

Gold Coast Transit District ZEB Transition and Rollout Plan



Update for Board of Directors | Feb 2, 2022

Fuel Technology Comparison
Recommendation for Gold Coast Transit
Bus Fleet



Our Mission

GCTD's mission is to provide safe, responsive, convenient, efficient, and *environmentally responsible* public transportation that serves the diverse needs of our community.

Zero-Emission Bus Rollout Plan

Conceptual Future Fleet Composition and ZEB Technology

Recommendation



GCTD's ZERO EMISSION BUS TRANSITION PLAN

Current Fleet



Standard Buses

- Fixed-route service
- 40-ft (44) & 35-ft (17)
- CNG
- Total of 61 active
- 9.9 years avg age

Cutaways

- Demand response
- 23-ft
- CNG
- 8 total
- 4 years avg age

MV-1 Vans

- Demand response
- Unleaded gasoline and CNG
- 18 total
- 4.3 years avg age

CARB's "ICT" RULE & WHAT IT MEANS?



**In 2018, California Air Resources Board (CARB)
"Innovative Clean Transit" Rule**

GOAL: Transition to Zero Emissions by 2040

TRANSITION PLAN DUE BY 2023

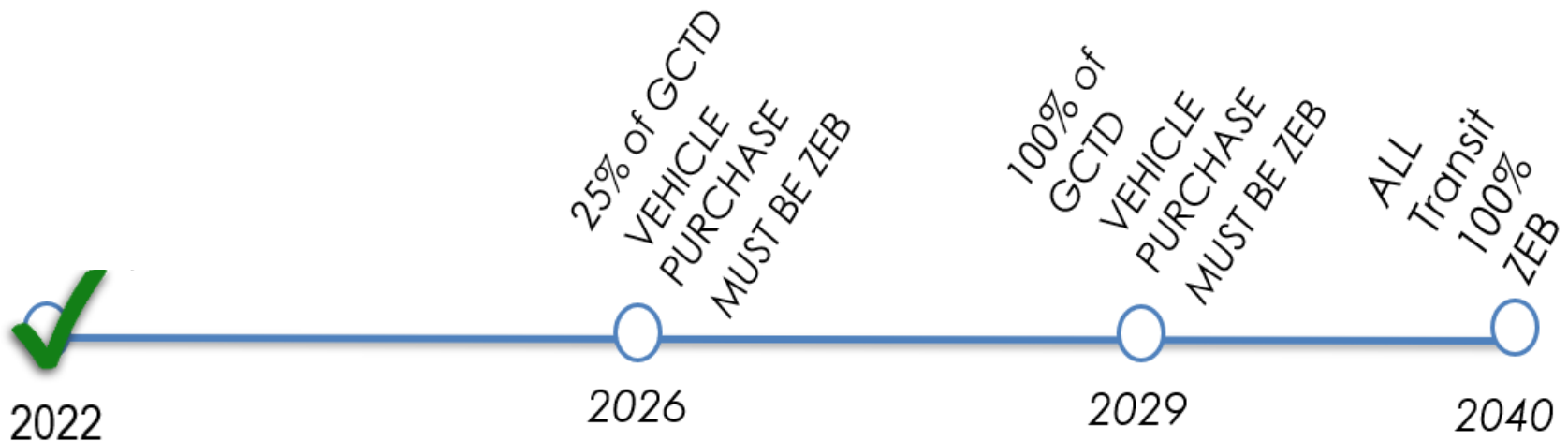


CARB: Innovative Clean Transit Regulation

2026: Innovative Clean Transit (ICT) regulation states 25% of all buses purchased by GCTD must be zero-emission.

