

**S T A F F   R E P O R T**

SUBJECT: Zero-Emission Bus Study Update  
FROM: Toan Tran, Director of Operations and Innovation  
DATE: September 14, 2020

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**Action Requested**

None – information only.

**Background**

In December 2018, the California Air Resources Board (CARB) approved an Innovative Clean Transit Rule requiring the state’s public transit agencies to:

1. Transition to all zero-emission bus purchases by 2030; and
2. Submit a board-approved Zero-Emission Bus (ZEB) Rollout Plan to CARB with specific required components by July 1, 2023.

Under the new regulation, CARB will require LAVTA’s new bus purchases to be a minimum of 25% ZEBs beginning in 2026 and ramping up to 100% in 2029, with the goal of transitioning the state’s entire transit fleet to 100% ZEBs by 2040.

In July 2019, the Board of Directors authorized the Executive Director to execute a task order with the Center for Transportation and the Environment (CTE) to perform a ZEB study. The goal of the study is to develop a transition plan outlining the capital projects required to fully electrify the fleet in accordance with the CARB Innovative Clean Transit Rule and LAVTA’s local priorities. The study is currently underway and is expected to be completed by the end of 2020.

At the June 2020 Projects and Services Committee meeting, CTE had an opportunity to introduce the project team, provide a high-level overview of the project, and discuss the project timeline and deliverables.

**Discussion**

Savannah Gupton from CTE will make a presentation to the Board of Directors on the progress of the project.

**Recommendation**

None – information only.

**Attachment**

1. LAVTA ZEB Transition Study Presentation

Approved: \_\_\_\_\_



# LAVTA ZEB Transition Study Service, Fleet and Fuel Assessment Workshop

September 14, 2020

**Steve Clermont**, Director of  
Planning & Deployment  
**Savannah Gupton**,  
Managing Consultant  
**Niki Rinaldi El-Abd**,  
Associate

# Introduction

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- Today's Objective: Review route achievability results and obtain guidance for remainder of study
- Today's Topics:
  - CARB Innovative Clean Transit Requirements
  - Modeling and Simulation Approach
  - Service Assessment
  - Fleet Transition Assessment
  - Fuel Transition Assessment
  - Define Next Steps



# CARB Innovative Clean Transit Regulation

100% ZEB Fleet by 2040 is not a mandate, but a goal

There is only a *purchasing* mandate:

## *ZEB Purchase Requirements*

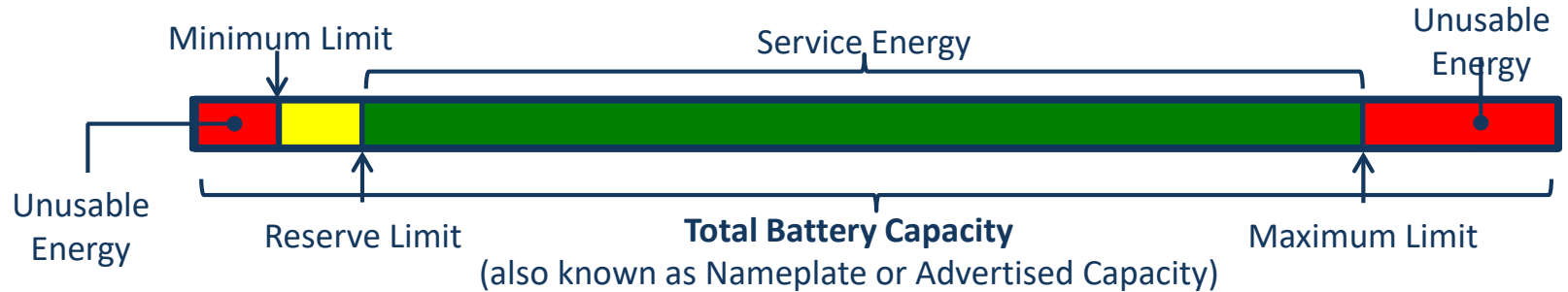
Starting January 1	ZEB Percentage of Total New Bus Purchases
2026	25%
2027	25%
2028	25%
2029	100%

- Small CA Transit Agencies (<100 buses) are required to submit a board-approved ZEB Rollout Plan by **July 1, 2023**.
- **If the available depot-charged battery electric buses cannot meet a transit agency's daily mileage needs, the agency may request an exemption**

