless inductive charging • Overhead conductive charging	Hydrogen storage and fueling station • Purchased liquid or gaseous hydrogen (most common) • Produce hydrogen on-site through electrolysis or natural gas reformation
Capital Costs	• BEBs are currently more expensive than diesel buses • Charging infrastructure costs vary and do not scale easily; incrementally more charging infrastructure will be required for more buses	• FCEBs are currently more expensive than BEBs • Fueling infrastructure costs vary and depend on the required fueling rate. • Infrastructure scales more easily with similar equipment and space requirements. Additional buses do not necessarily require additional infrastructure
Fueling Considerations	• Depot-charged buses may require hours to fully recharge • Electricity rates will have a significant impact on fuel costs	• Refueling procedure and time required are slower than diesel buses, but similar to Compressed Natural Gas (CNG) fueling • Electricity costs may be significant if producing hydrogen on-site • Relatively few hydrogen suppliers across the country; costs may vary based on the distance from the supplier

Analysis Results

2023 Fixed-Route Service Assessment*

35'/40' BEBs

Block feasibility is based on efficiencies and associated energy use calculated for each route. A block may be shorter, but more energy intensive due to external factors such as grade, traffic, speed, etc. (see slide 19 for route efficiencies)

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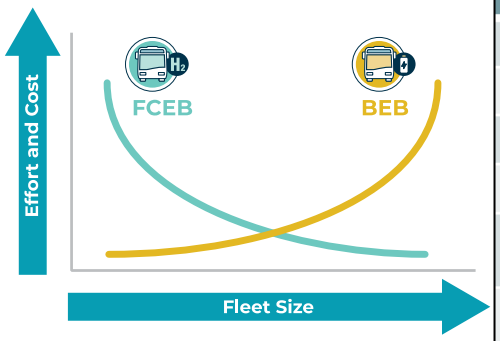
Analysis Results



Cumulative cost projections 2023 – 2050 (Fixed Route only)

Total Cost of Ownership	Baseline	BEB Depot Charging Only	BEB Depot and On-Route Charging	Mixed Fleet (BEB/FCEB)	FCEB Only
Fleet	$270,264,000	$408,825,000	$468,644,000	$477,540,000	$493,523,000
Fuel	$109,293,000	$71,148,000	$50,543,000	$71,297,000	$102,052,000
Maintenance	$95,730,000	$81,464,000	$73,971,000	$79,948,000	$88,172,000
Infrastructure	$-	$10,598,200	$21,599,000	$17,677,000	$11,636,000
Total	**$ 475.3 M**	**$ 572 M**	**$ 614.8 M**	**$646.5 M**	**$ 695.4M**
Compared to Baseline	-	+ $ 96.8 M	+ $ 139.5 M	+ $ 171.2 M	+ $ 220.1 M
% of Blocks Achievable by 2050	0%	83%	100%	100%	100%
Cumulative Metric Tons of CO_2e Reduced	-	**~70,000**	**~108,000**	**~62,000 – 113,000**	**~0 – 121,000**

Assumptions:

- 100% ZEB purchases beginning in 2026 for fleet replacement
- Infrastructure totals DO NOT include property acquisition or utility upgrades
- Fuel costs:
  - Hydrogen = $8.61/kg – PNW H2 Hub expected to drive costs down (~30%)
  - Electricity = $0.081/kwWh, Demand charges $11.16 - $15.24/kW (actual charging rate structure would be negotiated)
    - ~6MW needed for BEB Depot Charging
    - No solution for resiliency included

