



# Zeroing in on **Zero-Emission Trucks**



January 2025 Market Update  
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## OVERVIEW

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This update on the U.S. zero-emission truck (ZET) market presents ZE deployment statistics for cargo vans, medium-duty (MD) step vans, MD trucks, heavy-duty (HD) trucks, refuse trucks, and yard tractors as of June 2024. More than 42,500 ZETs have now been deployed across the country, with 12,851 new deployments since December 2023. This pace must double to meet the federal climate targets of **100% new ZE truck and bus sales by 2040**, with an interim goal of 30% by 2030—ZETs made up just 2.6% of new truck sales in the first six months of 2024.

Of deployments since December 2023, 88% are ZE cargo vans, with 11,900 new vehicles. ZE deployments of MD step vans, MD trucks, HD trucks, and refuse trucks, however, have remained flat for 18 months. The leading three states for ZET deployments are California (6,313), Texas (4,155), and Florida (3,744). Sixteen states now have more than 1,000 ZET deployments. Outside of California, ZE deployments of MD step vans, MD trucks, HD trucks, refuse trucks, and yard tractors are minimal, with approximately 2,727 across all other states. Used ZETs are starting to hit the road, with a total of 2,708 deployed or approximately 6% of all ZET deployments.

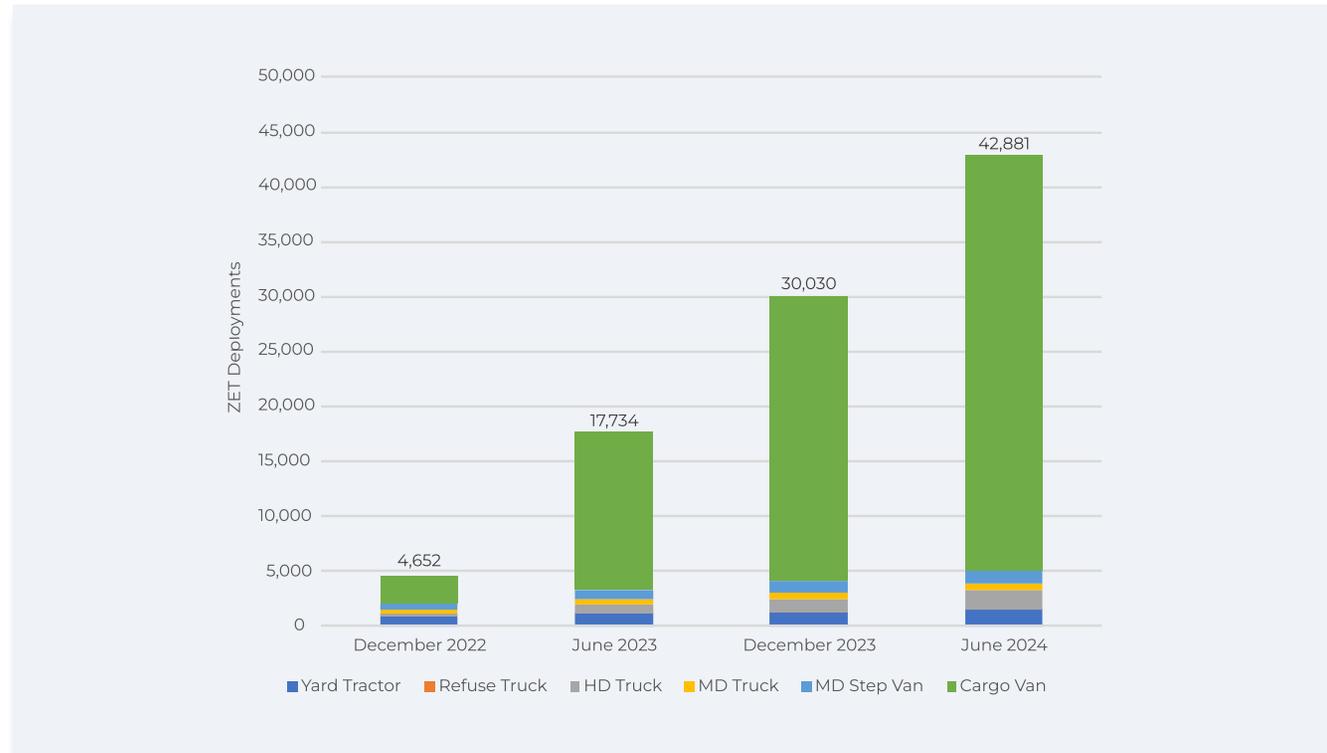


# 1 TOTAL U.S. ZET DEPLOYMENTS

ZET technology has reached market readiness in several applications, especially for local return-to-base operations, first- and last-mile delivery, and drayage. ZETs are now capable of meeting the demands of [approximately 65% of all MD truck routes and 49% of all HD truck routes](#). As of June 2024, more than 42,500 cargo vans, MD step vans, MD trucks, HD trucks, refuse trucks, and yard tractors have been deployed in the United States (Figure 1) from 37 original equipment manufacturers (OEMs).<sup>1</sup> Nearly all deployments are battery-electric, but 67 fuel cell electric trucks have been deployed in the HD truck segment.

