icct

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Re: Comments to ZEV Forward Dialogue Sessions

The International Council on Clean Transportation (ICCT) respectfully submits these comments to the California Air Resources Board's (CARB) ZEV Forward Public Dialogue Sessions.

The ICCT was established in 2001 as an independent source to provide unbiased research and technical and policy expertise for motor vehicle regulators working to improve the environmental performance and energy efficiency of road, marine, and air transportation, in order to benefit public health and mitigate climate change. Our work supports the development and implementation of advanced regulatory and non-regulatory policies in the world's largest markets to overcome consumer barriers to zero-emission vehicles and advance progress on light-duty zero-emission vehicle adoption.

The ICCT commends the California Air Resources Board (CARB) on its continuing effort to reduce passenger vehicle emissions and to support the state's growing zero-emission vehicle (ZEV) market. We welcome the opportunity to provide comments to CARB's ZEV Forward Public Dialogue Sessions on potential measures to support increased zero emission vehicle adoption in California. ICCT has compiled suggestions to advance zero-emission vehicles, drawing from our international experience and research in major vehicle markets around the world. These comments summarize for CARB the ideas we suggest be considered in their response to the Governor.

We would be glad to clarify or elaborate on any points made in the comments. CARB staff can feel free to contact our U.S. Passenger Vehicle Program Lead, Pete Slowik (peter.slowik@theicct.org) with any questions.

Sincerely,

Stephanie Searle, PhD
Chief Progam Officer
International Council on Clean Transportation

OVERVIEW OF FACTORS ENABLING WIDESPREAD ZEVs

ICCT research shows that the markets with the greatest ZEV success tend to have the strongest and most comprehensive policy packages in place to actively overcome prevailing consumer barriers to adoption.[1] Key factors enabling the widespread transition to ZEVs include widespread model availability, upfront and total cost of ownership affordability, convenient and prevalent recharging infrastructure, and strong consumer awareness and education. Various policies work to enable these conditions. For example, ZEV regulations and emission standards drive advanced technology vehicles to market and increase ZEV supply. Consumer fiscal incentives such as purchase subsidies, income tax credits, or vehicle tax reductions improve ZEVs' economics and increase consumer savings relative to driving on gasoline. Charging infrastructure policies such as funding allocation, direct deployment, incentives, streamlined permitting, and EV-ready building codes that expand charging deployment at homes, workplaces, and public locations maximize convenience and expand electric vehicle range and functionality. Consumer awareness programs such as outreach and education campaigns, automaker advertising and point of sale information, ride-and-drive events, and consumer-friendly informational materials increase consumer familiarity, exposure, and understanding of the benefits of electric vehicles.

Several additional actions incentivize electric vehicle adoption and simultaneously increase consumer awareness such as preferential access to high-occupancy vehicle (HOV), preferred access in urban areas, preferred parking, reduced toll fees, and zero-emission zones where polluting vehicles are barred from entering the area or must pay an access charge, making zero-emission vehicles more attractive. In parallel, industrial policies support the development of zero-emission vehicle supply chains and economic development. Because most electric vehicles are manufactured in the same region in which they are sold, markets that incentivize and promote electric vehicle uptake and electric vehicle production simultaneously could see a rise in electric vehicle sales and the corresponding economic and job benefits.[2]

Executive Order N-27-25 in California directs state agencies to assess additional actions to advance progress on ZEV adoption in California, who seek public input on opportunities to support increased ZEV adoption in the state.[3] ICCT has identified several specific actions to advance zero emission light-duty vehicles in California, which are discussed below.

SUGGESTED ACTIONS TO ADVANCE ZERO EMISSION LIGHT-DUTY VEHICLES

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1 Slowik, P., Hall, D., Lutsey, N., Nicholas, M., and Wappelhorst, S. (2019). Funding the transition to all zero-emission vehicles. *International Council on Clean Transportation*. https://theicct.org/publication/funding-the-transition-to-all-zero-emission-vehicles/; Also see Hall, D., Xie, Y., Minjares, R., Lutsey, N., and Kodjak, D. (2021). Decarbonizing road transport by 2050. Effective policies to accelerate the transition to zero-emission vehicles. *International Council on Clean Transportation.* https://theicct.org/publication/zevtc-effective-policies-dec2021/

2 Bui, A., Slowik, P., and Lutsey, N. (2021). Power play: evaluating the U.S. position in the global electric vehicle transition. *International Council on Clean Transportation.* https://theicct.org/publication/power-play-evaluating-the-u-s-position-in-the-global-electric-vehicle-transition/ and Bui, A., Pierce, L., Slowik, P., Searle, S., Orvis, R. (2025). *International Council on Clean Transportation* and *Energy Innovation.* https://theicct.org/publication/how-the-ira-is-driving-us-job-growth-across-the-electric-vehicle-industry-apr25/

3 Executive Department State of California (2025). Executive Order N-27-25. https://www.gov.ca.gov/2025/06/12/governor-newsom-signs-executive-order-doubling-down-on-states-commitment-to-clean-cars-and-trucks-kickstarts-next-phase-of-leadership/

Develop a revenue-neutral and self-funding Clean Vehicle Purchase Incentive Program for new ZEVs

Fiscal policies are particularly effective at driving increased ZEV sales, and they are most effective when they are immediately available to the consumer at the point of purchase rather than collected at some later date.[4] In 2024 the ICCT explored the evolution and future direction of financial incentive programs to promote ZEV adoption and suggested adjustments to reflect the maturing ZEV market.[5] Integrating polluter-pay principles enables ZEV incentives to be managed in a fiscally neutral way while discouraging purchases of inefficient, polluting vehicles. A new polluter-pay Clean Vehicle Purchase Incentive Program in California that applies a new separate bonus or rebate for ZEVs (i.e., battery-electric or fuel-cell electric) and a malus or fee for vehicles that emit tailpipe pollution at the point of sale would be particularly effective at accelerating ZEV purchases and discouraging purchases vehicles with tailpipe pollution.