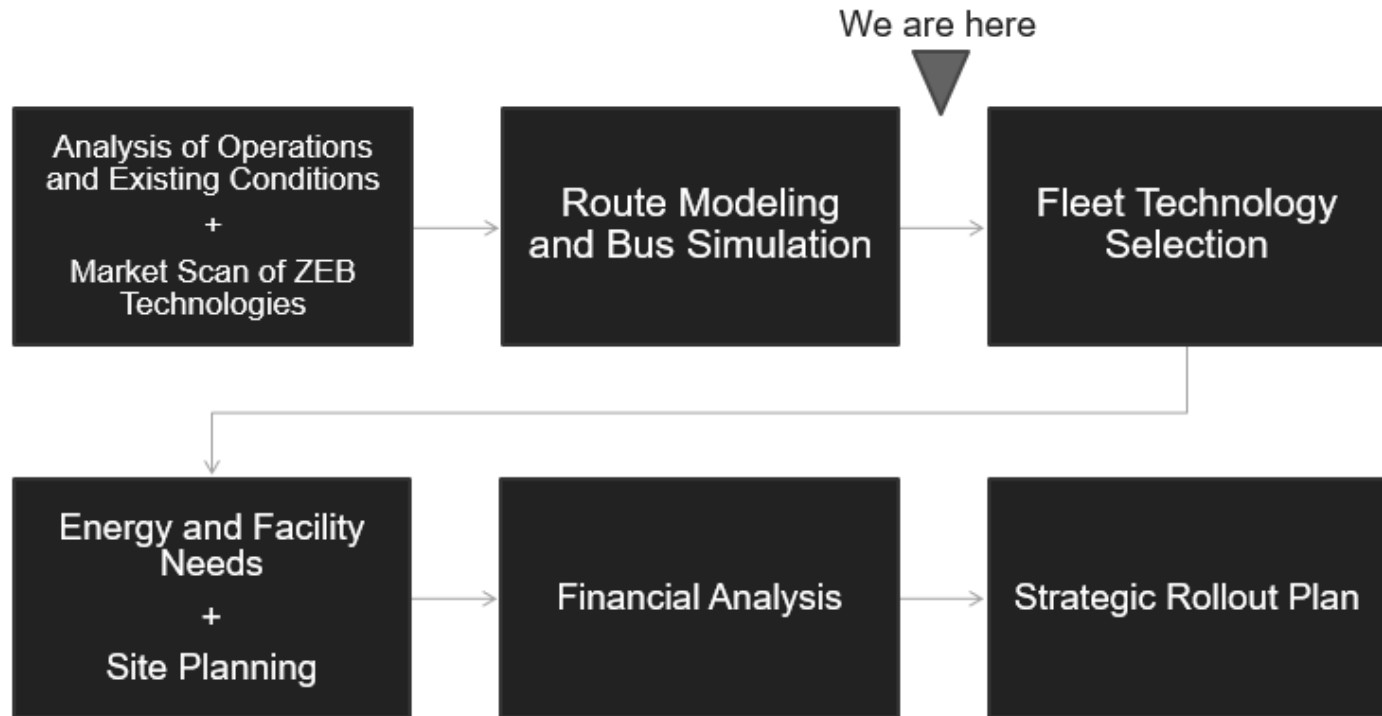
2029: All purchases must be 100% zero-emissions for small transit agencies (Fewer than 100 buses).

2040: All transit agencies transition to 100% zero-emissions fleets.



