

Zero-Emission Bus Pilot Update





BACKGROUND

- In 2018, the California Air Resources Board (CARB) passed the Innovative Clean Transit (ICT) rule requiring all public transit agencies to transition their bus fleets to zero-emission technologies by year 2040.
- In 2020, the Orange County Transportation Authority (OCTA) Board of Directors (Board) approved the OCTA zero-emission bus (ZEB) rollout plan, which included the deployment of a mix of hydrogen fuel-cell electric buses (H2B) and plug-in battery-electric buses (BEB).
- In anticipation of the ICT rule, OCTA developed a strategy to pilot both H2B and BEB technologies using available grant funding. Piloting both technologies allows OCTA to gain direct experience with operational effectiveness, maintenance, and cost.



OCTA ZEB PILOT DETAILS

- H2B Pilot – Initiated on February 9, 2020, which included ten, 40-foot H2Bs and a hydrogen fueling station capable of fueling up to 50 buses per day.
- BEB Pilot – On October 12, 2020, the OCTA Board approved the purchase of ten, plug-in BEBs. On June 14, 2021, the OCTA Board approved the purchase of ten 150 kilowatt (kW) BEB depot charging stations.
- Key Performance Indicators
 - Bus Availability
 - Miles Between Road Calls
 - Fuel Economy
 - Cost Per Mile

OCTA ZEB PILOT UPDATE - BEB

- The first two BEBs arrived in December of 2021.
 - Undergoing acceptance inspection and testing.
 - Remaining eight will arrive in Mid-May.
 - BEB charging stations due to arrive in December 2021.

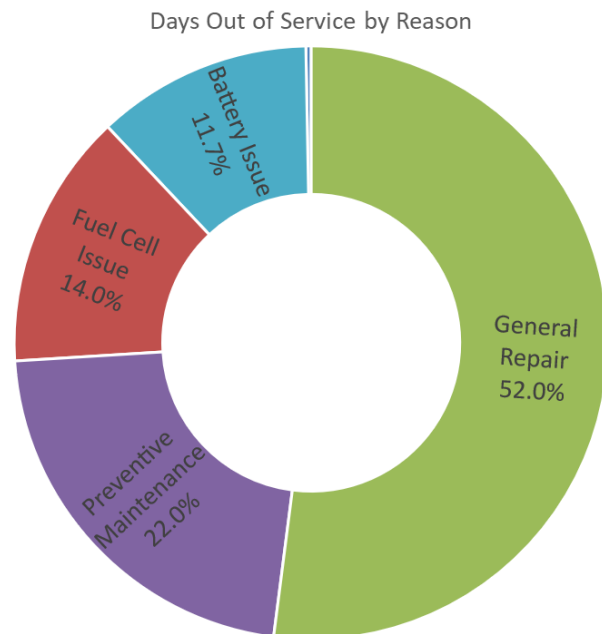
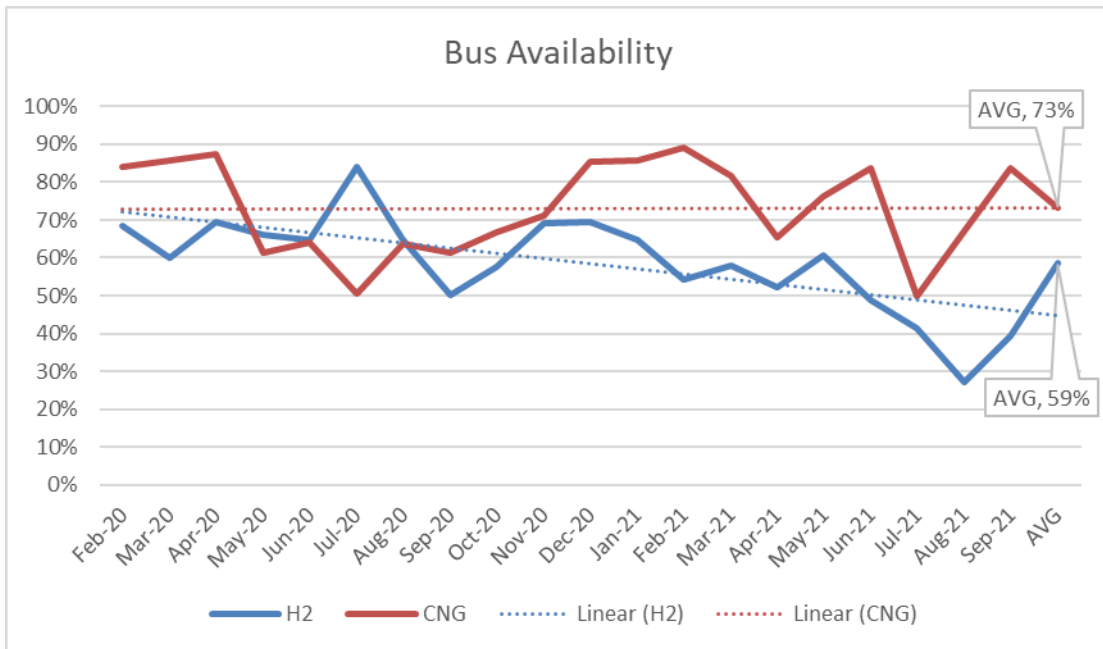


