ZERO EMISSION TRANSPORTATION ASSOCIATION

Summary of Final EPA Multi-Pollutant Emissions Standards for Model Years 2027-2032 Light- and Medium-Duty Vehicles

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Note: As applicable, all page number references to the final rule in this document refer to the pdf page at the link above.

Key Links:

- EPA Final Rule Landing Page
- EPA Final Rule Fact Sheet
- Final Regulatory Impact Analysis (March 2024)
- EPA Response to Comments (March 2024)
- ZETA Comments on Proposed Rule (July 2023)

Introduction

The final rule is technology-neutral and includes a slower increase in stringency in the earlier years (relative to the proposed rule) but a more rapid increase in the later years, ending in a similar point as the proposed rule. The program consists of several key elements: more stringent emissions standards for greenhouse gases, more stringent emissions standards for criteria pollutants, changes to certain optional credit programs, durability provisions for light-duty and medium-duty electrified vehicle batteries, warranty provisions for both electrified vehicles and diesel engine-equipped vehicles, and various improvements to several elements of the existing light-duty and medium-duty programs.

While the proposed rule projected an BEV[1] penetration rate of 67% new sales by 2032, the final rule modeled multiple manufacturer compliance pathways that include varying penetrations of BEVs, internal combustion engine vehicles, plug-in hybrids, and traditional hybrids. The resulting analysis makes it difficult to create a specific number for projected EV penetration rates. The different scenarios are discussed on page 4 of this document.

As a result of the final rule, EPA projects that cumulative carbon dioxide (CO_2) reductions as a result of the new standards are approximately 7.2 billion metric tons over the life of the program—and estimates that the aggregate criteria air pollutant reductions from these standards

[1] Note: EPA uses "BEV" or battery electric vehicle in the rule to refer to EVs. Both terms are used interchangeably throughout this document.

will provide $13 billion in annual health benefits. Additionally, EPA calculates that benefits of this rule will far exceed the total costs, with the annualized value of monetized net benefits to society estimated to be $99 billion through the year 2055. This includes $46 billion in reduced annual fuel costs, and nearly $16 billion in reduced annual maintenance and repair costs for drivers. Consumers are expected to save an average of $6,000 over the lifetime of a new vehicle from reduced fuel and maintenance costs, once the standards are fully phased in.

The following document summarizes the effects of the rule on BEV penetration, emissions, economic, and other key targets. The document also compares the final rule with the comments ZETA submitted in response to EPA's proposed rule in July 2023.

Next Steps

EPA's rulemaking will likely face a variety of challenges, both from states and from Congress. Senator Crapo introduced S.4072, cosponsored by 15 Republicans and Senator Manchin , that prohibits EPA from using funds to implement, administer, or enforce the standards. Senators Ricketts and Sullivan announced a Congressional Review Act resolution shortly following EPA's announcement, but have not introduced it yet since the rule has not been officially published in the *Federal Register*. Following the rule's final publication, ZETA also anticipates legal challenges from states similar to those brought in *Texas v. EPA*, though a decision in that case may inform the argument brought against EPA for the latest round of standards. ZETA will continue to monitor relevant legislation and legal action and alert its members of any relevant developments.

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Summary of Key Items

Topline CO_2 Tailpipe Emissions Targets

EPA finalized light-duty fleet targets equivalent to "Alternative 3" outlined in its proposed rulemaking. The finalized standards will reach a similar stringency by 2032 but will provide a more linear decrease in fleetwide targets as opposed to a more rapid decrease in the proposed rule. EPA anticipates the decreased stringency will result in about 230 million more tons of CO_2 emissions and 3.9 million fewer new BEV sales relative to the proposed rule.

Note that the final rule also includes tailpipe emissions standards for other criteria pollutants but for the sake of simplicity, we have only included CO2 targets in this document.

Table 19: Projected fleet-wide CO_2 targets corresponding to the final standards[a,b]

Model Year	Cars CO_2 (g/mile)	Trucks CO_2 (g/mile)	Total Fleet CO_2 (g/mile)
2026	131	184	168
2027	139	184	170
2028	125	165	153
2029	112	146	136
2030	99	128	119
2031	86	109	102
2032 and later	73	90	85

Projected New BEV Sales

Since EPA rules are technology-neutral, manufacturers can achieve compliance through a combination of PHEVs, HEVs, BEVs, and other technologies. EPA has adjusted for this and provided rough outlines of the outer bounds of compliance pathways, as showcased below. While Pathway A is the most optimistic projection of BEV adoption, *it is also the most likely according to EPA analysis*. Pathway C assumes no additional BEV market penetration beyond that of the No Action Scenario, and Pathway B somewhat splits the difference. (Page 15 of Final Rule)

Table 3: Projected new vehicle technology penetrations for final light-duty vehicle GHG standards for varying scenarios[153]

Pathway	Technology	2027	2028	2029	2030	2031	2032
Pathway A - Higher BEV Pathway (central analysis case)	ICE	64%	58%	49%	43%	35%	29%
	HEV	4%	5%	5%	4%	3%	3%
	PHEV	6%	6%	8%	9%	11%	13%
	BEV	26%	31%	39%	44%	51%	56%
Pathway B - Moderate HEV and PHEV Pathway	ICE	62%	56%	49%	39%	28%	21%
	HEV	4%	4%	3%	6%	7%	6%
	PHEV	10%	12%	15%	18%	24%	29%
	BEV	24%	29%	33%	37%	41%	43%
Pathway C - Higher HEV and PHEV Pathway	ICE	61%	41%	35%	27%	19%	17%
	HEV	4%	15%	13%	16%	15%	13%
	PHEV	10%	17%	22%	27%	32%	36%
	BEV	24%	26%	30%	31%	34%	35%

Projected BEV Fleet Penetration

EPA's modeling projects the total LMDV stock by technology type. Below is the breakdown of projected BEV stock under the adopted rules, using EPA analysis downloaded from its OMEGA documentation website. The LMDV final rule will lead to about 20 million more BEVs on the road by 2035, and 51 million more by 2055.

