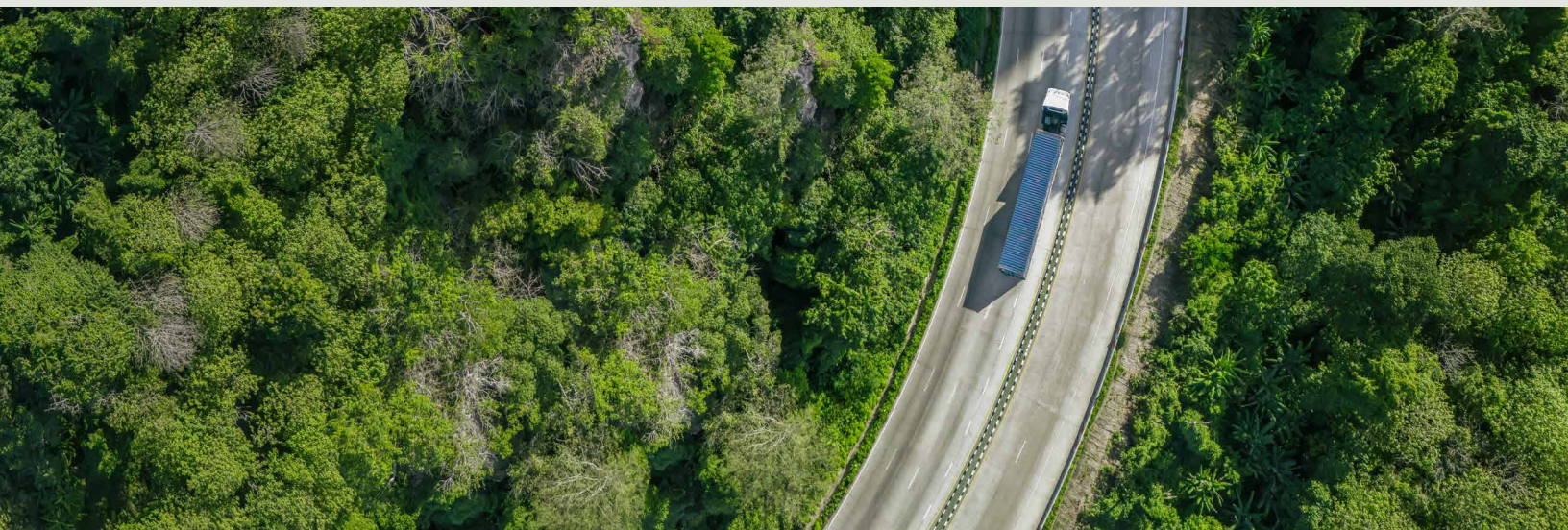




Transportation CARB Regulations and Zero-Emission Trucks: Implications for California Agriculture (Summary)

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This is a summary of *Transportation CARB Regulations and Zero-Emission Trucks: Implications for California Agriculture* by Chris Carr and Cyrus Ramezani.¹ This research and analysis received funding from USDA's Agricultural Marketing Service (AMS) through cooperative agreement number 24-TMTED-CA-0005. The opinions and conclusions expressed are the authors' and do not necessarily reflect the views of USDA or the Agricultural Marketing Service. The full report is available online at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=6952784.

WHAT IS THE ISSUE?

California's zero-emission vehicle (ZEV) mandates for commercial transportation present significant challenges for the State's containerized agricultural export sector. The California Air Resources Board (CARB) implemented three interconnected initiatives to phase out diesel trucks in favor of battery-electric and hydrogen fuel cell alternatives: the Advanced Clean Trucks (ACT) rule targeting manufacturers; the Advanced Clean Fleets (ACF) rule focusing on fleet operators; and the Clean Truck Partnership (CTP) fostering industry collaboration.

Although the regulatory landscape for ZEV mandates has become increasingly complex, California ports continue advancing ZEV initiatives through independent tariff authority and various incentive programs, maintaining momentum for ZEV adoption in drayage-logistics operations.²

These ZEV regulations fundamentally impact California's agricultural exporters, who rely on Class 8³ trucks to transport containerized commodities like almonds, walnuts, pistachios, and other high-value specialty crops from processing facilities to the Ports of Los Angeles, Long Beach, and Oakland. The agricultural sector faces unique challenges in ZEV adoption

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² For example, the San Pedro Bay Ports' Clean Truck Fund Rate program charges \$10 per loaded container for diesel trucks while exempting ZEV, creating ongoing economic incentives independent of Federal regulations.