Such programs, sometimes called "bonus-malus" or "feebates," can be designed to be financially self-sustaining, with no net impact on public finance, or it could be designed to be revenue-generating with the funds used for other complementary measures (e.g., charging infrastructure). A 2022 ICCT blog discussed the effectiveness of such 'feebate' programs and the opportunity for governments to spur the transition to ZEVs while disincentivizing the purchase of vehicles that pollute the most, and summarized examples of feebate programs in France, Singapore, Sweden, and New Zealand with details about their program design and impact on EV sales.[6] These programs typically levy a fee on the purchase of vehicles with high carbon dioxide (CO_2) emissions and use the revenues to incentivize the purchase of vehicles with zero or low CO_2 emission in the form of a rebate. The program can be a restructure of existing tax or fee, such as the sales tax or registration in California, or an introduction of new tax/fee item. Alternatively, a new bonus-malus program could be based on criteria pollutants rather than CO_2 emissions. Another ICCT blog illustrated how such "polluter-pay" policies with polluting vehicle fees and ZEV incentives could apply to a hypothetical group of vehicles and summarized the benefits of doing so in California.[7] The ICCT hosts a customizable excel-based feebate simulation tool on its website and has published research on best practices for feebate program design and implementation.[8]

ICCT identified that a properly constructed feebate system has several important features: 1) it creates a continuous incentive for vehicle manufacturers to improve the environmental performance of their vehicles, 2) it incorporates environmental performance into consumer decision making and rewards the consumer in a tangible, immediate way for improved environmental performance, 3) it establishes a known, certain price for any future improvement in environmental performance, enabling manufacturers to accurately estimate the benefit of

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4 Yang, Z., Slowik, P., Lutsey, N., and Searle, S. (2016). Principles for effective electric vehicle incentive design. *International Council on Clean Transportation.* https://theicct.org/publication/principles-for-effective-electric-vehicle-incentive-design/

5 Tankou, A., Hall, D., and Slowik, P. (2024). Adapting zero-emission vehicle incentives for a mainstream market. *International Council on Clean Transportation.* https://theicct.org/publication/izeva-adapting-zev-incentives-for-a-mainstream-market-april24/

6 Wappelhorst, S. (2022). Incentivizing zero- and low-emission vehicles: the magic of feebate programs. *International Council on Clean Transportation.* https://theicct.org/magic-of-feebate-programs-jun22/

7 Minjares, R. (2025). A clean commercial vehicle sales incentive that costs nothing. *International Council on Clean Transportation.* https://theicct.org/a-clean-commercial-vehicle-sales-incentive-that-costs-nothing-jul25/

8 Feebate simulation tool. *International Council on Clean Transportation*. https://theicct.org/tools-feebate-simulation/ and German, J., and Meszler, D. (2010). Best practices for feebate program design and implementation. *International Council on Clean Transportation.* https://theicct.org/publication/best-practices-for-feebate-program-design-and-implementation/

developing and offering advanced technologies, 4) it sets a benchmark or "pivot point" so as to balance revenues and fees, and revisits and potentially adjusts the pivot point along with fee/rebate rate periodically to reflect changing conditions and ensure long-term program effectiveness, sustainability and fiscal durability.[9]

Fee and rebate amounts would ideally vary continuously with vehicle performance, increasing as vehicles move away from the pivot point. ICCT research shows that fees and rebate amounts that are set according to a stepwise schedule are less effective than a continuous linear or progressive curve. For fee and rebate amounts that are set according to a stepwise schedule, there is no incentive to improve the performance of vehicles that are not close to the next step, and it is more challenging to maintain a neutral budget due to automakers manufacturing vehicles with environmental performance just below the step function. This situation occurred in France, which previously used step functions to set levels of fees and rebates, and manufacturers quickly learned that they could greatly increase rebates by designing vehicles to register emission levels during the type-approval tests that were just below the step function cut points, leading to rapid increase in the rebates paid by France for relatively small emission changes. France addressed these issues by making annual adjustments to maintain a balance between fees collected and rebates paid, by reducing the size of the steps, and eventually changing from a stepwise function to a continuous function to minimize gaming and improve program effectiveness.[10]

Depending on state goals and priorities, California could also set the pivot point at 1 gram/mile so that only new ZEVs receive a rebate and non-ZEVs pay an additional fee. This would send more clear message to consumers and be particularly effective at encouraging ZEV purchases and discouraging combustion vehicle purchases.

The collection of fees and granting of rebates can be done at the consumer or at the manufacturer level. Previous ICCT research discussed key considerations and tradeoffs of administrating feebates at the consumer vs. manufacturer level.[11] For example, consumer-based programs potentially have more impact on consumer purchase price, although they have large administrative costs, as money would need to be exchanged for more than a million new light-duty vehicle sales in California each year. Consumer based programs could also potentially face opposition from dealerships due to administrative burden and potential liability. Administrating feebates at the manufacturer level can largely eliminate administrative costs and dealer opposition, as the manufacturer would pay fees and collect rebates for each vehicle, which could be accumulated and settled on a quarterly or annual basis. Administrating a feebate program at the manufacturer level could possibly reduce the impact on consumer purchase decisions, but this could be minimized by requiring the amount of the fee or rebate to be included in with the vehicle pricing information to ensure consumers know the amount of fee or rebate without imposing administrative burdens on customers, dealers, and government agencies.

Coupling a new polluter-pay clean vehicle purchase incentive program with a voluntary standard for compliance with the Advanced Clean Cars II regulatory requirements would bring additional

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9 IBID.