GCTD's ZERO EMISSION BUS TRANSITION PLAN

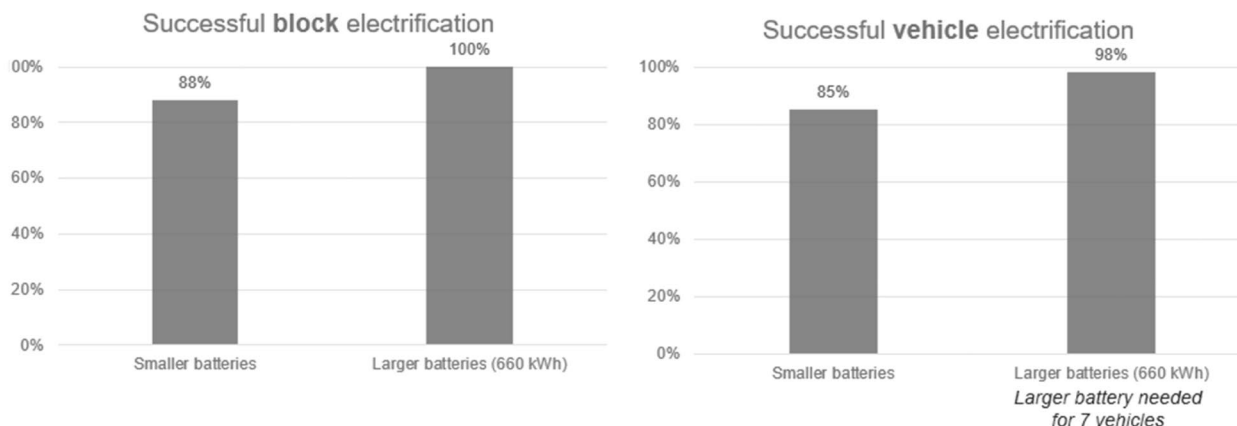
Project process



GCTD's ZERO EMISSION BUS TRANSITION PLAN

Modeling results – Fixed Route

BEBs



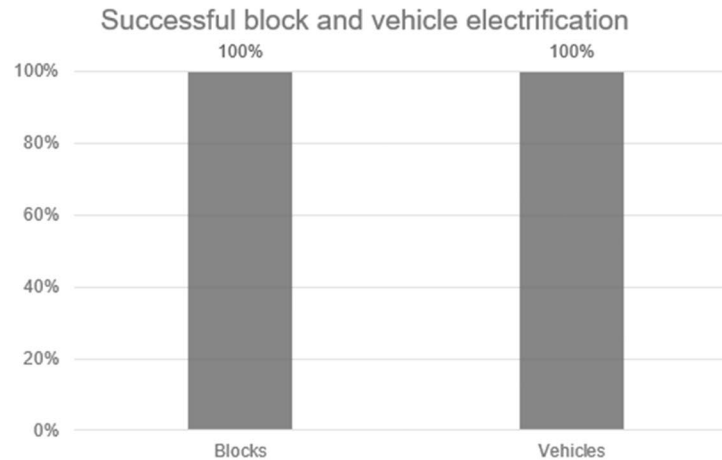
- **8 vehicle assignments** unsuccessful without 660-kWh battery
- **1 vehicle assignment** unsuccessful with larger battery size (35-ft bus)
 - Vehicle completes blocks 201 and 2002
 - 35-ft bus not available with 660-kWh battery

Vehicle type	Average fuel efficiency (kWh/mi)
40-ft bus	2.23 kWh/mi
35-ft bus	2.15 kWh/mi
Overall	2.21 kWh/mi

Note: 660-kWh batteries can only be used on 40-ft BEBs.

GCTD's ZERO EMISSION BUS TRANSITION PLAN

Modeling results – Fixed Route Hydrogen

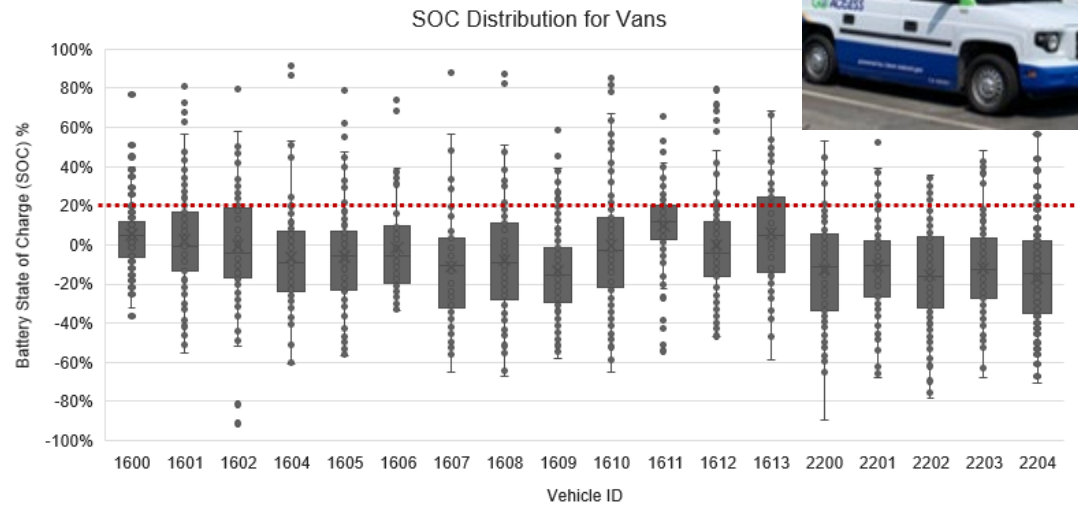
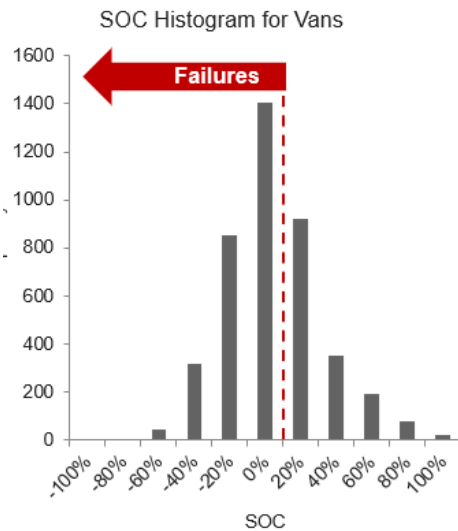