Year	Total LMDV stock	BEV share of fleet	BEV LMDV stock	No Action BEV Stock
2027	278,426,487	5.2%	14,385,316	14,309,465
2031	281,941,272	13.5%	37,938,453	31,511,106
2035	284,589,312	22.6%	64,384,985	44,765,417
2039	289,074,717	30.3%	87,721,294	55,308,655
2043	295,427,347	35.9%	106,186,911	63,291,213
2047	302,668,087	39%	118,057,880	69,122,051
2051	310,273,849	40.7%	126,478,310	74,967,238
2055	318,289,093	42%	133,750,705	82,281,195

Estimated Overall Emissions Impacts

While EPA's standards are technology-neutral and thus make it difficult to precisely model impacts on BEV penetration, modeled automaker compliance with the standards is assumed to be similar across all technology penetration scenarios. EPA modeled emissions in three broad categories: direct impacts from lower average vehicle fleet emissions, indirect emissions from increased electricity generating units (EGUs), and reduced domestic refining of liquid hydrocarbon fuels resulting from lower demand for liquid fuels.

Table 5: Projected cumulative GHG emission impacts from the final rule in 2027-2055 (Million metric tons)*

Pollutant	Vehicle	EGU	Refinery	Net Impact	Net Impact (%)
CO_2	-7,500	550	-280	-7,200	-21%
CH_4	-0.13	0.027	-0.016	-0.12	-15%
N_2O	-0.13	0.0034	-0.0023	-0.13	-23%
CO_2e	-7,500	550	-280	-7,200	-21%

*** Percent changes reflect changes associated with the light- and medium-duty fleet, not total U.S. inventories.**

EPA had originally assumed a refinery elasticity of 93% in its proposal, i.e. that 93% of reduced demand for gas and diesel would translate directly into decreased domestic refining. This depends mostly on the ability of U.S. refineries to profitably export to foreign markets. In the final analysis, EPA revised that number to 50%, assuming greater market transition flexibility (Final RIA, 8-39). This change had a relatively small impact on modeled emissions, however, as a refinery sensitivity case study with a 20% refinery sensitivity resulted in 7,100 million MT of CO_2 reductions rather than 7,200 (Final Rule p. 257). Additionally, the Final Rule's effects on EGU emissions rates for both criteria and GHG pollutants is negligible compared to a No Action scenario (Final RIA 8-32). In total, EPA estimates that the final rule will result in 7.2 billion tons of avoided CO_2 emissions.

Projected Power Sector Impacts

EPA modeled impacts to the power sector including emissions from power generation, total demand, and EVs' percentage of total demand. Some notable data highlights include EPA's projection that power generation for EVs will increase by 5% 2035 (12% by 2050) relative to no action, and Light- and Medium-duty Vehicles accounting for 12% of total demand by 2050.

Table 5-3: National electric power sector emissions, demand, generation and cost for the final rule.

Emission	2028	2030	2035	2040	2045	2050
SO_2 (million metric tons)	0.4792	0.2826	0.1570	0.08755	0.04420	0.02115
$PM_{2.5}$ (million metric tons)	0.07168	0.06103	0.04861	0.03635	0.02940	0.02541
NO_X (million metric tons)	0.4856	0.3605	0.2445	0.1593	0.1135	0.09330
VOC (million metric tons)	0.03328	0.02987	0.02568	0.02059	0.01815	0.01592
CO_2 (million metric tons)	1,267	1,014	737	513	455	394
CH_4 (metric tons)	82,950	63,218	42,952	30,026	19,054	15,271
N_2O (metric tons)	11,439	8,530	5,642	3,908	2,360	1,846
Hg (metric tons)	2.513	2.028	1.608	1.378	1.120	1.023
HCL (million metric tons)	2.591	1.785	1.053	0.6930	0.2604	0.1336
Total Demand (TWh)	4,475	4,646	5,222	5,734	6,173	6,578
Light- and Medium-duty Vehicle PEV Demand (TWh)	110.8	193.2	436.8	617.1	736.9	809.6
Light- and Medium-duty Vehicle PEV % of Total Demand	2.48%	4.16%	8.36%	10.8%	11.9%	12.3%
Light- and Medium-duty Vehicle PEV % of Transportation Demand	88.5%	84.2%	70.0%	66.3%	65.5%	65.8%
Total Generation (TWh)	4,562	4,783	5,469	6,117	6,651	7,212
% Change in Generation from No-action	0.293%	0.932%	5.52%	9.38%	11.2%	11.6%
Total Cost (Billion $)	129.8	128.5	142.4	152.3	157.0	160.4
% Change in Costs from No-action	-1.09%	0.275%	7.97%	9.00%	11.5%	12.2%

Projected Battery Costs

EPA significantly increased its projected battery costs between the proposed and final rule, based in part on analysis by Argonne National Laboratory (ANL). Costs increased by an average of 26 percent compared to the proposal, ranging from about 21 percent higher in the early years to about 36 percent higher in the later years.