³ Defined as having a gross Vehicle Weight Rating over 33,000 pounds.

because agricultural transportation involves longer distances (200-400 miles between the Central Valley and ports); heavier loads (40,000-44,000 pounds for export containers); and seasonal demand peaks during harvest compared to other industrial transport. In addition, agricultural producers face financial obstacles, operating on thin margins and competing in global commodity markets where they cannot easily pass along the costs of ZEV adoption to buyers.

The objective of this study is to better understand the impact of ZEV requirements on California's agricultural sector, particularly as related to containerized commodity exports. This study explores the various transportation and supply chain challenges faced by relevant stakeholder groups in complying with ZEV regulations and offers strategies and recommendations to mitigate adverse impacts from the adoption of ZEV technologies.

HOW WAS THE STUDY CONDUCTED?

This study was investigative and practical in nature, focusing on public information, records, data, reports, articles, websites, industry webinars and podcasts, and business-focused media platforms. This wide-ranging approach helped the authors understand the transportation and logistical challenges faced by relevant stakeholder groups, their issues of concern, and the obstacles they face in adopting ZEV technologies. The study also incorporated data from the authors' previous USDA-funded research on the agricultural export logistics system. Stakeholder groups included agricultural exporter-producers and their processors, trucking and drayage companies, technology companies serving agriculture, chassis providers, port officials, and others.

WHAT DID THE STUDY FIND?

Although CARB's regulations face Federal challenges, the ZEV transition in California continues to be driven by State, local, and market forces. California ports maintain significant autonomy through tariff authority and continue supporting clean truck development. The key findings are summarized below.

Higher Cost and Weight of ZEV Trucks Pose Challenges for Agricultural Exporters. Current ZEV Class 8 trucks cost two to three times more than diesel equivalents (over \$450,000 for electric, over \$550,000 for hydrogen versus \$160,000 for new diesel and \$60,000-\$70,000 for used diesel). Battery-electric trucks have limited range (150 to 160 miles), unsuitable for many agricultural routes. Hydrogen trucks offer better range (up to 500 miles) but face severe infrastructure constraints as few hydrogen fueling stations exist across the State. Because both ZEV technologies weigh approximately 10,000 pounds more than diesel trucks, agricultural exporters would need to reduce container payloads by approximately 6,000 pounds despite California's 2,000-pound weight exemption.⁴

ZEV Weight Limits Raise Transport Costs for Agricultural Exporters. The payload reduction effectively increases transportation costs by requiring additional ZEV trips to move the same amount of cargo that is now transported with fewer diesel trips. This lost payload significantly affects agricultural exporters who routinely ship dense commodities at maximum legal weight limits. The payload challenges are compounded by inadequate rural infrastructure, which offers limited charging capacity and minimal hydrogen fueling options in agricultural regions.

ZEV Technology Impacts Agricultural Exporters Disproportionately in the Near-Term. Agricultural exporters compete in global commodity markets where transportation cost increases cannot be easily passed on to buyers. For example, if a ZEV truck is used to move high-value nuts from field to processing plant and from processing plant to port, ZEV truck use may add at least 3 percent to the product cost. If loads must be reduced from 44,000 pounds to 38,000 pounds to observe maximum legal weight limits, then shipping costs could rise by 3.5 to 4-percent of the product price. However, this calculation does not account for ZEV range limitations: in cases where shippers must hire two different ZEV trucks—one to go 150 miles and another for the next 150 miles—these percentages could double.

⁴ A truck's payload capacity is the maximum amount of weight you can safely add to a truck's cargo area in addition to its empty weight.

Agricultural Exporters May Benefit from ZEV Technology Over Time. Despite near-term challenges, the study identifies potential competitive advantages for agricultural exporters as ZEV technology and infrastructure mature. Manufacturing cost projections suggest battery-electric trucks may achieve cost parity with diesel vehicles as soon as 2027-30. Moreover, early agricultural adopters could gain advantages in sustainability-conscious export markets, particularly premium segments in Europe.

WHAT DID THE STUDY RECOMMEND?

The research emphasizes the need for agriculture-specific incentive programs that recognize seasonal shipping patterns, rural locations, weight-sensitive economics, and global competition. Current programs designed for urban delivery operations poorly serve agricultural needs. The authors' recommendations include enhanced weight allowances, rural infrastructure development priorities, seasonal-use incentives, and charging networks that are specific to agricultural corridors. According to the authors, successful ZEV transition for California agriculture requires policies that acknowledge the sector's unique operational realities, while supporting competitiveness in global markets as the technology transitions.

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