Briefing Paper

States Pave the Way for ZET Adoption: Assessing the Impact of ACT and ACF Through 2030

By Jonah Kasdan and Jordan Steen

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CALSTART's Trucks and Off-Road Equipment Initiative works to keep goods and services moving while reducing air pollution and climate change, growing jobs, and increasing energy security.

The Trucks Initiative uses four strategies to drive change: helping fleets reduce the risk and cost of purchasing the cleanest trucks and equipment; partnering with industry and public agencies to develop the next generation of heavy-duty near-zero and zero-emission technologies; validating the performance and business case of clean vehicles to support fleet acceptance; and working with industry partners to craft smart regulations, policies, and funding for near-zero and zero-emission trucks and equipment.

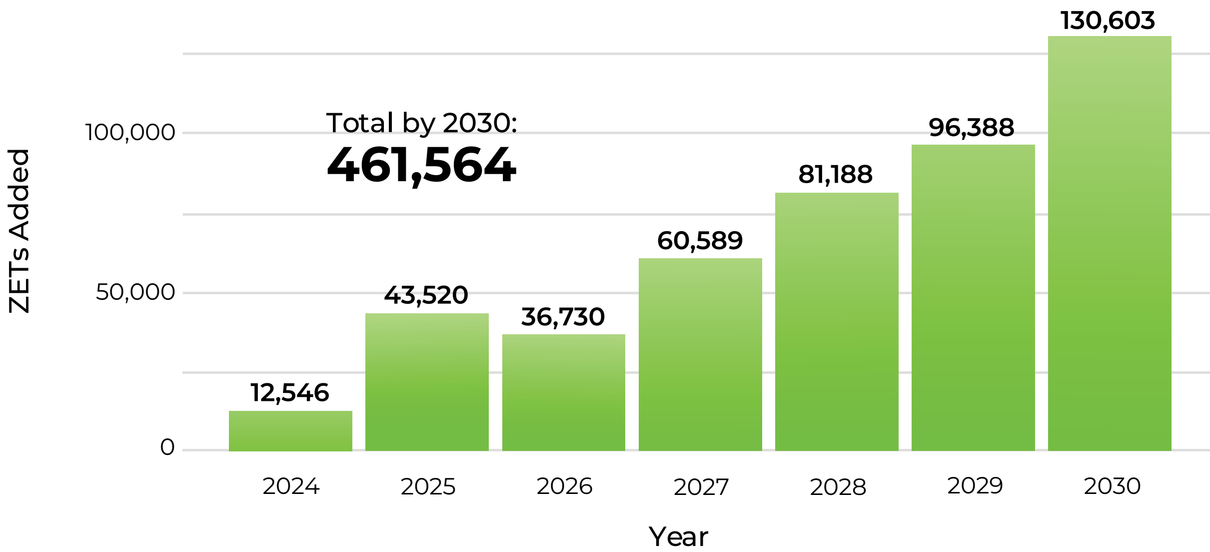
Executive Summary

This assessment projects the impact that the Advanced Clean Trucks (ACT) and Advanced Clean Fleets (ACF) regulations (together ACT/F) will have on zero-emission truck (ZET) deployments[1] through 2030 in states that have adopted the regulations to date. As of May 2024, 11 states have adopted ACT, including California, which has also adopted ACF. These states comprise roughly 27 percent of the U.S. medium- and heavy-duty vehicle (MHDV)[2] market and 37 percent of national ZET deployments.

The results show that **by 2030, ACT/F compliance will lead to the deployment of at least 461,000 ZETs in the 11 ACT/F states** (Figure ES-1). Roughly two-thirds of these vehicles (306,000) will be in the pickup, straight truck, and delivery classes, with Class 8 tractor demand starting to grow near 2030. In addition, demand is concentrated geographically in key states with supportive state-level policies. These projections allow stakeholders to understand the market through the end of the decade and the need for focused infrastructure investment in key hubs, and to plan well in advance in areas with high anticipated Class 8 demand.

[1] This assessment also includes vans and buses, but the authors have used the term ZET for simplicity. See the appendix for the full definition of ZET applied in this report.
[2] Commercial trucks in the United States are classified according to their gross vehicle weight rating (GVWR). For this assessment, MHDVs refer to vehicles in Class 2b (GVWR 8,501–10,000 lbs.) through Class 8 (GVWR 33,000 lbs. and above).

Figure ES-1. ZETs Deployed Yearly Through 2030 Under ACT and ACF



Introduction

State-level regulations are one of the main drivers of zero-emission truck (ZET) adoption across the United States. As of May 2024, 11 states have adopted the Advanced Clean Trucks (ACT) regulation, including California, which has also adopted the Advanced Clean Fleets (ACF) regulation. Taken together, these states comprise roughly **27 percent** of the U.S. medium- and heavy-duty vehicle (MHDV) market and **37 percent** of total U.S. GDP. Despite boasting a quarter of the nation's MHDV registrations, these states account for **37 percent of national ZET deployments**.[3] As states continue to adopt and implement these regulations, they will undoubtedly spur even more ZET deployments.

