

# Zeroing in on Zero-Emission Trucks

June 2022  
Market Update



## ABOUT

This report provides a concise and current snapshot of the dynamic U.S. medium- and heavy-duty (MHD) truck market (Class 2b-8). It presents deployed sales statistics for zero-emission trucks (ZETs)<sup>1</sup> and characterizes the existing U.S. MHD truck market. "Deployed sales" is defined as trucks that have been sold, delivered, and placed into service on U.S. roads or in off-road applications. This analysis also highlights key takeaways that can help guide future ZET deployments through insights into state-specific markets.<sup>2</sup> These findings can be a vital component in the informed decision-making process of policymakers, original equipment manufacturers (OEMs), and fleet owners.

## KEY TAKEAWAYS

- The U.S. MHD ZET market is experiencing strong growth. Since January 2017, annual MHD ZET sales increased year over year by 78% in 2018, 26% in 2019, 65% in 2020, and 155% in 2021. 136 models are available for purchase across over 41 manufacturers as of March 2022.
- Cumulative U.S. MHD ZET deployed sales from January 2017 to March 2022 total 1,895 (cumulative sales since 2010 are 2,646).
- The growth of key zero-emission heavy-duty (HD) segments in the United States, like yard tractors (110% growth from January 2017 to March 2022) and HD trucks (1400% growth from January 2017 to March 2022), reflect the suitability of zero-emission technologies to meet and exceed the demanding characteristics of internal combustion engine vehicles.
- From 2011 through 2022, redeemed and unredeemed vouchers from California's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) for MHD ZETs total \$542 million over 5,337 units, an average of ~\$101,000 per MHD ZET or ~29% of the average original retail price for a deployed MHD ZET.
- California's strong ZET policy ecosystem is a major factor that has enabled the state to lead in deployments, with 60% of total U.S. MHD ZET sales from January 2017 to March 2022. For each \$1 invested in MHD ZETs through California's HVIP program, \$2.40 is matched by fleets purchasing MHD ZETs.

### Overall U.S. MHD Truck Market

- In 2021, total U.S. MHD truck sales were 967,115. Of this total, Class 4-8 truck sales were 265,388. California leads the nation in U.S. MHD trucks sales, with 68,578 Class 4-8 units sold in 2021.
- As of 2022, diesel-powered trucks constitute 36% of registered Class 2b trucks, increasing to 97% of registered Class 8 trucks. Class 2b-3 trucks are composed of 46% gasoline, 44% diesel, and 10% flexible fuel.<sup>3</sup> Class 4-8 trucks are composed of 9% gasoline, 89% diesel, and 1% natural gas. As MHD ZET deployments cut into these market shares, the numerous benefits these vehicles offer over their gasoline- and diesel-powered counterparts, such as improved air quality and mitigated effects of climate change, will increase.

<sup>1</sup> CALSTART's definition of ZETs are those that do not emit exhaust gases or other pollutants from their on-board power source. Such power sources include battery-electric and hydrogen fuel cell vehicles and excludes low-emission technologies like natural gas (compressed, liquid, or renewable), hybrid electric, and biodiesel vehicles. Trucks in this report are segmented according to the [Zero-Emission Technology Inventory tool's](#) categorization scheme, which divides Class 2b-8 trucks into seven distinct segments. This report also tracks yard tractors. For more information on the definition and segmentation of commercial ZETs in this analysis, please refer to <https://calstart.org/zeroing-in-on-zero-emission-trucks/> for the first version of this report released in January 2022.