The increase in cost is largely a product of the most recent trends and forecasts of future mineral costs being now explicitly represented via the ANL work and also are an outcome of basing the future costs on a specific set of technology pathways instead of applying a year-over-year cost reduction rate. Most other forecasts of future battery costs, including some of those that EPA cited in the proposal, are based largely on application of a historical cost reduction rate (i.e., learning rate), without reference to the specific technology pathways that might lead to those cost reductions. EPA acknowledges one potential criticism of such an approach is that it may lead to conservative results, because it excludes the potential effect of currently unanticipated or highly uncertain developments that may nonetheless come to fruition.

Table 68: Difference in battery cost per kWh from NPRM to FRM, 100-kWh battery example

Year	NPRM	FRM	Difference
2023	114	138	21%
2024	114	138	21%
2025	113	137	21%
2026	111	120	8%
2027	99	115	16%
2028	89	110	24%
2029	83	106	27%
2030	77	101	31%
2031	73	97	33%
2032	69	94	36%
2033	66	90	36%
2034	64	87	35%
2035	62	83	34%

Projected Consumer Fuel Savings

The final standards are projected to reduce liquid fuel consumption (gasoline and diesel) while simultaneously increasing electricity consumption.

Table 215: Liquid-fuel and Electricity consumption impacts associated with the final rule

Calendar Year	Gasoline (billion gallons)	Diesel (billion gallons)	Electricity (billion kWh)
2027	-0.068	-0.0025	0.94
2028	-0.47	-0.0043	4.1
2029	-1.4	-0.03	13
2030	-2.9	-0.097	27
2031	-4.8	-0.17	47
2032	-6.9	-0.27	67
2035	-16	-0.54	150
2040	-29	-0.8	260
2045	-38	-0.99	330
2050	-41	-1.1	350
2055	-42	-1.3	360
sum	-760	-21	6,700

The net effect of these changes for consumers is decreased fuel expenditures or fuel savings.

Table 216: Fuel savings associated with the final rule (billions of 2022 dollars)*

	Gasoline		Diesel		Electricity		Sum	
Calendar Year	Retail	Pretax	Retail	Pretax	Retail	Pretax	Retail	Pretax
2027	$0.18	$0.14	$0.0092	$0.0079	$0.021	$0.02	$0.21	$0.17
2028	$1.4	$1.1	$0.016	$0.013	-$0.26	-$0.24	$1.1	$0.89
2029	$4.3	$3.5	$0.11	$0.095	-$1.2	-$1.1	$3.2	$2.5
2030	$8.5	$7.1	$0.35	$0.3	-$2.6	-$2.5	$6.3	$4.9
2031	$14	$12	$0.61	$0.52	-$4.5	-$4.3	$10	$7.9
2032	$20	$17	$1	$0.86	-$6.8	-$6.4	$14	$11
2035	$47	$39	$2	$1.7	-$14	-$13	$35	$28
2040	$85	$72	$3	$2.6	-$22	-$21	$66	$53
2045	$110	$94	$3.8	$3.3	-$27	-$26	$87	$71
2050	$130	$110	$4.5	$3.9	-$28	-$27	$100	$86
2055	$140	$120	$4.9	$4.3	-$29	-$27	$110	$94
PV2	$1,600	$1,300	$57	$49	-$380	-$360	$1,200	$1,000
PV3	$1,300	$1,100	$47	$41	-$320	-$300	$1,000	$840
PV7	$660	$560	$24	$21	-$170	-$160	$520	$420
AV2	$72	$61	$2.6	$2.3	-$18	-$17	$57	$46
AV3	$68	$58	$2.5	$2.2	-$17	-$16	$54	$44
AV7	$54	$46	$2	$1.7	-$14	-$13	$42	$34

* Positive values represent monetary savings while negative values represent increased costs.

Projected Critical Minerals Availability

EPA's analysis in the final rule is largely based on a February 2024 study by Argonne National Laboratory (ANL) which highlighted the growth in critical minerals supply available from North America, FTA countries, MSP partners, and other economic allies. In light of the information provided in the public comments and additional information that EPA has collected through continued research, including the ANL study, it remains EPA's assessment that future availability of critical minerals is not likely to pose a constraint on automakers' ability to meet the tailpipe emissions standards.