This assessment projects the impact that ACT and ACF (together ACT/F) will have on ZET deployments through 2030 in states that have adopted the regulations to date. These projections can help stakeholders such as original equipment manufacturers (OEMs), utilities, battery manufacturers, and fleets understand the ZET market through the end of this decade. This understanding will empower them to prepare for market needs by offering new products and services to customers and smartly building out ZET charging and refueling infrastructure. Aligning ZET production, battery manufacturing, and workforce development with the demands of the market will help avoid bottlenecks and ensure that the transition to ZETs occurs as smoothly and rapidly as possible.

Overview of ACT and ACF

Advanced Clean Trucks

ACT is a supply-side regulation that requires MHDV OEMs to sell ZETs as an increasing percentage of their overall MHDV sales each year. The sales requirements

[3] Please note that *Zeroing in on ZETs: May 2024 Market Update* does not include electric pickup trucks, while this assessment does include that vehicle segment. See the appendix for the full definition of ZET applied in this report.

vary by gross vehicle weight rating (GVWR) vehicle class. Vehicles are grouped into three categories (Class 2b–3 vehicles, Class 4–8 vocational vehicles, and Class 7–8 tractors), and the ZET sales requirements increase in stringency from the smaller vehicle group to the larger vehicle groups.

ACT was first adopted by California in 2021 and has since been adopted by 10 other states: Colorado, Maryland, Massachusetts, New Jersey, New Mexico, New York, Oregon, Rhode Island, Vermont, and Washington, all of which will follow California's zero-emission vehicle (ZEV) percentages but start in different years. For the year-over-year and vehicle class ZET sales requirements, see the California ACT ZET sales percentage schedule below:

Table 1. ACT Electric Vehicle Sales Percentage Schedule

Model Year	Class 2b-3 Group	Class 4-8 Group	Class 7-8 Tractors Group
2024	**5%**	**9%**	**5%**
2025	**7%**	**11%**	**7%**
2026	**10%**	**13%**	**10%**
2027	**15%**	**20%**	**15%**
2028	**20%**	**30%**	**20%**
2029	**25%**	**40%**	**25%**
2030	**30%**	**50%**	**30%**
2031	**35%**	**55%**	**35%**
2032	**40%**	**50%**	**40%**
2033	**45%**	**65%**	**40%**
2034	**50%**	**70%**	**40%**
2035 and beyond	**55%**	**75%**	**40%**

Source: California Air Resources Board, "**Advanced Clean Trucks Final Regulation Order**," 2019.

Advanced Clean Fleets

ACF is a demand-side regulation[4] that requires fleets to *purchase* ZETs. The stringency of the purchasing requirements varies by fleet type. The regulation prioritizes electrifying large fleets with more than 50 trucks deployed (termed high-priority fleets);[5] drayage fleets; and fleets belonging to federal, state, or local government agencies. So far, only California has adopted ACF, but other states may do so in the future.

There are two options that high-priority and federal (HPnF) fleets can choose from to comply with ACF. The first option is known as the Model Year (MY) schedule, which is based on several sets of retire and replace rules for vehicles once they reach End of Useful Life (EOUL), which the regulation sets at either 18 years of service or at least 13 years of service with more than 800,000 miles driven.

[4] ACF also includes a supply-side 100 percent ZEV sales mandate in 2036, but that is beyond the timeline of this assessment.
[5] The regulation also considers fleets with revenues over $50 million to be high-priority fleets, regardless of the number of vehicles deployed. For this assessment, the authors used the 50-vehicle threshold as the determinant for a high-priority fleet designation, since they did not have access to fleet revenue data.

For fleets following the MY schedule, compliance will look like the following:

- **Drayage fleets:** Beginning on January 1, 2024, new drayage trucks registered in California must be ZE. Internal combustion engine (ICE) drayage trucks can continue operating in the state through their EOUL if they were registered before December 31, 2023, after which they will need to retire.[6] EOUL retirements will begin to go into effect on January 1, 2025.
- **HPnF fleets:** Beginning in 2024, any new trucks these fleets purchase must be ZE. Starting on January 1, 2025, these fleets must retire ICE trucks that reach their EOUL.
- **State and local agencies:** Beginning in 2024, 50 percent of vehicles these fleets purchase must be ZE. In 2027, that percentage increases to 100 percent of all purchases. That timeline is pushed back for small fleets of less than 10 vehicles and fleets in certain dedicated counties, which are required to begin their ZET purchases in 2027.

