

Bay Area Transit Agencies Propel Fuel Cell Buses Toward Commercialization

Led by the Alameda-Contra Costa Transit District (AC Transit), several transit agencies in the San Francisco Bay Area are kicking off a demonstration—called Zero Emission Bay Area, or ZEBA for short—of the next generation of fuel cell buses in its mass transit system.

A total of 12 of these buses will provide service in cities around the Bay. Once all the buses are delivered, the Bay Area will be home to the largest single fleet of fuel cell buses in the United States. This bus demonstration is focused on moving to the next stage in commercialization by increasing bus reliability and investigating future cost reductions and what is needed to scale up fueling stations for larger fleet requirements.

About ZEBA

The ZEBA fuel cell bus demonstration grew out of AC Transit’s HyRoad program, begun in 1999, and the California Air Resources Board’s (CARB’s) 2000 Fleet Rule for Transit Agencies, Urban Bus Requirements. The rule set more stringent emissions standards for new urban bus engines and promoted advances in the cleanest technologies, specifically zero emission buses (ZEBs). Under the rule, agencies with more than 200 buses must eventually include ZEBs as a percentage of new bus purchases. Transit agencies that fall under the rule and are on the diesel fuel path are required to participate in an advanced ZEB demonstration.

ZEBA Participants

Five Bay Area transit agencies have joined to form the ZEBA demonstration group: AC Transit, Golden Gate Transit (GGT), Santa Clara Valley Transportation Authority (VTA), San Mateo County Transit District



The first of twelve fuel cell buses were delivered to AC Transit in May 2010.

(SamTrans), and the San Francisco Municipal Transportation Agency (SFMTA). AC Transit is leading the project by purchasing the buses; providing facilities to house, maintain, and fuel them; and serving as the primary operator. The other transit agencies in the ZEBA demonstration group will contribute funding, participate in training activities, and periodically operate buses as part of the demonstration.

Participating Agency Facts at a Glance

Agency	AC Transit	GGT	SamTrans	SF MTA	VTA
Location	Oakland	San Rafael	San Carlos	San Francisco	San Jose
Coverage area (square miles)	364	325	97	49	326
Active fleet (number of vehicles)	634	204	322	1,196	414
Modes	Bus; paratransit	Bus	Bus; paratransit	Bus; light rail; trolley; cable car	Bus; light rail; paratransit
Annual ridership (in millions)*	65.8	7.5	15.5	221.2	44.9

*Unlinked passenger trips, 2008.

Source: National Transit Database, <http://www.ntdprogram.gov/ntdprogram/>

The Metropolitan Transportation Commission, the Bay Area Air Quality Management District, CARB, the California Energy Commission (CEC), and the Federal Transit Administration’s National Fuel Cell Bus Program help to fund the ZEBA demonstration program. This funding was put toward the purchase of the 12 new buses and two new hydrogen fueling facilities to expand total fueling capability from 150 kg/day to 420 kg/day.

Fuel Cell Bus Facts

Bus chassis	Van Hool, A300L
Length/width/height	40 ft/102 in./136 in.
Curb weight	31,400 lb
Passenger capacity	28 seated plus two wheelchair positions, or 32 seats without wheelchairs
Hybrid system	Siemens hybrid-electric ELFA drive system integrated by Van Hool
Fuel cell	UTC Power, PureMotion 120 kW
Energy storage	EnerDel, lithium ion batteries, Rated energy: 17.4 kWh; Rated capacity: 29 Ah
Fuel/storage	Gaseous hydrogen, 40 kg at 5,000 psi, 8 Dynetek type 3 tanks

AC Transit routes to fully test their capabilities. The other transit partners will participate in training along with AC Transit staff and will occasionally operate one to two buses in their respective service areas.

New Buses, New Fueling Stations

AC Transit is working with Linde to construct new hydrogen stations at the East Oakland and Emeryville divisions. The new East Oakland station, which will replace and expand the current outdated hydrogen facility, will feature liquid hydrogen delivery and storage, and possibly an electrolyzer. The dispensers will be added in-line with the division's existing diesel fueling dispensers to help transition the technology to mainstream use. This station will also be used by VTA and SamTrans. The Emeryville fueling station will be a combined facility for light-duty fuel cell vehicles and fuel cell buses. A solar-powered electrolyzer will generate up to 65 kg of hydrogen, with the balance of demand to be met with liquid hydrogen. This new station will be a convenient fueling location for future bus operations by ZEBA partner transit agencies like GGT and SF MTA.

In-Service Evaluation

AC Transit and the other transit agency partners are collaborating with the U.S. Department of Energy's (DOE) Fuel Cell Technologies Program to evaluate the buses in real-world service. DOE's National Renewable Energy Laboratory will collect and analyze performance and operations data from the new buses and the fueling stations. Comparing those data side by side with similar information from conventional technology buses allows researchers to better understand the status of the technology and determine if future development work is needed. Information gathered during the demonstration will also help fleets make informed purchase decisions. Results will be fed back into the research and development process to focus future resources, as appropriate.

If questions remain, contact:

Jaimie Levin
AC Transit
510-891-7244
jlevin@actransit.org

Leslie Eudy
National Renewable Energy Laboratory
303-275-4412
leslie.eudy@nrel.gov

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Past Demonstrations Pave the Way

Both AC Transit and VTA have previously led fuel cell bus demonstrations. The new buses for the ZEBA demonstration represent the logical next step in fuel cell bus development for AC Transit's HyRoad program. For more than a decade, AC Transit's HyRoad has integrated on-site fueling and maintenance with public education, first responder training, and real-world testing of fuel cell vehicles. From March 2006 through mid-2010, AC Transit and its manufacturer partners tested three fuel cell buses in service in Oakland, California, during which time the buses logged over 250,000 miles and carried over 660,000 passengers, all while achieving significantly greater overall energy efficiency compared to diesel buses. The manufacturers used the lessons learned from the demonstration at AC Transit (and the demonstration of two similarly designed fuel cell buses at SunLine in Thousand Palms, California, and Connecticut Transit in Hartford) to improve the system and components, increasing efficiency, reliability, and durability.

Project Details

The new buses feature significant improvements over two previous generations of fuel cell buses, including a redesigned Van Hool chassis that is 5,000 lb lighter in weight and 3 in. shorter in height than that of the earlier generation buses. The buses have the newest UTC Power fuel cell power system and an advanced lithium ion energy storage system by EnerDel. Van Hool fully integrated the hybrid design using a Siemens hybrid system

The fleet of fuel cell buses will be split between two of AC Transit's four divisions. Six buses will be stationed at the East Oakland Division and the remaining six buses will operate from the Emeryville Division. The buses will be placed in daily service on a variety of