Comparison to ZETA Comments

Base Year Fleet & Inclusion of Rivian in Modeling (RTC p. 1822 and 1884)

> **ZETA Comments:** *ZETA pointed out that using MY 2019 in EPA's base analysis did not take into account the broad shifts in the EV market seen from 2019 to 2022, and encouraged "incorporation of the most recent base year data available for the final rule." ZETA also urged EPA to include Rivian as a manufacturer in its analysis for both LDVs and MDVs, as it was omitted from the proposed rule modeling and projections.*
>
> **Result:** *EPA updated its base year fleet analysis to 2022 per ZETA's ask. Rivian is included in the final LDV analysis, but not in the MDV analysis. While EPA said that it had no compliance data for Rivians in 2022, that doesn't fully explain the decision to exclude Rivian MDVs from the modeling while including Rivian LDVs. EPA is unclear as to why this is, not addressing it directly in its response to both ZETA and Rivian. One possible explanation, however, is that the Rivian MDVs put on the road in 2022 were the result of a direct purchase by Amazon and thus not commercially available to anyone else, which may preclude them from EPA's analysis due to lack of data on factors such as price.*

Rivian was not included in either LD or MD analysis for the proposed rules. It is included in the LD analysis in the final RIA, but not in the MD analysis. From the below excerpt from EPA's response to comments, they say that they updated their analysis for the base year fleet with Rivian's vehicles for 2022, but don't mention MD analysis directly:

> *"Zero Emission Transportation Association commented that EPA's analysis for the proposal excluded Rivian from the manufacturers represented in the base year vehicle fleet. Tesla similarly commented that the MY 2019 base year fleet used in the NPRM has lower volumes for their vehicles than today. In response, EPA notes that it updated the base year fleet for this final rulemaking analysis, consistent with our general practice of using the most recent data whenever possible. The MY 2022 base year fleet used for the updated analysis now includes Rivian vehicles, and Tesla production volumes (and volumes of other manufacturers) that represents MY 2022 instead of the MY 2019 base year used for the NPRM analysis." (RTC, p. 1822)*

EPA also responded directly to Rivian's request for an updated base fleet, along with a request for MDV modeling, by saying that certification data for 2022 Rivians was unavailable. Rivian MDVs were on the road in 2022, but were sold directly to Amazon and only made commercially available starting in 2023. EPA was not clear if this was the reason they were excluded from the base fleet:

"For this final rulemaking analysis, EPA has updated the base year fleet to MY 2022, which is the latest available, allowing time to process the data and quality check the resulting modeling inputs. EPA notes that even though the first Rivian model was introduced for MY 2022, the certification data for that model year was not available. As a result, the relatively small volume of Rivian vehicles produced for MY 2022 are not included in EPA's updated base year fleet for this final analysis." (RTC, p. 1884)

Car & Light Truck Footprint Curves (Final Rule p. 64)

Comments: *ZETA commented in support of the proposed revisions to the car and light truck footprint curves, including the flattening of each slope over the 2027-2032 timeframe.*

Results: *EPA finalized footprint curves with higher initial intercepts but lower initial slopes than proposed. This is in line with their shift to "Alternative 3" from the proposed rule, but is accomplished through a slight adjustment in the footprint curve. The finalized curve is thus initially higher (less stringent), but not as steep (relatively more stringent for larger footprint vehicles), but ends in the same place as proposed by 2032.*

EPA uses a footprint-based formula for calculating CO_2 targets for Light-Duty vehicles:

$$Slope \times Footprint + Intercept = Target$$

The footprint formula inputs are also limited to certain ranges, resulting in a piecewise function. In addition to cutting the intercepts in half, EPA has also finalized large cuts to the slope of the curves, meaning that an increase in vehicle footprint will no longer correspond to as significant of an increase in effective CO_2 target. The effect is most pronounced for light trucks.

Table 17: Footprint-based standard curve coefficients for cars: Final Standards

	2027	2028	2029	2030	2031	2032
MIN CO_2 (g/mile)	135.9	123.8	110.6	98.2	85.3	71.8
MAX CO_2 (g/mile)	145.2	131.6	117.0	103.4	89.8	75.6
Slope (g/mile/ft2)	0.66	0.60	0.54	0.47	0.41	0.35
Intercept (g/mile)	108.0	97.9	87.0	76.9	66.8	56.2
MIN footprint (ft2)	42	43	44	45	45	45
MAX footprint (ft2)	56	56	56	56	56	56

Table 18: Footprint-based standard curve coefficients for light trucks: Final Standards

	2027	2028	2029	2030	2031	2032
MIN CO_2 (g/mile)	150.3	136.8	122.7	108.8	91.8	75.7
MAX CO_2 (g/mile)	239.9	211.7	184.0	158.3	133.5	110.1
Slope (g/mile/ft2)	2.89	2.58	2.27	1.98	1.67	1.38
Intercept (g/mile)	28.9	25.8	22.7	19.8	16.7	13.8
MIN footprint (ft2)	42	43	44	45	45	45
MAX footprint (ft2)	73.0	72.0	71.0	70.0	70.0	70.0

TABLE 26—PROPOSED FOOTPRINT-BASED STANDARD CURVE COEFFICIENTS FOR CARS

	2027	2028	2029	2030	2031	2032
MIN CO_2 (g/mi)	130.9	114.1	96.9	89.5	81.2	71.8
MAX CO_2 (g/mi)	139.8	121.3	102.5	94.2	85.5	75.6
Slope (g/mi/ft2)	0.64	0.56	0.47	0.43	0.39	0.35
Intercept (g/mi)	104.0	90.2	76.3	70.1	63.6	56.2
MIN footprint (ft2)	42	43	44	45	45	45
MAX footprint (ft2)	56	56	56	56	56	56