HPnF fleets can alternatively choose to comply with ACF through the ZEV Milestones option. In this option, fleets must ensure that a specified percentage of their total deployed vehicles (not annual purchases) are ZE, with the percentages varying by vehicle type groups and increasing annually from 2025 through 2039 (the start date varies by vehicle type). The vehicle type groups[7] and fleetwide ZET-composition requirements are as follows in Table 2:

Table 2. ZEV Fleet Milestones by Milestone Group and Year

Percentage of vehicles that must be ZEVs	10%	25%	50%	75%	100%
Milestone Group 1: Box trucks, vans, buses with two axles, yard tractors, light-duty package delievery vehicles	**2025**	**2028**	**2031**	**2033**	**2025 and beyond**
Milestone Group 2: Work trucks, day cab tractors, pickup trucks, buses with three axles	**2027**	**2030**	**2033**	**2036**	**2039 and beyond**
Milestone Group 3: Sleeper cab tractors and specialty vehicles	**2030**	**2033**	**2036**	**2039**	**2042 and beyond**

Source: California Air Resources Board, "Advanced Clean Fleets Regulation - ZEV Milestones Option," 2023.

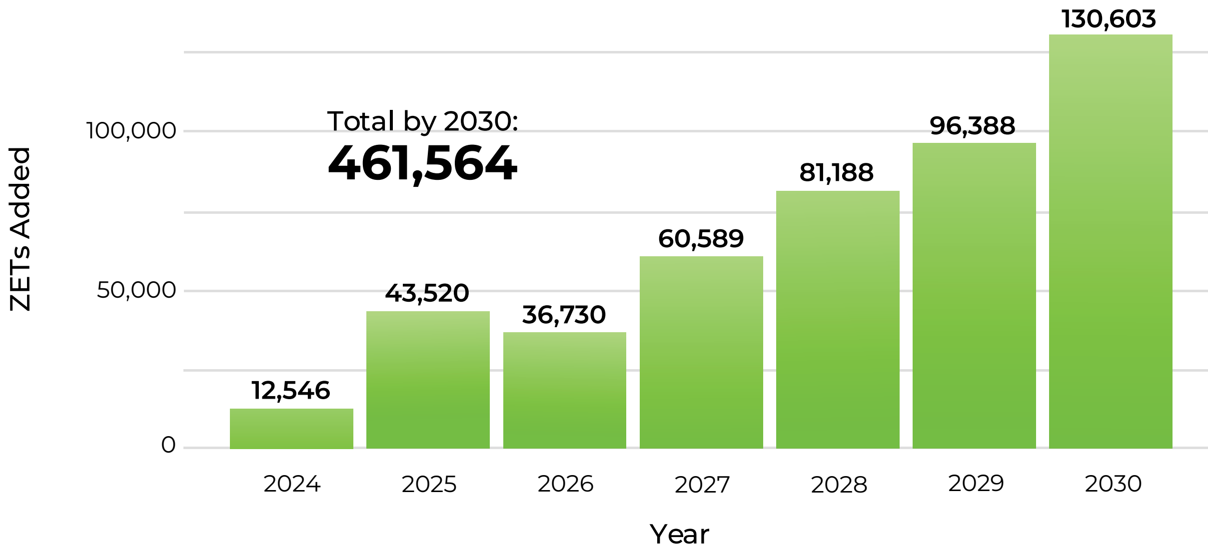
Please Note: While multiple aspects of the ACF's MY schedule are slated to go into effect in 2024, such as the first drayage fleet requirement that was slated to go into effect on January 1, 2024, the implementation of ACF is currently on hold pending the U.S. Environmental Protection Agency granting California a **Clean Air Act waiver** for the regulation. Nonetheless, the authors assumed that ACF will go into effect in 2024 and modeled the 2024 ZET requirements for fleets following the MY schedule.

[6] ACF also includes a requirement for 100 percent of drayage trucks operating in the state to be ZETs by January 1 , 2035, but that is beyond the scope of this assessment.
[7] The data used in CARB's report lists "straight trucks" as a vehicle type and not box trucks. For the purpose of calculating the number of ZE straight trucks deployed by fleets following the ZEV Milestones compliance pathway, the authors assumed that all straight trucks in the data would be classified as box trucks.

Findings

The assessment conducted[8] projects that both ACT and ACF will have a sizeable impact on ZET demand in the 11 ACT/F states; taken together, at least **461,000 Class 2b–8 ZETs will need to be deployed between 2024 and 2030 to comply with the regulations (Figure 1).**

