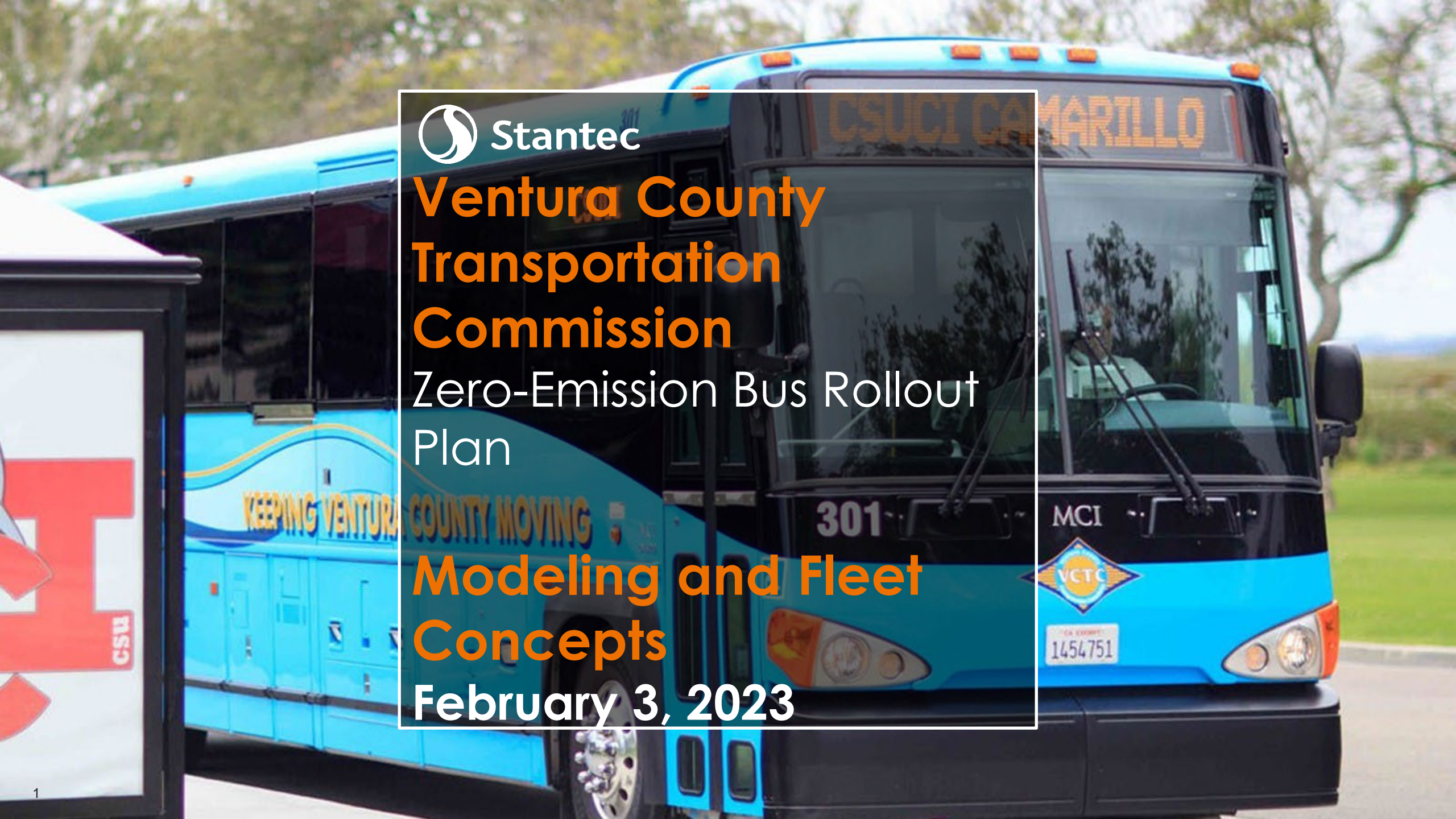


Stantec

Ventura County Transportation Commission

Zero-Emission Bus Rollout Plan

Modeling and Fleet Concepts

February 3, 2023

Project Overview

CALIFORNIA
AIR RESOURCES BOARD

Project Purpose

1. To develop a CARB-compliant zero-emission rollout plan in response to the ICT Regulation

2. To develop a transition plan and strategy for VCTC's goal of 100% ZE fleet by 2040

CARB Innovative Clean Transit (ICT) Mandate

1. Requires that small transit agencies begin **purchasing ZEBs in 2026, with 100% transition by 2040**

2. Requires that small transit agencies submit a **Board-approved plan by July 1, 2023**

3. Exempts cutaways, motorcoaches and articulated until 2026 (and later if no Altoona tested vehicles are available)

4. Provides exemptions for agencies based on lack of feasible vehicle alternatives, challenging terrain, operating profiles that aren't feasible with ZE alternatives, and other challenges

Presentation Overview

1. Project Overview
2. Existing Conditions Summary
3. Fleet Modeling
4. Fleet Concepts
5. Recommendations
6. Next Steps

What is a Zero-Emission Bus?

Battery Electric Bus (BEB)

- Propulsion occurs from electricity directly stored in batteries