Each six-month interval of reporting continues to show a steady increase of ZET deployments. However, after a steep jump at the start of 2023 due to many OEMs beginning delivery of their ZETs, the growth rate since then remains flat (Figure 2). Even as more OEMs begin production of their vehicles, manufacturing facilities

**Figure 1:** Cumulative U.S. ZET Deployments



expand for more production capacity, and states continue to offer incentives<sup>2</sup> to reduce the upfront cost of ZETs, deployments have stagnated over the past 18 months.

While establishing a baseline of roughly 25,000 new ZET deployments each year

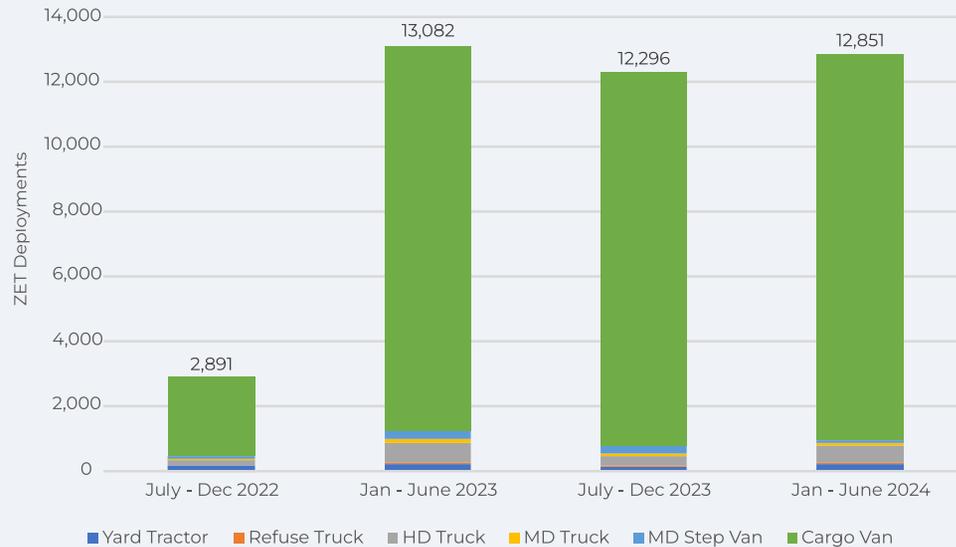
shows progress, this number must begin to double every year to meet the federal climate targets of [100% new ZE truck and bus sales by 2040](#), with an interim goal of 30% by 2030.

<sup>1</sup>See Appendix A for definitions, data sources, and assumptions made in this market update.

<sup>2</sup>See Appendix B for a comprehensive list of state incentive programs.



**Figure 2:** U.S. ZET Deployments by Reporting Interval



ZETs made up just 2.6% of new truck sales in the first six months of 2024. Current efforts to promote ZETs have not spurred demand due to several barriers:

- The high purchase price of ZETs remains unaffordable for many fleets.
- Infrastructure delays for building out charging and refueling stations have

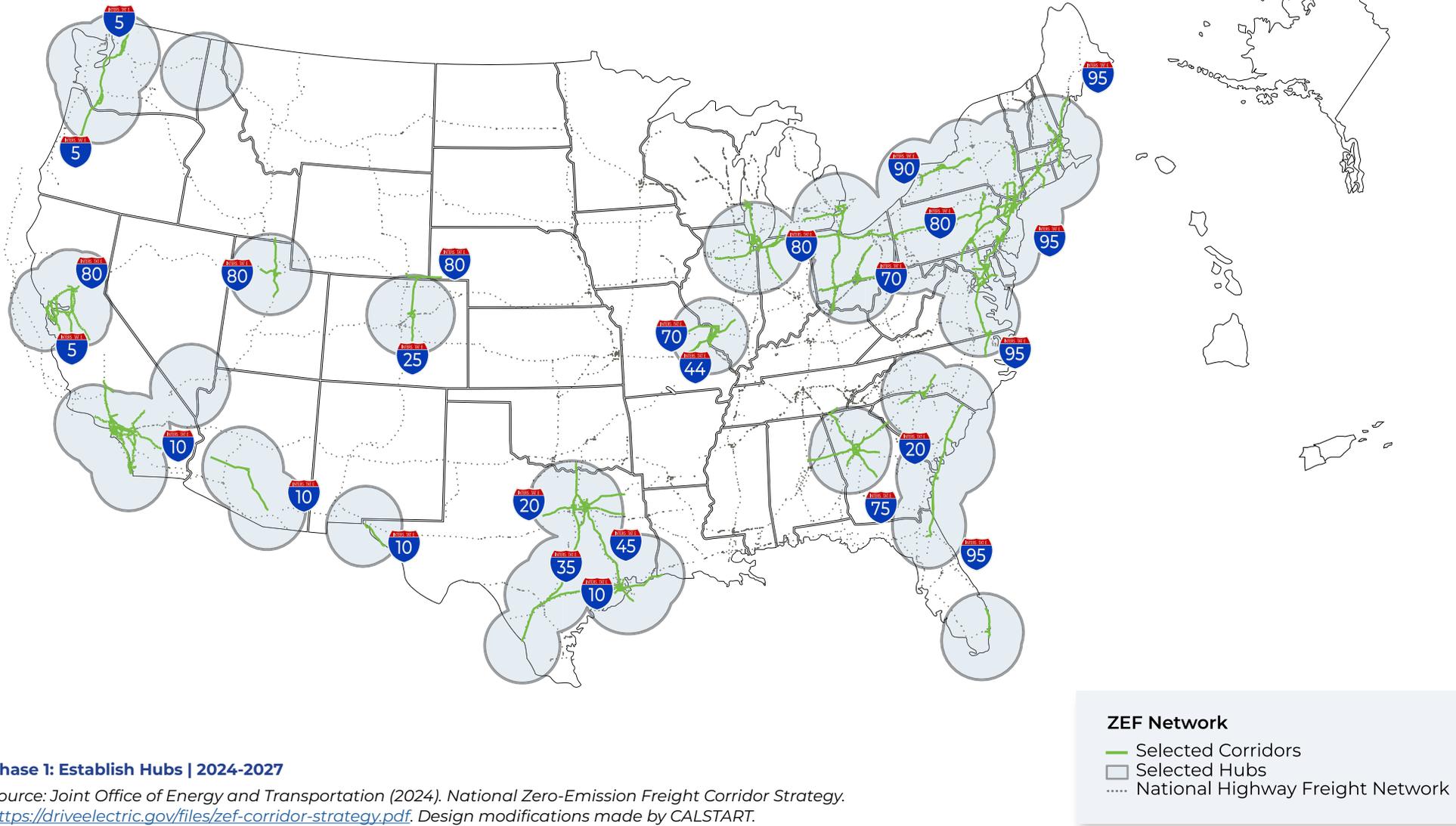
created logistical challenges for fleets considering buying a ZET.

