



Hydrogen Detection Project

AB2766
Contract No. MS18103

Prepared for the Mobile Source Air Pollution Review Committee under the AB 2766
Discretionary Fund Work Program.

Acknowledgments

The completion of the Hydrogen Detection project required collaboration between the Orange County Transportation Authority (OCTA), Center for Transportation and the Environment (CTE) and Mobile Source Air Pollution Reduction Review Committee (MSRC).

This report was submitted in fulfillment of MS18103 and Hydrogen Detection project by the OCTA under the partial sponsorship of the MSRC. Work was completed as of January 2020 (open for use).

Disclaimer

The statements and conclusions in this report are those of the contractor and not necessarily those of the MSRC or the South Coast Air Quality Management District (SCAQMD). The mention of commercial products, their sources or their uses in connection with material reported herein is not to be construed as either an actual or implied endorsement of such products.

Project Description

The project scope included the installation of 42 hydrogen gas detectors, 25 hydrogen flame detectors, two control panels, hydrogen gas warning lights and horns; and interface detectors within existing alarm and fire control systems.



Problems Encountered

The existing display panel in bus maintenance shop supervisor office was not compatible with integrating and displaying hydrogen sensors. A change order was issued on June 18, 2019 to install a new display panel and related wiring and programming work for hydrogen detection display in the bus maintenance shop supervisor office.

Benefits

- Provides safety precaution by detecting the presence of hydrogen gas emitted from the buses. The OCTA hydrogen buses produce emissions reduction of 296 pounds of reactive organic gases, 936 pounds of nitrogen oxides, 696,000 pounds of carbon monoxide and 46 pounds of particulate matter under 10 micrometers annually.
- OCTA has the largest hydrogen fueling station in the nation for transportation purposes. The fueling capacity is 18,000 gallons.
- Provides increase in MPG. Current OCTA CNG buses average 3 MPG. New hydrogen fuel cell buses average 6 MPG (gas equivalent).
- Provides safety benefits when there is a leakage. If a leak occurs, lighter-than-air hydrogen gas rises and disperses rapidly. This non-toxic gas is also safe to breathe.
- Enhance perception of OCTA by positioning OC Bus as environmentally green by providing clean air transportation in Orange County.
- Build excitement about the new hydrogen fuel cell electric bus and fueling station.
- Provide education about OCTA's initiatives to have a positive effect on the community's net vehicle air emission levels by operating clean vehicles and the role that grant funding plays in accomplishing lower emissions.
- Engage the community and encourage participation in events throughout the year.

Photographs & Outreach

On January 31, 2020, the OCTA joined with local, state and federal officials to mark the debut of the largest transit-operated hydrogen fueling station in the nation and 10 new hydrogen fuel cell electric buses. The event highlighted OCTA's continuing efforts to use zero-emission transportation technology for a balanced and sustainable transit future.





Strategy

An outreach plan was developed to create awareness, enhance perception and encourage ridership on those new buses in the disadvantaged communities. OCTA's strategy included to:

- Develop an overall educational campaign highlighting OCTA's various green transit initiatives.
- Promote OC Bus green initiative through targeted campaign
- Identify geographic and demographic market segments in the disadvantaged community and distribute culturally relevant, in-language information.
- Participate in yearly events to create awareness.



Audiences

- All Orange County residents.
- Riders and residents along service routes.

Bus Customer and Community Communications

Provide on-board riders and community with information about the new bus and fueling technology and the role they play in the OC Bus fleet and OCTA's vision for the future of bus transit in Orange County. Materials emphasize main features and benefits of the hydrogen fuel cell electric buses and fueling station, and benefits to community.

- **Brochure:** Develop a take-one document highlighting facts about hydrogen bus and fueling station, where the buses will operate and their green footprint.
- **Bus Interior Cards:** Develop a series of interior cards showcasing how the hydrogen buses and fuel station work.