- Fueling occurs by recharging batteries

Hydrogen Fuel Cell-Electric Bus (FCEB)

- Propulsion occurs from hydrogen converted by fuel cells into electricity for propulsion
- Fueling occurs by refilling on-board hydrogen tank

What are some…?

Benefits

- Zero emissions
- Near silent ride
- Cleaner cabin air
- Smoother ride
- Fewer moving parts to maintain—more reliable vehicles

Challenges or drawbacks

- **More expensive**
- Costly infrastructure upgrades
- New training
- Coordination with public utilities
- Range constraints
- **Lack of maturity for ZE cutaways, and motorcoaches**

VCTC Intercity Services

Vehicles travel long distances

- Intercity vehicles travel long distances
- Over-the-road coaches are required due to distance and traveling on the freeway

Limited ZE motorcoach options

BEBs

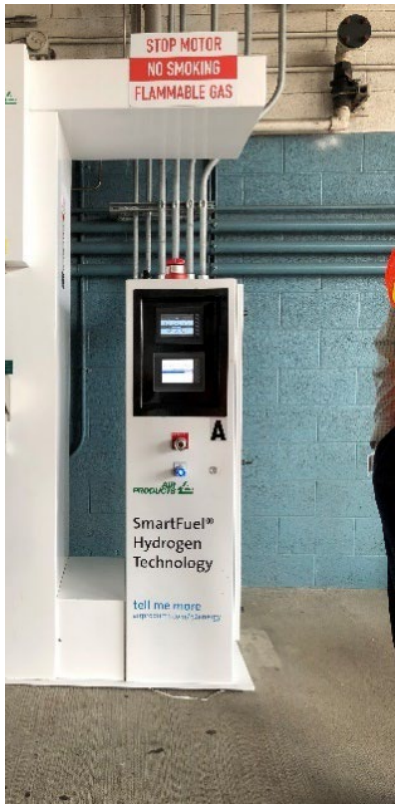
Battery: 544 kWh
Range: 170-230 mi.
Cost: $1.2 million

FCEBs

Tank: 37.5 kg
Range: 240-250 mi.
Cost: ??? >$1.5 million
Not 45-ft
Not market ready

VCTC does not own Intercity facility

- Investing in facility modifications does not make sense
- Need to coordinate with peer transit agencies
  - GCTD
  - Goleta
  - Camarillo
  - SCE Charge Ready Program

