Institute of Transportation Studies | UNIVERSITY OF CALIFORNIA

Navigating the Shift: Critical Insights of California Fleet Operators into Zero-Emission Technologies

Youngeun Bae, Ph.D., Stephen G. Ritchie, Ph.D., Craig R. Rindt, Ph.D.
Institute of Transportation Studies, University of California, Irvine

January 2025

Issue

California is committed to transitioning heavy-duty vehicles (HDVs) from diesel to zero-emission vehicles (ZEVs) like battery electric vehicles (BEVs) or hydrogen fuel cell electric vehicles (HFCEVs) by 2045, and in certain cases much sooner.[1] [2] Achieving this goal requires substantial efforts from various sectors, including vehicle manufacturers, infrastructure developers, and governments. It is particularly important to understand the perspectives of HDV fleet operators, as their viewpoints and willingness to adopt ZEVs will be critical to California's success in this transition.

To better understand the perspective of fleet operators, we conducted in-depth interviews with 18 California HDV fleet operators, across various sectors and fleet sizes, on the viability of zero-emission fuels and vehicles over the next 10 to 20 years and the main motivators for, and barriers to, procuring ZEVs.

Key Research Findings

Fleet operators noted similarities between BEVs and HFCEVs with some points of distinction. Most fleets referred to BEVs during the interviews, noting environmental benefits, rapidly advancing technologies, and infrastructure limitations. While HFCEVs were mentioned less during the interviews, fleets made similar comments about these vehicles compared to BEVs along with some unique advantages like leveraging renewable hydrogen sources. Figure 1 further illustrates fleet operators' assessments of positive, negative, and neutral aspects of each ZEV technology.

Fleet operators had a positive view of BEVs in terms of pace of technology advancement and environmental benefits. Fleet operators across various industries noted that BEV technologies are advancing very quickly. One operator expressed confidence, stating "I think everything will be battery-operated 20 years from now." Both public and private fleet operators underscored the importance of ZEVs, citing environmental advantages.

Unresolved concerns with BEVs include functional suitability, insufficient infrastructure, and total cost of ownership. Operators commonly cited concerns such as heavy batteries causing range limitations and payload parity issue. These comments indicate that there will be a learning curve for assessing the suitability of ZEVs for different uses. One fleet operator also noted various challenges with insufficient charging infrastructure. These include financial burdens and feasibility problems when planning to build on-site charging facilities, as well as a lack of off-site charging stations available for HDVs.[3] Fleet operators also discussed total cost of ownership. One operator explained, adopting a BEV truck would depend on "whether it's cheaper and pays for itself, that makes good business sense."

Fleet operators pointed to additional environmental benefits of HFCEVs. One fleet operator viewed HFCEVs as