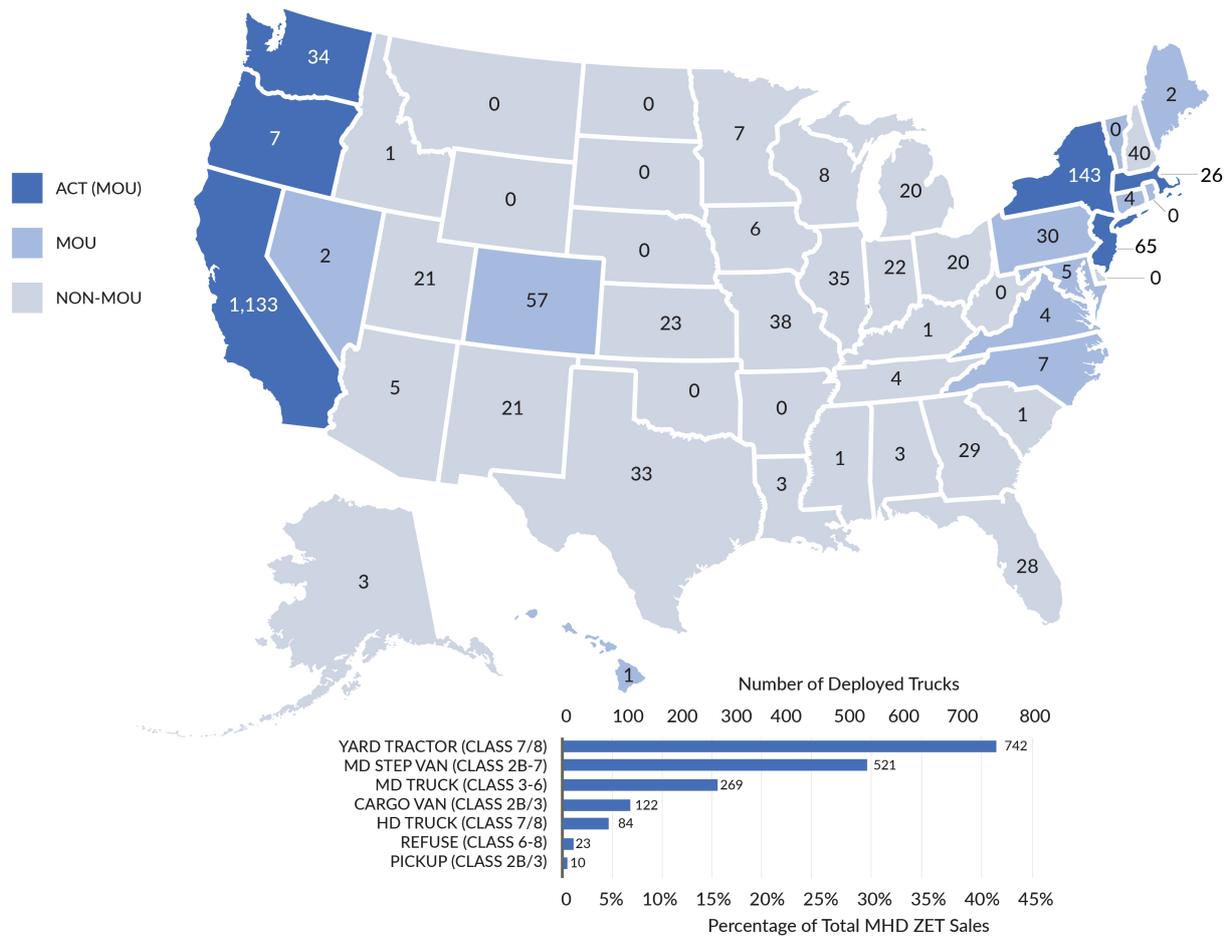
<sup>2</sup> This analysis is based on U.S. MHD ZET information gathered as of March 2022 and U.S. MHD truck data (IHS Polk) as of December 2021.

<sup>3</sup> Flexible fuel vehicles are internal combustion engine vehicles capable of operating on gasoline and any blend of gasoline with up to 83% ethanol.

# U.S. MHD ZET DEPLOYMENTS BY STATE

U.S. MHD ZETs deployed since January 2017 reached a total of 1,895 units, the majority (60%) of which were deployed in California. Figure 1 presents the number of deployed MHD ZETs by state and identifies major ZET sales regulations. Categories include states with the highest level of ZET policy ambition that have adopted California's Advanced Clean Truck (ACT) regulation (dark blue), states that have signed a memorandum of understanding (MOU) indicating intent to follow the ACT regulation (light blue), and non-MOU states that do not have an aligned policy on ZETs (gray).