- Insurance and monthly lease payments for ZETs are notably higher as insurers and financiers lack historical data to this new technology, meaning higher risk and higher payments.

- Regulatory uncertainty at both the state and federal level leaves fleets and OEMs unsure about how aggressively they should invest in ZETs.

After a surge in 2023, which saw 25,378 new ZETs on the road, 2024 will likely see fewer deployments. Understanding how to generate demand, and where it will be, is crucial. As outlined in the Joint Office of Energy and Transportation’s [National Zero-Emission Freight Corridor Strategy](#), efforts should focus on the freight hubs ready to use these vehicles in applications such as local return-to-base operations, first- and last-mile delivery, and drayage (Figure 3). The phased-in approach for accelerated ZET adoption aims to target public investment to amplify private-sector movement and support utility and regulatory planning and action at local, state, and regional levels. Prioritizing infrastructure development within these hubs will provide convenient access to charging and refueling for the high priority vehicle applications that are viable for ZETs today. These actions will help build the foundation for a strong ZE freight ecosystem.

Figure 3: Phase 1 of the National Zero-Emission Freight Corridor Strategy





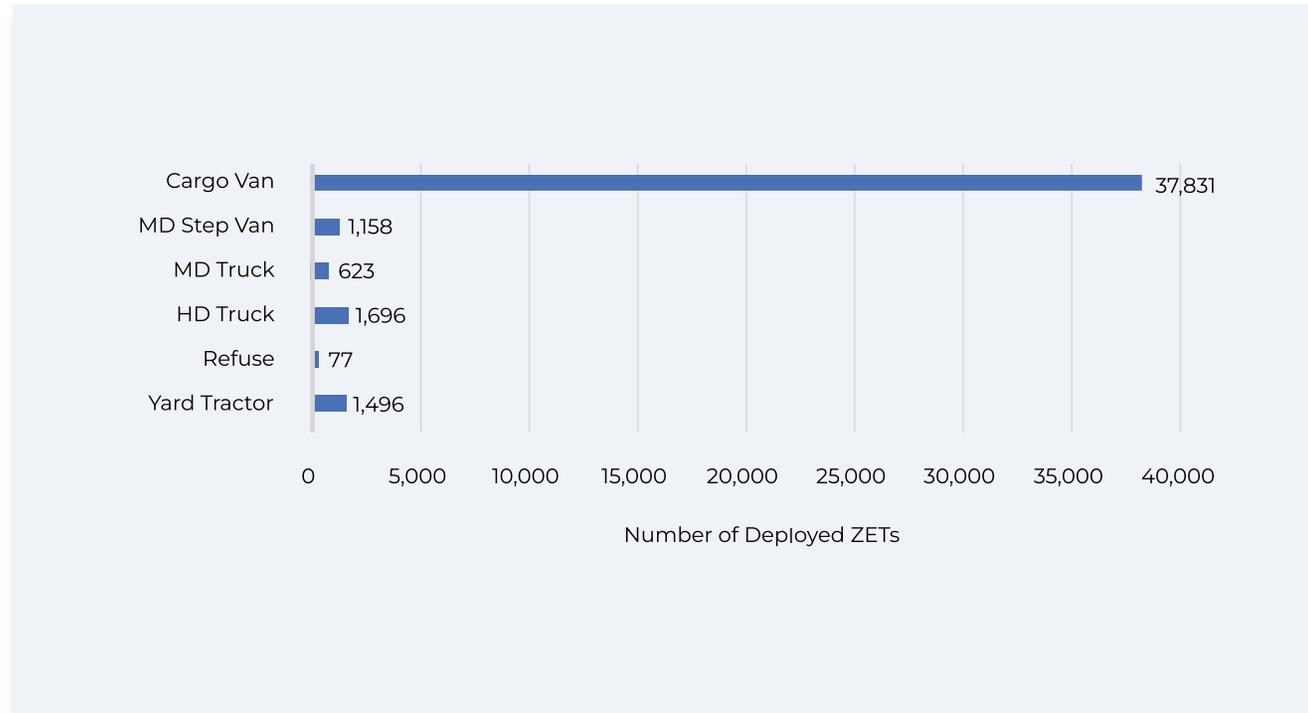
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**U.S. ZET DEPLOYMENTS BY SEGMENT**

Approximately 37,831 ZE cargo vans have been deployed (Figure 4), with 11,900 new vehicles in the first six months of 2024. With industry efforts focusing on decarbonizing local return-to-base operations, first- and last-mile delivery, and drayage, the growth of ZE cargo vans is expected to continue. This segment has grown due to smaller batteries, high production volumes from multiple OEMs, ideal duty-cycle capability, and much lower upfront costs compared to other segments.