- **Website:** Develop a bus transit green initiatives section on OCTA website highlighting all projects and their benefits, including the hydrogen buses and the fueling station, and the role of the grant funding in these projects.
- **Blog Posts:** Utilize OCTA Blog to create awareness of the grant-funded projects and benefits, including the hydrogen buses and fuel station.
- **Social Media:** Utilize social media outlets, Facebook and Twitter, to build awareness and drive traffic to website. Create a unique social tag – # I'm Not Exhausting.
- **Outreach events:** Distribute brochures at marketing and public outreach events, as appropriate.
- **Public Relations:** Develop press releases throughout the year highlighting the buses and fuel station.

Sample marketing materials are included in **Attachment A**.

Conclusions

In conclusion, the OCTA completed the installation of hydrogen gas detection and flame detection devices; warning lights and horns; control panels; related conduit and wiring; programming; and Orange County Fire Authority Inspection. OCTA will continue to use zero-emission transportation technology for a balanced and sustainable transit future.

Attachment

Attachment A – Marketing Materials

CLEAR ZERO-EMISSION BUS TECHNOLOGY PATH

*On the road to protect
our environment!*

Special thanks and acknowledgements to our zero-emission bus partners:

FUNDING PARTNERS



PROJECT PARTNERS



Greener ways to get there.

OCTA is working toward a brighter future of reliable zero-emission transportation by investing in the latest technology for a balanced and sustainable transportation system.

That cleaner future is already well under way as we debut a new hydrogen fueling station, the largest transit-operated hydrogen fueling station in the United States. In addition, OCTA is introducing 10 hydrogen fuel-cell electric buses. This \$22.9 million program follows a pilot program during which OCTA became the first large public transportation agency in Southern California to operate a hydrogen fuel-cell electric bus.

What's next? OCTA is preparing to purchase 10 plug-in battery-electric buses to add to the fleet. Those buses are expected to begin arriving in 2021.

We are proud to be putting the cleanest, most reliable buses available on the road to a greener future with the assistance of our funding partners and vendors.



- OC Bus
- OC ACCESS
- OC Flex
- OC Streetcar
- OC Vanpool
- OC Carpool
- OC Bike
- OC Freeways
- OC Roads
- OC HOV Lanes
- OC Metrolink
- OC Fair Express

Zero-Emission Bus Technology Dedication Event

Today, the Orange County Transportation Authority debuts the largest hydrogen fueling station in the nation for transportation and 10 new hydrogen fuel-cell electric buses. This event highlights OCTA's continuing efforts to use zero-emission transportation technology for a balanced and sustainable transit future.

Additional details are available online at OCBus.com/clearpath.



FUELING STATION & VEHICLE FLEET

GRANT FUNDING PROVIDED BY:
California Air Resources Board (CARB): Zero-Emission Truck and Bus Pilot Commercial Deployment Project as well as South Coast Air Quality Management District (SCAQMD)

FUNDING SOURCE:
CARB award funded through Climate Change Investments (CCI) and SCAQMD award funded through Clean Fuels Fund

AWARDED TO:
Center for Transportation and the Environment (CTE)

CARB AWARD:
\$12.5 million

SCAQMD AWARD:
\$1 million

FUNDING BREAKDOWN

TOTAL PROJECT COST ESTIMATED AT \$22.9 MILLION. \$13.5 MILLION PROVIDED BY CARB AND SCAQMD

- \$4.8 million covers the cost of the fueling station
- \$710,000 for utility upgrades
- \$7.3 million for 10 hydrogen fuel-cell electric buses, which covers the incremental cost of a hydrogen fuel-cell electric bus as compared to a compressed-natural-gas (CNG) bus
- \$414,000 for adding hydrogen detection system to the Santa Ana maintenance facilities
- \$200,000 for Center for Transportation and the Environment (CTE)

OCTA COST SHARE IS ESTIMATED AT \$9.4 MILLION

- \$5.6 million for hydrogen fuel-cell electric buses, achieved by reducing the last CNG bus order by 10 buses. (Funding from the SB1 State of Good Repair program, administered by Caltrans).
- \$3.8 million for in-kind contributions (staff resources and fueling station operations and maintenance).