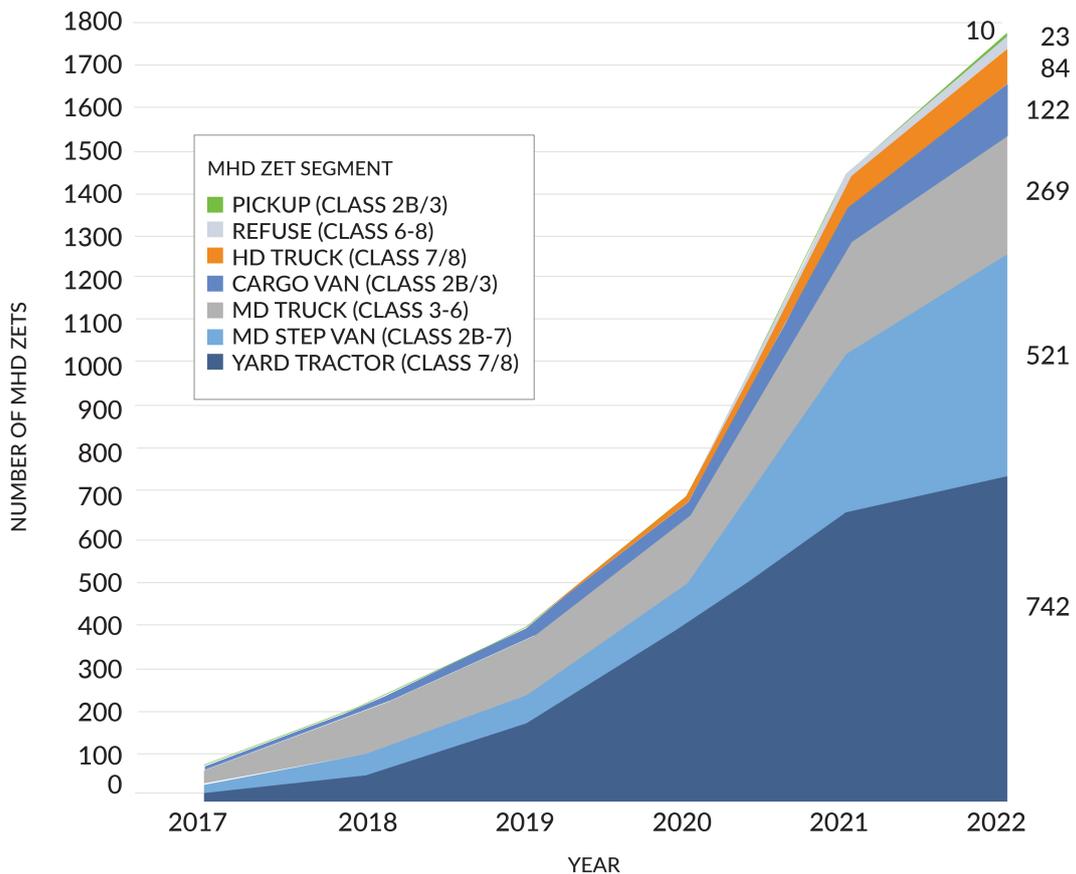
**Figure 1.** MHD ZET Deployed Sales by State (January 2017 – March 2022)



## U.S. MHD ZET DEPLOYMENTS BY SEGMENT

Figure 2 represents the cumulative growth of the seven MHD ZET segments in this analysis over the past five years. (Vehicle sales that do not fall within the Zero-Emission Technology Inventory tool's segments are not shown.) As of March 2022, 136 models are available for purchase across over 41 manufacturers.