Figure 1. ZETs Deployed Yearly Through 2030 Under ACT and ACF

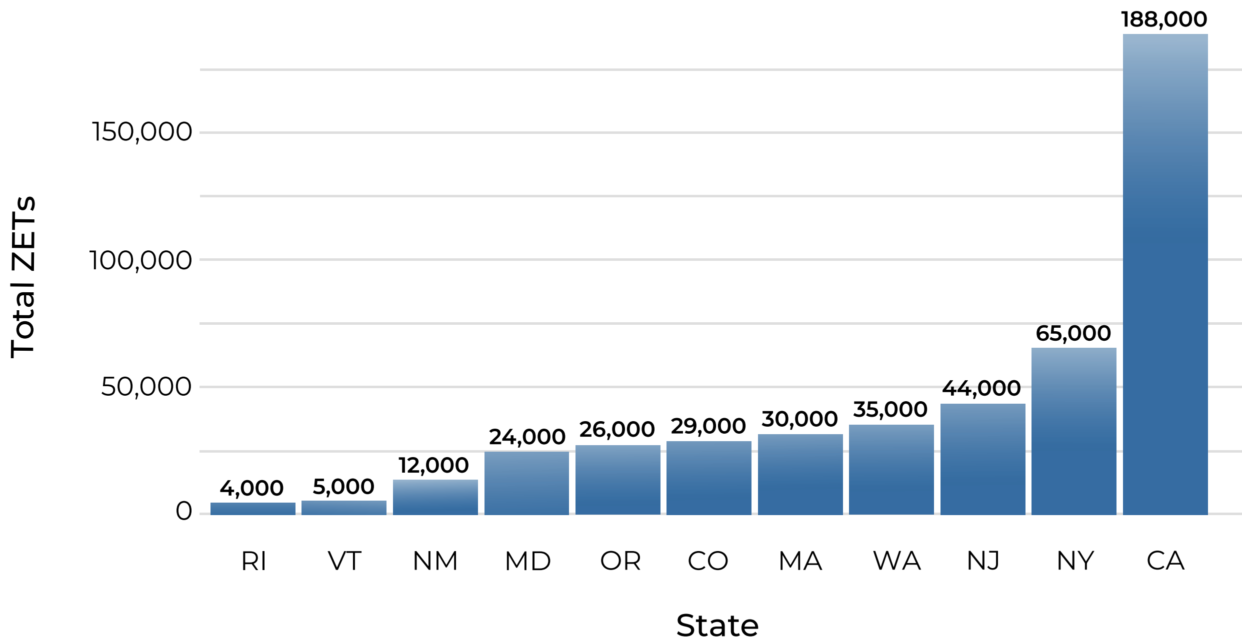


The projections show that ZETs will not be deployed evenly from year to year, with jumps in 2025, 2027, and 2030. These jumps are due to a combination of ACT sales requirements ramping up, ACF MY requirements for state/local and small fleets kicking in, and ACF ZEV Milestone requirements for Groups 2 and 3 vehicles beginning and increasing in those years. While the jumps may prove to be more evenly spread out from year to year as fleets prepare for regulation ahead of the mandated schedule, this assessment takes the most conservative approach to estimate ZETs deployed each year.

[8] Please see the appendix for a detailed discussion of the methodology behind these projections. Results for state-level and vehicle-type specific ZET deployments are rounded to the thousands place.

California is projected to add the most ZETs, with roughly 188,000 ZETs by 2030 (Figure 2). New York is projected to add the second most ZETs at 65,000, followed by New Jersey with 44,000 and Washington with 35,000.

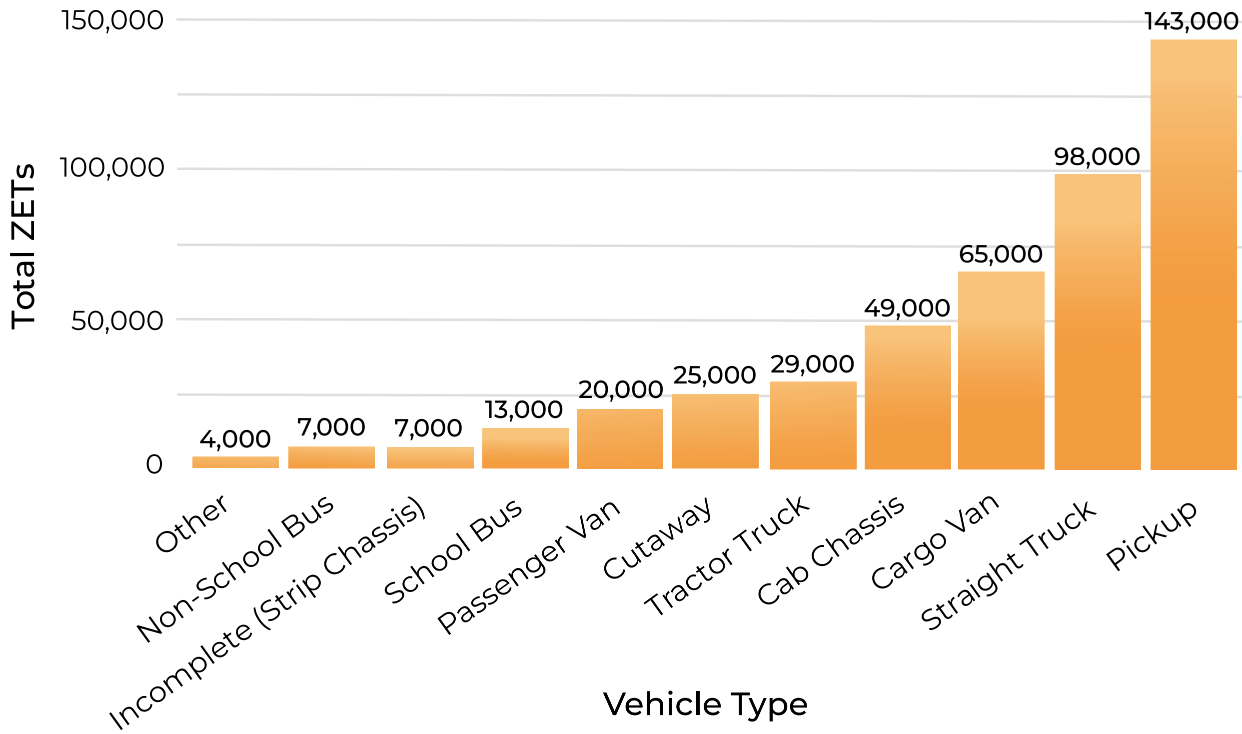
Figure 2. ZETs Deployed by State Through 2030