TABLE 27—PROPOSED FOOTPRINT-BASED STANDARD CURVE COEFFICIENTS FOR LIGHT TRUCKS

	2027	2028	2029	2030	2031	2032
MIN CO_2 (g/mi)	133.0	117.5	101.0	94.4	85.6	75.7
MAX CO_2 (g/mi)	212.3	181.7	151.5	137.3	124.5	110.1
Slope (g/mi/ft2)	2.56	2.22	1.87	1.72	1.56	1.38
Intercept (g/mi)	25.6	22.2	18.7	17.2	15.6	13.8
MIN footprint (ft2)	42	43	44	45	45	45
MAX footprint (ft2)	73	72	71	70	70	70

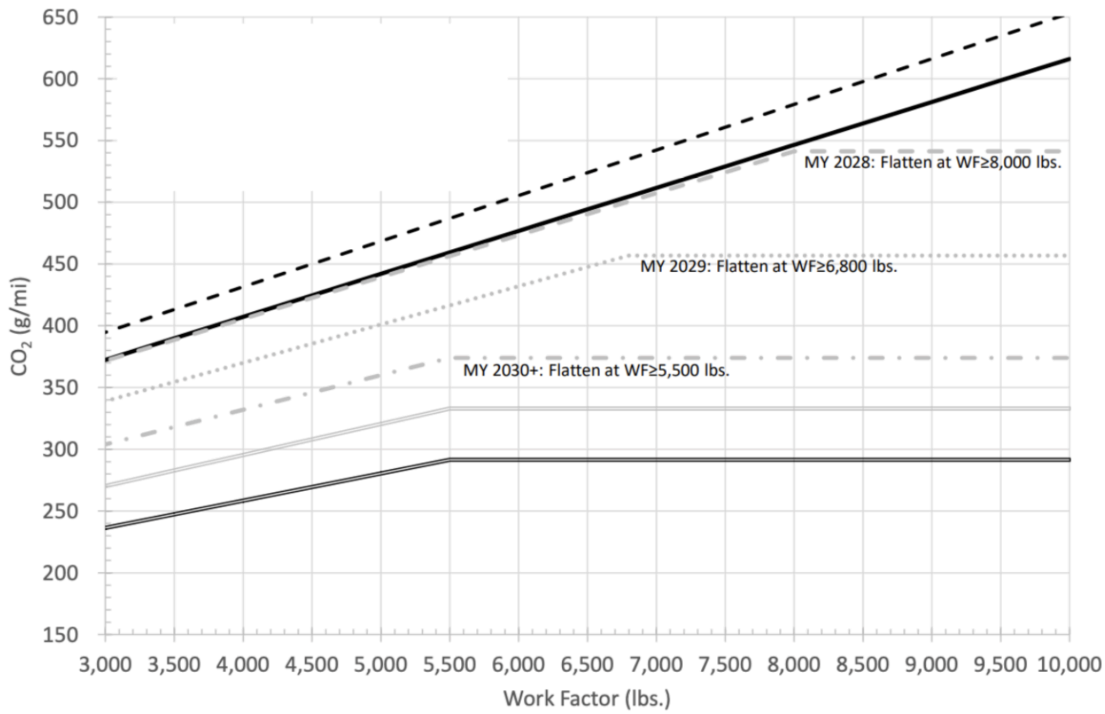
EPA finalized these changes in slopes in part in order to disincentivize a shift to larger vehicle footprints to avoid more stringent targets, and verified through its modeling that the effect on vehicle footprints would be minimal (RIA 1-16).

MD van work factor curve cutpoints (Final Rule p. 72)

Comments: *ZETA supported the proposed revisions to the work factor curves, including cut points and slope changes.*

Result: *EPA is slightly modifying the MDV GHG coefficients in a way that resembles Alternative 3 for LDVs, and is also phasing in its Work Factor curve cut points gradually rather than immediately, compared to the proposed rules.*

The work factor coefficients have been modified in similar ways that Alternative 3 was for Light-Duty, even though EPA didn't list any alternatives in its proposed rule. EPA is making its requirements more lenient in terms of work factor cutpoints. The previous limit of the Gross Combined Weight Rating (GCWR) input to 22,000 lbs had the practical effect of limiting the calculated work factor to 5,500 lbs, creating a flattening of GHG targets for MDVs above a certain combined weight rating. Instead of a 22,000 lb limit for the GCWR, EPA is instead using a phased-in approach to flattening the curves above a certain work factor (WF) - see below. The elimination of that input limit will mean that many MDVs with GCWRs above 22,000 will now have much less stringent targets initially, which will gradually phase in to the 5,500 flattening by 2030.



Additionally, the final coefficients for the MDV GHG standards are modified in similar ways to A3 in for LDVs. The "a", i.e. Work Factor multiplier, is unchanged, but "b", i.e. the intercept, actually increases for 2028 and then phases down gradually to reach the same endpoint in 2032.

