

UC Davis

Policy Briefs

Title

Promoting Affordable Access to Zero Emission Trucks:A Total Cost of Ownership (TCO) Based Approach to a Zero Emission Truck Incentive Program

Permalink

<https://escholarship.org/uc/item/6zt5110c>

Authors

Dhole, Anuj

Fulton, Lewis

Hwang, Roland

et al.

Publication Date

2025-11-01

Promoting Affordable Access to Zero Emission Trucks

A Total Cost of Ownership (TCO) Based Approach to a Zero Emission Truck Incentive Program

Anuj Dhole, Lewis Fulton, Roland Hwang, Craig Segall*

Institute of Transportation Studies, University of California Davis

* Consultant, CS Consulting LLC

Abstract

Zero emission trucks are on the verge of rapid adoption in California due to strong regulatory and incentive support, but recent actions at the federal level threaten to stall progress. To achieve the next phase of widespread commercialization, California must take further action to ensure that ZETs are affordable, abundant, and accessible to all businesses. Continuation of purchase incentives is critical to the success of the ZET market, given the current high upfront purchase cost. ITS-Davis has analyzed the design of a zero-emission truck (ZET) incentive program that could help re-design or supplement the current Clean Truck and Bus Voucher Program (HVIP) and continue to provide certainty for fleet buyers to transition, given the recently withdrawn Advanced Clean Fleets (ACF) regulation for trucks and federal actions that could weaken or delay implementation of the Advanced Clean Truck (ACT) regulation. Our analysis shows that a 10-year time-limited incentive program designed to achieve the ACT sales targets would cost about \$4.34 billion^{1,2}. With long-term funding certainty and transparency on rebate levels, manufacturers that envisage a large volume ZET production would have a strong incentive to competitively price their trucks. California has already invested over \$6 billion in incentives for the ZET transition and with additional funding and policy support, could help ensure the state reaps the health and economic benefits of its past investments in the ZET transition.

Issue

Although diesel trucks account for only 6% of vehicles on the road in California, they contribute a disproportionate amount to air pollution (31% of nitrogen oxide, 55% of particulate matter pollution and 8.3% of GHG emissions). Fluctuating fuel costs associated with internal combustion trucks are also a continuing challenge to fleets and drivers. Ensuring access by businesses to ZETs will help modernize the state's centrally important freight and shipping industry and lower business costs over time, potentially improving affordability of goods throughout the system. Further, meeting the state's air quality and climate goals will require a suite of policies to accelerate the adoption of ZETs, including strong regulations and incentives. California's ACT regulation, currently facing federal rollback attempts, requires 75% of medium- and heavy-duty truck sales and 40% of heavy-duty tractor sales to be zero-emission by 2035.

Since ZETs are currently significantly more expensive to purchase than diesel equivalents, purchase incentives are critical to ensure the transition to ZETs, especially given the withdrawal of the ACF regulation, federal clean vehicle tax credits, and the uncertain funding of the current California ZET

¹ We recognize that additional programs or incentives may be required to ensure fleets switch to ZETs, such as greater pricing transparency, higher incentive levels, reductions in electricity prices (through Low Carbon Fuel Standard (LCFS) credits), and/or lower finance and insurance rates. For more details of our previous analysis, see [Dhole, A., Ramji, A., Fulton, L., Sperling, D., & Hwang, R. \(2025\). *Designing a Self-Financing Incentive Program for Zero-Emission Trucks in California: A Market-Based, Feebate-Inspired Policy Framework*.](#)

² We note that using innovative financing instruments, such as providing the incentives in the form of a loan from a revolving fund, would allow that state to recover funds over time.

rebate program (HVIP). The uncertainty in long-term funding for HVIP creates instability in the market as both fleets and manufacturers work toward meeting the original targets of the ACT.

Upfront incentives can address capital barriers for business and, combined with efforts to promote a well-functioning and transparent market, would stabilize and expand ZET access, achieving market shares consistent with state environmental, public health and economic goals. We note that other market enabling conditions must also be met, including sufficient charging infrastructure and electricity rates that provide fuel cost savings.