In terms of absolute volumes, the most common ZET types that will be deployed to meet the regulations are pickup trucks, straight trucks, cargo vans, and cab chassis trucks (Figure 3). There will be approximately 143,000 ZE pickup trucks, 98,000 ZE straight trucks, 65,000 ZE cargo vans, and 49,000 ZE cab chassis trucks deployed by 2030. Only 29,000 of the vehicles will be Class 7–8 ZE tractor trucks, with most likely operating in regional applications.[9]

[9] This number is notably lower than the projected number of ZE Class 7–8 tractors that CARB has estimated will be deployed as a result of ACT/F. The authors believe this discrepancy is due to the fact that this assessment's baseline population of tractors subject to ACF's HPnF rule is based on a conservative approach and therefore likely lower for several reasons. One factor is that the methodology cannot account for tractors operating in, but not registered in, California, which CARB estimated in **Appendix F of the ACF ISOR** to be around 50,000 vehicles. Another factor is that it is possible that tractor sales in a number of years that the authors used to generate an average sales year were unusually low due to COVID-related market disruptions, which would make the baseline population of tractors in the assessment low.

Figure 3. ZETs Deployed by Vehicle Type Through 2030 From ACT and ACF



It should be noted that to conduct the assessment, the authors assumed a consistent base-market growth rate across all vehicle classes and types.[10] In practice, different sectors of the MHDV market grow at different rates, so the results for ZET growth in specific vehicle types should be taken as rough estimates.

Market Implications and Trends

The roughly 461,000 ZETs that will need to be deployed in the 11 ACT/F states to comply with the regulations represent a nearly 25-fold increase in **ZET deployments since 2023**. OEMs will have to increase their ZET production to meet the sales requirements in those states. Similarly, California fleets that are subject to ACF will have to deploy appreciably more ZETs as a percentage of their total vehicles by 2030.

Assuming overall market composition does not change, 306,000 of these deployed ZETs—two-thirds of the projected total—will be pickup trucks, straight trucks, and cargo vans. Market readiness for ZETs in these categories is promising but uneven. Production of ZE pickup trucks and cargo vans is currently the most advanced and will be easily scalable. If the e-commerce sector continues to grow, it is likely that cargo vans will take up a larger segment of the MHDV market, and production demands for ZE cargo vans will likewise increase. For larger trucks like straight trucks, there are many ZE models in production, but deployments will need to increase substantially.

[10] "Other" includes vehicle types that are not projected to see a large increase in ZET deployments under ACT/F such as specialty and sport utility trucks and certain step vans.

Importantly, this assessment's results project that Class 7–8 tractors make up only about 29,000 of the total ZETs deployed under ACT/F by 2030, and the authors acknowledge this projection may be low because of several factors (see footnote 9). Nonetheless, Class 7–8 tractors will make up a relatively small percentage of the total ZETs on the road and most will likely operate in regional duty cycles.

The buildout of ZET charging and refueling infrastructure will need to be scaled up to meet this increase in demand. As shown in CALSTART's **Phasing in U.S. Charging Infrastructure report** and the Joint Office of Energy and Transportation's **National Zero-Emission Freight Corridor Strategy**, such a buildout can be realistically and affordably achieved by a strategically targeted and phased-in approach. Indeed, the national strategy and the funding it will direct specifically prioritizes ACT states during its first two phases (2024–2030).

The findings in this report support the feasibility of the phased-in infrastructure approach. As the bulk of these first vehicles will be concentrated in the urban and regional delivery, cutaway, and pickup classes, this will enable ZET infrastructure investment and energy planning to be initially targeted toward urban and regional hub charging. Additionally, as the number of deployed ZE Class 7–8 tractors is projected to remain relatively low through 2030, there should be adequate lead time to install infrastructure for the volumes of tractors expected, and that infrastructure should likely focus most on regional hub charging, with a few key connecting corridors.

Moreover, these projections show that increased ZET deployments will be concentrated geographically, further supporting a targeted, phased-in buildout of charging and refueling infrastructure. As of May 2024, ACT states accounted for 37 percent of national ZET deployments, and that percentage will likely increase as more states' ACT requirements go into effect. OEMs will need to prioritize ZET sales in ACT states to comply with the regulations, and consequently, infrastructure providers, investors, charging-as-a-service providers (CaaS), and other industry stakeholders may consider focusing their efforts in ACT states through the end of the decade.