- All blocks successful
- All vehicle assignments successful

Vehicle type	Average fuel efficiency (mi/kg)
40-ft bus	7.20 mi/kg
35-ft bus	7.29 mi/kg
Overall	7.22 mi/kg

GCTD's ZERO EMISSION BUS TRANSITION PLAN

Modeling results – BE Vans



About **37%** of runs operated by vans could be electrified with currently available ZEVs

A sensitivity analysis suggests that with ideal weather and topography, **~75% of runs** may be successful

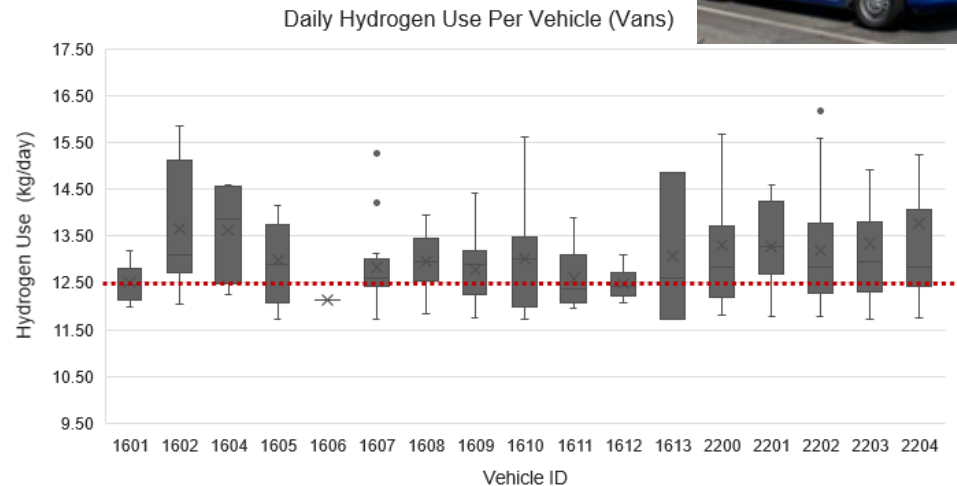
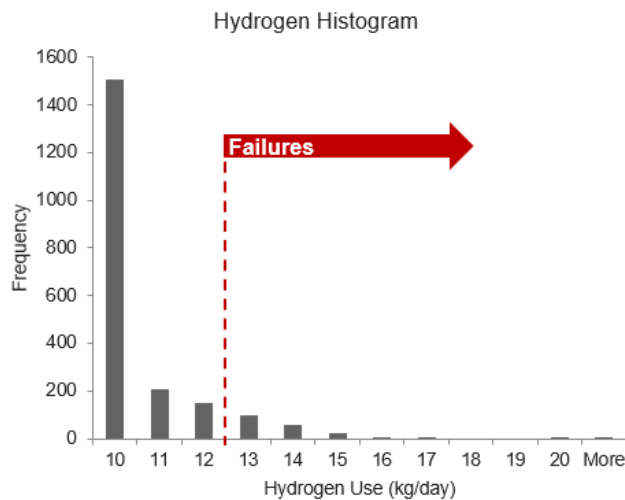
- The electrification rate drops to **25%** when considering a full day of service for each vehicle
- A sensitivity analysis suggests that with ideal weather and topography, **~60% of vehicle assignments** may be successful