10 Yang, Z. (2018). Practical lessons in vehicle efficiency policy: the 10-year evolution of France's CO_2-based bonus-malus (feebate) system. *International Council on Clean Transportation.* https://theicct.org/practical-lessons-in-vehicle-efficiency-policy-the-10-year-evolution-of-frances-co2-based-bonus-malus-feebate-system/

11 German, J., and Meszler, D. (2010). Best practices for feebate program design and implementation. *International Council on Clean Transportation.* https://theicct.org/publication/best-practices-for-feebate-program-design-and-implementation/

benefits. Section 3. b. of Executive Order N-27-25 directs any state agencies implementing incentive programs that support the purchase of zero-emission vehicles to prioritize funding for the listed manufacturers and fleets that are continuing to certify and follow the requirements of the Advanced Clean Cars II regulation, regardless of the status of those regulations under federal law. Coupling purchase incentive eligibility with a voluntary standard for ACC II compliance would ensure that the ZEV models eligible for incentives are those manufactured by automakers that are meeting the overall fleetwide emissions and certification requirements of the LEV and ZEV programs under ACC II. Without coupling new clean vehicle incentive programs with a voluntary standard for ACC II compliance, there is risk that new ZEV incentives are granted to models manufactured by automakers with fleet average emission levels far greater than what the ACC II regulation requires. California could also restrict models from incentives for companies that do not publicly acknowledge the state's legal authority to set its own emissions standards under Section 209 of the Clean Air Act. The state already has similar fleet purchasing restrictions for its state agencies.[12]

Several additional incentive design principles could be considered when developing a new polluter-pay purchase incentive. Several governments including California have implemented criteria upon which eligibility for ZEV incentive programs have been restricted, or where ZEV incentive values have been increased. Examples include eligibility restrictions for ZEV models with high Manufacturer Suggested Retail Price (MSRP), restrictions for consumers with high Adjusted Gross Incomes (AGI), or increased incentives for low- and moderate-income households.[13] If a new feebate program is administered at the manufacturer level, California could consider allowing "pre-approval" of rebates to enable expedited receipt of increased incentives at the point of sale, based on income or other criteria. Depending on state goals and priorities, California could develop a smaller, narrower polluter-pay program that limits new ZEV bonuses to low- and moderate-income consumers and limit new polluting vehicle maluses to luxury or highly polluting vehicles.

An alternative to a new polluter-pay Clean Vehicle Purchase Incentive Program would be to reinstate California's previous Clean Vehicle Rebate Project (CVRP). While new polluter-pay policies have several benefits compared to traditional rebate programs (polluter-pay policies can be revenue-neutral or revenue-generating and simultaneously disincentivize polluting vehicles), reinstating the CVRP is an alternative measure that could improve ZEV affordability and support market growth across the state. CVRP stopped accepting new applications in 2023 due to funding shortages, and funding remains a key challenge as annual ZEV volumes increase. If traditional rebate programs are pursued instead of a new polluter-pay program, the state could seek renewed and increased funding from the California Climate Investments, General Fund, and Air Quality Improvement Programs or develop new funding sources. In Colorado, a Community Access Enterprise was created in 2021 to fund electric vehicle and infrastructure projects, with revenues expected to be over $300 million over its first decade and largely generated from per-trip retail delivery fees.[14]

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[12] California Department of General Services. Vehicle manufacturer purchasing restrictions. Accessed July 16, 2025, https://www.dgs.ca.gov/OFAM/Resources/Page-Content/Office-of-Fleet-and-Asset-Management-Resources-List-Folder/Vehicle-Manufacturer-Purchasing-Restrictions

[13] See for example: Slowik, P., Hall, D., Lutsey, N., Nicholas, M., and Wappelhorst, S. (2019). Funding the transition to all zero-emission vehicles. *International Council on Clean Transportation*. https://theicct.org/publication/funding-the-transition-to-all-zero-emission-vehicles/

[14] Colorado Energy Office (2025). Colorado's Community Access Enterprise. https://energyoffice.colorado.gov/about-us/boards-commissions/community-access-enterprise

Eliminate annual ZEV registration fees and explore potential for increased preferential ZEV access, preferential pricing, and zero-emission areas

In addition to standard registration fees, ZEV owners in California pay an annual Road Improvement Fee which was $118 in 2025. To improve ZEV affordability and avoid disincentivizing ZEV ownership, the state could eliminate the annual ZEV Road Improvement Fee and also reduce the standard registration fees for ZEVs.

Preferential ZEV access, reduced fees on toll roads or bridges, and zero-emission areas promote ZEV uptake by providing additional perks for consumer use. Research has shown that California's Clean Air Vehicle Decals program for ZEV HOV Lane access was a key motivating factor for ZEV purchases in the early market.[15] New access-based perks for ZEVs and restrictions for polluting vehicles can be a powerful motivator for consumer ZEV uptake. California could take inventory of state-infrastructure, including but not limited to HOV lanes, toll roads, toll bridges, parking spaces, state buildings, state parks, and other state-owned areas and consider opportunities for preferential ZEV access, reduced fees, or limiting access for polluting vehicles.

As of April 2025, there were more than 25 cities across Europe and China with implemented and planned zero-emission zones or near-zero-emission zones.[16] Emerging evidence indicates that zero emission vehicle zones are effective at driving ZEV uptake in Europe. In the Netherlands, where 15 cities have zero-emission zones in effect as of January 2025 and ZEVs are exempt from registration tax, shares of medium electric trucks skyrocketed from 10% in 2024 to 80% in the first quarter of 2025.[17]

New zero-emission areas or low-emission zones could be developed in select areas across the state; restrictions could be based on vehicle size, weight, or criteria pollutants at the tailpipe. At the same time, state agencies could provide recommendations for cities to develop, implement, and enforce their own local zero-emission areas or low-emission zones. ICCT research in 2023 provided recommendations for planning and implementing low- and zero-emission zones in cities.[18] As one example, in France, local-level emissions-related vehicle restrictions in Paris are enforced by the use of Crit'Air air quality rating stickers, a national-level program.[19] The French Crit'Air system is one potential model for how California could establish a framework that displays emissions levels on all vehicles operating in the state while providing cities with flexibility on implementation and enforcement.