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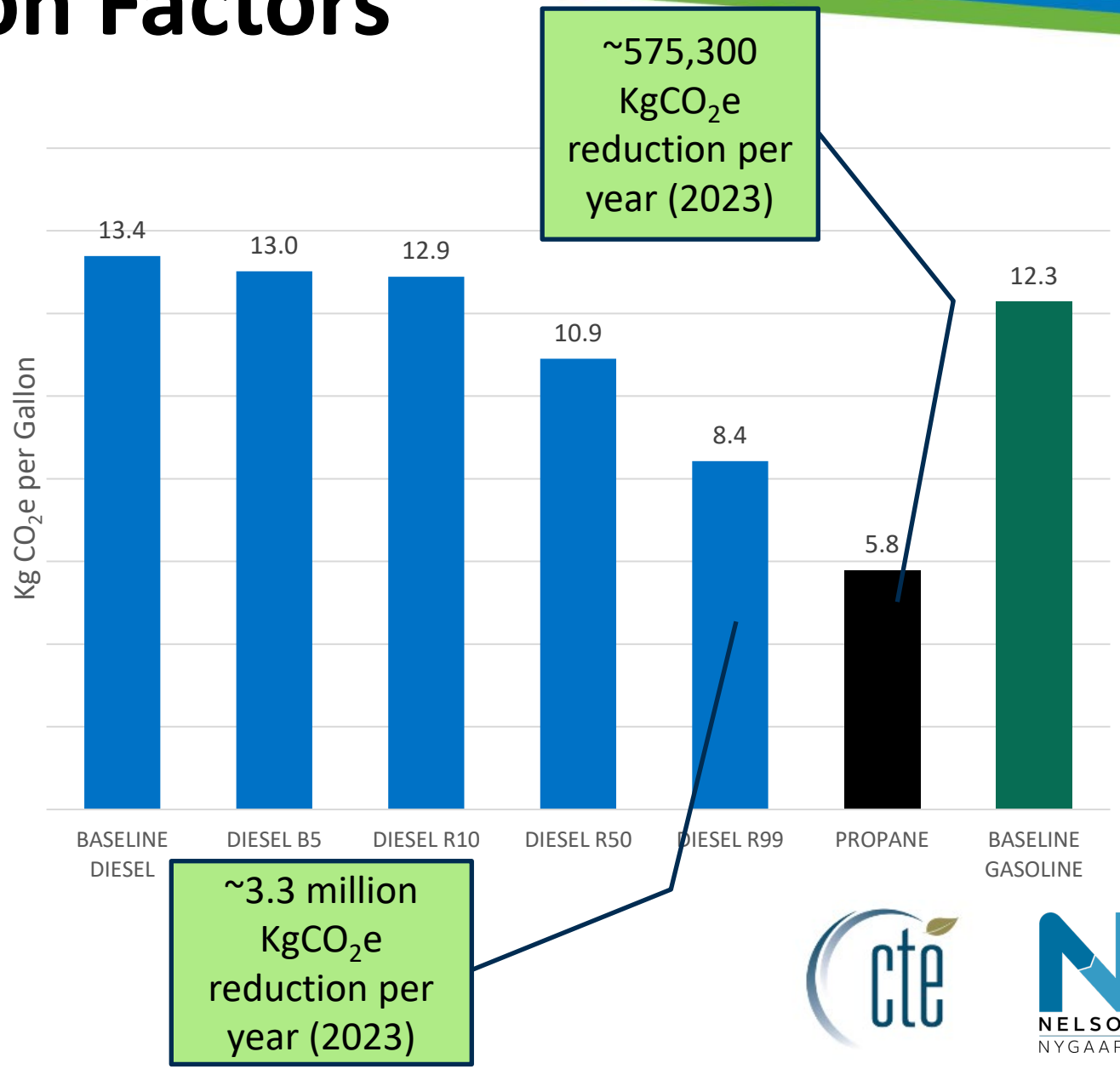
Well to Wheel Emission Factors

- Emissions factors obtained from U.S. Environmental Protection Agency
- U.S. Renewable Fuel Standard (RFS) program analyzes CO_2 emissions from production, transportation and use of renewable fuels
- Intercity fuel transitions
  - B5 – 2008
  - Propane – 2018 (DAL only)
  - R10 – July 2020
  - R50 – Oct 2021
  - R99 – Jan 2023