ZE MD and HD trucks are not experiencing the same growth. Upfront costs increase with each vehicle class: some Class 2b ZE cargo vans have upfront cost parity while Class 8 ZE HD trucks' average price is \$460,000,<sup>3</sup> more than double the average diesel-powered version of the same truck. ZE cargo vans are mainly used for last-mile delivery, an application with predictable routes normally under 100 miles. MD and HD trucks are used

**Figure 4:** Cumulative U.S. ZET Deployments by Segment



in a variety of applications and can have regular daily routes of 250 miles or more, the current high end of ranges for available ZE models. ZE cargo vans can also utilize Level 2 charging, which involves less expensive chargers and grid updates than installing direct current fast chargers that larger vehicles need. These specific

needs for larger vehicle segments can be drawbacks for fleets looking to purchase a ZET. However, first movers who have deployed ZE MD and HD trucks in short-run applications like return-to-base and drayage have proven to be successful.

<sup>3</sup>Aggregated data from Price Digests.



## ZE DRAYAGE AT PORTS OF LOS ANGELES AND LONG BEACH

There are 22,550 trucks in the drayage registry for the Ports of Los Angeles and Long Beach, the nation’s busiest port. In November 2023, these ports launched the Port Plus Up Program, designed to stack an additional \$75,000 or \$100,000 of incentives with the Clean Truck and Bus Voucher Incentive Project (HVIP) to further reduce the upfront cost of ZE HD trucks. The program has been successful, with all money allocated as of October 2024. This program funded 796 ZE HD trucks in the first year, with 160 having already been deployed. These ports now have 415 ZETs in their drayage registry (as of October 14, 2024), with more to come. There are approximately 693 ZE HD trucks deployed in California, and the ports can take credit for more than half of those deployments as well as why California has 483 more ZE HD truck deployments than the next state.



### 3

## U.S. ZET DEPLOYMENTS BY STATE

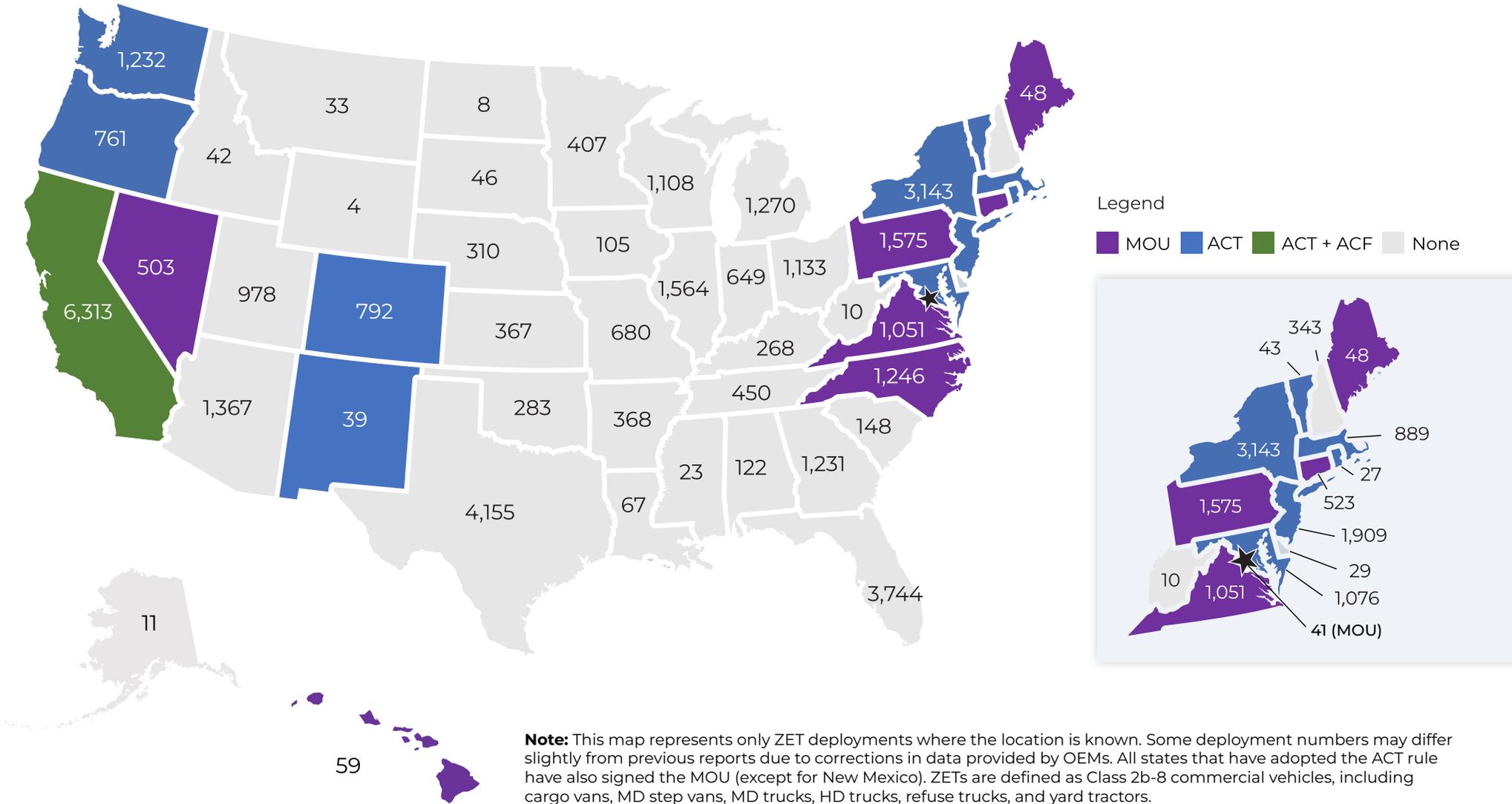
Of the cumulative U.S. ZET deployments, 37% were in states that have adopted the [Advanced Clean Trucks \(ACT\) rule](#), despite those same states representing only 27% of all truck stock.<sup>4</sup> Moreover, 11% of ZET deployments were in states that have signed the [Multi-State Medium-](#)