**Figure 2.** Cumulative U.S. MHD ZET Deployed Sales (January 2017 - March 2022)

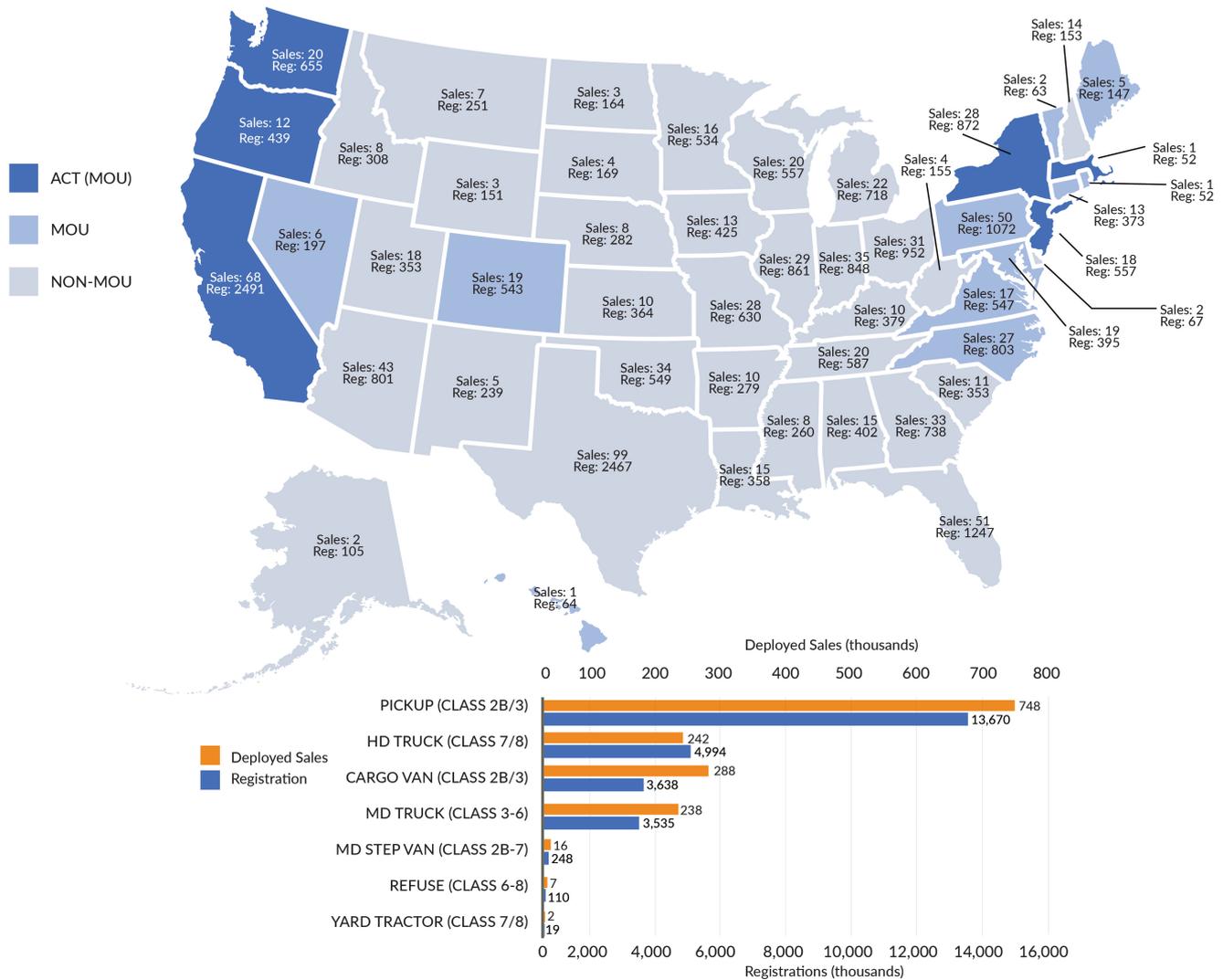


- From 2017 through 2021, HD ZETs experienced the steepest average annual growth rate (1400%). This growth rate is expected to continue its aggressive upward trend as more OEMs enter the market and established OEMs expand their offerings. Over the same period, zero-emission MD step vans experienced an average annual growth rate of 253%, followed by zero-emission cargo vans (229%), refuse ZETs (153%), zero-emission yard tractors (110%), and MD ZETs (81%).
- Zero-emission yard tractors and other vehicles with low range requirements are dominating MHD ZET deployed sales. Yard tractors lead the U.S. ZET market share (registration) at 41%, followed by MD step vans at 30%, MD trucks at 15%, cargo vans at 7%, and HD trucks at 5%. Orange EV manufactures zero-emission yard tractors and leads the U.S. deployed sales of MHD ZETs with 384 deployed sales since January 2017.

# U.S. MHD TRUCK REGISTRATION AND TOTAL SALES

The United States has the largest number of registered trucks globally with 26 million reported in 2021. Pickup trucks (Class 2b/3) dominate with around 13.7 million registrations, more than twice all other truck types combined. Figure 3 presents the number of registered MHD trucks and deployed sales (as of year-end 2021) by state in thousands and highlights major policy for ZET sales in the same manner as Figure 1. Juxtaposing overall U.S. MHD truck market statistics with ZET sales regulations can help inform market and policy opportunities for ZETs at the state level.