PROJECT SCOPE

HYDROGEN FUELING STATION

- Requires liquid hydrogen deliveries via tanker truck, bi-weekly for 10 buses, daily if scaled to 100 buses
- 40-50 bus capacity, scalable to 100 buses with additional fuel storage and components
- **Trillium:** Construction, operations and maintenance
- **Air Products:** Station design
- **Fiedler Group:** Upgraded existing methane detection system to include hydrogen and flame detection in all maintenance shops and fuel station

10 HYDROGEN FUEL-CELL ELECTRIC BUSES

- **New Flyer** Xcelsior bus – same as 157 of OCTA's CNG 40-foot buses
- All-electric drive, 300-mile range, 2-year/100,000-mile warranty (6 years on batteries and drive)
- **Ballard** Fuel Cell, 6-year warranty



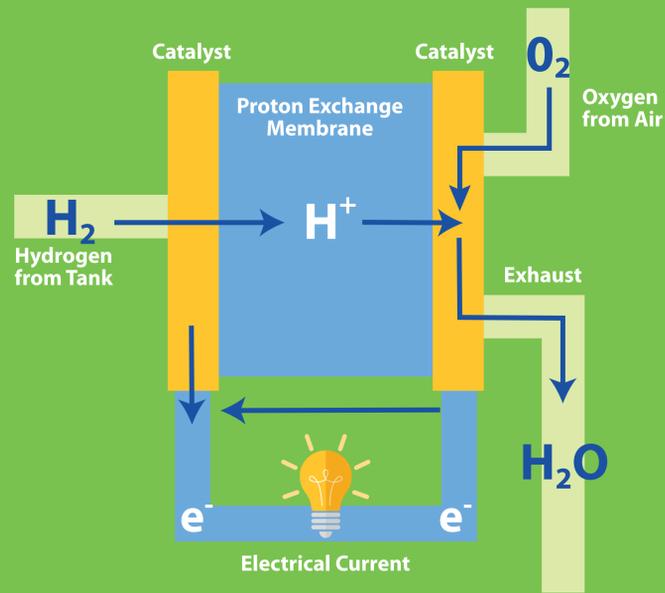
ABOUT THIS BUS



OCTA is working toward a brighter future of reliable zero-emission transportation by investing in the latest technology for a balanced and sustainable transportation system. That cleaner future is under way with our new hydrogen fueling station, the largest hydrogen fueling station in the United States for transportation. Along with that, OCTA is introduced 10 hydrogen fuel-cell electric buses. This \$22.6 million program follows a pilot program in which OCTA became the first large public transportation agency in Southern California to operate a hydrogen fuel-cell electric bus.



HOW DOES A HYDROGEN FUEL CELL WORK?



It is OCTA's goal to provide our community with the cleanest, most efficient transportation possible. Our new fuel-cell buses run solely on hydrogen and, with no harmful gases created, there are zero emissions which make for a greener Orange County.



THE FUTURE OF TRANSIT IS HERE!

OCTA'S ZERO-EMISSION BUS TECHNOLOGY

By switching to 10 fuel-cell electric buses, over the course of 5 years OCTA will remove 3,836,000 lbs of CO₂* from the atmosphere which is equivalent to . . .



Planting approximately 4,870 mature trees.



Stopping approximately 70 roundtrip flights from Los Angeles to San Francisco.



Taking approximately 370 passenger vehicles off the road for one year.



EFFICIENCY OF HYDROGEN FUEL-CELL TECHNOLOGY

Buses

- Current OCTA CNG buses average 3 MPG
- New fuel-cell buses average 6 MPG (gas equivalent)
- Number of hydrogen fuel-cell electric buses: 10
- Length: 40 feet
- Capacity: 35 seated, 33 standing
- Range: 300 miles
- Zero emissions!

Fueling Station

- Largest hydrogen fueling station in nation for transportation
- Fuel capacity: 18,000 gallons
- Bus capacity: 40-50 buses, scalable to 100 with additional fuel storage and components



PROJECT PARTNERS



FUNDING PARTNERS



*Figure calculated from California Air Resources Board. 2014 Cummins ISL-G emits 1,854 grams of CO₂ per mile.