- Daily mileage for an electric van can range between 135 and 170 mi
- Average fuel efficiency – 0.87 kWh/mi



GCTD's ZERO EMISSION BUS TRANSITION PLAN

Modeling Results – Hydrogen Vans

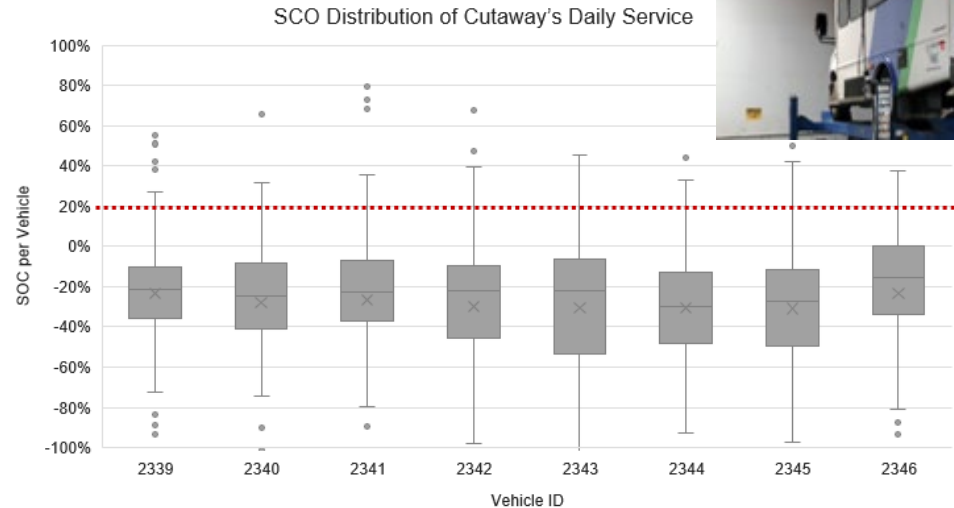
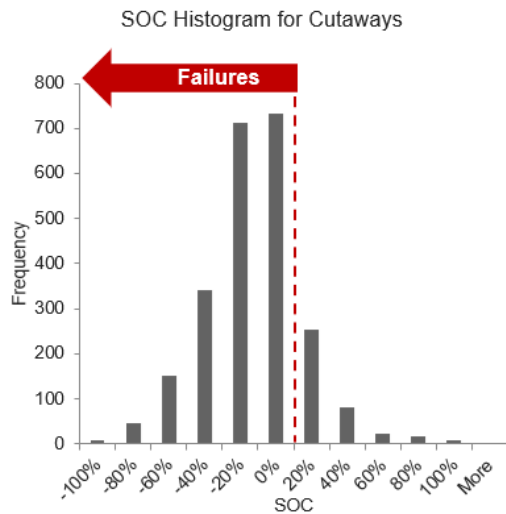


- Around 90% of the daily service assigned to vans can be converted to hydrogen fuel cell vans
- Daily mileage for a hydrogen van can range between 210 and 250 mi
- Average fuel efficiency – 17 mi/kg



GCTD's ZERO EMISSION BUS TRANSITION PLAN

Modeling results – BE Cutaways



About **16%** of **runs** operated by cutaways could be electrified with currently available ZEVs

A sensitivity analysis suggests that with ideal weather and topography, **65% of runs** may be successful

- The electrification rate drops to **10%** when considering a full day of service for each vehicle
- A sensitivity analysis suggests that with ideal weather and topography, **50% of vehicle assignments** may be successful

- **Daily mileage for an electric cutaway can range between 105 and 135 mi**
- **Average fuel efficiency – 1.13 kWh/mi**



GCTD's ZERO EMISSION BUS TRANSITION PLAN

STANTEC'S RECOMMENDATION

- 1 star indicates a Fair fit for GCTD



- 2 stars indicate a Good fit for GCTD



- 3 stars indicate a Best fit for GCTD



Scheduling + Planning

Operations + Dispatch

Training + Agency-wide
buy-in

Tech. availability/
OEMs/Procurement

Service area
considerations

Cost of ownership



Fuel Technology Comparison

BEB

HFCE

Scheduling + Planning



Operations + Dispatch



Training + Agency-wide
buy-in



Fuel Technology Comparison

	<u>BEB</u>	<u>HFCE</u>
Tech. availability/ OEMs/Procurement	★★★	★★★
Cost of ownership	★★★	★★★
Infrastructure	★★★ ★★★	★★★ ★★★