Fill gaps in charging infrastructure deployment

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[15] Bui, A., Slowik, P., and Lutsey, N. (2021). Evaluating electric vehicle market growth across U.S. cities. *International Council on Clean Transportation.* https://theicct.org/publication/evaluating-electric-vehicle-market-growth-across-u-s-cities/ and Tal, G., and Nicholas, M. (2014). Exploring the impact of high occupancy vehicle (HOV) lane access on plug-in vehicle sales and usage in California. *University of California, Davis*. Research report – UCD-ITS-RR-14-16. https://itspubs.ucdavis.edu/download_pdf.php?id=2355

[16] ICCT (2025). Zero-emission vehicle phase-ins: zero-emission zones (April 2025). https://theicct.org/zero-emission-vehicle-phase-ins-zero-emission-zones-april-2025/

[17] See for example, Mulholland, E. (2025). European heavy duty vehicle market development quarterly (January – March 2025). *International Council on Clean* Transportation. https://theicct.org/publication/eu-hdv-market-development-quarterly-jan-mar-2025-may25/ and Mulholland, E. LinkedIn post. June 2025. https://www.linkedin.com/feed/update/urn:li:activity:7341364612354736130/

[18] Kok, Irem. (2023). Planning and implementation of low- and zero-emission zones in cities. *International Council on Clean Transportation*. https://theicct.org/publication/planning-and-implementation-lezs-zezs-in-cities-sept23/

[19] The Crit'Air anti-pollution vehicle sticker. (2025). https://www.france.fr/en/article/crit-air-anti-pollution-vehicle-sticker/

Numerous studies find a clear statistical link between charging infrastructure deployment and ZEV uptake, and data show that charging infrastructure and ZEV deployment have grown in unison.[20] A 2022 ZEV Transition Council study quantified future charging needs to support electric vehicle market growth in California and discussed the policies that could accelerate its deployment.[21] The analysis identified a need for about 5 million home charge points for light-duty electrification in 2030, including about 500,000 home chargers in apartments, and about 400,000 public charge points. To provide context to these 2030 charging needs, as of August 2024 there were about 84,000 public chargers deployed across the state.[22] Continuing to expand public and residential charging deployment will be key to supporting continued ZEV market growth. Much of the additional charging needs will be filled by private sector investments that have been announced or are already underway.[23] These private sector investments are most likely to be made in the areas with the strongest business case and highest projected utilization, which are generally areas with high EV penetration. The state could complement these investments with direct deployment, incentives, or allocating additional funding for deployment in areas that may experience relatively lower utilization to ensure basic geographic coverage of both DC fast and Level 2 charging infrastructure across the entire state. This could include expanding or providing additional funding to programs such as the California Electric Vehicle Infrastructure Project (CALeVIP), the Fast Charge California Project, the Clean Transportation Program, the Rural Electric Vehicle Charging 2.0 (REV 2.0) program, and others.

To further expand publicly accessible electric vehicle charging infrastructure, California could consider modifying the CALGreen building standards code for commercial buildings. The codes require a percentage of parking spaces to be "EV capable" and "EV ready" and allows DC fast chargers to replace Level 2 chargers to meet the overall requirements. DC fast chargers are more commonly deployed at many commercial locations as a result. Faster charging at commercial areas is important for shoppers to get a quick charge but suboptimal for the employees in these business areas who would benefit from relatively more affordable and slower Level 2 chargers. The charging ecosystem in commercial areas would ideally include a mix of Level 2 chargers for employees and DC fast charging for customers, given their unique needs. To promote a healthy mix of Level 2 and DC fast chargers in these areas, the state could consider amending the CALGreen code to make sure the employees in these areas have a Level 2 "workplace" charging option at dedicated employee parking.

Supporting greatly expanded and accelerated infrastructure deployment at residential locations is also important to continued electric vehicle market growth. The convenience and affordability of charging at home is a key factor in driving electric vehicle adoption. To maximize this opportunity and bring home charging to more prospective electric vehicle drivers in California, the state could develop and implement new home charging programs such as dedicated funding, rebates, tax incentives, or other fiscal measures to increase the number of home chargers deployed across the state.

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[20] Hall, D., Xie, Y., Minjares, R., Lutsey, N., and Kodjak, D. (2021). Decarbonizing road transport by 2050. Effective policies to accelerate the transition to zero-emission vehicles. *International Council on Clean Transportation.* *https://theicct.org/publication/zevtc-effective-policies-dec2021/*

[21] Bernard, M R., Kok, R., Dallmann, T., and Ragon, P-L. (2022). Deploying charging infrastructure to support an accelerated transition to zero-emission vehicles. *International Council on Clean Transportation.* https://theicct.org/publication/deploying-charging-infrastructure-zevtc-sep22/

[22] California Energy Commission (2025). Electric vehicle chargers in California. https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics-collection/electric

[23] Pierce, L., and Slowik, P. (2024). Assessment of U.S. electric vehicle charging needs and announced deployment through 2032. *International Council on Clean Transportation.* https://theicct.org/publication/assessment-of-us-ev-charging-needs-and-announced-deployment-through-2032-mar24

For electric vehicles adoption to reach the majority market and beyond, greatly increased charging access at multifamily homes is important. Multifamily charging has its own set of barriers and challenges and requires unique solutions.[24] To expand access for these consumers, California could expand upon and provide additional funding to programs that specifically target multi-family homes and other community charging in residential areas, including the Reliable, Equitable, and Accessible Charging for Multi-family Housing (REACH) and Communities in Charge programs. At the same time, the state could also begin exploring the opportunity to expand residential curbside charging, which could include cableless charging and the "bring your own cord" model which is popular in Europe, directing collaboration amongst stakeholders, and other actions to break down regulatory barriers preventing expanded curbside charging in California cities. California's "right to charge" law Civil Code section 1947.6 requires landlords to approve tenant requests to install charging in their parking spaces provided the tenants pay for all costs incurred. To increase tenant participation and tenant-led charging installation at rental properties across the state, California could expand on existing programs or develop new programs that allocate funding, rebates, or other financial incentives to renters to offset some or all of the costs associated with charging installation. Doing so would support expanded residential charging at rental properties while minimizing the financial burden on tenants and landlords alike.