Within ACT states, California is expected to see around 41 percent of the increased demand for ZETs under ACT and ACF, with more than double the demand of New York, which has the second-highest level of expected ZET deployments. This will help ensure ZET charging and refueling infrastructure buildout can meet demand; buildout can be focused largely geographically in these key regions, taking advantage of higher early utilization and sharing of charging assets while serving the majority of ZET deployments.

Beyond infrastructure buildout, battery manufacturers and other companies along the ZET supply chain will need to ensure that they can scale their operations to support the increase in ZET production. Similarly, utilities and CaaS providers in ACT/F states should prepare for increased deployments of ZETs by 2030, especially in California.

Conclusion

ACT and ACF are impactful regulations that will require at least 461,000 ZETs to be deployed by 2030 in the 11 states that have adopted these regulations to date. OEMs will need to ramp up production of ZETs across all vehicle categories to meet the increased demand brought on by ACT and ACF—but they will need to especially focus on producing ZE cargo vans, pickup trucks, straight trucks, and cab chassis trucks. Battery manufacturers and other companies along the ZET supply chain will need to ensure that they can scale their operations to support the increase in ZET production. Similarly, utilities and CaaS providers in ACT/F states should prepare for increased deployments of ZETs by 2030, especially in California. However, the bulk of the infrastructure buildout will focus on smaller vehicle sizes for regional applications.

Appendix

Methodology

For this assessment, ZETs refer to MHDVs that emit no tailpipe emissions, including both battery-electric vehicles and hydrogen fuel cell vehicles. The specific types of vehicles considered in this assessment include pickup trucks, delivery vans, passenger vans, straight trucks, cab chassis trucks, cutaway trucks, strip chassis trucks, tractor trucks, school buses, non-school buses, and other specialty vehicles that make up an insignificant percentage of the total market.

The authors modeled the ZET-demand impact of ACT in the 10 states that passed only ACT and not ACF. In California, the authors modeled ACT for pickup trucks and ACF for all other vehicles, as the model showed that ACT was more stringent than ACF for pickup trucks in terms of required ZET deployment and that ACF was more stringent than ACT for all other vehicles. This decision helped the model avoid double counting ACT/F-driven ZET demand in California and was made after the authors ran the full model for all vehicle types for both ACT and ACF to compare the impacts of the regulations.

This modeling decision closely resembles a decision that the California Air Resources Board (CARB) made for their ACT and ACF modeling, in which they modeled ACT for Class 2b–3 vehicles (not just pickup trucks) and ACF for all other vehicles.

Data Sources

Both the ACT and ACF projections are built on data provided by IHS Markit of national vehicle registrations for Quarter 2 of 2023. This includes data on the overall size of the national MHDV market, state-by-state MHDV purchases, and the number of vehicles purchased per year in selected vehicle classes. While there tends to be a small discrepancy between in-state vehicle registrations and in-state vehicle sales, the authors assumed registration and sales numbers to be identical for the sake of this assessment. This decision was due to the generally small size of the discrepancy between the two numbers and the lack of available high-quality data on actual vehicle sales.

Information about program details for California's ACT and ACF regulations, and the ACT regulations in non-California states, comes from official regulation texts hosted on state webpages, as well as supplementary explanatory literature hosted on the same sites (see References).

Advanced Clean Trucks

To assess the sales impact of ACT, the authors first built a large data table of all applicable vehicles in the 11 states that have adopted the regulation. To do this, they combined the IHS Markit vehicle registration data for Class 2b–8 vehicles from each ACT state into one table. They then removed all vehicle registrations for vehicles that do not fall under ACT regulation, including transit buses, SUVs, and other vehicles.

It should be noted that in states that have passed California's **Advanced Clean Cars II (ACCII)** regulations, OEMs can choose whether to generate compliance credits for medium-duty vehicles through ACT or the **ZEV Rule** of ACCII. For this assessment, the authors assumed that OEMs would choose to earn vehicle credits for Class 2b–3 vehicles entirely through ACT and not through the ZEV Program.

Once the combined dataset was constructed, the authors categorized each vehicle by both the size of the fleet they belonged to, vehicle type, and vehicle weight class. For fleet size, vehicles were categorized as being part of a "large" (≥ 50 vehicles) or "small" (< 50 vehicles) fleet. Vehicles without clear fleet names were designated as "small" fleets, because they likely belonged to a single owner/operator.

Once the authors had a data set of vehicles categorized by vehicle type, weight class, and fleet size, they then used the data to project both overall MHDV market size and market growth per vehicle type, weight class, and fleet size at the state level. To do this, they averaged the number of vehicles sold each year from 2017–2022 and used the number as an estimate for the number of MHDVs sold in 2023. This is because MHDV sales vary widely from year to year, so picking any single year as a baseline (i.e., 2023) would run the risk of that year being an outlier that is not representative of broader market trends. The authors segmented the 2023 baseline sales year by vehicle type, weight class, and state by averaging the number of vehicles sold within each individual vehicle type, weight class, and state within the same five-year period and applying those averages to the 2023 baseline.