[and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding \(MOU\)](#), and 53% were in non-MOU states. Figure 5 presents the number of deployed ZETs by state and identifies major state-level ZET sales regulations and commitments. Categories include states with the highest level of ZET policy ambition that, as of June 2024, have adopted both the ACT and Advanced Clean Fleets (ACF) rules (green), states have adopted only ACT (blue), states

that have adopted neither rule but have signed the MOU indicating intent to adopt ACT (purple), and non-MOU states (gray).

<sup>4</sup>States that have adopted the ACT rule as of June 2024 include California, Colorado, Maryland, Massachusetts, New Jersey, New Mexico, New York, Oregon, Rhode Island, Vermont, and Washington. All states that have adopted the ACT rule have also signed the MOU (except for New Mexico).

Figure 5: State ZET Deployments and Policy Status



## U.S. ZET DEPLOYMENTS BY STATE

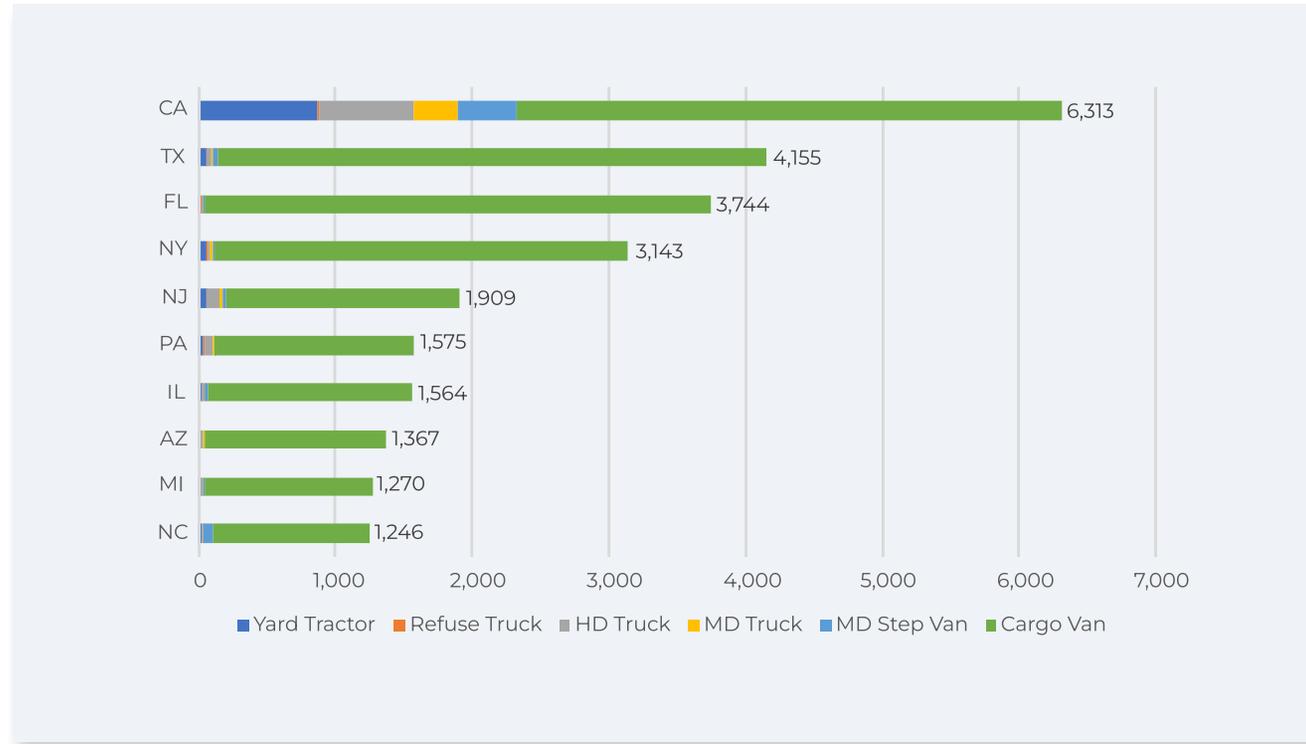


The leading states for overall ZET deployments are California (6,313), Texas (4,155), and Florida (3,744). There are now sixteen states with more than 1,000 ZET deployments, up from six since December 2023. The majority of every state's ZET population is driven by ZE cargo vans, with almost every state having a ZET mixture of more than 90% ZE cargo vans—showing regulations or incentives are not required to drive deployments for this segment.