Table 24: Final coefficients for MDV GHG standards

Model Year	a	b
2027	0.0348	268
2028 [a]	0.0339	270
2029 [b]	0.0310	246
2030 [c]	0.0280	220
2031 [c]	0.0251	195
2032 [c]	0.0221	170

TABLE 31—PROPOSED COEFFICIENTS FOR MDV TARGET GHG STANDARDS

Model year	a	b
2027	0.0348	268
2028	0.0339	261
2029	0.0310	239
2030	0.0280	216
2031	0.0251	193
2032	0.0221	170

Medium-Duty Passenger Vehicle (MDPV) definition (Final Rule p. 117)

Comments: *ZETA voiced support for EPA's proposed changes to the medium-duty passenger vehicle (MDPV) definition.*

Result: *EPA is finalizing the modification of the MDPV definition largely as proposed, with slight decreases in weight cutoffs resulting in a more stringent definition of MDPV compared to the proposed rule.*

EPA is finalizing two modifications to the MDPV definition:

- Including any pickup at/below 14,000 pounds GVWR with work factors at/below 4,500 pounds, except those with fixed interior length cargo areas of eight feet or larger.
    - The prior MDPV category only included pickups below 10,000 pounds GVWR with a fixed interior length cargo area of less than six feet.
    - The change is in order to address new BEVs that are primarily passenger vehicles but are heavier due to battery pack weight.
- Including any pickups with a GVWR below 9,500 pounds and a fixed interior length cargo area of less than eight feet regardless of whether the work factor is above 4,500 pounds. Pickups between 9,500 and 14,000 pounds GVWR with work factors above 4,500 pounds are included only if their fixed interior length cargo area is less than six feet.

The tables below highlight the difference between the final rule (Table 57) and the proposed rule (Table 56). The final rulemaking is slightly less stringent since it sets lower cutoffs for GVWR (9,500 rather than 9,900 lbs) and Work Factor (4,500 rather than 5,000 lbs). The 94 inch number is meant to account for vehicle design variability, but is mainly aimed at excluding eight foot (96 inch) interior lengths. The final rule also modifies the language from “bed length” to “cargo area fixed interior length,” but these two terms seem to be equivalent since the proposed rule also referred to interior length.

Table 57: Summary of exclusions for the revised MDPV definition

A vehicle would be an MDV and not an MDPV if:		
	WF ≤ 4,500 lb	WF > 4,500 lb
GVWR ≤ 9,500 lb	Cargo area fixed interior length ≥ 94.0 inches	Cargo area fixed interior length ≥ 94.0 inches
9,500 lb < GVWR ≤ 14,000 lb	Cargo area fixed interior length ≥ 94.0 inches	Cargo area fixed interior length ≥ 72.0 inches

TABLE 56—SUMMARY OF EXCLUSIONS FOR THE PROPOSED REVISED MDPV DEFINITION

A vehicle would not be an MDPV if:		
	Work factor (WF)	
	WF <5,000 lbs.	WF >5,000 lbs.
GVWR <9,900 lbs	bed length >94.0 inches	bed length >94.0 inches.
9,900 lb ≤GVWR ≤14,000 lbs	bed length >94.0 inches	bed length >72.0 inches.

A/C Efficiency Credits (Final Rule p. 76)

Comments: *ZETA urged EPA to maintain parity between BEVs and ICEVs on AC efficiency credits, pointing out that AC efficiency does affect overall vehicle efficiency.*

Result: *Rather than sunsetting them in 2027 as proposed, EPA is gradually phasing down A/C leakage credits to about 10 percent of their current values by 2032. All other changes are as proposed, with BEVs excluded from efficiency credits.*

EPA outlined two main revisions to A/C credits program:

- Limiting eligibility for A/C efficiency credits to ICEVs only
- Phasing down the A/C leakage control credit from 2027-2030 with a small permanent credit for MY 2031 and onwards. See table below (credits in CO_2 grams/mile)

MY	Car	Truck
2026	13.8	17.2
2027	11.0	13.8
2028	8.3	10.3
2029	5.5	6.9
2030	2.8	3.4
2031	1.6	2.0
2032 and later	1.6	2.0

EPA is phasing down the A/C leakage credits due to a separate EPA rule which restricted use of high-Global Warming Potential (GWP) HFCs. The credits are seen as less impactful now that most new vehicles use much less harmful HFCs, and EPA states that "there is no reason… to believe that manufacturers would redesign [current low-GWP systems] again under the AIM Act, in the absence of EPA vehicle-based credits." While the proposed rule would have completely ended the leakage credits, EPA received comments concerned about the lead time, which led to the gradual phase-down. Additionally, EPA says they are retaining small leakage credits in order to incentivize the lowest GWP refrigerants leakage beyond EPA Technology Transitions Rule.

EPA is ending its application of A/C efficiency credits to BEVs since they would result in negative performance values for certain BEVs. The final rule specifically mentioned Tesla reporting a fleet-wide average of -23 g/mile.

Omitting upstream emissions from BEV GHG calculations (Final Rule p. 82)

Comments: ZETA supported EPA's proposal to continue omitting upstream emissions from electricity generation for purposes of BEV emissions calculations.