While those estimates will not be an exact match for 2023 MHDV sales, the authors assumed the differences would be negligible. Another assumption was that the number of MHDVs purchased in the last five years but no longer in use as of 2023 (and therefore not accounted for in the 2023 estimate) would be negligible as well.

After establishing a baseline sales year and market segmentation, the authors projected MHDV market growth through 2030 by assuming a yearly market growth rate of 1.01 percent. The growth rate was taken from a previous CALSTART project that calculated the increase in freight ton-miles averaged out per year between 2023 and 2050. Several internal policy experts have verified the number as a reasonable assumption. The authors held market segmentation by vehicle type and weight class steady for each sales year, although that assumption will potentially prove inaccurate.

To calculate the number of ZETs sold each year through 2030, the authors imported the yearly ZET sales requirement schedule from the ACT regulation and applied the percentages to the appropriate sales year in each state. For example, looking at Colorado in 2027, ACT requires 15 percent of Class 2b–3 trucks, 20 percent of Class 4–8 trucks, and 15 percent of Class 7–8 tractors to be ZE, and the authors' model projected that Colorado's MHDV market in 2027 would consist of 22,000 Class 2b–3 trucks, 4,900 Class 4–8 trucks, and 1,600 Class 7–8 tractors. Applying the ZET requirements to their corresponding classes yielded 3,300 Class 2b–3 ZETs, 1,000 Class 4–8 ZETs, and 250 Class 7–8 ZETs for 4,500 ZETs in Colorado in 2027.

It is important to note that ACT works on a credit system in which OEMs can transfer compliance credits between vehicle class groups. This means that OEMs can produce a higher percentage of ZETs than required by the regulation in one vehicle class group and a lower percentage of ZETs than required in another group and use credits from one to make up for the deficit in the other. Due to lack of data around the exact usage of these credits, the authors did not model any credit transfers and assumed a 1:1 match between ACT ZEV sales requirements and actual vehicle sales per vehicle category.

The final steps in the ACT-induced demand modeling process were both simple aggregations. The authors added up the yearly state-level ZET projections for each year to get the total number of ZETs sold through 2030 in each state to comply with ACT. They then combined all the 11 state-level ZET counts to get a total number of ZETs sold to comply with ACT through 2030.

Advanced Clean Fleets

When looking at California, the authors modeled the impact of ACF for Class 2b–8 vehicles, except for Class 2b–3 pickup trucks, which were covered by the ACT modeling step.

Learning from decisions that CARB made when modeling ACF in **Appendix F** to their **Initial Statement of Reasons** (ISOR) for the regulation, the authors assessed the impact of ACF on ZET adoption by modeling different ACF compliance pathways for different HPnF fleets. For HPnF fleets that had the majority of their vehicles fall into Group 1, the authors modeled the MY compliance pathway, while for fleets that had the majority of their vehicles fall into Groups 2 and 3, the authors modeled the ZEV Milestones pathway. The authors followed this assumption because, in general, the MY pathway will require Group 1 dominant fleets to purchase fewer ZETs and the ZEV Milestones pathway will require Groups 2 and 3 dominant fleets to purchase fewer ZETs; the authors assumed that fleets would follow the less-stringent compliance pathway.

It should be noted that there are various exemptions/delays for ZET sales requirements in ACF for possibilities such as ZEV model unavailability for specific use cases and infrastructure buildout delays, among others. This assessment did not account for the potential impact of those delays on ZET deployments.

To model the ZET sales impact brought on by ACF in California, the authors began by following a process similar to their ACT modeling methodology. They used IHS Markit vehicle registration data to create a table of all applicable Class 2b–8 vehicles in California. Vehicles were then classified by fleet type and size. Once tagged by fleet type, vehicles were then grouped into the three fleet categories under ACF: small fleets (< 50 vehicles) were placed in the small fleet category, state and local government fleets were combined into the state/local government category, and large (≥ 50 vehicles) and federal government fleets were combined into the high priority/federal fleet category. For vehicles that fell into multiple fleet designations, such as a vehicle in a state-government fleet with more than 50 vehicles, it was assumed that they would have to follow the more stringent set of fleet-specific regulations.

To calculate the number of drayage trucks registered in the state and subject to the drayage fleet requirements, the authors used an estimate from CARB that put the number at **33,510 Class 7 and 8 tractors**. Due to other California port regulations, these trucks are from model year 2013 or later. Based on these qualifications, the authors decided to designate trucks as participating in port drayage activities by taking a random sampling of 33,510 Class 7 or 8 tractor trucks with model year 2013 or later.

Lastly, the authors also categorized vehicles and fleets by their ZEV Milestones pathway group number. Individual vehicles were assigned to a group based on their vehicle type, and fleets were given a group number based on whichever group most of their vehicles were in. As an example, a fleet with 40 Group 1 vehicles and 20 Group 2 or 3 vehicles would be considered a Group 1 fleet.

Once vehicles were categorized into their appropriate fleet groups, the authors established a baseline sales year value using the same 2017–2022 averaging technique they used for creating the ACT projections and assumed a 1.01 percent annual growth rate for the California MHDV market through 2030.