**Figure 3.** U.S. MHD Trucks Registration and Yearly Deployed Sales by State as of 2021 (Thousands)

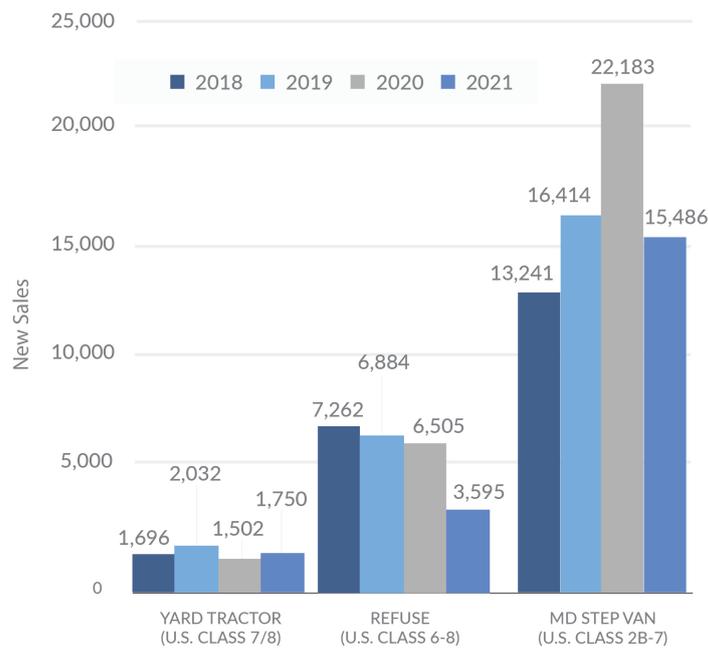


- The majority of the registered U.S. MHD truck market (as of year-end 2021) is comprised of pickup trucks (52%). When pickup trucks are not considered, Class 7-8 HD trucks lead in registrations (40%), followed by Class 2b/3 cargo vans (29%) and Class 3-6 MD trucks (28%).
- Four states represent 28% of registered U.S. MHD trucks: California (10%), Texas (9%), Florida (5%), and Pennsylvania (4%). All other states each comprise 4% or less of registered vehicles.
- States that have enacted the ACT regulation represent 25% of national MHD truck registrations and 22% of national MHD deployed truck sales.
- States that have signed the MOU represent 37% of national MHD truck registrations and 33% of national MHD deployed truck sales.
- Five states represent 31.5% of yearly U.S. MHD deployed truck sales: Texas (10%), California (7%), Florida (5%), Pennsylvania (5%), and Arizona (4.5%). All other states each comprise 4% or less.

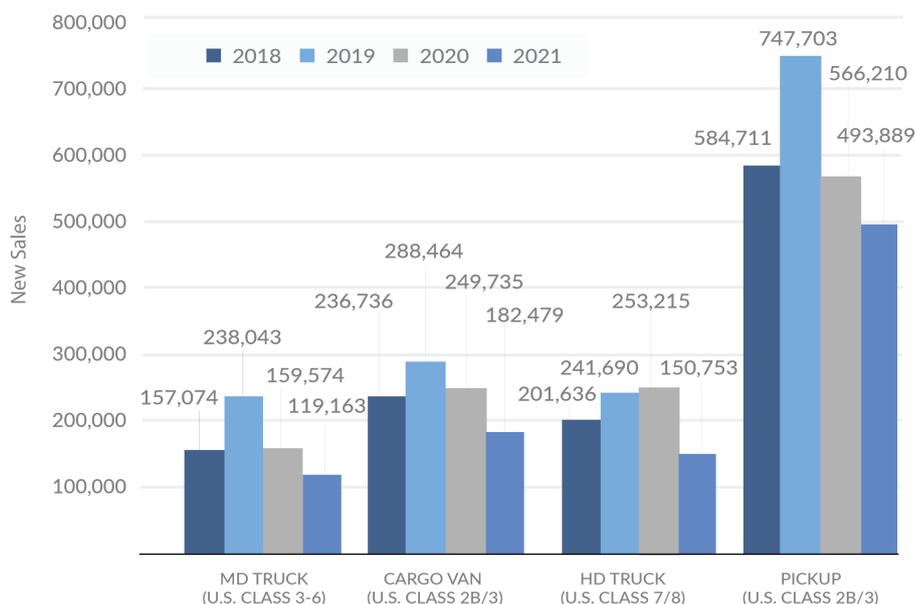
- Over half (55%) of registered U.S. MHD trucks are owned by individuals. Of these individually owned trucks, 69% are 2b/3 pickup trucks, 10% are cargo vans, 7% are HD trucks, and 7% are MD trucks.
- Internal combustion engine vehicles represent 95% of the U.S. registered MHD trucks: diesel (58%), gasoline (35%), and flexible fuel (7%). All other fuel types are less than 1% (natural gas, propane, hybrid, and electric).
- MHD trucks (including pickup trucks) represent 87% of registered U.S. MHD vehicles. (SUVs are 2%, and buses are 11%.) The sales share of each of these segments is consistent with registrations, differing by a degree of only 1%.