The vehicle distribution of the top 10 states (Figure 6) highlights the challenges of scaling ZET adoption nationwide. ZE deployments of MD step vans, MD trucks, HD trucks, refuse trucks, and yard tractors are minimal outside of California, with approximately 2,727 vehicles deployed across all other states.

In California, a variety of vehicle segments has propelled the state to lead in ZET deployments. California has had state-wide incentive programs longer than any other state and invested more than \$1.5 billion for ZETs and infrastructure, resulting in 6,313 ZETs on the road and more than [50 public charging and refueling stations for ZETs](#) opened, in development, or planned.

**Figure 6:** Top 10 States for ZET Deployments with Vehicle Distribution



The Low Carbon Fuel Standard has also encouraged the production and use of low-carbon transportation fuels within the state. This credit system, which no other state has implemented to date, helps fund fleets for using electricity or hydrogen as a fuel. It has also been proven to save Californians almost \$5 billion in health cost

savings and 42% in fuel costs per mile while helping [cut greenhouse gas emissions by 20%](#) since the year 2000. In addition, California adopted the ACT rule, a supply-side regulation, along with the ACF rule, a demand-side regulation, pending EPA waiver approval.



These steps have helped fleets throughout California more easily plan and deploy ZETs. California has also implemented innovative ways to get more ZETs on the road with short-term lease programs, temporary charging pilots, and free technical assistance for fleets to help guide them through the process of transitioning to ZETs. Other states have followed, with seventeen states having or currently offering incentives for both the trucks and infrastructure and eleven having adopted the ACT rule. Fleet assistance programs are also on the rise to help bridge knowledge gaps, with Massachusetts and New Jersey offering similar advisory programs.

initial investment through resale. The ability to resell trucks provides owners with residual value numbers—an important element for understanding the total cost of ownership of a vehicle—and allows them to reinvest into next generation models. This creates a circular economy within the trucking industry, as resources are efficiently utilized across multiple owners and makes quality trucks accessible at a lower cost. This dynamic is well-established for internal combustion engine (ICE) trucks, but the [value of used ZETs is still being determined](#). Building a healthy secondary market for ZETs will be key to broaden adoption across all fleet sizes.

Outlined in Table 1, the United States has approximately 2,708 used ZETs deployed, representing 6% of all ZET deployments—a stark contrast to the national average for used trucks at 54%. The used truck market is particularly critical for small fleets. Of the more than 4.2 million trucks on U.S. roads operated by small fleets, 61% of them are used trucks. These small fleet operators face unique challenges when adopting new technologies, such as limited access to capital and less control over infrastructure development.

## 4 USED U.S. ZET MARKET

Used trucks make up most of all trucks on the road, with approximately 54% of registered trucks classified as used. A used truck market is crucial to the freight economy, as it enables fleets to purchase trucks at a fraction of the cost and allows original owners to recoup some of their

**Table 1:** Used U.S. Trucks by Fleet Size and Fuel Type

Fleet Type	Used	New
<b>Small fleets ZE</b>	6%	94%
<b>Small fleets ICE</b>	61%	39%
<b>All other fleets ZE</b>	8%	92%
<b>All other fleets ICE</b>	51%	49%
<b>National average</b>	54%	46%



The high upfront cost for new ZETs is a top barrier for small fleets. Historically reliant on the affordability of used trucks, small fleets are now faced with hefty sales tax and the federal excise tax, [an additional 12% tax](#) for Class 7 and 8 trucks, the latter of which does not apply to used trucks. For example, purchasing a new Class 8 ZE HD truck at \$460,000 could result in tens of thousands of dollars in sales tax, and then an additional \$55,200 for federal excise tax to the purchase price—costs not covered by current incentive programs. Disincentivizing all fleets to purchase ZETs with these taxes will slow the creation of a secondary market and in turn forces more small fleets to purchase a new ZET with these additional, likely unaffordable costs. Exempting federal excise tax for ZETs would provide tax relief on the initial purchase of the truck and drive more demand due to the lower upfront costs. Eliminating sales tax for the purchase of a new ZET, an incentive Colorado has already implemented, can further reduce the upfront cost for fleets.

Insurance costs and monthly lease payments also remain high for ZETs. The

technology’s newness and lack of historical data have made it a challenge for insurers and financiers to properly assess the value of ZETs. Unknowns around new parts, such as batteries and electric drivetrains, and an underdeveloped maintenance network can drive premiums up as well, further adding to the financial hurdle for fleets. These additional expenses make it difficult, if not impossible, for many fleets to justify the purchase of a new ZET.

## 5 OVERALL U.S. TRUCK MARKET

Understanding the overall market can help contextualize where efforts can be more impactful to accelerate ZET adoption. Below are key insights<sup>5</sup> about the overall U.S. truck market:

- Most of the U.S. medium- and heavy-duty (MHD) truck stock consists of HD trucks at 36%, followed by MD trucks (34%) and cargo vans (28%).
- The leading five states for truck stock represent 33.1% of the national truck

stock: California (11%), Texas (7.3%), Florida (5.2%), Pennsylvania (4.9%), and Indiana (4.7%).

