

Benefits of adopting California's Advanced Clean Truck Program, Heavy-Duty Vehicle Omnibus Standards and a 100% sales requirement in Colorado

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In July 2020, fifteen states and the District of Columbia, who together represent roughly 35% of the U.S. medium- and heavy-duty (M/HD) market, signed a Memorandum of Understanding (MOU), committing themselves “to work together to foster a self-sustaining market for zero-emission medium- and heavy-duty vehicles.”¹ The signatories of this Multi-State MOU share a goal of 30% M/HD zero-emission vehicle (ZEV) sales by 2030 and 100% ZEV sales no later than 2050. The MOU further recognizes the importance of “low-NOx heavy-duty trucks to reduce harmful emissions of NOx, particulate matter, and toxic air contaminants that adversely impact public health.” Taken together, the combined actions of these signatories have the potential to accelerate the national transition toward the cleanest combustion engines and to rapidly expand the fleet of zero-emission M/HD vehicles.

The State of California has adopted two regulations that are cornerstones in the state's effort to reduce emissions from heavy-duty vehicles and meet the targets of the M/HD ZEV MOU. If adopted by other signatories, these regulations could assist states in achieving the goals of the M/HD ZEV MOU: the Advanced Clean Trucks (ACT) rule, which requires the sale of at least 30% zero-emission trucks by 2030, and the Heavy-Duty Vehicle Omnibus rule, which requires a 90% reduction in NOx emissions from model year 2027 engines. States could go even further and adopt a 100% ZEV sales requirement, as the New York State legislature has done, or the California Air Resources Board proposes to do under a new Advanced Clean Fleets rule.

The ICCT commissioned Sonoma Technology, Inc. (STI) in 2022 to estimate the cumulative avoided nitrogen oxides (NO_x), fine particulate matter (PM_{2.5}) and well-to-wheel carbon dioxide equivalent (WTW CO_{2e}) emission reductions expected from implementation of these rules beginning in 2027 in

¹ The signatories are California, Colorado, Connecticut, Hawaii, Maine, Maryland, Massachusetts, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, Washington, and the District of Columbia, “Multi-State Medium- and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding,” (2020, July 14), <https://www.nescaum.org/documents/multistate-truck-zev-governors-mou-20200714.pdf>. Additional signatories since 2020 are Virginia, Nevada, and Quebec. STI did not model results for California or Hawaii, but did model results for non-signatories including Delaware, Illinois, and New Mexico.

Colorado. These results update estimates first published in 2021.² This revised analysis includes lower estimates of vehicle electricity consumption to account for the fact that ZEVs are more efficient on a tank-to-wheel basis than conventional vehicles, updates to upstream emission factors taken from GREET2021, and adjustments to account for energy transmission losses from EVSE equipment. The full spreadsheet analysis with detailed emissions and vehicle population projections is available on the ICCT website.³ As part of the analysis, a business as usual (BAU) case was developed along with three regulatory scenarios: Omnibus only, ACT only, and Omnibus and ACT combined. New this year is a scenario reflecting 100% M/HD ZEV sales in 2040.

Table 1 presents the estimated M/HD truck and bus population in Colorado by powertrain type, conventional or electric, between 2025 and 2050. These projections include all ZEVs, regardless of whether they are produced to meet the requirements of the ACT program or the GHG Phase 2 program, and assume 100% M/HD ZEV sales beginning with model year 2040. The summary spreadsheet prepared for this project includes additional projections reflecting the ACT program individually, and also provides more detailed projections by vehicle weight class.

Table 1. Effect of the Advanced Clean Trucks Program and a MY2040 100% ZEV sales requirement on M/HD vehicle population, by fuel type, 2025–2050

Year	M/HD vehicle population		
	Internal combustion engine vehicles	Zero emission vehicles	Total
2025	510,177	2,603	512,780
2030	519,243	32,187	551,430
2035	564,011	114,389	678,400
2040	550,137	255,233	805,370
2045	512,136	544,014	1,056,150
2050	436,659	870,251	1,306,910

Note: The M/HD vehicle category includes all vehicles with a Gross Vehicle Weight Rating of 8500 pounds or higher. Estimates for 2040 and later include 100% ZEV sales beginning with model year 2040. ZEV sales projections for baseline and ACT only scenarios—without a 100% requirement in 2040—can be found in the Excel report accompanying this fact sheet.