Proposal for a Total Cost of Ownership (TCO) Based Incentive Program

Incentives are important for improving the affordability of ZETs. A battery electric class 8 tractor, for example, currently costs two to three times the cost of a comparable diesel tractor. To re-design the HVIP or to inform a complementary program, ITS researchers propose a new approach by offering enough incentives to new trucks to ensure TCO parity with diesel trucks over a five-year ownership period. With ZETs, the higher upfront cost can be partially or fully offset by the operating cost savings from cheaper fueling and maintenance. This latest analysis builds on our previous work on a self-financing ZEV incentive program for California (aka feebate) where we set the incentive level at 80% of the estimated upfront purchase cost differential between a ZET and a diesel truck.³ As in the feebate study, the incentive levels would decline over time with ZET prices with higher truck volumes and technology maturity.

We designed a ten-year program from 2026 to 2035 with declining levels of rebates, but enough to ensure TCO parity for large fleets operating over 100 trucks. We find that such a program would cost about \$4.34 billion with \$2.24 billion required in the first five years (see Table 1).

Table 1. Total Program Costs (\$ million)

Segment	2026-30	2030-35	Total
Class 8 Heavy Duty Long Haul	\$1600	\$1900	\$3500
Class 8 Heavy Duty Short Haul	\$20	\$0	\$20
Class 4-6 Medium Duty Delivery	\$300	\$0	\$300
Class 4-6 Medium Duty Vocational	\$20	\$0	\$20
Class 8 Heavy Duty Vocational	\$300	\$200	\$500
Total	\$2240	\$2100	\$4340

The program could support up to 110,000 ZETs out of 240,000 required to achieve ACT targets through 2035, which is almost half of the ZETs receiving an incentive over the program period. The remaining 130,000 ZETs are likely to benefit from market scale. Three segments that may not require incentives by 2030 include medium-duty delivery, vocational and short-hauls. Class 8 long haul trucks is the only category that will likely require subsidies in 2035, but that level will be modest (about \$28,000) compared to today's HVIP incentive level offering of \$120,000.⁴

³ For this analysis, we assume all the ZETs are battery electric trucks. For more details of our previous analysis, see [Dhole, A., Ramji, A., Fulton, L., Sperling, D., & Hwang, R. \(2025\). *Designing a Self-Financing Incentive Program for Zero-Emission Trucks in California: A Market-Based, Feebate-Inspired Policy Framework*.](#)

⁴ We note that our cost projections could be conservative if the battery-electric truck (BET) market becomes truly competitive. Our bottom-up engineering cost estimates for a BET Class 8 long haul truck is about \$250K in 2035, while some BET manufacturers are reported to be meeting that target as early as 2026.

We view this incentive program as a key element in a potential portfolio of policies. In the absence of strong regulatory requirements, truck owners are likely to require a net TCO savings over the life of the vehicle to be willing to adopt ZETs. Options for providing even greater cost savings include increasing the purchase incentive levels, lowering the price of electricity (possibly by requiring at least a portion of the LCFS credit value be used to lower electricity prices), and lower financing and/or insurance rates.⁵ Other interventions could further support adoption – including pricing transparency and other market oversight policies that ensure competition on price and volume amongst manufacturers. State programs focused on supporting resale value (such as resale or insurance guarantees) could also make fleets more willing to invest in ZETs. Policies that create additional value for zero emissions good movements, such as Indirect Source Rules and Low Emission Zones, could also provide indirect savings, thus improving the TCO value proposition of ZETs.

California has long been a leader in structuring economic policies to support new technologies. Having helped bring ZETs to market, it can now model policy approaches that make them broadly affordable. Notably, the policy design proposed here could also be adopted by other states, further extending its value as a market-transformation program. There is a real opportunity to accelerate the affordability of ZETs which are likely to be the future backbone of a lower-pollution and lower-cost freight system.

More Information

This policy brief is drawn from a forthcoming report from the Institute of Transportation Studies, University of California Davis. For more information about the findings presented in this brief, contact Anuj Dhole at aadhole@ucdavis.edu.

⁵ Note that although we do not assume electricity price reductions due the LCFS, it is a critically important program for funding the capital costs of installing charging infrastructure. Requiring some of the LCFS value to be passed on to users could provide significant TCO benefits.