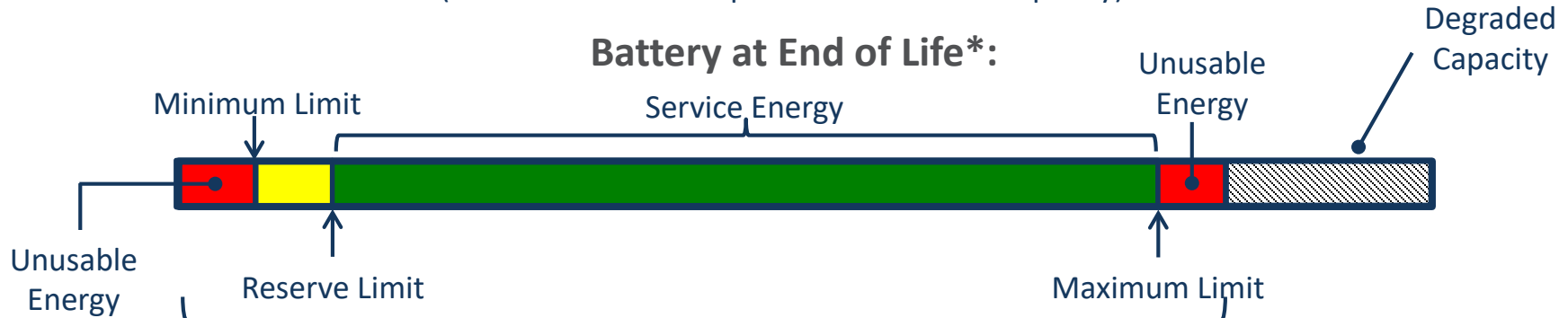
# Why Model?

Understanding how much of the battery is usable for service is critical for planning your deployment.

## Battery at Start of Life:



## Battery at End of Life\*:



**Total battery capacity is less than original.**

\*as defined by battery warranty

# Factors Affecting Range



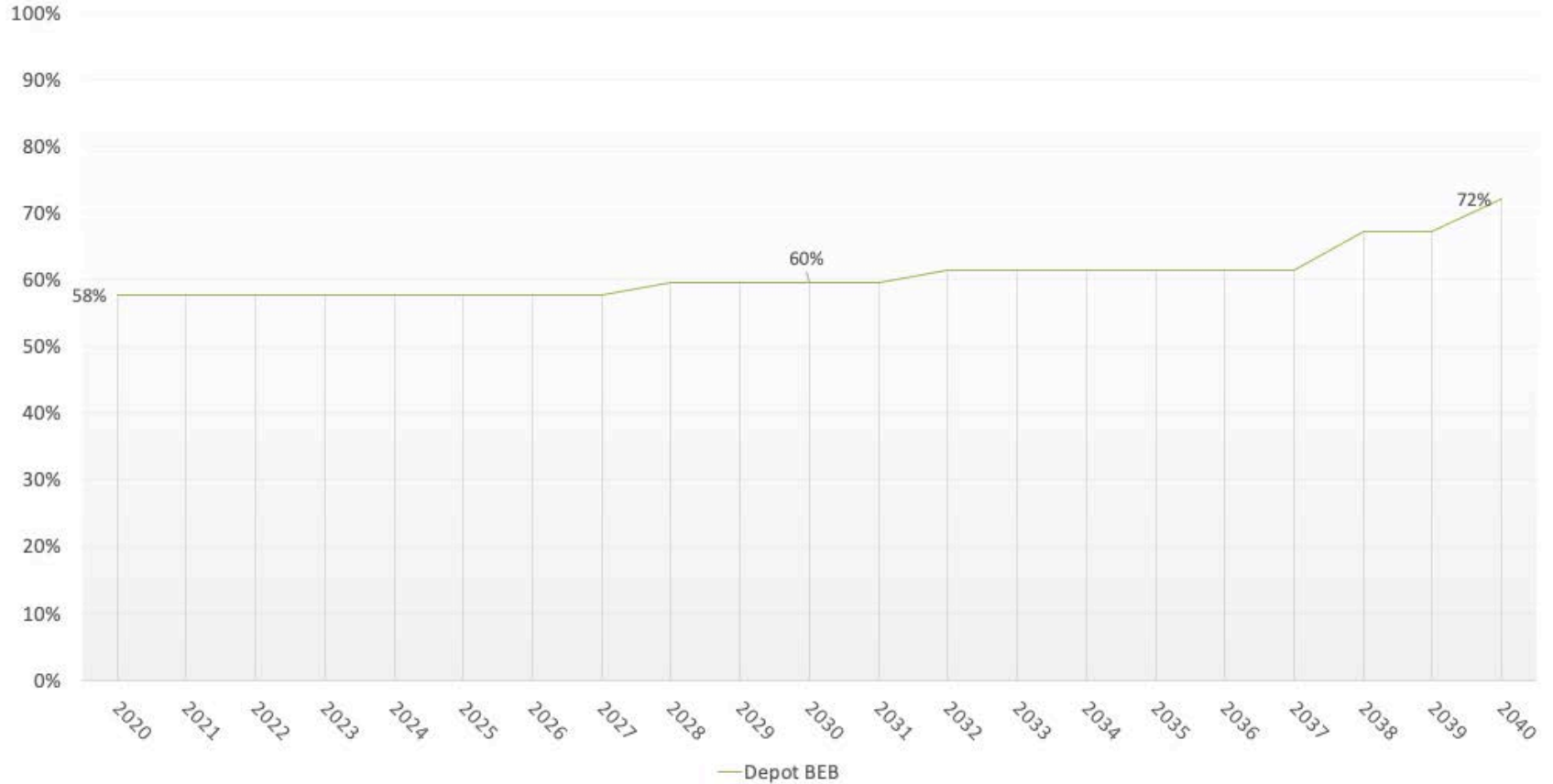
- **Route characteristics:** speed, stops, grade
- **Ridership**
- **Heating and cooling.** (Heat is no longer “free.”)
- **Battery degradation**
- **Unusable battery energy**
- **External climate**