Support continued ZEV and battery-sector industrial development in California

Industrial policies are important to bolstering electric vehicle supply chains and economic development. Data show that most electric vehicles are manufactured in the same region in which they are sold.[25] Markets that incentivize electric vehicle uptake and domestic electric vehicle and battery production could see a rise in auto market dominance with corresponding economic and job benefits. The electric vehicle transition could create hundreds of thousands of new jobs in the United States.[26] ICCT has published several studies quantifying job impacts of the electric vehicle transition. Our charging infrastructure analysis found that growth in U.S. charging infrastructure can create 160,000 jobs by 2032.[27] Our battery manufacturing analysis found that growth in U.S. battery production can create up to 125,000 jobs by 2032.[28] Our analysis of IRA repeal found that repealing the IRA would slow U.S. EV sales and

[24] Pierce, L., and Bui, A. (2024). Electric vehicle charging at multifamily homes in the United States: barriers, solutions, and selected equity considerations. *International Council on Clean Transportation.* https://theicct.org/publication/promoting-equity-ev-transition-barriers-and-solutions-to-charging-at-multi-family-homes-us-apr24/

[25] Bui, A., Slowik, P., and Lutsey, N. (2021). Power play: evaluating the U.S. position in the global electric vehicle transition. *International Council on Clean Transportation*. https://theicct.org/publication/power-play-evaluating-the-u-s-position-in-the-global-electric-vehicle-transition/

[26] Pierce, L., and Callahan, J. (2025). Electric vehicles could create hundreds of thousands of new American jobs – if policies hold. *International Council on Clean Transportation.* https://theicct.org/evs-could-create-hundreds-of-thousands-of-jobs-in-the-us-if-policies-hold-mar25/; Isenstadt, A., and Slowik, P. (2023). Two reasons the EV transition could mean more U.S. manufacturing jobs: vertical integration and onshoring. *International Council on Clean Transportation.* https://theicct.org/two-reasons-the-ev-transition-could-mean-more-us-manufacturing-jobs-dec23/

[27] Bui, A., Pierce, L., Ragon, P-L., Sen, A., Slowik, P. and Waites, T. (2024). Charging up America: the growth of United States electric vehicle charging infrastructure jobs. *ICCT and IBEW*. https://theicct.org/publication/us-ev-charging-infrastructure-jobs-jan24/

[28] Bui, A., and Slowik, P. (2025). Powering the future: assessment of U.S. light-duty vehicle battery manufacturing jobs by 2032. *International Council on Clean Transportation.* https://theicct.org/publication/us-ldv-battery-manufacturing-jobs-by-2032-jan24/

manufacturing activity and lead to a loss of 130,000 direct jobs across vehicles, batteries, and charging infrastructure sectors and potentially 310,000 indirect jobs in other sectors.[29]

Most of the jobs are located in the states that already have well-established light-duty vehicle manufacturing industries and battery production facilities, and where significant supply chain investments have been announced. California was identified as the 5th most impacted state in our study in terms of jobs lost from IRA repeal, with about 10,000 lost jobs across vehicle and parts manufacturing, battery production, and charging infrastructure. There would be additional job impacts in battery material mining or refining.[30] To support continued ZEV and battery sector industrial development in California, the state could consider new subsidies, tax incentives, low interest loans, dedicated funding for job training and workforce development programs, or consider introducing mandatory recovery rates and recycled content targets for electric vehicle batteries.[31]

The growing demand for jobs in the ZEV industry indicate the need for strategies to ensure an adequate and steady supply of workers for these jobs and that those workers are equipped with the proper skills and training. At the same time, workforce development and job training programs can help vest communities and individuals in California's ZEV transition and the associated economic benefits. The California Energy Commission has already published a funding Roadmap for ZEV workforce training and development and identified several high-, medium-, and low-priority strategies and programs to advance workforce training and development across the state.[32] Delivering and expanding on these actions in the Roadmap with increased resources and funding will maximize the benefits of its implementation.

Expand funding and reach of key consumer outreach and education program Veloz

Continued and expanded consumer outreach and education campaigns are important to increasing awareness and familiarity with electric vehicles and counter anti-EV misinformation. The ICCT's "Clearing the Air: Understanding the EV Advantage" series provides clear, factual information to stakeholders to better explain the many benefits of driving electric.[33] To greatly increase consumer awareness, California could build on the success of Veloz with expanded funding and membership and conduct widescale ZEV outreach and campaigns to the general public and tailored messages to selected target audiences. Additional funding for Veloz could come from expanded membership, increased annual dues for membership, or continued funding from GO-Biz and other funding partners.[34] This could include greatly expanded membership and participation amongst California dealerships. Expanding outreach and awareness efforts at the local level with more programs that educate, engage, and motivate

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29 Bui, A., Pierce, L., Slowik, P., Searle, S., and Orvis, R. (2025). How the inflation reduction act is driving U.S. job growth across the electric vehicle industry. *ICCT and Energy Innovation.* https://theicct.org/publication/how-the-ira-is-driving-US-job-growth-across-the-electric-vehicle-industry-apr25/

30 Pierce, L., and Callahan, J. (2025). Electric vehicles could create hundreds of thousands of new American jobs – if policies hold. *International Council on Clean Transportation.* https://theicct.org/evs-could-create-hundreds-of-thousands-of-jobs-in-the-us-if-policies-hold-mar25/

31 Tankou, A., Bieker, G., and Hall, D. (2023). Scaling up reuse and recycling of electric vehicle batteries: assessing challenges and policy approaches. *International Council on Clean Transportation*. https://theicct.org/publication/recycling-electric-vehicle-batteries-feb-23/

32 California Energy Commission. (2025). Zero-emission vehicle workforce training and development strategy, a roadmap for clean transportation program funding. https://www.energy.ca.gov/publications/2024/zero-emission-vehicle-workforce-training-and-development-strategy-roadmap-clean

33 ICCT. (2025). Clearing the air: Understanding the EV advantage. https://theicct.org/clearing-the-air-series-understanding-the-ev-advantage/

34 Veloz. (2025). Funding partners. https://www.veloz.org/funding-partners/

dealerships and their salespeople to become EV champions would improve the consumer experiences at the point-of-sale and facilitate sales of electric vehicles.[35]

Consider modifying Clean Miles Standard Regulatory Fee to expand on Driver Assistance Program for accelerated ZEV adoption

Accelerating ZEV adoption in ride-hailing fleets is important as the reach and use of ride-hailing continues to expand. Electrifying more ride-hailing vehicles can directly reduce their environmental externalities while expanding awareness, understanding, and exposure to electric vehicles among riders. In 2025 the California Public Utilities Commission finalized a $0.09 per trip Clean Miles Standard Regulatory fee on all transportation network company (TNC) (e.g., Uber, Lyft) trips, with the revenues going to a new Driver Assistance Program to provide incentives for eligible low- and moderate-income TNC drivers to transition to ZEVs.[36] Based on various eligibility restrictions including income and number of trips, it was estimated that about 0.66% of drivers could access the upfront ZEV incentive. By increasing the per-trip fees on polluting vehicles, the program budget could increase and the number of drivers that could be eligible for ZEV purchase incentives could also increase. Several U.S. states and cities already levy taxes or fees on ride-hailing that are substantially greater than the $0.09 per trip Clean Miles Standard Regulatory fee in California.[37] Increasing fees for polluting vehicles to expand the Driver Assistance Program budget and the number of drivers eligible for upfront incentives would accelerate ZEV adoption within TNC operations, their electric vehicle-miles-traveled (eVMT), and the number of passengers and passenger-miles in electric vehicles.