OCTA ZEB PILOT UPDATE – H2B

- In Service 22 months.
- Performance Data for 20 months
February 2020 – September 2021
- Performance measured against the performance of ten compressed natural gas-powered (CNG) buses
- Key Performance Indicators
 - Bus Availability
 - Miles Between Road Calls
 - Fuel Economy
 - Cost Per Mile

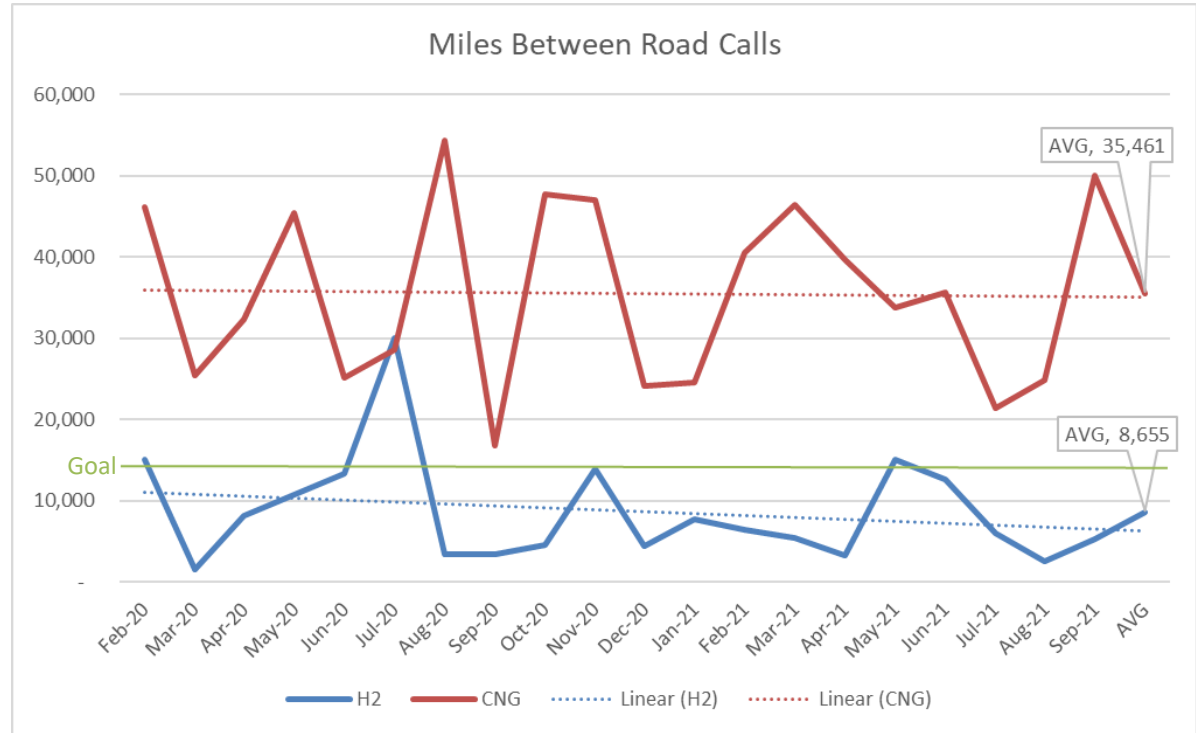


H2B – BUS AVAILABILITY



H2B – MILES BETWEEN ROAD CALLS (MBRC)