# Modeling Results

35/40' Average Efficiencies by LAVTA Route Categories				
	Nominal Efficiency		Strenuous Efficiency	
	(kWh/mi)	(MPDGe)	(kWh/mi)	(MPDGe)
Flat, Low Speed	2.0	19.0	2.7	14.1
Flat, High Speed	2.2	17.3	2.6	14.6
Hilly, Low Speed	1.9	20.0	2.6	14.6

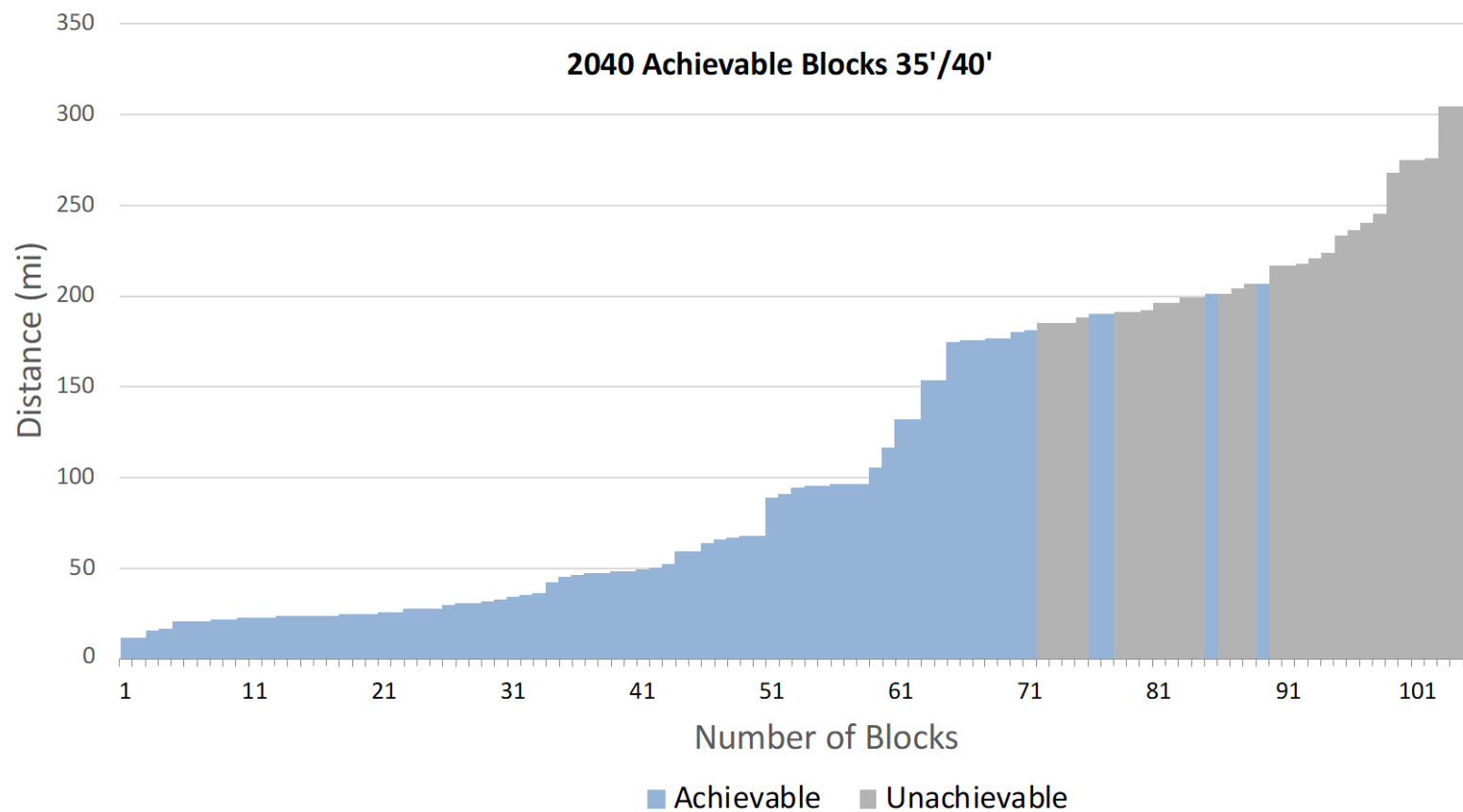


# LAVTA Service Assessment: Block Feasibility





# Battery Electric Bus Block Achievability by Bus Length in 2040



# ZEB Transition Methodology

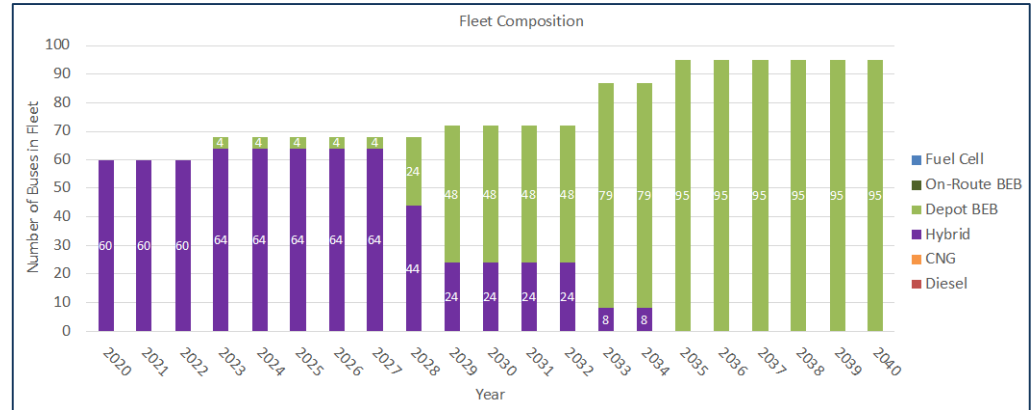
- Scenarios
  0. Baseline
  1. Depot Only Charged BEB Fleet
    - A: Without expansion (requires ICE buses to remain in fleet)
    - B: With expansion (replaces buses that cannot meet block demands at a 2:1 ratio)
  2. Depot and On-Route Charged BEB Fleet
  3. Depot BEB & Fuel Cell Fleet
  4. All FCEB Fleet
  
- Prepared for today
  - Fleet Assessment
  - Fuel Assessment
  
- Next steps
  - Maintenance Assessment
  - Facilities Assessment
  - Total Cost of Ownership Assessment