Annual U.S. MHD truck sales fluctuate from year to year due to several factors such as fleets' acquisition cycles, market economy, supply chain constraints, regulations, and anticipated models. As seen in Figures 4a and 4b, sales over the past five years have fluctuated based on the factors mentioned above (sales in 2018 declined 11% year over year, followed by a 28% increase in sales in 2019) and further constraints from the global COVID-19 pandemic.

**Figure 4a.** U.S. Yard Tractor, Refuse, and MD Step Van Deployed Sales (2018-2021)



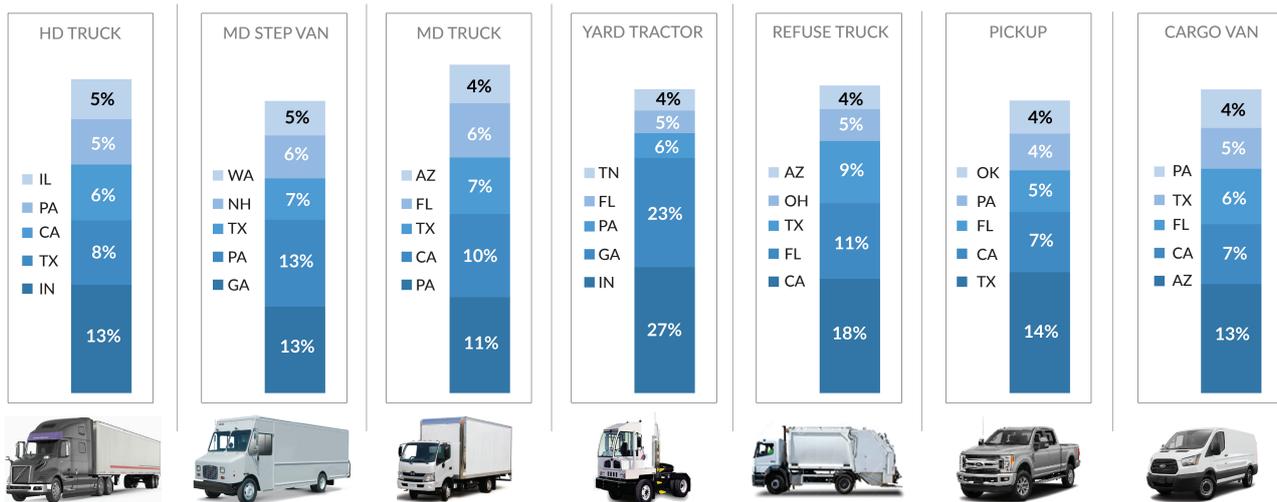
**Figure 4b.** U.S. MD Truck, Cargo Van, HD Truck, and Pickup Deployed Sales (2018-2021)



- Deployed truck sales have declined overall by 37% since 2019 due to COVID-19; amid the pandemic in 2020, sales dropped by 18% and fell another 23% in 2021.

Although truck sales have declined from 2019 to 2021, the share of sales by truck segment vary in each state. Figure 5 represents the top five states with the highest 2021 deployed sales under each truck segment. States with high sales numbers in 2021 may appear to have large markets for certain vehicle segments, but to fully understand the state of these markets, registration of those truck segments must also be considered. Furthermore, depending on the market dynamics of each state, new trucks will either replace old trucks or expand existing fleets.

**Figure 5.** Top U.S. States with High 2021 Deployed Sales by Truck Type



- The top five states by sales for each MHD truck segment account for over a third of the national sales by segment: HD truck (37% or 54,360 units), MD step van (44% or 6,787 units), MD truck (38% or 45,277 units), yard tractor (65% or 1,118 units), refuse truck (47% or 1,665 units), pickup truck (34% or 165,783 units), and cargo van (35% or 66,452 units).
- Truck sales are not distributed across states evenly; the breakdown of deployed MHD truck sales in each state is largely dependent on the dominant vocational needs specific to each state. Some states like Indiana, California, Georgia, and Pennsylvania serve as freight hubs and are home to large ports and shipping infrastructure. Financial elements such as fee reductions may also play a role in influencing where logistics companies establish operations and purchase vehicles. Indiana leads HD truck and pickup truck sales deployments in 2021, in alignment with Indiana's current position in the U.S. freight and logistics chain.
- California's deployed MHD truck sales in 2021 represent approximately 10% of total U.S. sales.

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