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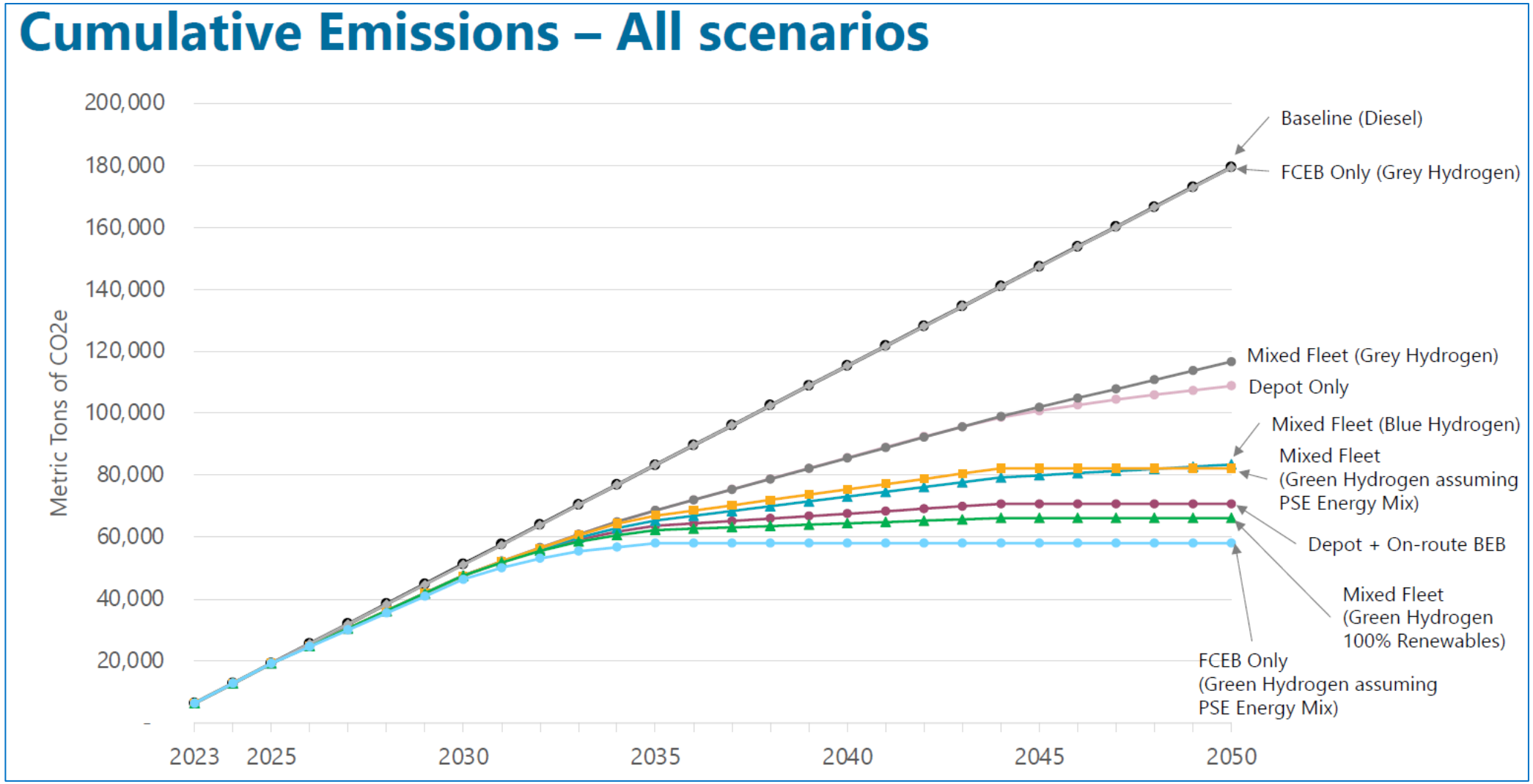
Analysis Results



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We've done the analysis, so which way do we head from here?

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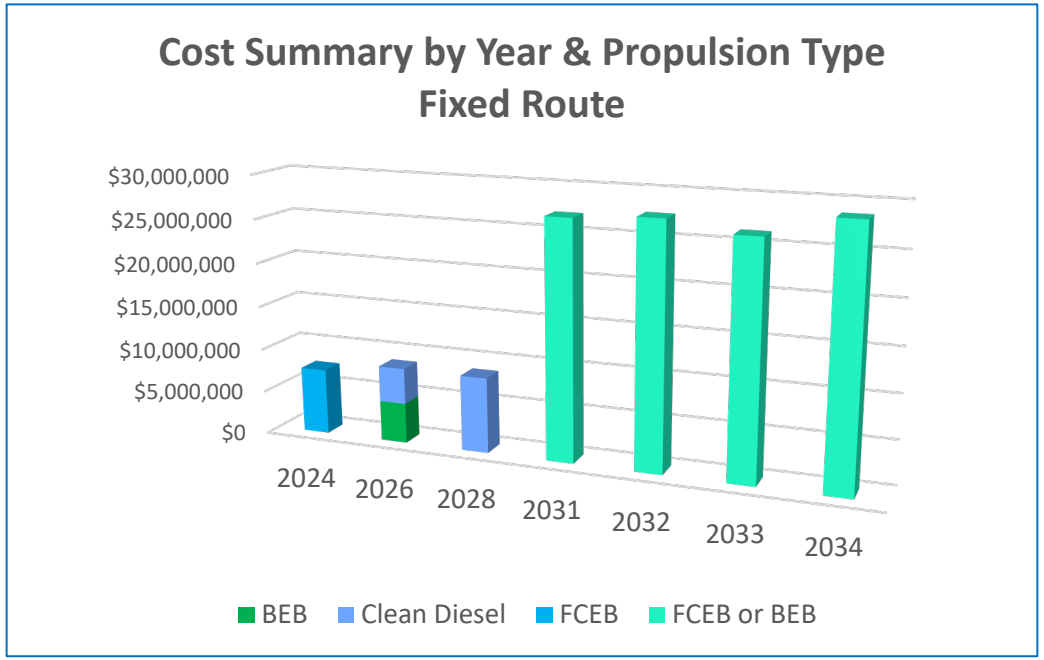
Looking Forward