# Depot-Only Scenarios

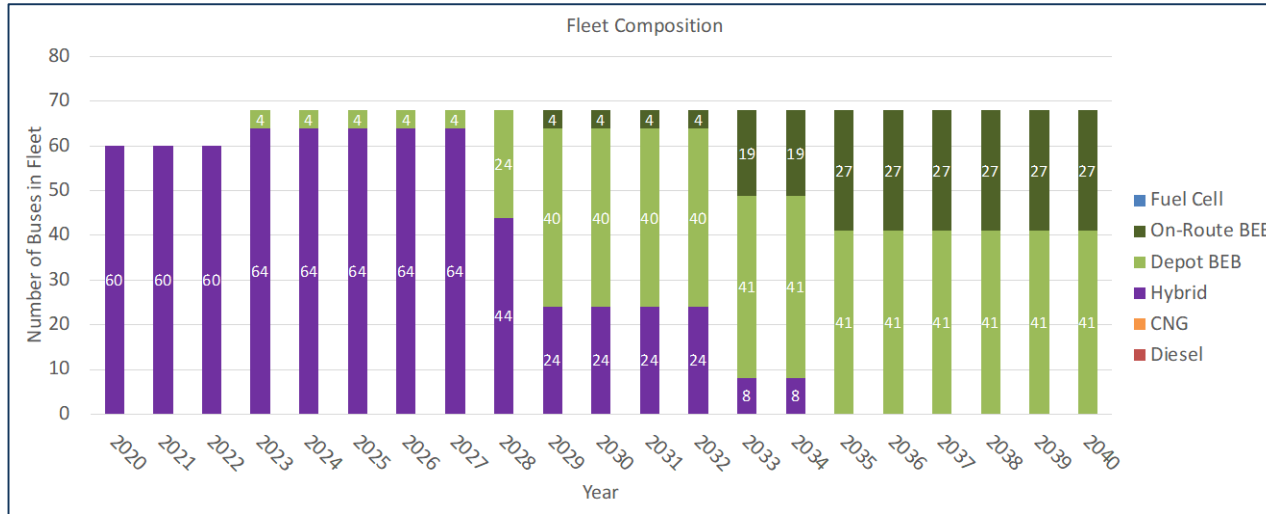


## Scenario 1A: Depot-Only Charging

## Scenario 1B: Depot-Only Charging – With Expansion



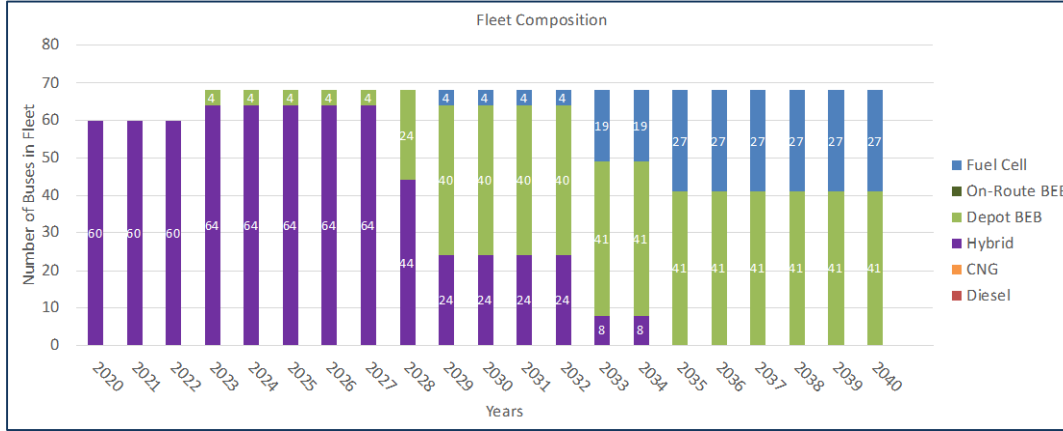
# Depot and On-Route Charging Scenario



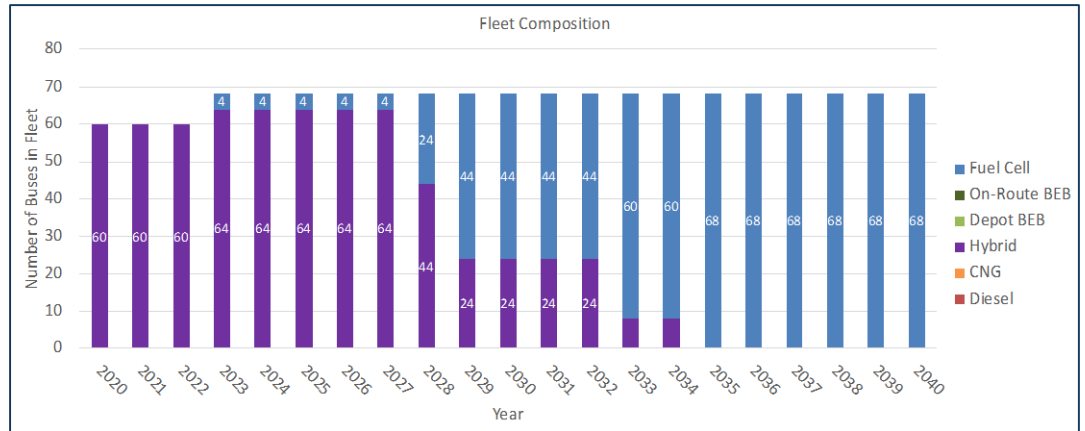