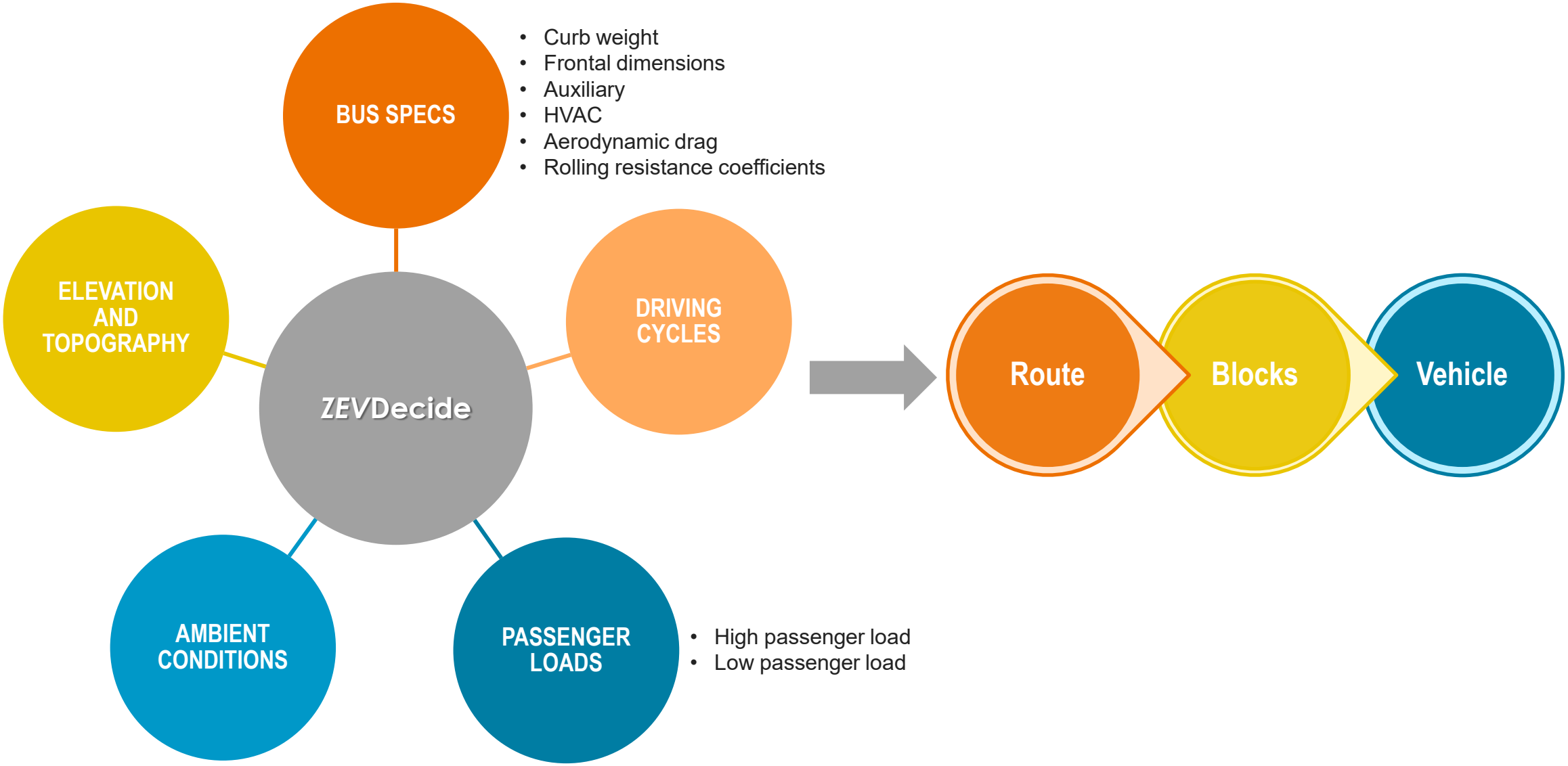


VCTC's Situation

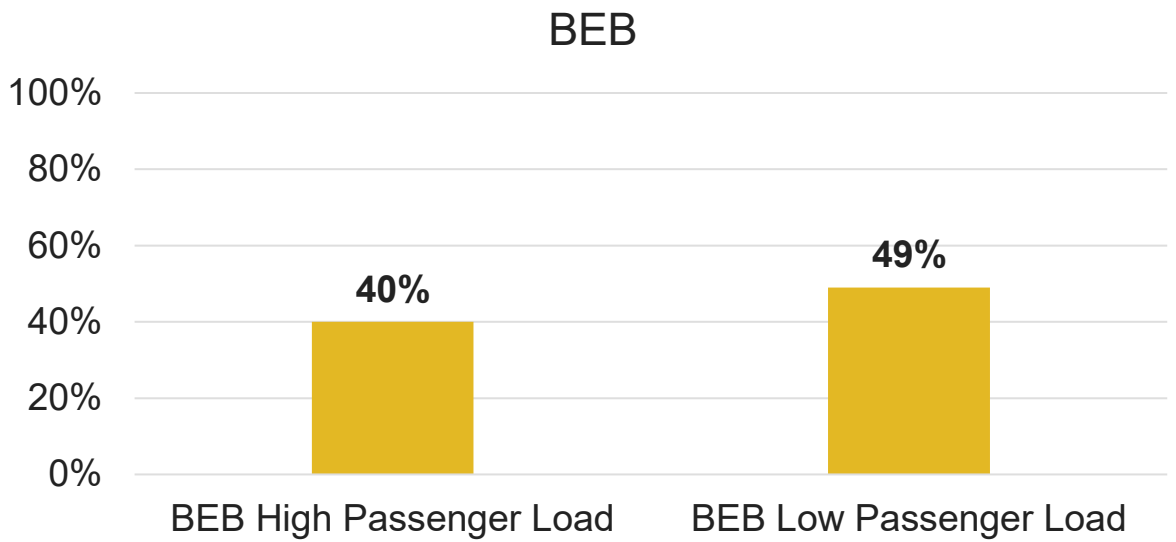
Long distances and mileages + **Limited types of ZEBs** + VCTC **does not own the