Table 2 shows the estimated cumulative emissions avoided between 2020 and 2050 in Colorado compared to the Business as Usual (BAU) emissions scenario. These results reflect the benefits of all M/HD ZEVs following California’s approach to estimating in-use fleet penetration under the ACT program without adjustments to account for vehicles purchased out-of-state, ZEVs that may migrate out-of-state over time, or ZEVs that would have been produced to meet other requirements like the federal GHG Phase II standards. For estimates with these adjustments, which enable direct comparisons

² Jeff Houk, Joey Huang, Shih Ying Chang, and Doug Eisinger, “Benefits of state-level adoption of California medium- and heavy-duty vehicle regulations,” (Washington, DC: ICCT, 2021), <https://theicct.org/publications/state-level-hdv-emissions-reg-oct21>

³ Available at <https://theicct.org/benefits-ca-multi-state-reg-data/>

to the California Air Resources Board ACT benefits estimates, please refer to the 'ACT-only' scenario results included in the accompanying spreadsheet files.

Table 2. Cumulative M/HD emissions benefits in Colorado compared to BAU, 2020–2050

Program	Cumulative emissions reduction		
	NO _x (U.S. tons)	PM _{2.5} (U.S. tons)	CO ₂ e (MMT*)
ACT	73,670	670	60.72
HDV omnibus	45,980	N/A	N/A
ACT + HDV omnibus	99,680	670	60.72
ACT + HDV omnibus + 100% HD ZEV sales in 2040	119,263	967	77.06

*million metric tons

Figures 1–3 illustrate the emissions trends in Colorado over the timeframe of the analysis.