Scenario 2: Depot & On-Route Charging

# FCEB Scenarios

## Scenario 3: BEB & FCEB

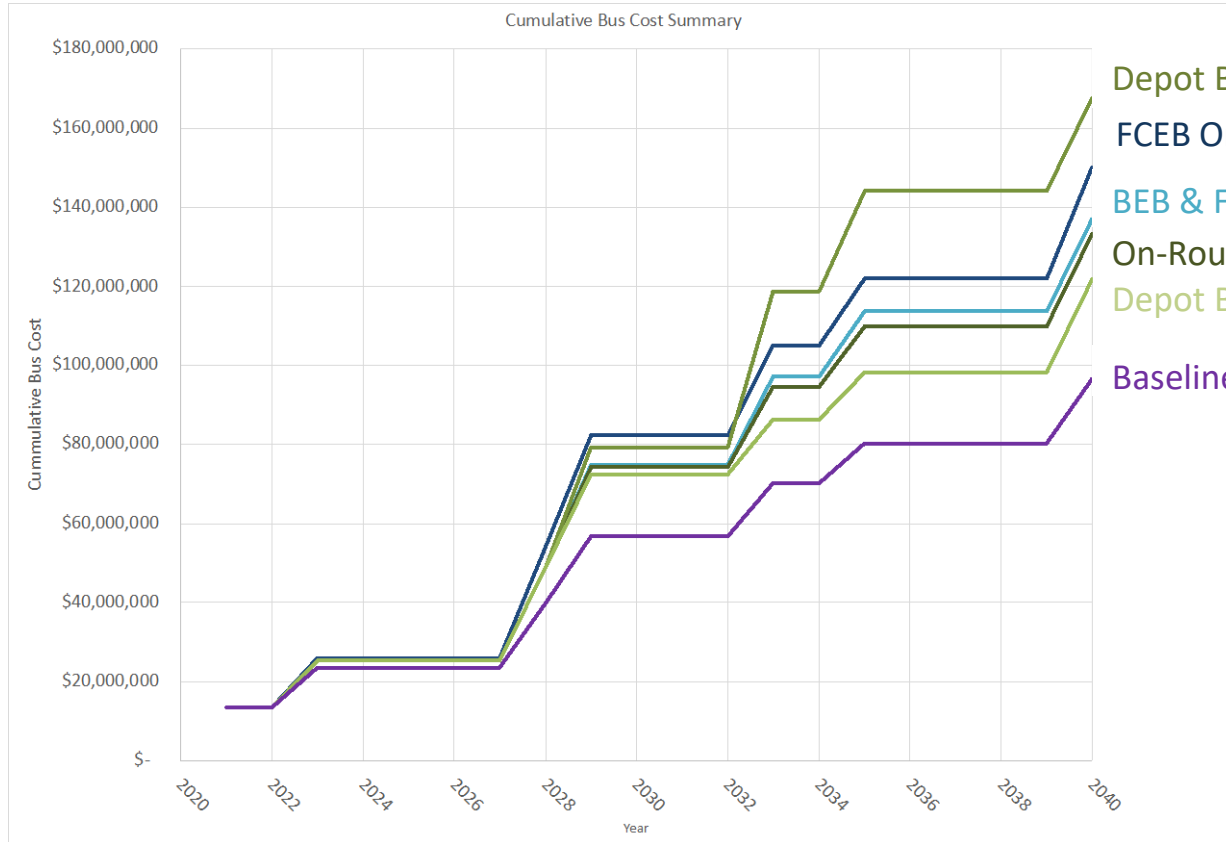


## Scenario 4: FCEB Only





# Cumulative Bus Cost Summary:

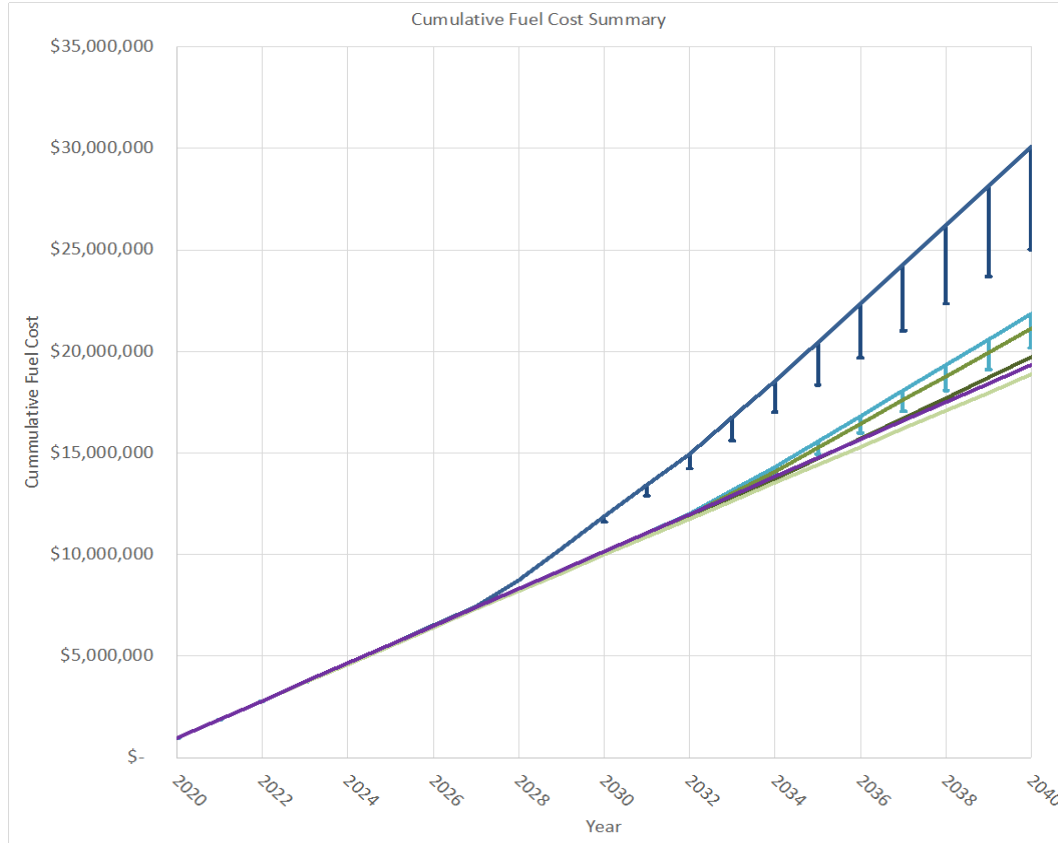


Depot BEB (B): \$167,576,176  
FCEB Only: \$150,182,484  
BEB & FCEB: \$137,105,259  
On-Route BEB: \$133,270,584  
Depot BEB (A): \$121,715,929  
Baseline: \$96,503,466

*Note: Bus Costs include all types of buses purchased over the transition period of a given scenario*