Options to Increase Support for Electrification in the Low-Carbon Fuel Standard

The Low Carbon Fuel Standard supports both vehicle electrification and the use of alternative fuels in internal combustion engine (ICE) vehicles. However, since 2022, an oversupply of LCFS credits has lowered prices, reducing the value of EV charging and charging capacity credits, and limiting accrual of revenues for EV rebates.[38] Revisions to the LCFS could increase support for ZEVs while simultaneously addressing concerns about the program's overall cost.

Below, we offer for CARB's consideration ideas for modifications to the LCFS that could address these issues.

LCFS EV charging sub-target

To enhance LCFS support for ZEVs, CARB could consider implementing an EV charging sub-target within the existing standard. While implementing sub-targets within a GHG intensity standard like the LCFS may sound complicated, such a system has been implemented for

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[35] Jin, L., and Slowik, P. (2017). Literature review of electric vehicle consumer awareness and outreach. *International Council on Clean Transportation.* https://theicct.org/publication/literature-review-of-electric-vehicle-consumer-awareness-and-outreach/

[36] California Public Utilities Commission. (2025). Resolution approving Lyft, Inc.'s interim greenhouse gas emissions reduction plan submitted as Lyft advice Letter 22. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M559/K807/559807041.PDF

[37] Slowik, P., Wappelhorst, S., and Lutsey, N. (2019). How can taxes and fees on ride-hailing fleets steer them to electrify? *International Council on Clean Transportation*. https://theicct.org/publication/how-can-taxes-and-fees-on-ride-hailing-fleets-steer-them-to-electrify/

[38] Southern California Edison. 2023 Clean fuel reward annual report. https://cleanfuelreward.com/2023_CCFR_Annual_Report_Public.pdf

years in Germany's GHG Mitigation Quota,[39] which has a similar structure to the LCFS. In that system, the German government has implemented a GHG intensity standard with caps for specific compliance options (such as crop-based fuels) as well as sub-targets for specific pathways such as advanced biofuels and for synthetic e-fuels.[40] In Germany's system, electricity is treated as an uncapped compliance pathway, whose credits generally trade at a higher price than capped pathways.[41]

Under this arrangement, a portion of a fuel supplier's credit purchase obligation could be met only with ZEV charging and infrastructure credits. These credits would be tracked and traded separately from the overall LCFS market, necessitating a separate market price and credit category. The share of credits required by the sub-target could be set based on EV sales targets, estimated projected EV energy demand, and projected electricity grid average GHG intensity, ensuring that the market is not over-supplied and LCFS support for EVs is aligned with statewide goals. This sub-target could be adjusted based on the performance of the EV market in California, allowing for implementation flexibility.

Under-compliance with the EV charging sub-target could be resolved via the existing Credit Clearance Market mechanism in the LCFS. Under this mechanism advanced credits are issued to eligible large investor-owned utilities and large publicly owned utilities that opt into the LCFS and are eligible to receive base credits. If there is a shortfall of EV charging credits on the market, advanced credits would therefore be pledged for sale at the maximum LCFS price. To further support light-duty ZEV adoption, revenues from these sales could be designated for light-duty ZEV rebates. Eligibility criteria for ZEV purchases with high Manufacturer Suggested Retail Price (MSRP), restrictions for consumers with high Adjusted Gross Incomes (AGI), or increased incentives for low- and moderate-income households, as discussed more broadly for ZEV incentives above, could also be considered.

Program cost stabilization

Under the 2024 LCFS revisions the number of deficits generated by each gallon of conventional gasoline and diesel increase significantly as time goes on; the pace of this increase can surge if the auto-acceleration mechanism is triggered. In a scenario where credit-values increase beyond $100 per ton, the impact on fuel costs could greatly increase the policy's price impact on consumers who have not yet transitioned to a ZEV. However, with support for ZEVs secured by an EV-charging sub-target, cost containment measures could be considered to ensure that overall LCFS costs remain manageable. For example, an EV sub-target could be implemented with a baseline of 13 Million tonnes CO_2e for 2026; this would comprise approximately 37% of the projected 2026 LCFS deficits.[42] By setting a more stringent EV charging sub-target, the market could be tighter for electrification, but softer in the outside credit market; this would partially insulate EV credits from price volatility in the broader market attributable to the remaining pool of LCFS pathways.

[39] https://www.zoll.de/DE/Fachthemen/Steuern/Verbrauchsteuern/Treibhausgasquote-THG-Quote/Allgemeine-Informationen/allgemeine-informationen_node.html

[40] Liepold, C., Fabianek, P. & Madlener, R. Tradable performance standards for a greener transportation sector: an economists' appraisal of the German greenhouse gas mitigation quota. *Energ Sustain Soc* **15**, 14 (2025). https://doi.org/10.1186/s13705-024-00509-5

[41] Ibid.

[42] The 13 Mtonne estimate is based on CARB's CATS modeling for the 2024 LCFS rulemaking, assuming a stepdown

Cost containment could be accomplished by removing the recently adopted auto-acceleration mechanism. A second option would be to reduce the current cap on credit prices for the non-EV compliance market from the current cap of $200 per ton. Either modification could ensure that excess support for alternative fuels used in ICE vehicles does not jeopardize the LCFS's ability to support ZEV adoption by driving up overall program costs. In effect, combining an EV sub-target with additional cost containment measures could allow the LCFS to maintain a high level of ZEV support without impacting fuel costs.