operating and maintenance facility** =

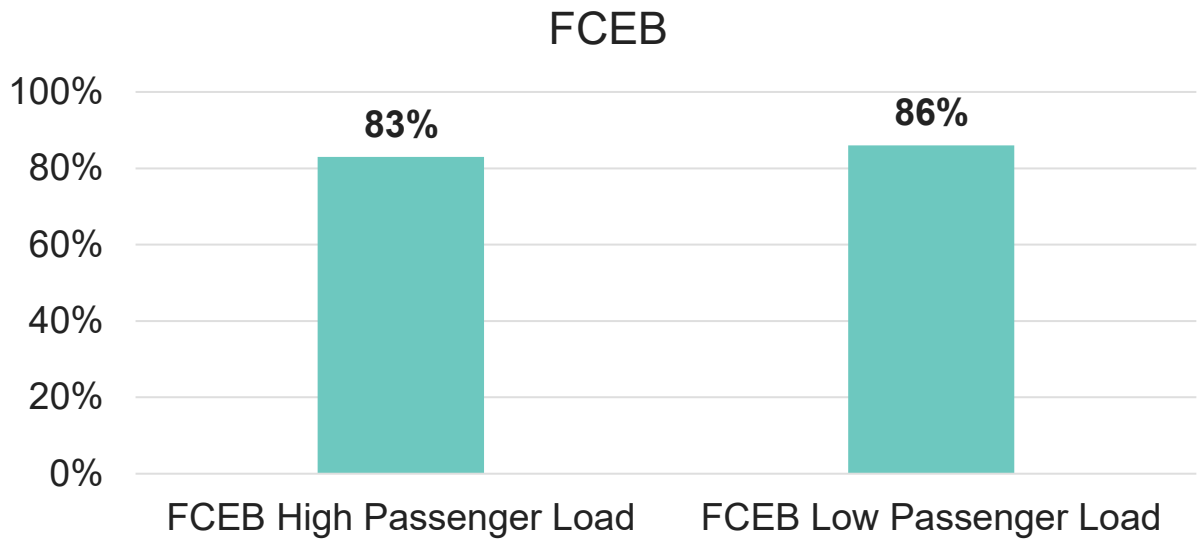
VCTC's ZEB transition planning is more challenging than most agencies, including those in Ventura County