- States that have adopted the ACT rule represent 25.6% of national MHD truck stock and 19.6% of January–June 2024 MHD truck deployments.
- States that have signed the MOU (including ACT states) represent 38% of national MHD truck stock and 32.7% of January–June 2024 MHD truck deployments.
- Over the past 18 months, Texas has seen a large increase in new MHD truck deployments, totaling 95,759 or 5,380 more than the next closest state.
- Five states represent 29.3% of January–June 2024 U.S. MHD truck deployments: Texas (6.8%), Indiana (5.8%), Florida (5.7%), California (5.6%), and Pennsylvania (5.4%).
- Used trucks make up 54% of the national MHD truck stock. Of those used trucks, 32% are owned by small fleets.
- Over a quarter (30%) of the U.S. MHD truck stock is owned by individuals.

<sup>5</sup>Explore updated data for both the U.S. overall truck market and ZET market using the interactive dashboard at <https://calstart.org/zio-zets/>.



Of these individually owned trucks, 39% are cargo vans, 38% are MD trucks, and 23% are HD trucks.

- Seven vocations represent 77% of MHD truck stock: individual (30%), general freight (13%), services (10%), construction (9%), lease/rental (7%), wholesale/retail (5%), and government/miscellaneous (3%).
- Fuel type of MHD truck stock in the United States is primarily diesel (59%) and gasoline (33%). Flexible fuel (7%) follows with all other fuel types (natural gas, electric, hydrogen, hybrid, etc.) representing the remaining 1%.

## CONCLUSION: ZET MARKET NEEDS A BOOST

Transitioning to ZE transportation in the freight industry is critical to combat the climate crisis. MHD vehicles, though only 10% of the U.S. vehicle fleet, account for [more than 25%](#) of all transportation-related greenhouse gas emissions. Focusing on decarbonizing freight operations will make an impact in reducing emissions from the entire transportation sector.

The data makes it clear that the freight industry is not on track to meet climate goals in place for 2030 and beyond. While ZE cargo vans have made significant inroads and prove that certain segments are ready for mass adoption, the lagging growth in MHD truck segments and overall stagnation of ZET deployments over the past 18 months indicate a need for accelerated action.

Maximizing the impact in key freight hubs through local return-to-base operations, first- and last-mile delivery, and drayage—applications where ZETs have already demonstrated their ability to meet operational demands—can be achieved by:

- Expanding incentives for fleets operating in these hubs.
- Providing targeted infrastructure investments to make charging and refueling readily available.
- Enacting additional policies to signal to OEMs, fleets, shippers, utilities, and infrastructure providers to further invest in ZETs.

To ensure broader adoption, states must start driving demand for ZETs while addressing existing barriers. States that

have implemented regulations, incentives, and support systems are proving that these actions help drive demand, but these efforts need to be replicated and expanded nationwide. States have the opportunity to help fleets or risk losing valuable business and jobs to those that offer a more favorable framework to transition to ZETs. Continuing to drive demand will further bring down costs and ultimately lead to an accelerated market for ZETs.

The pace of ZET deployments must double to meet the federal climate targets of 100% new ZE truck and bus sales by 2040, with an interim goal of 30% of new sales by 2030. This will require not just regulatory action but also market-driven solutions such as truck-sharing programs, bulk purchasing initiatives, and guaranteed residual value schemes that can stimulate demand in the private sector. Cross-sector collaboration will be essential to build the necessary infrastructure and support fleets in their transition to ZETs. Continuing to focus on segments that are ready for decarbonization today will create a robust ZE freight ecosystem and drive the kind of transformative change the industry—and the planet—urgently needs.



## APPENDIX A: DEFINITIONS, DATA SOURCES, AND ASSUMPTIONS

This update provides a concise and current snapshot of the dynamic U.S. MHD truck market as of June 2024. It presents deployment statistics for ZETs and characterizes the existing U.S. MHD truck market for Class 2b (8,501–10,000 lbs.) through Class 8 (33,000 lbs. and above) vehicles. These vehicles are categorized into six distinct segments: cargo vans, MD step vans, MD trucks, HD trucks, refuse trucks, and yard tractors.

ZET deployments are from 2017 and on. While ZETs could have been deployed prior to 2017, they are not included in this analysis due to technological maturity.

Yard tractor deployments are likely underreported as many are not registered for on-road use and much of the data on deployments comes from vehicle registrations.

Unless otherwise noted, all figures are copyright CALSTART based on data from author correspondence with manufacturers, IHS Markit, California’s

Clean Off-Road Equipment Voucher Incentive Project (CORE), California’s Clean Truck and Bus Voucher Incentive Project (HVIP), public press releases, and the New York Truck Voucher Incentive Program (NYTVIP). Figure 4 represents only the 42,593 ZETs for which deployment locations are known. Some deployment numbers may differ slightly from the previous market update due to corrections in the data provided by OEMs. State totals

do not equal total deployments because deployment locations are not known for all ZETs.

Data sources in Table A-1 are in order from most to least prevalent within the data used to determine ZET deployments.