Result: EPA had originally set a target date of MY 2027 for including upstream emissions from electricity generation. EPA has decided to indefinitely exclude upstream emissions from BEV compliance calculations on the basis that those pollutants and sources are regulated under other EPA programs and authorities and further regulation under the transportation program would be unnecessarily duplicative. *This is in line with their proposed rule.*

Phaseout of off-cycle credit generation (Final Rule p. 78)

> **Comments:** *ZETA supported EPA's proposed phaseout of off-cycle credit generation by MY 2031.*
>
> **Result:** *EPA is pushing back the off-cycle menu cap. Originally supposed to end at 0 g/mile in 2031, it will now stay at 10 g/mile until 2030 and then phase down to 0 g/mile by 2033 and later.*

There were originally three pathways for earning off-cycle credits:

1. Off-cycle menu credits: predetermined list of specific technologies that EPA acknowledges reduce emissions but are not reflected in two-cycle testing. The menu cap is 10 g/mile.
2. Manufacturers can use 5-cycle testing rather than two-cycle to demonstrate and justify CO_2 credits.
3. Manufacturers can seek EPA approval to use an alternative methodology for determining off-cycle CO_2 credits

EPA's proposed changes were as follows:

1. Phasing out the menu pathway by setting a declining menu cap, ending at 0 g/mile in 2031,
2. Eliminating 5-cycle and public process pathways starting in 2027, and
3. Excluding BEVs from eligibility.

EPA finalized the second two changes as proposed, but is adopting a slower phase-out of off-cycle credits than proposed (proposed rule on top, final rule on bottom):

TABLE 36—PROPOSED OFF-CYCLE MENU CREDIT CAP PHASE DOWN

Model year	Off-cycle menu credit cap (g/mile)
MY 2027 (current program)	10
MY 2028	8.0
MY 2029	6.0
MY 2030	3.0
MY 2031 and later	0.0

MY	Off-cycle Menu Credit Cap (CO_2 g/mile)
2027	10
2028	10
2029	10
2030	10
2031	8.0
2032	6.0
2033 and later	0.0

Accelerated phaseout of MDEV credit multipliers by MY 2027 (Final Rule p. 74)

Comments: *ZETA supported the proposed accelerated phaseout of MDEV credit multipliers by MY 2027.*

Result: *EPA is finalizing the removal of BEV, PHEV, and FCEV multipliers for MY 2027 as proposed.*

In 2016, EPA adopted credit multipliers through MY 2027 for PHEV, BEV, and FCEV (fuel cell electric vehicles). While this was through a Heavy-duty GHG Phase 2 rulemaking, the standards apply to Medium-duty Electric Vehicles (MDEVs) as well. At the time, penetration of those technologies was very limited and the credit multipliers were designed to encourage early–stage adoption of the technologies by automakers. Since then, penetration has increased at an unexpected pace, and EPA is eliminating the credit multipliers to prevent backsliding of emissions reductions as proposed.

Table 27: Advanced Technology Multipliers in HD GHG Phase 2 - the 2016 Final Rule applied these multipliers to MYs 2021 through 2027

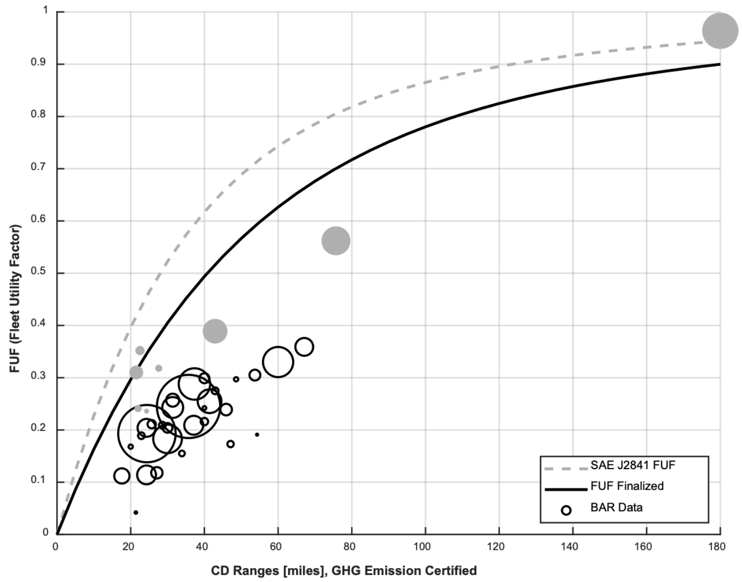
Technology	Multiplier
Plug-in hybrid electric vehicles	3.5
All-electric vehicles	4.5
Fuel cell electric vehicles	5.5

PHEV Fleet Utility Factor (FUF) (Final Rule p. 82)

Comments: *ZETA supported the proposed changes to the PHEV fleet utility factor, or FUF.*

Result: *EPA is finalizing its proposed change to the FUF, but is delaying its implementation until MY 2031 to "provide adequate lead time for product development and product plan adjustments."*

The FUF is the share of a PHEV's total mileage that is traveled using electricity, or charge depleting mode. The FUF depends on two significant factors: the size of the battery, which affects how far a PHEV can travel on a single charge, and drivers' propensity to charge their batteries. EPA acknowledged the conclusion of recent literature and data that drivers generally charge their PHEVs less often than traditionally assumed, and are operating them in a manner which results in greater CO_2 emissions than the current FUF accounts for. Accordingly, EPA has lowered the FUF (see figure below), while also acknowledging that an even lower FUF may be appropriate given real-world data provided by California's Bureau of Automotive Repair (BAR). EPA also acknowledged that demonstrated FUF may change in the future, depending on factors such as public and at-home EVSE infrastructure, driver behavior, and general consumer understanding of PHEV technology. In response to comments received from the Alliance, among others, EPA is extending the transition to the new FUFs from 2027 to 2031.