Increased Credits for Charging Infrastructure

Increasing the credit cap for fast charging infrastructure (FCI) capacity can provide a cost-effective method of increasing EV support in the LCFS. An ICCT analysis (in Press) assesses this potential using HDV CHARGE, a charging infrastructure model developed by ICCT that estimates energy and charging needs for zero-emission MHDVs (Schmidt et al., 2025).[43] HDV CHARGE calculates charging and energy needs based on input traffic data and zero-emission vehicle sales shares combined with charging characteristics such as utilization rate, capacity, and distribution across public and depot charging locations. We update the HDV CHARGE model with inputs specific to the California market and estimate that the state will need to install 46,287 chargers that service the heavy-duty segment by 2030, growing to 103,915 in 2035. Our modeled run assumes that manufacturers continue to comply with the ACT. A full list of assumptions is provided in Steimer et al. (2025).

That analysis estimates the theoretical total credit generation of HDV infrastructure crediting in the LCFS as well as the implied cap on FCI credits based on CARB's modeling of program deficits for the 2024 LCFS rulemaking. Setting a limit on FCI credits equivalent to 2.5% of program deficits based in the LCFS in CARB's 2024 CATS modeling, we estimate that the FCI crediting cap may begin to constrain the quantity of MHDV-FCI credits generated in the LCFS market beginning in 2027. With a cap on credits in place, cumulative capacity credits decline by approximately 7 Mtonnes, though this has a large uncertainty due to recent policy changes. By increasing the cap to 5%, we estimate that this would provide a valuable incentive for HDV EV charging (approximately $400 million, based on present-day LCFS credit prices).

Other measures to bolster LCFS credit prices

Currently, the majority of the value of LCFS support goes towards biofuels, with smaller share supporting electrification. Together, biomass based diesel (BBD) and manure biomethane pathways made up 64% of LCFS compliance in 2024.[44] However, these pathways' contributions to the LCFS are distortionary for a few reasons, including 1) production of these fuels is subsidized or attributable to outside policies (greatly reducing their value to reducing transportation emissions in California), 2) the fuels were previously being consumed in other regions (and in the case of biomethane, often continue to be consumed outside of California) to take advantage of greater incentives in California, or 3) the assigned carbon intensities (CI) of these fuels are in some cases much lower than some analysts would agree with.[45]

[43] https://github.com/theicct/HDVCHARGE

[44] Low Carbon Fuel Standard Reporting Tool Quarterly Summaries. https://ww2.arb.ca.gov/sites/default/files/2025-05/quarterlysummary_Q42024_0.xlsx

[45] Nik Blog Post Pavlenko, N. (2024). Delays in California's LCFS revisions are an opportunity to improve. *International Council on Clean Transportation.* https://theicct.org/delays-in-ca-lcfs-revisions-are-an-opportunity-to-improve-june24/

The 2024 LCFS revisions did not meaningfully change the treatment of these pathways, and so we expect that these fuels will continue to generate the majority LCFS credits through the 2020s. Also included in these revisions were changes to the carbon intensity standard which increase credit purchase obligations and the introduction of an auto acceleration mechanism to drive further increases in credit purchase obligations, each of which could significantly increase overall program costs in the future.

Dairy and swine manure biomethane pathways are strongly incentivized within the LCFS because of their assigned negative carbon intensity scores and so receive a significant portion of overall LCFS support.[46] The contribution of avoided methane emissions to the LCFS has increased significantly in recent years, with dairy biomethane contributing approximately 20% of LCFS compliance in 2024 for a relatively small quantity of physical fuel (roughly 162 million diesel gallon-equivalents, compared to the roughly 3 billion gallons of biomass-based diesel and ethanol consumed in California over that time period).[47] The negative CI scores for these pathways are derived from avoided methane emissions occurring outside the transportation sector and in some cases outside the state of California.[48] Thus, biomethane is displacing relatively little petroleum and many of the estimated emissions reductions are for changes in manure management practices in other states.

The cost of using manure biomethane-derived RNG for LCFS compliance is distorted by the high support that manure digester projects receive from outside policies. For example, biomethane can generate Renewable Fuel Standard (RFS) RIN credits and can also qualify for section 45Z clean fuel production credits. Manure biomethane qualifies for D3 RINs in the RFS, which currently trade for close to $2-$3 per ethanol-equivalent gallon (or approximately $3-5 per diesel-equivalent gallon).[49] This is in addition to the recently-revised 45Z tax credit, which can provide more than $1 per gasoline-equivalent value for manure-derived fuels with negative carbon intensities; together, RFS and 45Z can provide over $10 per gallon equivalent for bio-CNG pathways, depending on their CI.[50] These programs facilitate manure RNG projects nationally, which can then take advantage of book-and-claim accounting to generate LCFS credits without needing to physically deliver fuel into the state. The very high combined policy value for these fuels, when including the LCFS, has led to high volumes of biomethane being claimed in the LCFS program. This has contributed to credit oversupply, which has in turn reduced the value of the LCFS for EV and EV infrastructure credits.[51]

Measures to limit avoided methane crediting could allow the LCFS to better support EVs without increasing overall costs. One option that could be considered is stricter deliverability requirements ensuring that biomethane must be physically supplied to California to take advantage of LCFS credits, and to phase in those requirements sooner for new projects. This measure would limit future LCFS funding for out of state manure methane capture projects. The 2024 rulemaking indicated that deliverability requirements would not come into effect until 2037

[46] Low Carbon Fuel Standard Reporting Tool Quarterly Summaries
[47] Based on Quarter 3 2024 data, available from CARB: https://ww2.arb.ca.gov/resources/documents/lcfs-data-dashboard
[48] O'Malley, J., Pavlenko, N., & Kim, Y. H. 2023. *2030 California renewable natural gas outlook: Resource assessment, market opportunities, and environmental performance*. *International Council on Clean Transportation*. https://theicct.org/publication/california-rng-outlook-2030-may23/
[49] https://www.epa.gov/fuels-registration-reporting-and-compliance-help/rin-trades-and-price-information
[50] https://rsmus.com/insights/services/business-tax/obbba-tax-clean-fuels.html
[51] ICCT. (2024). International Council on Clean Transportation comments on the proposed low carbon fuel standard amendments. https://theicct.org/international-council-on-clean-transportation-comments-on-the-proposed-low-carbon-fuel-standard-amendments-feb24/

at the earliest for CNG and even later for biomethane-derived hydrogen. Phasing these requirements in for new projects sooner, such as during the current decade, could help to reduce the contribution of out-of-sector, out-of-state avoided methane credits in the LCFS while also tightening the credit markets. This would enable LCFS credit prices to rise, providing greater value for electrification.