- The performance standard for MBRC is 14,000 miles.
- Recently, the majority of the road calls are related to fuel control and fuel cell failures.



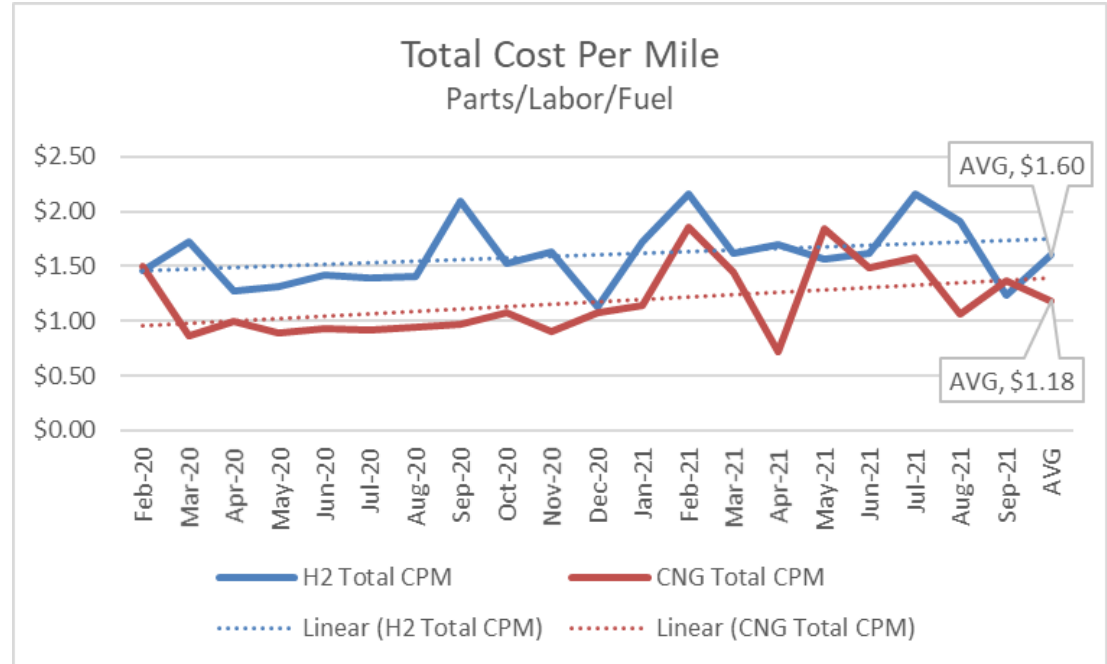
H2B – FUEL ECONOMY

- H2B fuel economy is 2.3 times that of a CNG-powered bus.
- The current cost per mile for hydrogen fuel is \$0.97 compared to the CNG fuel at \$0.42.

	H2B	CNG
Miles per gasoline gallon equivalent	8.45	3.77
Miles per diesel gallon equivalent	9.73	4.22
Miles per kilogram equivalent	8.61	3.85
Miles per kilowatt	0.26	NA

H2B – COST PER MILE (CPM)

- CPM parts and labor for H2Bs is 17 percent lower than CNG
 - H2B = \$0.62
 - CNG = \$0.75
- Total CPM, includes fuel cost, H2B is 26% higher than CNG
 - H2B = \$1.60
 - CNG = \$1.18



HYDROGEN FUELING STATION UPDATE



- Early months – variety of issues resulting in station shutdowns. Issues have been resolved.
- Availability has improved, matching the performance of the CNG fueling station.



Questions?