**Table A-1:** Data Sources

Data Source	Description	Specific Data Used
<b>Private Correspondence</b>	Author correspondence with OEMs	ZET deployments as of June 2024
<b>IHS Markit</b>	Global provider of information and analysis on world markets and industries	U.S. truck registrations as of June 2024
<b>California CORE</b>	California’s Clean Off-Road Equipment Voucher Incentive Project	ZE tractor deployments as of December 2023
<b>California HVIP</b>	California’s Clean Truck and Bus Voucher Incentive Project	ZET deployments as of December 2023
<b>Public Press Releases</b>	Press releases from OEMs announcing delivered sales	ZET deployments as of December 2023
<b>NYTVIP</b>	Truck voucher incentive program administered by the State of New York	ZET deployments as of December 2021



## APPENDIX B: STATE INCENTIVE PROGRAMS

**Table B-1:** State Incentive Programs

State	Incentive Program	Incentive Type	Funding	Year Started	Active
California	<a href="#">California's Clean Truck and Bus Voucher Incentive Project (HVIP)</a>	Voucher	Vehicle	2010	Yes
California	<a href="#">Clean Off-Road Equipment (CORE) Voucher Incentive Project</a>	Voucher	Vehicle	2021	Yes
California	<a href="#">Energy Infrastructure Incentives for Zero-Emission (EnerGIIZE) Commercial Vehicles</a>	Voucher	Infrastructure	2022	Yes
California	<a href="#">Implementation of MHD Vehicle Infrastructure</a>	Grant	Infrastructure	2023	No
Colorado	<a href="#">Clean Fleet Vehicle Technology Grant Program</a>	Grant	Vehicle	2023	No
Colorado	<a href="#">Fleet Zero</a>	Grant	Infrastructure	2023	Yes
Colorado	<a href="#">Colorado State Sales and Use Tax Exemption</a>	Tax Exempt	Vehicle	2024	Yes
Delaware	<a href="#">EV Charging Equipment Rebates</a>	Rebate	Infrastructure	2023	Yes
Federal	<a href="#">Commercial Clean Vehicle</a>	Tax Credit	Vehicle	2023	Yes
Federal	<a href="#">Clean Ports Program</a>	Grant	Both	2024	No
Federal	<a href="#">Clean HD Vehicles</a>	Grant	Both	2024	No



State	Incentive Program	Incentive Type	Funding	Year Started	Active
<b>Hawaii</b>	<a href="#">Diesel Replacement Rebate</a>	Rebate	Vehicle	2023	Yes
<b>Illinois</b>	<a href="#">Business &amp; Public Sector Electric Vehicle Rebate Program</a>	Rebate	Vehicle	2024	Yes
<b>Maryland</b>	<a href="#">Medium-Duty and Heavy-Duty Zero-Emission Vehicle Grant Program</a>	Grant	Both	2024	No
<b>Massachusetts</b>	<a href="#">Massachusetts Offers Rebates for Electric Vehicles (MOR-EV) Trucks Program</a>	Rebate	Vehicle	2022	Yes
<b>Massachusetts</b>	<a href="#">MassEVIP</a>	Grant	Infrastructure	2014	Yes
<b>Minnesota</b>	<a href="#">Heavy-Duty On-Road Replacement Grant</a>	Grant	Vehicle	2024	No
<b>Montana</b>	<a href="#">Clean Truck, Bus &amp; Airport Equipment Funding Program</a>	Grant	Vehicle	2024	Yes
<b>Nevada</b>	<a href="#">Nevada Clean Trucks and Buses Program</a>	Grant	Vehicle	2024	No
<b>New Jersey</b>	<a href="#">New Jersey Zero-Emission Incentive Program (NJ ZIP)</a>	Voucher	Vehicle	2020	No
<b>New Jersey</b>	<a href="#">Clean Fleet EV Program</a>	Grant	Both	2023	Yes
<b>New Jersey</b>	<a href="#">Sales and Use Tax Exemption</a>	Tax Exempt	Vehicle	2004	No
<b>New York</b>	<a href="#">New York Truck Voucher Incentive Program (NYTVIP)</a>	Voucher	Vehicle	2011	Yes
<b>New York</b>	<a href="#">New York City Clean Trucks Program (NYCCTP)</a>	Voucher	Vehicle	2012	Yes



State	Incentive Program	Incentive Type	Funding	Year Started	Active
Oklahoma	<a href="#">On-Road Program</a>	Grant	Vehicle	2024	No
Oregon	<a href="#">Rebate Program for Medium and Heavy Duty Zero-Emission Vehicles</a>	Rebate	Vehicle	2024	Yes
Pennsylvania	<a href="#">Medium- and Heavy-Duty Zero-Emission Vehicle Fleet Pilot Grant</a>	Grant	Both	2023	No
Pennsylvania	<a href="#">Alternative Fuels Incentive Grants</a>	Grant	Vehicle	2022	Yes
Texas	<a href="#">All-Electric Grant Program</a>	Grant	Both	2023	Yes
Texas	<a href="#">Grants for Heavy-Duty Vehicles and Equipment</a>	Grant	Vehicle	2024	No
Washington	<a href="#">Clean Alternative Fuel Commercial Vehicles and Vehicle Infrastructure</a>	Tax Credit	Both	2020	Yes
Washington	<a href="#">EV Charging Infrastructure Program</a>	Grant	Infrastructure	2023	No
Washington	<a href="#">Infrastructure and Incentive Program for Medium and Heavy Duty Zero Emission Vehicles</a>	Voucher	Both	2024	No

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[zev-initiative](https://www.nescaum.org/initiatives/mhd-zev-initiative)

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## ABOUT CALSTART

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