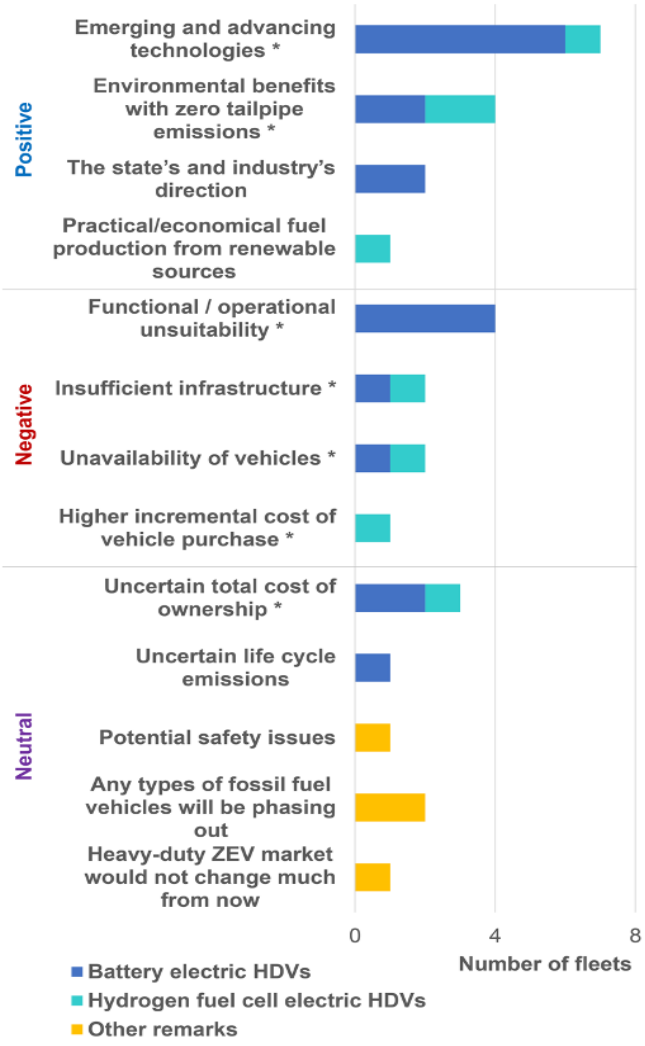

Figure 1. Breakdown of fleet viewpoints on ZEVs: Positive, negative, and neutral aspects. Note: The remarks explained in this brief are denoted with an asterisk

having greater environmental benefits when hydrogen is produced from renewable sources (e.g., biomass, wind, and solar) .[4] Some fleet operators highlighted hydrogen as a true zero-emission option.

For HFCEVs, the purchase cost, insufficient infrastructure, and availability of vehicles were all cited as negative factors. One fleet operator shared that the substantial cost of purchasing a HFCEV is a major barrier to considering them as a viable option, despite the environmental advantages. Another fleet operator also pointed to the lack of fueling infrastructure as another significant barrier. Despite the greater number of hydrogen fueling stations in California compared to other states, the majority cater to light-duty vehicles, with less than 10 percent designed for HDVs.[5] Participating fleets described the infrastructure as severely restricted, with one operator stating there was "no infrastructure for hydrogen." In addition, one operator perceived HFCEVs as commercially unavailable due to the limited number of vehicle models on the market.

More Information

This policy brief is drawn from Bae, Y., Rindt, C.R., Mitra, S.K., and Ritchie, S.G. "Fleet Operator Perspectives on Alternative Fuels for Heavy-Duty Vehicles" Transport Policy, 149 (2024): 36-48. The article can be found at: https://doi.org/10.1016/j.tranpol.2024.01.023. For more information about the findings, please contact Youngeun Bae at youngeub@uci.edu.

[1]State of California, Executive Order N-79-20, 2020, https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf.

[2]California Air Resources Board. Advanced Clean Fleets, 2020, https://ww2.arb.ca.gov/our-work/programs/advanced-clean-fleets.

[3]Bae, Y., Rindt, C. R., Mitra, S. K., and Ritchie, S. G. Fleet Operator Perspectives on Heavy-duty Vehicle Alternative Fueling Infrastructure. Transportation Research Record 2678, No. 1 (2024): 490-506, https://doi.org/10.1177/03611981231171150.

[4]U.S. Department of Energy, "Alternative Fuels and Advanced Vehicles," Alternative Fuels Data Center, 2024, https://www.afdc.energy.gov/fuels/.

[5]California Energy Commission. California Energy Commission Zero Emission Vehicle and Infrastructure Statistics, 2024, http://www.energy.ca.gov/zevstats.

Research presented in this policy brief was made possible through the Resilient and Innovative Mobility Initiative (RIMI) led by the UC Institute of Transportation Studies (UC ITS). RIMI is supported by the State of California through a one-time allocation in the 2021 State Budget Act. The UC ITS created RIMI as a living laboratory – bringing together university experts, policymakers, public agencies, industry stakeholders, and community leaders – to inform the state transportation system's immediate COVID-19 response and recovery needs, while establishing a long-term vision and pathway for directing innovative mobility to develop sustainable and resilient transportation in California. Established by the California Legislature in 1947, the UC ITS has branches at UC Berkeley, UC Davis, UC Irvine, and UCLA.

Project ID UC-ITS-RIMI-3E | DOI: 10.7922/G2PG1Q3R