Model Year Schedule

To project the number of ZETs that would be deployed by fleets using the ACF's MY pathway (small, drayage, and Group 1 HPnF fleets), the authors performed two different, but closely related, sets of calculations. They first calculated the number of ICE trucks in drayage and HPnF fleets that would be forced out of service in "retirement waves" due to reaching their EOUL and are required to be replaced by ZETs. Retirement waves refer to the first years that the MY pathway EOUL retirement rules go into effect, which are 2024 for drayage and 2025 for HPnF fleets. Based on CARB's ACF modeling, the authors assumed that ICE tractors would reach EOUL at 15 years of service, while all other ICE vehicles would reach EOUL at 18 years. The authors then removed that number of ICE vehicles from the data table and replaced them with ZETs.

To capture the rest of the ZETs that would be deployed by fleets using the MY pathway, the authors calculated the number of ZETs that would be added to drayage and Group 1 HPnF fleets outside of the-retirement waves by simply taking all the new vehicles that would be added to those fleets due to the projected yearly MHDV market growth and counting 100 percent of them as ZETs, as per ACF regulations. For state/local government fleets, the authors applied the ZET purchase requirements of 50 percent in 2024 and 100 percent in 2027 (or 50 percent in 2027 for small fleets) to the number of new vehicles that would be added to those fleets through projected market growth.

The number of ZETs added from the drayage and HPnF retirement waves and yearly ZET additions from all fleet types were combined to give the total number of additional ZETs that will be deployed by fleets using the MY pathway.

Groups 2 and 3 Fleets – ZEV Milestones Schedule

To project the number of ZETs that would be deployed in California by fleets using the ACF ZEV Milestones pathway (fleets dominated by non-Group 1 vehicles), the authors first divided all vehicles in each individual fleet into ZE and ICE vehicles. The authors then projected fleet growth out through 2030 using the 1.01 percent annual growth factor mentioned above, while holding the composition of the fleet steady in terms of percent of vehicles per vehicle group.

The next step in the model involved calculating the number of ICE vehicles that fleets would have to retire and replace with ZEVs to comply with the fleet ZEV composition percentages laid out in the Milestones schedule. As a reminder, the ZEV composition percentages in the Milestones schedule refer to overall fleet makeup, not vehicle purchases. A fleet comprised entirely of 50 Group 2 ICE vehicles must ensure that five of those vehicles are ZETs by 2027 to comply with the 10 percent ZEV milestone target. The authors assumed that fleets would comply with the regulation by retiring ICE vehicles in their fleet and replacing them with ZETs, rather than expanding their overall size by adding ZETs. For example, the 50-vehicle fleet above would scrap five of its ICE vehicles and replace them with five ZETs, rather than add six ZETs to the existing ICE vehicles and have a 56-vehicle fleet (which would be slightly over-complying). This assumption is consistent with the overall model assumption that fleets will purchase the minimum possible number of ZETs to be compliant with the regulations.

Once the number of ICE retirements were calculated for each vehicle group in each fleet in a given year, the retired ICE vehicles were replaced with ZETs. The number of ZETs added to each vehicle group in a fleet in every Milestone year were then combined to get the total number of ZETs added to the fleet through 2030. The number of ZEVs added to each fleet following the Milestones pathway were then combined to get the total number of ZETs deployed via the Milestones pathway through 2030.

To break down the ZETs deployed under the Milestones pathway into vehicle types and classes, the authors multiplied the total number of ZETs in the Milestones pathway by the vehicle class and type percent for all fleets participating in the Milestones pathway. For example, there were 36,000 ZETs deployed by Milestone fleets, and Class 8 tractors comprised 24 percent of the group, which means 8,600 Class 8 ZE tractors were deployed through
this pathway.

Total ZETs Added Through ACF and ACT

After calculating the number of ZETs deployed through the ZEV Milestones pathway, the authors added them to the number of ZETs generated through compliance with the MY pathway to get the total number of ZETs needed to comply with ACF. Finally, the authors then combined the ACT and ACF calculations to get the total number of ZETs deployed in all 11 ACT/F states through 2030.[11]

[11] The authors assumed that all ZEVs added by ACT and ACF from 2024–2030 would still be in operation in 2030.

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About the Authors

Jonah Kasdan served as the Trucks Regulatory Analysis Program Manager at CALSTART. In this role, he led research and analysis efforts to support CALSTART's medium- and heavy-duty vehicle policy efforts at both the national and state level.

Jordan Steen is the Electric Vehicle Market Analyst at CALSTART. He leads technical assessment, economic viability, and market modeling projects for CALSTART's Data and Analytics team.

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About CALSTART

A mission-driven industry organization focused on transportation decarbonization and clean air for all, CALSTART has offices in New York, Michigan, Colorado, California, Florida, and Europe. CALSTART is uniquely positioned to build the national clean transportation industry by working closely with its member companies and building on the lessons learned from the major programs it manages for the State of California. CALSTART has more than 280 member companies and manages more than $500 million in vehicle incentive and technical assistance programs in the United States.

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