Fixed Route Fleet Transition Recommendation:

- 2024
  - FCEB (5 buses) – Awarded Grant Projects
- 2026
  - BEB (3 buses and charging)
  - Clean Diesel (5 buses)
- 2028
  - Clean Diesel replacements (10 buses)
  - Begin Infrastructure Deployment
- 2031 and beyond:
  - ZEB purchases for all replacements – technology TBD



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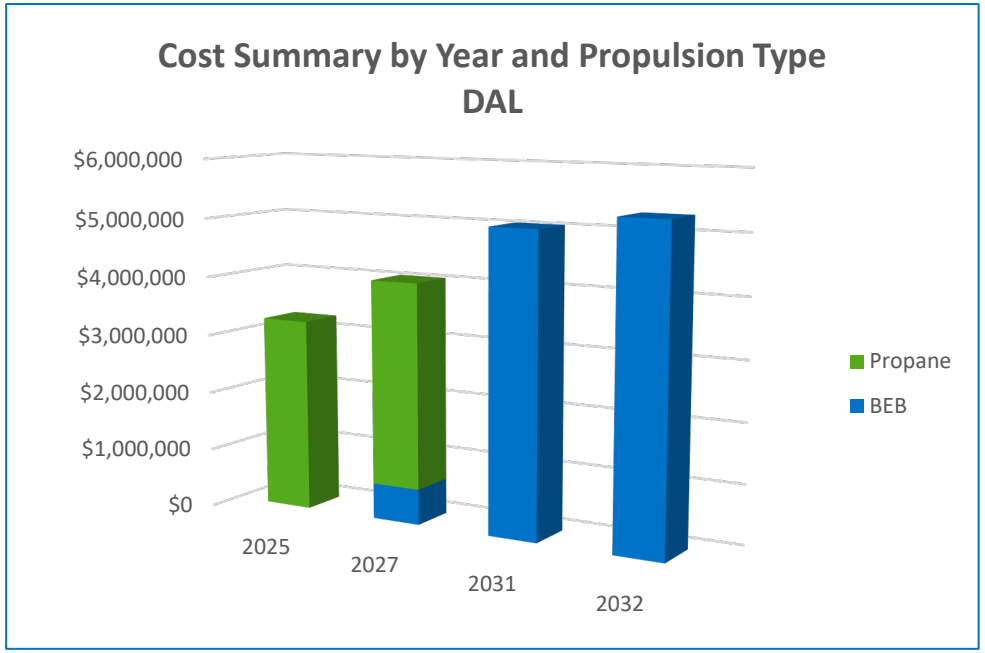
Looking Forward

Dial-A-Lift Fleet Transition Recommendation:

- 2025
  - Propane (12 buses)
- 2027
  - BEB (2 buses)
  - Propane (12 buses)
- 2028
  - Begin Infrastructure Deployment
- 2031
  - BEB (14 buses)
- 2032
  - BEB (14 buses)



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Looking Forward

Vanpool Fleet Transition Recommendation:

- Monitor WA Zero-Emission Vehicle laws, rules, initiatives
  - Example: WA Zero Emission Vehicles Law = 2035 all light/medium duty vehicle sales 100% ZEV
- Watch the market for feasible vehicle technologies, charging partnerships for groups, and grant opportunities

Looking Forward

Non-Revenue Fleet Transition Recommendation:

- Monitor WA Zero-Emission Vehicle laws, rules, initiatives
  - Example: WA Zero Emission Vehicles Law = 2035 all light/medium duty vehicle sales 100% ZEV
- Watch the market for feasible vehicle technologies, charging, and grant opportunities

Looking Forward

Next Steps

- Phase II:
  - Review Analysis results for decision making – Q4/2023
  - Create Fleet Transition Plan – Q1/2024
    - Comprehensive plan to include all FTA requirements and change management plans (review and refresh as needed)
- Phase III:
  - ZEB implementation – grant funded demonstration projects
- Site Master planning
  - Based on long-term transition plan

Thank you!

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