POLICY BRIEF | INSTITUTE OF TRANSPORTATION STUDIES

Developing Zero-Emission Bus and Truck Markets Will Require a Mix of Financial Incentives, Sale Mandates, and Demonstration Projects

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California has a number of programs intended to encourage the introduction of zero- and near-zero emission vehicle (ZEV) technologies into the medium- and heavy-duty truck markets. Meeting the goals of these programs will require the sale of large numbers of battery-electric and hydrogen fuel cell transit buses and trucks by 2025 and beyond. However, several barriers to widespread adoption of these technologies will need to be addressed, including their purchase price, utility, durability and reliability, as well as the cost of energy and the availability of refueling infrastructure. Policies such as mandates or incentives will likely be necessary to overcome these barriers and the uncertainty of adopting a new, unproven technology. These policies must make economic sense to both the bus and truck manufacturers and the vehicle purchasers if they are to be successful in the long term.

To gain a better understanding of the financial barriers for ZEV bus and truck adoption, researchers at UC Davis conducted technology and cost assessments for battery-electric and fuel cell vehicles in the medium- and heavy-duty truck sector. High-level findings and the policy implications of this research are summarized in this brief.

Key Research Findings

Purchase incentives for ZEV trucks will be important in the short term. The present costs of both battery-electric and hydrogen fuel cell trucks are significantly greater than the corresponding diesel-engine vehicles. However, this vehicle cost difference should become negligible by 2040 (Figure 1), because the costs of batteries and fuel cells are decreasing rapidly. In the meantime, incentives will be critical to make ZEV technologies attractive.

Early mandates for ZEV bus and truck sales should focus on battery-electric transit buses and urban delivery trucks. Battery-electric vehicle technology is currently more economically viable and practical for use in transit buses and short-range delivery trucks than for other medium- and heavy-duty trucks. Thus, the incentives required for the sale of battery-electric vehicles for those uses should be relatively modest. The limited range of ZEV technologies will be less of a concern for these applications compared to long-haul trucks.

Battery-electric and fuel cell truck demonstration projects are important first steps in making sure ZEV truck mandates will be successful. Uncertainty concerning the utility and reliability of ZEV trucks can considerably affect the purchase

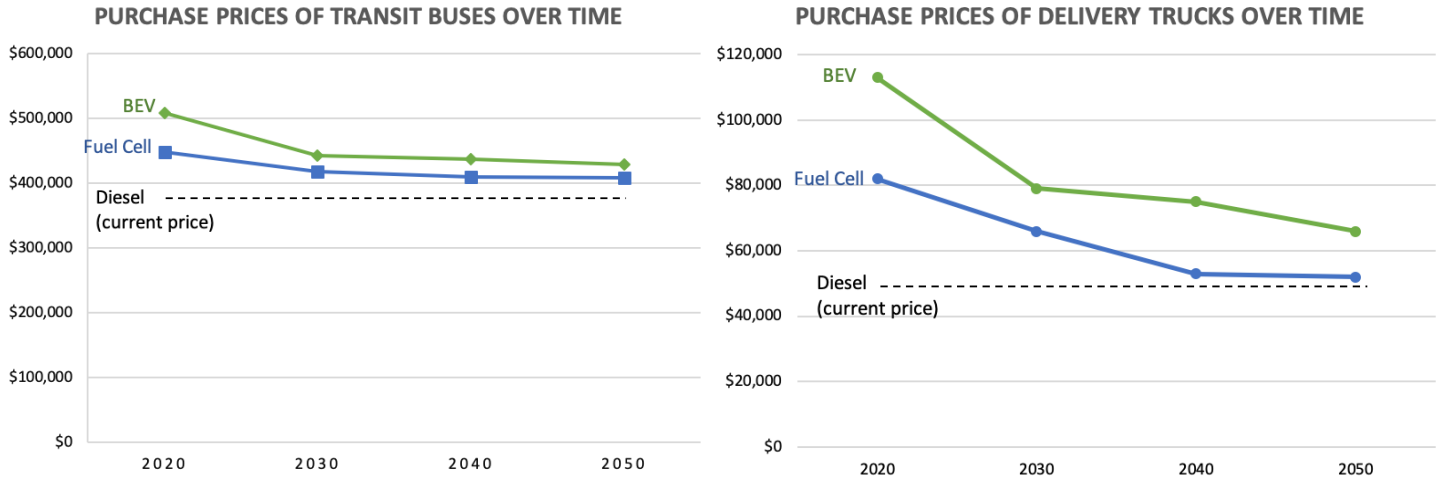

Figure 1. The purchase prices of transit buses (left) and delivery trucks (right) approach the current prices of their diesel counterparts by 2050.

decisions of fleet operators. The financial incentive required to offset these uncertainties is probably too large to be practical. A more cost-effective approach to overcoming uncertainties would be supporting field demonstrations of the vehicles by trucking companies.

Reducing the costs of electricity and particularly hydrogen used by ZEV buses and trucks is also essential. The cost of energy to operate battery-electric vehicles is significantly less than fuel costs for diesel engine vehicles. Over the lifetime of the electric vehicle, this differential can more than offset the higher up-front purchase cost of the electric vehicles. In addition, policies like the Low Carbon Fuel Standard credit for renewable electricity can make electricity costs for battery-electric vehicles very low. Present hydrogen costs are high, but they can also benefit from the Low Carbon Fuel Standard credit. In order to offset the higher purchase cost of fuel cell vehicles, hydrogen would need to cost less than $5/kilogram (current market rate is $10-$15/kilogram).

The economics of developing the fueling infrastructure are more feasible for battery-electric vehicles in the short-term than for fuel cell vehicles. The analysis of refueling infrastructure for battery- electric and fuel cell vehicles indicates that the complexity and cost of fast charging batteries is less than for hydrogen refueling. Despite this disadvantage, hydrogen fuel cell ZEV technology seems likely to be used for long distance bus and freight applications over the longer term, as it is likely to be the only feasible option for applications in which a range greater than 300 miles is needed.

More Information

This policy brief is drawn from the research report "Zero-Emission Medium- and Heavy-duty Truck Technology, Markets, and Policy Assessments for California," from the University of California Institute of Transportation Studies (UC ITS) authored by Andrew Burke and Marshall Miller with the Institute of Transportation Studies at the University of California, Davis. The full report can be found on the UC ITS website at https://www.ucits.org/research-project/2018-30/.

For more information about the findings presented in this brief, please contact Andrew Burke at afburke@ucdavis.edu.

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