As another option that could be considered in conjunction with the above, CARB could directly phase out avoided methane emissions for new manure pathways earlier, contingent on implementing new regulations for manure methane emissions. Currently, the LCFS offers an all-carrot approach for incentivizing manure management projects for California dairy farms to meet the goals of California's short-lived climate pollutant (SLCP) strategy. CARB's board published a resolution in November 2024 that directs CARB staff to prepare a plan for develop a binding livestock methane regulation. The development and implementation of this livestock methane regulation could be paired with an earlier phaseout of the avoided methane crediting for manure biomethane pathways in the LCFS. Whereas now pathways that are certified with avoided methane before 2030 are entitled to two, ten-year crediting periods, this change would eliminate this option for any new pathways that apply after the livestock methane regulation is implemented. This change would also reduce the contribution of methane credits to the LCFS and enable credit prices to rise and better support EVs.

Renewable diesel is the largest source of LCFS credits, and its contribution to the LCFS continues to grow. As with biomethane, this fuel also receives significant federal support from the RFS and section 45Z tax credits. The RFS in particular mandates that fuel suppliers deliver certain shares of BBD nationally. However, due to the LCFS, an outsized share of the fuel required by the RFS is supplied to California, amounting to 45% of national BBD consumption in 2024. Recently proposed RFS renewable volume obligations would see the total volume of BBD required under the program increase from a projected supply of 5 billion gallons in 2025 to 6.8 billion gallons in 2026.[52] If finalized, these changes to the RFS will likely increase the supply of renewable diesel to California, further depressing credit prices.

To counter the distortions caused by the RFS, CARB could consider adjusting the CI values of BBD to discount the savings already achieved by the RFS. Under the RFS, BBD must achieve a minimum 50% GHG reduction to qualify under the program.[53] Revising BBD crediting such that only GHG savings beyond the 50% minimum generate credits would ensure that BBD LCFS credits are additional to what is federally required. This change would be consistent with how CARB previously assessed the GHG impact of the LCFS. For example, in its 2018 rulemaking, CARB only assessed the GHG benefits in excess RFS thresholds for the purposes of estimate the GHG reductions from biomass-based diesel.[54]

The contribution of renewable diesel to the LCFS is also high because of generous CI assessments. An increasing share of the BBD used in California is produced using virgin vegetable oil feedstocks, which cause significant GHG emissions from land use change (LUC). The land use change emissions estimates used in the LCFS are significantly lower than estimates from reputable modelers. CARB's land-use model has been critiqued as having

[52] U.S. Environmental Protection Agency. 2025. Renewable Fuel Standard (RFS) Program- Standards for 2026 and 2027: Draft Regulatory Impact Analysis. https://www.epa.gov/system/files/documents/2025-06/420d25001.pdf
[53] U.S. Environmental Protection Agency. Overview of the Renewable Fuel Standard Program. https://www.epa.gov/renewable-fuel-standard/overview-renewable-fuel-standard-program
[54] https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/lcfs18/15dayattf2.pdf

severe structural issues that may systematically understate land use change emissions.[55] ICCT has further detailed reasons why this modeling should be updated in previous public comments.[56] Another life-cycle methodology change that would make CARB's assessment aligned with international best practice would be to allocate emissions for soy on an energy basis. CARB currently uses a mass-based allocation method for soy, which over-allocates the GHG emissions of farming and land use change to meal and under-estimates those from the soy oil used to make renewable diesel and biodiesel. A more accurate land use change assessment and allocation methodology would ensure that renewable diesel credit generation is commensurate with actual GHG reductions and allow the program to more effectively support EVs.

In lieu of CI adjustments, another measure CARB can pursue to limit the contribution of BBD to the program and constrain its contribution of credits would be to implement a cap on lipid-based fuels. Though CARB's 2024 rulemaking implements a limited crediting restriction on soybean and canola oil is a good step in this direction, we have previously assessed that it would have only a modest impact on program implementation. Second, CARB's crediting restriction only applies to soybean and canola oil consumed as BBD, which could incentivize greater use of other vegetable oils and oilseed cover crops for BBD production; use of these feedstocks also carries market and environmental risks. As written, the proposal also preserves incentives for soybean and canola oil that are processed into jet fuel. Lastly, we have found that design of the grandfathering provisions could allow for a significant expansion of vegetable oil volumes over present-day consumption. More analysis of these provisions is available in ICCT's August 2024 15-day comment period submission.[57] If CARB were to aim to more meaningfully limit the contribution of BBD to the LCFS, it would be more effective to cap lipid-based pathways, including SAF, at current levels.

One further step CARB could consider would be to assign vegetable oil derived BBD beyond the 20 percent limit with the carbon intensity of fossil diesel rather than with the annual CI reduction target; thus, producing neither credits nor deficits. Likewise, vegetable oil-derived SAF's could be treated consistently with road sector fuels, and not excluded from any crediting restrictions. Finally, the restriction on vegetable oil crediting could be introduced under a more accelerated timeframe to strengthen its impact in the near-term.

[55] Berry, Steven, Timothy Searchinger, and Anton Yang. "Biofuels, Deforestation, and the GTAP Model." Tobin Center Working Paper Series. December 2024.

[56] ICCT. (2024). International Council on Clean Transportation comments on the proposed low carbon fuel standard amendments. https://theicct.org/international-council-on-clean-transportation-comments-on-the-proposed-low-carbon-fuel-standard-amendments-feb24/

[57]