# Cumulative Fuel Cost Summary:



FCEB Only: \$29,171,078\*

BEB & FCEB: \$21,832,762\*

Depot Only (B): \$21,117,703

On-Route BEB: \$19,689,172

Baseline: \$19,338,900

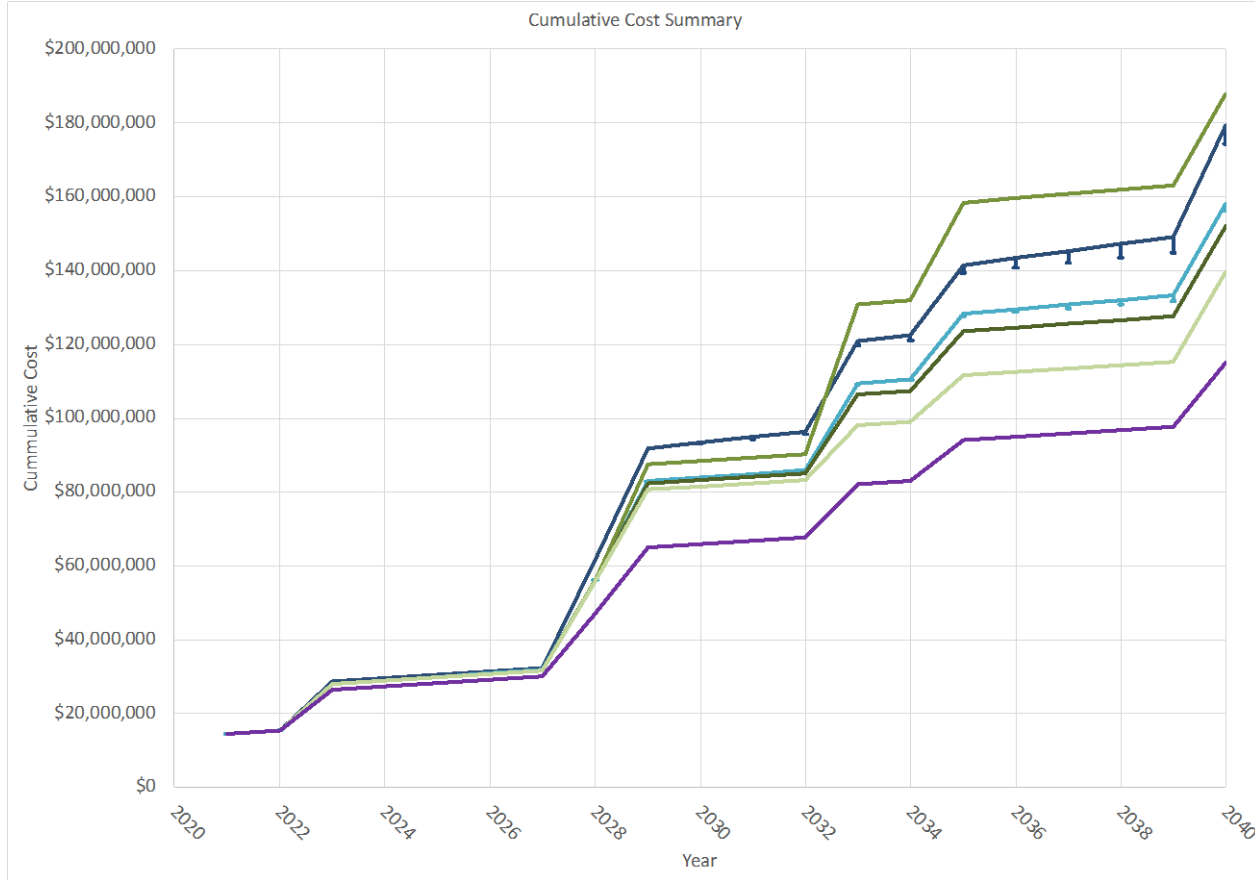
Depot Only (A): \$18,850,098

*Note: Fuel Costs include all types of fuels purchased over the transition period of a given scenario*

*\*Sensitivity analysis conducted for hydrogen fuel pricing. Price range used: \$7.95-\$5.50*



# Cumulative Fleet & Fuel Cost Summary



Depot Only (B): \$188,693,879

FCEB Only: \$179,353,561\*

BEB & FCEB: \$158,938,021\*

On-Route BEB: \$152,959,756

Depot Only (A): \$140,566,025

Baseline: \$115,842,366

*\*Sensitivity analysis conducted for hydrogen fuel pricing. Price range used: \$7.95-\$5.50*



# Next Steps

- Evaluate Scenarios with LAVTA Preference/Confirmation
- Maintenance Assessment
- Infrastructure Assessment
- Total Cost of Ownership Assessment
- LAVTA ZEB Transition Master Plan
- ICT Rollout Plan Master document
  - LAVTA point of contact, document workshop with POC





# Questions?

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