

Revisiting Green Approaches

By Brian Shaw, CAPP

STANFORD UNIVERSITY, CALIFORNIA has a growing and effective sustainability enterprise that covers most aspects of the university's operations and systems. However, it never hurts to revisit our approaches occasionally.

I was recently asked by our new university leadership to provide an overview and, arguably, a justification for Stanford's investment in battery electric buses (BEBs). Back in 2012, as the university needed to source new transit buses for its aging fleet, Parking & Transportation Services (P&TS) evaluated traditional diesel, hybrid-diesel, alternative fuels, battery-retrofits, and BEBs. It was decided that BEBs would be the best bus platform for Stanford. BEBs are more expensive to acquire than traditional diesel buses—about 40 percent more—but their maintenance and fuel (electricity) was supposed to be substantially less than diesel buses. Would those savings be realized? Would BEBs prove more cost effective for Stanford to operate over their lifecycle? Or was there a financial price to be paid?

Instead of having to turn to industry data or standards, P&TS could use its own experience operating BEBs to answer those questions. P&TS now has more than three years of operating experience and data with BEBs. What did the data tell us?

The Data

There is a significant delta in the acquisition costs between a conventional diesel 40-foot transit bus and an equivalent 40-foot BEB—around \$215,000 or 44 percent more. While Stanford can lease the BEBs and use state grants to reduce acquisition costs, there is still

that significant delta. Can it be made up with the operating costs?

P&TS is still using conventional diesel buses in addition to the BEBs. During the same three-year time frame, P&TS reviewed the maintenance and fuel costs for its diesel fleet and its growing fleet of BEBs. For the diesels, maintenance averaged just under \$25,000 per bus while fuel was over \$20,000 per bus at an average fuel price of \$3.25 per gallon in a three-year timespan. For the BEBs, maintenance was just under \$15,000 per bus while fuel or electricity costs were only \$1,600 per year at \$0.10 KWH.

Another way to compare the operating costs between diesel and BEBs is to look at the cost per mile. For the diesel fleet, the cost per mile was \$1.78, while for the BEBs, the cost per mile was only \$0.48.

Using those data points, P&TS ran a 12-year life cycle cost projection for the diesel fleet as well as the BEBs. The annual operations and maintenance (O&M) savings between a diesel and a BEB is \$29,000. Assuming that annual savings holds over the 12-year life cycle of a typical 40-foot transit bus, after four years, the \$215,000 acquisition delta is wiped out by the O&M savings. After four years, P&TS is realizing significant savings to its O&M costs, which could be used to help acquire additional BEBs.

There are other environmental benefits. BEBs use fewer fluids and

have less moving parts than diesel buses. Because of those differences, BEBs have much less exposure from accidental spills, used oil disposal, and used parts. Because BEBs use electricity instead of diesel fuel, there are no risks from potential fuel spills. There is also a reduction/elimination of tailpipe emissions with BEBs, which is particularly relevant at Stanford as we source the majority of our electricity from renewable sources.

The Results

The analysis conducted by P&TS concluded that during the 12-year life cycle of a typical 40-foot transit bus, the BEBs would save the university money while reducing environmental effects. In addition, with Stanford Energy System Innovations sourcing a large majority of the university's power from renewable sources, including on-campus solar generation, the BEBs are in large part powered by the sun.

Leadership has given P&TS the green light to continue to electrify the entire bus fleet. Our plan is to have the entire fleet moved over to BEBs by 2022.

When given the challenge to justify your sustainable initiatives embrace it and do your homework. Use your data to make your case and keep up the good work! 



BRIAN SHAW, CAPP, is executive director of parking and transportation services at Stanford University and co-chair of IPI's Sustainability Committee. He can be reached at bshaw2@stanford.edu.