Zero-Emission Bus Modeling (ZEVDecide)



Modeling Results





40-49% of service can be successfully completed with BEBs without purchasing more vehicles or reblocking

83-86% of service can be successfully completed with FCEBs without purchasing more vehicles or reblocking

Preliminary Fleet Concepts

Preliminary Fleet Concepts

	BEB Concept	FCEB Concept*	Mixed Concept
Intercity Fleet Concept	35 BEBs (active fleet)	35 FCEBs (active fleet)	17 BEBs (active fleet) 18 FCEBs (active fleet)
Charging/ Refueling	Off-site charging Goleta, Camarillo, Ventura + Overnight charging	Refueling at GCTD	Refueling at GCTD + Overnight charging

Considerations:

- Deploy BEBs on shortest blocks/routes
- Coordinate charging infrastructure with partners
- *FCEB concept would include 5 BEBs on order

BEB Concept – *Not Recommended*

Strengths	Opportunities
• Existing technology • Deployed at transit agencies • Lower capital costs than FCEB	• Partnerships with regional agencies for shared charging infrastructure • Leverages BEBs on order
Weaknesses	**Challenges**
• Shorter range than FCEB • Charging takes longer than FCEB refueling • Requires installation of charging infrastructure at facilities not owned by VCTC • Restructure service delivery • Increases fleet size by 2 additional vehicles	• Complex coordination with partners for charging • Potential issues with electric grid reliability

FCEB Concept

Strengths	Opportunities
• Longer range than BEBs • Shorter refueling time than BEBs • Refueling process similar to current situation • Minimal service delivery changes	• Opportunity to fuel at GCTD • Hydrogen becoming more prevalent in industry
Weaknesses	**Challenges**
• Technology does not exist/market ready in vehicle type required • Likely more expensive per-bus cost compared to BEBs	• Unknown timelines for market ready FCEBs

Mixed BEB/FCEB Concept

Strengths	Opportunities
• BEB technology exists • Deploy BEBs on shorter routes • Deploy FCEBs on longer routes	• Opportunity to fuel FCEBs at GCTD • Partnerships with regional agencies for shared charging infrastructure • Leverages BEBs on order
Weaknesses	**Challenges**
• FCEBs currently do not exist/market ready • Service delivery and scheduling challenges • Considerations for multiple technologies (training, spart parts, etc.)	• Unknown timelines for market ready FCEBs • Complex coordination with partners for charging • Potential issues with electric grid reliability

High-Level (Preliminary) Capital Cost Considerations

Costs are comparable since hydrogen fueling infrastructure will be available at Gold Coast

	Capital Cost Estimates	Totals
FCEB Concept	35 FCE Coaches X $1.5M** =	$52.5M
	TOTAL =	**$52.5M**
Mixed BEB/FCEB Concept	17 BE Coaches X $1.2M* =	$20.4M
	18 FCE Coaches X $1.5M** =	$27.0M
	8 Chargers (150 kW) X $170K =	$1.4M
	TOTAL =	**$48.8M**

**Bus purchase prices represent baseline costs and do not include taxes, warranties, add-ons, etc.*
***Estimates based on cost differential of 40-ft BEBs and 40-ft FCEBs*

Fleet Recommendation

FCEB Fleet Concept

- Utilize 5 incoming BEBs to offset future purchase requirements
- Deploy BEBs on feasible routes
- Phase out BEBs and phase in FCEBs

Valley Express

Preliminary Valley Express Fleet Concepts

	BEB Concept
Valley Express	9 BEBs (active) with a fleet increase of **4 BEBs** **5 chargers, each with dual dispensers**
Notes	• Requires charging infrastructure • Requires a larger fleet • VCTC does not own the facility • Must determine fueling location • Fast charging technology is not as mature for cutaways as for fixed-route vehicles