Fuel Technology Comparison

Summary for Gold Coast Transit Fleet

Trade-Off	Fleet Concept A (BEB concept)	Fleet Concept B (FCEB concept)
Scheduling and planning	★★★	★★★
Operations and dispatching	★★★	★★★
Training and agencywide adoption	★★★	★★★
Technology availability/ OEMs/ procurement	★★★	★★★
Depot infrastructure	★★★	★★★
Other infrastructure	★★★	★★★
Other	★★★	★★★
Overall best fit	★★★	★★★

Fuel Technology Comparison

Best Overall Fit for Gold Coast Transit Fleet

BEB



HFCE



**300-340
miles**

Proven range
(300 to 340 miles,
with advanced
fueling technology
that can extend this
range by almost
double)



Significant reduction
in vehicle weight
and vehicle axle
weight to maximize
passenger loads

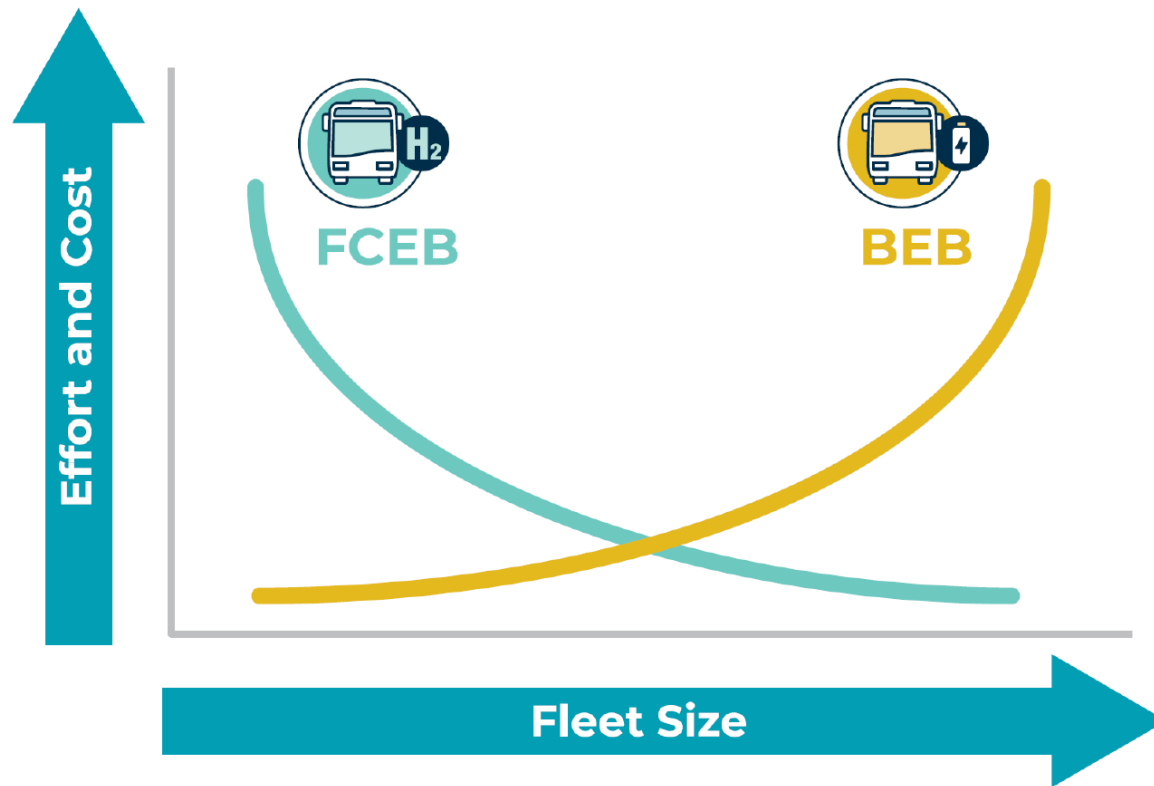


Fast refueling
speeds
comparable to
conventional diesel
and CNG buses



1:1 replacement of
conventional buses
enabling full flexibility
for route planning
and operations





