

AQMD Contract No. MS10012

FINAL REPORT

Date: May 2, 2014

Contractor: Foothill Transit

Project Officer: Roland M. Cordero
Director of Maintenance & Vehicle Technology

BACKGROUND:

The Foothill Transit Ecoliner electric bus fully complements state and federal efforts to achieve ambient air quality standards as funds dedicated to this project fully support GHG reductions in the South Coast Air Basin. This project provides a vital link in helping California reach its environmental goals outlined in Assembly Bill (AB) 118, AB 32, and subsequently in Senate Bill (SB) 375. In testing, the Ecoliner bus' performance significantly exceeded the FTA goal to quadruple fuel efficiency of 40' transit buses to greater than 12 miles per diesel equivalent gallon by 2030.

The CARB has already demonstrated its full support of the Foothill Transit Ecoliner and noted specifically that this project was not undertaken in response to mandatory regulation.

PROJECT OBJECTIVE:

Foothill Transit will purchase 12 fast-charge Ecoliner electric buses to be placed in service on Foothill Transit's Line 291 serving the cities of La Verne on the north and Pomona on the south.

The northbound bus travels 8.1 miles to the end of the route while the southbound bus travels 8.0 miles. The roundtrip is 16.1 miles. This line was specifically chosen for commercialization of the technology because of its roundtrip mileage, minimal deadhead from the Pomona Operations and Maintenance Facility, and its ridership demographic. Coaches on Line 291 transport five percent of Foothill Transit's total ridership annually, or 750,000 people

TECHNOLOGY DESCRIPTION:

The Ecoliner offers zero emissions, the potential for 90% reduction in fuel costs, lower maintenance costs, a quiet drive system, and up to 90 percent regenerative braking recapture.

The Ecoliner is different than most battery drive vehicles where range is dictated by the number of batteries. The Ecoliner can operate on its route 24 hours a day, seven days a

week on routes outfitted with fast-charge stations. The key to the Ecoliner project is the utilization of the fast-charge battery; it will retain its energy reserve and charging profile from 8,000 to 25,000 charge-discharge cycles and can be quick-charged from a 10 percent to a 95 percent charge in ten minutes or less while the bus is at a layover. The Ecoliner battery utilizes Nanosafe lithium titanate technology, which has been laboratory tested at four to 10 times the usable charge-discharge cycles over conventional batteries and has a shelf life of up to 25 years.

STATUS:

The project is complete and all 12 Ecoliner buses have been received, inspected, accepted and registered. Three buses have been placed in service while nine buses await the delivery of new Computer-Aided Dispatching and Automatic Vehicle Locator equipment. The equipment is slated for installation by the end of May. The list below shows when the Ecoliners were purchased, licensed and placed in service.

ELECTRIC BUS LIST

BUS NUMBER	VIN NUMBER	MILEAGE	GROSS WEIGHT	LICENSE PLATE	DATE LICENSED	DATE IN SERVICE	DATE PURCHASED
2004	1M9TG16J6DS816040	259	28440	1403566	2/10/2014	2/13/2014	1/23/2014
2005	1M9TG16J8DS816041	155	28120	1403567	2/10/2014	3/25/2014	1/23/2014
2006	1M9TG16JXDS816042	467	28360	1384544	3/19/2014	4/03/2014	1/23/2014
2007	1M9TG16J1DS816043	155	28440	1403568	2/10/2014		1/23/2014
2008	1M9TG16J3DS816044	292	28400	1403599	2/20/2014		1/23/2014
2009	1M9TG16J5DS816045	308	28460	1403771	2/20/2014		1/23/2014
2010	1M9TG16J7DS816046	212	28120	1403772	2/20/2014		1/23/2014
2011	1M9TG16J9DS816047	221	28420	1403773	2/20/2014		1/23/2014
2012	1M9TG16J0DS816048	285	28420	1384546	3/19/2014		1/23/2013
2013	1M9TG16J2DS816049	260	28300	1384545	3/19/2014		1/23/2013
2014	1M9TG16J9DS816050	259	28040	1403569	4/30/2014		2/19/2014
2015	1M9TG16J0DS816051	256	28380	1403570	4/30/2014		2/19/2014

RESULTS:

From March 2 to March 29, the buses were driven 5,568 miles achieving estimated fuel savings of \$4,325 and 1,392 gallons equivalent of diesel fuel saved. The average mile per gallon equivalent was 18.2 miles with 843 charge cycles. Average time per charge at the Pomona Transit Center charging station was 5 minutes and 11 seconds. The report for April 2014 is not yet available. The March 2014 report is attached.

BENEFITS:

This is the only transit technology to offer the combination of zero emissions at the tailpipe, a significantly reduced carbon footprint and the potential for elimination of fossil fuels as an energy source, compared to conventional diesel technology.

The Ecoliner's composite body is lightweight which results in significant energy savings and its nonconductive qualities make it the safest structure for an electric drive bus. The composite structure not only protects passengers, but it absorbs energy which lowers maintenance costs in the case of an accident. The energy-absorbing feature reduces exterior body damage, making minor damages negligible.

One advantage to the duty cycle of a fleet vehicle is the nature of the vehicle to return at a fixed time to a predetermined location or 'layover' for operator breaks and to re-align the schedule with the fixed route time points. These layovers are often 10 to 15 minutes long and present an opportunity for the Ecoliner to recharge. The charge system's hardware and software allows for rapid charge of the energy storage from 10 percent to 95 percent in 10 minutes or fewer.

The Ecoliner employs the following proven advanced components to minimize noise progression both interior and exterior to the vehicle:

No engine required for normal operation

- Only noise is drive train and electric accessories such as air conditioning, power steering and air compressor
- Air conditioning is roof mounted with variable speed fans directed vertically to minimize street noise

All electric accessories

- Power steering, air compressor, air conditioning, and cooling systems are all driven with variable speed all electric drives to allow for controlled output of all such systems to minimize noise while maximizing performance and efficiency

Suspended cradle mounting structure

- Composite unibody cushion mountings to the propulsion drive system minimizes noise transmission from rotating components to body

PROJECT COSTS:

COMMERCIALIZATION AND APPLICATIONS:

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The Ecoliner buses are used for revenue service on Line 291, an existing "loop" spanning from the City of La Verne to the City of Pomona. The Ecoliner operates identically to existing compressed natural gas (CNG) coaches on the line, with the exception of its need to fast-charge at the PTC. With funding from the Department of Transportation's (DOT's) Transit Investments in Greenhouse Gas and Energy Reductions (TIGGER II) grant, Foothill Transit purchased an additional 12 Ecoliners for deployment in 2014. With a total of 12 electric buses, Line 291 will be fully electrified.