Battery Durability Requirements (Final Rule p. 126)

Comments: ZETA urged EPA to "consider ways to uphold the intent of the minimum performance requirements (MPR) without disincentivizing non-propulsionary battery applications," such as vehicle-to-grid (V2G) or vehicle-to-building (V2B). ZETA also recommended the removal of the MPR midpoint and the retaining of the MPR endpoint, since "degradation may not be linear and depends on a large number of factors." ZETA also requested clarification on which compliance credits would be forfeited in the case of failure of a GTR No. 22 "Part B" compliance test.

Result: *EPA is counting non-propulsionary applications, defined as virtual mileage, such as V2G and V2B applications, towards its Minimum Performance Requirements (MPR). It is not adjusting the MPR as proposed to include only one target or the other, but is counting both in the MPR. While virtual miles will not count for the purpose of the warranty provisions, those provisions are lowered to 80,000 miles or 8 years, compared to 100,000 miles or 8 years for the durability requirements, in order to account for virtual mileage. EPA also defined forfeited credits in the case of failing durability requirements as all eligible compliance credits for BEVs, but only GHG credits for PHEVs.*

ZETA, in its comments, encouraged EPA to uphold the intent of the MPR without discouraging "non-propulsionary applications." EPA clarified that

"Under the EPA program, virtual mileage is applicable to the mileage used for determining compliance with the durability provisions, as defined in GTR No. 22. However, GTR No. 22 does not include warranty provisions, and so the mileage used for warranty under the EPA program does not include virtual mileage." (Final Rule, p. 128)

"Virtual mileage" here is defined as V2B or V2G applications as defined in Global Technical Regulation No. 22. The minimum performance requirements (MPR) fall under the durability requirements here:

Table 65: Minimum performance requirements

Years or mileage	Light-duty BEVs and PHEVs	Class 2b and 3 BEVs and PHEVs
5 years or 62,000 miles	80 percent SOCE	N/A
8 years or 100,000 miles	70 percent SOCE	N/A

GTR No. 22 defines the term "virtual distance," as opposed to virtual mileage, as below. The use of "worst case" vehicle efficiency metrics as opposed to measured averages will likely result in underestimated virtual mileage measurements, making compliance with the MPRs more difficult. This effect will increase in proportion to the use of V2X capabilities in EVs.

$$\boldsymbol{Virtual\ distance}\ (km) = \left(\frac{\text{total discharge energy during V2X } [Wh]}{\text{worst case certified energy consumption of PART B family } [\text{Wh/km}]}\right)$$

The warranty periods are listed as <u>8 years or 80,000 miles</u>, notably different from the MPRs, but doesn't include a requirement for SOCE (State of Certified Energy) in the battery, as was included in the proposed rule. Rather, EPA will "require manufacturers to specify the warranted percentage SOCE and will require use of the SOCE monitor value in determining a warranty claim." EPA explained that it didn't include virtual mileage under the warranty definition because it has only been used in the context of durability requirements, and "commenters did not clearly explain why virtual mileage should be extended to warranty mileage simply because it exists in the context of durability." However, EPA reduced the warranty mileage to 80,000 miles compared to the MPR of 100,000 miles (both with an alternative of the 8 year mark) in order to address these concerns.

EPA pointed out two separate studies that found that V2G control strategies actually seem to extend the lifetime of batteries and an improved State of Charge (SOC) profile (p. 132). This seems to have partially informed their decision not to include virtual mileage in their warranty requirements.

In response to ZETA's comments regarding forfeited credits, EPA has clarified that if vehicles fail the durability performance requirement, *"[t]he manufacturer's credit balance will be adjusted to remove compliance credits previously earned by those vehicles. In the case of BEVs, the credits affected include GHG and NMOG + NOx credits, as BEVs do not earn credits for other pollutants. For PHEVS, the credits affected include only GHG credits, as emissions performance for other pollutants is largely independent of usable battery capacity." (Final Rule, p. 129)*

Emissions control device warranties (Final Rule p. 133)

Comments: *ZETA requested clarity on the definition of "associated powertrain components" in EPA's requirements for emission control device warranties, saying that "a more exhaustive list would provide additional clarity for manufacturers and support a more thorough assessment of this aspect of the proposal." We also requested clarification on how enforcement would function when work may need to be performed on EV batteries and associated powertrain components.*

Result: *EPA provided some clarity on both questions in its Response to Comments.*

EPA did not provide an exhaustive list of associated powertrain components, but did create a new definition:

"In response to comments that we should clarify what is meant by "associated powertrain components," EPA has revised 40 CFR 85.2103(d)(1)(v) of the regulatory text, which now clarifies that the provision applies to "all components needed to charge the system, store energy, and transmit power to move the vehicle." (Final Rule, p. 133)

EPA responded to ZETA's request for clarification on emission control components definition:

"ZETA and Rivian requested that EPA clarify how anti-tampering rules would apply to components newly defined as SMECCs in scenarios where maintenance work is performed. EPA 2647 clarifies that the statutory provisions continue to apply. Annex 1 of GTR No. 22 specifies that vehicles that have had the battery replaced or repaired, or have been used for racing, are exempted from Part A testing." (RTC, p. 2647)