Source: TCRP; CTE

The California Air Resource Board (CARB) acknowledges that the ICT ZEB rollout plan submitted by every agency is a living document intended as a guideline or framework for ZEB adoption, and not a set-in-stone approach. Based on these considerations, Stantec recommends **Hydrogen Fuel-Cell Electric (HFCE)** for GCTD. Gold Coast Transit staff concurs with Stantec and is making the recommendation to the GCTD Board of Directors to adopt Hydrogen Fuel-Cell technology as the preferred Zero-Emission Bus (ZEB) technology moving forward.

It should be noted that with this HFCE approach, early in ZEB adoption, GCTD could still procure up to 5 BEBs and several electric demand response vehicles without significant investment in electrical infrastructure. GCTD is utilizing a battery electric transit van in our new micro-transit project.





GCTD is receiving real time data from these transit agencies that are leading the U.S. in Hydrogen Fuel Cell bus roll-outs. Lessons learned from these deployments will help ensure that GCTD's roll-out will be successful.



Foothill Transit



2022 NEXO Fuel Cell

Limited



Green News

Hydrogen Fuel Cell Bus Council Forms to Advance the HFC Bus Economy

Mass Transit – January 18, 2022

The mission of the HFC Bus Council is to educate policymakers, regulators and transportation stakeholders on the benefits of hydrogen fuel cell electric buses and related infrastructure. Through effective education and advocacy, the HFC Bus Council will expand the development, deployment and utilization of safe, clean and efficient hydrogen fuel cell electric buses, and create additional market opportunities to advance hydrogen fuel cell technology in the delivery of public transit services.

Data will drive the transition to zero-emission buses

By Erik Bigelow, Greg Olberding

With a solid grounding in data, operation and planning teams can save money for their agency without sacrificing the quality of their service.

Zero Emission Fleet Committee Digest for Monday January 31, 2022



APTACconnect <DoNotReply@ConnectedCommunity.org>

To ● James Beck

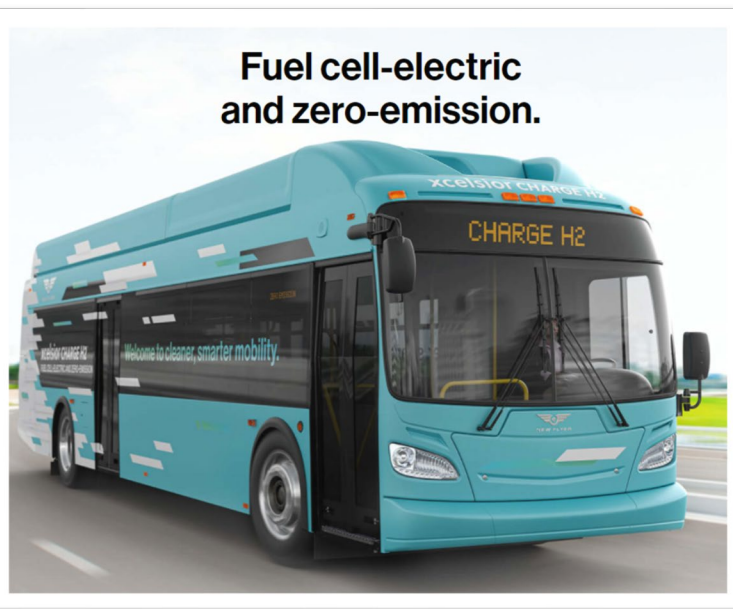


MISSION STATEMENT

The mission of ZEBRA is to advance transit agencies' capacity for ZEB adoption through information exchange, training programs, shared research and public education.

GOALS OF ZEBRA

- Enable transit operators to share and exchange standards, procurement documents, policies and procedures, as well as ZEB best practices
- Influence training programs to meet operator needs
- Conduct scheduled meetings
- Provide on-demand targeted research
- Initiate group-approved ZEB advocacy
- Share performance data
- Provide access to ZEBRA materials and website



QUESTIONS?

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