A BEB fleet has already been approved by HVPAC

Fleet Recommendations

Intercity

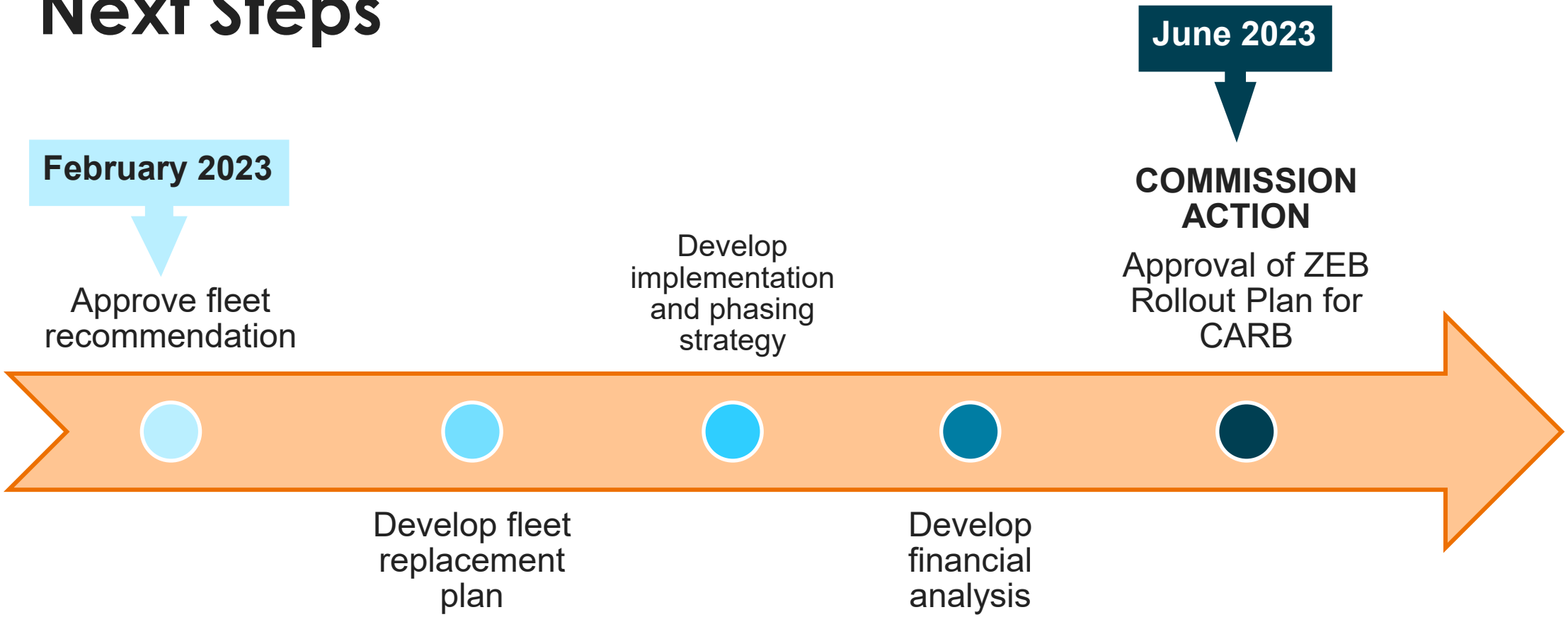
- FCEB fleet with 5 BEBs as a bridge
- Plan for a mixed technology fleet as a backup plan

Valley Express

- BEB fleet
- Begin to explore opportunities with local municipalities/partners for shared charging infrastructure
- *Approved by HVPAC*

The ICT ZEB Rollout Plan is intended to be a living document to be updated over time as technology matures. Exemptions can be explored on an as-needed basis.

Next Steps


February 2023
Approve fleet recommendation
Develop fleet replacement plan
Develop implementation and phasing strategy
Develop financial analysis
June 2023
COMMISSION ACTION
Approval of ZEB Rollout Plan for CARB

End