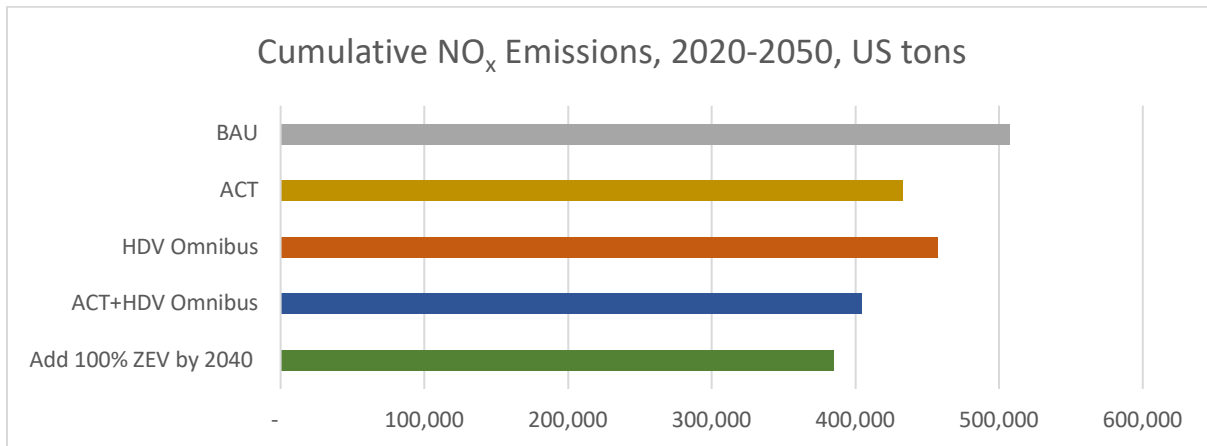


Figure 1. Tank-to-wheel HDV NO_x emissions by scenario 2020–2050

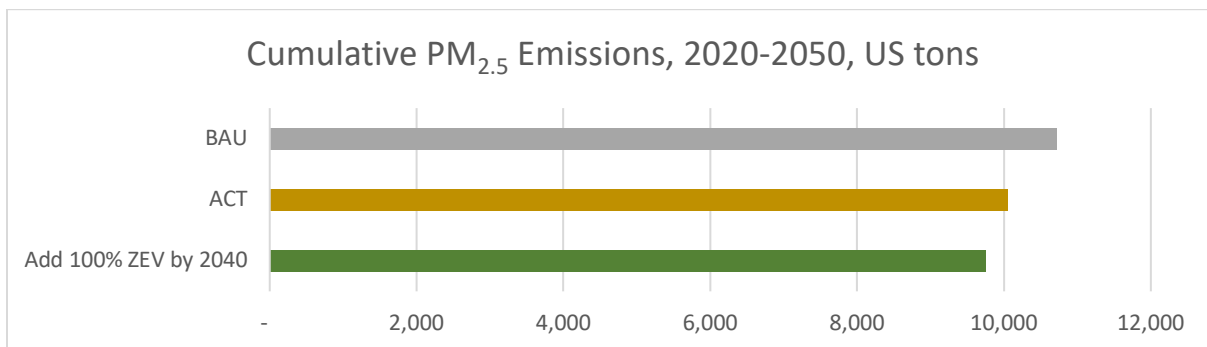


Figure 2. Tank-to-wheel HDV PM emission by scenario 2020–2050

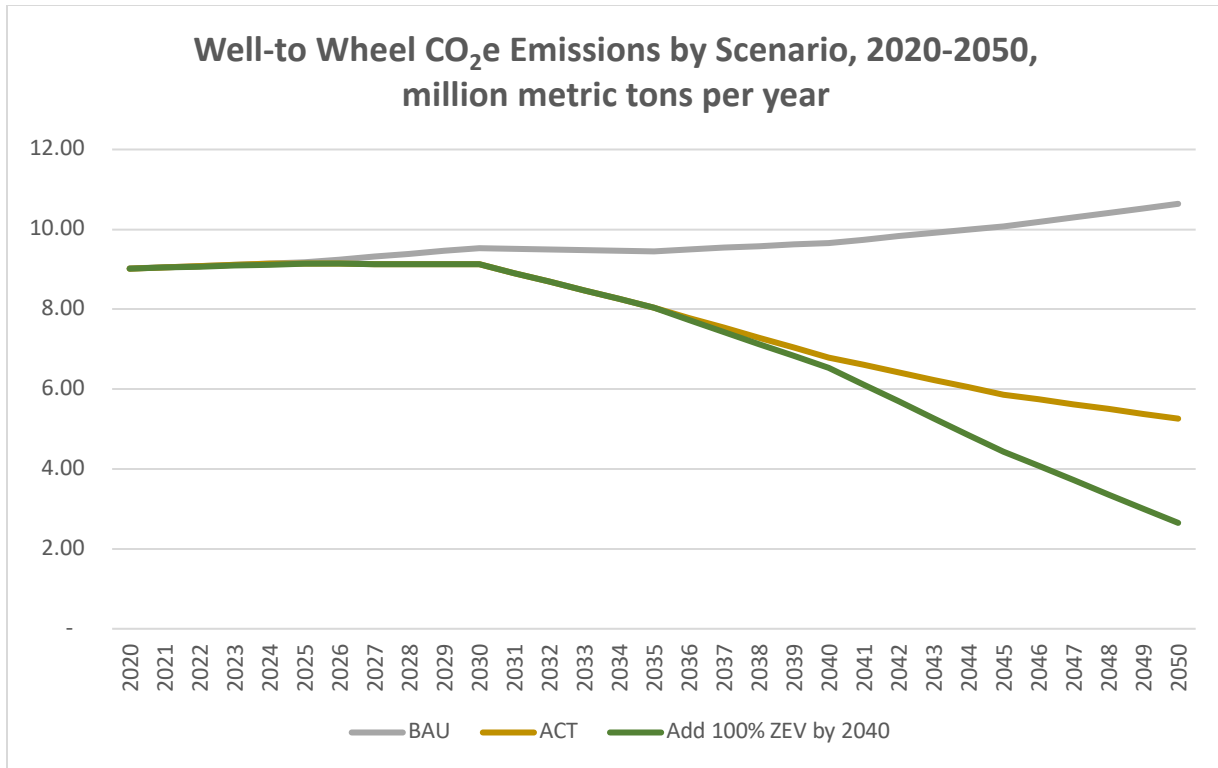


Figure 3. Well-to-wheel HDV CO₂e emissions by scenario 2020–2050

Related Publications

Title: Benefits of state-level adoption of California medium- and heavy-duty vehicle regulations

Authors: Jeff Houk, Joey Huang, Shih Ying Chang, and Doug Eisinger for Sonoma Technology

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Title: Update: Benefits of adopting California medium- and heavy-duty vehicle regulations under Clean Air Act Section 177

Authors: Ray Minjares

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Supporting files and detailed estimates are available, by state, year, rule, vehicle category, and pollutant are also posted here: <https://theicct.org/benefits-ca-multi-state-reg-data/>

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