Timeline of SunLine's Innovative Hydrogen-Fueled Buses

P4 FCB Demo:
Ballard
June 2000 - July 2001

2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
on-going

ThunderPower
FCB Demo:
ISE, UTC Power
Aug 2002 - Feb 2003

H/CNG Engine
Development:
Cummins - Westport
2003 - 2004

HHICE Bus Demo:
ISE, Ford
Dec 2004 - July 2009

FCB Demo:
UTC Power,
ISE, Van Hool
Jan 2006 - Present

Advanced
Technology
Bus Demo:
ISE, Ballard, New Flyer
May 2010 - Present

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Web sites:

SunLine Transit Agency: *www.sunline.org*

Ballard Power Systems Inc.: *www.ballard.com*

ISE: *www.isecorp.com*

DOE Fuel Cell Technologies Program:
hydrogenandfuelcells.energy.gov

NREL fuel cell bus publications:
www.nrel.gov/hydrogen/proj_fc_bus_eval.html

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SunLine Leads the Way in Demonstrating Hydrogen-Fueled Bus Technologies

SunLine Transit Agency reinforces its continued commitment to clean air technologies by adding another fuel cell electric bus to its fleet.

This advanced technology bus represents the sixth generation of hydrogen-fueled buses that the agency has operated in the last 10 years.

Focusing on the Environment

SunLine Transit Agency has provided public transit service in Southern California's Coachella Valley since 1977. Its service area covers more than 1,100 square miles, connecting nine cities in Riverside County.

Early concerns about air quality led SunLine to switch to compressed natural gas (CNG)-fueled buses in 1994. Since then, SunLine has proactively sought out low-emission technologies for its fleet, specifically targeting projects that use hydrogen as a fuel. A number of low- or zero-emission bus technologies, including CNG-hydrogen fuel blends, hydrogen-fueled internal combustion engines, and fuel cell buses, have been demonstrated at SunLine.

In February 2010, SunLine unveiled its newest fuel cell bus (FCB) at the 3rd Annual State of Public Transit Luncheon. This advanced technology (AT) bus incorporates the latest design improvements to help move the technology toward a market ready product.

SunLine's headquarters is located in Thousand Palms, California.

SunLine's newest hydrogen-fueled bus went into service in May 2010.

Advancing Fuel Cell Bus Technology

The AT bus is a 40-foot New Flyer model featuring a hybrid electric powertrain designed and integrated by ISE Corp. The propulsion electricity is provided by Ballard Power System's 150-kW fuel cell module in combination with an energy storage system consisting of Valence lithium ion batteries. The system design incorporates a number of lessons learned from previous configurations with a goal of improving reliability and performance. Upgrades include a smaller and lighter fuel cell system, advanced battery technology, lighter hydrogen storage tanks, and a smaller thermal management system.

Operating the bus at SunLine provides the manufacturers with an opportunity to investigate how the system performs in a hot, dry climate. The Coachella Valley is a desert valley region with annual rainfall around five inches per year. Average high temperatures are typically over 80°F for eight months of the year and can get as high as 120°F. The manufacturers are already gathering data on this hybrid-electric fuel cell drive system in a much colder climate. Twenty buses with an identical configuration to SunLine's AT bus are being operated by BC Transit in Whistler, Canada.

SunLine AT Fuel Cell Bus Facts

Bus Chassis/ Model	New Flyer/H40LFR
Model Year	2009
Length/ Width/Height	40 ft/102 in./137 in.
GVWR	44,530 lb
Seats	37 (with no wheelchairs)
Hybrid System	Siemens ELFA hybrid-electric drive system integrated by ISE Corp
Fuel Cell	Ballard Power Systems, FCvelocity HD6, 150 kW
Propulsion Motor	Two Siemens AC induction motors, 85 kW each
Energy Storage	Valence, Phosphate based lithium ion batteries, Rated energy: 47 kWh
Accessories	Electrically driven
Fuel/Storage	Gaseous hydrogen, 43 kg at 5,000 psi, 6 Dynetek, Type 3 tanks

Evaluating the Technology in Transit Service

SunLine is collaborating with the U.S. Department of Energy's (DOE) Fuel Cell Technologies Program to evaluate the bus in revenue service. DOE's National Renewable Energy Laboratory (NREL) is collecting and analyzing performance and operations data from the new bus and from five CNG buses in similar service. Comparing data side by side with similar information from conventional technology buses allows researchers and manufacturers 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. The results will be fed back into the research and development process to appropriately focus future resources.