American Petroleum Institute

Will Hupman
Vice President - Downstream
202-682-8463
HupmanWR@api.org

July 5, 2023

The Honorable Michael Regan
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Filed electronically: https://www.regulations.gov

Re: Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light- Duty and Medium-Duty Vehicles (Docket ID No. EPA-HQ-OAR-2022-0829)

Dear Administrator Regan:

The American Petroleum Institute appreciates the opportunity to submit the following comments on the proposed rule entitled "Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles." API is a national trade association representing all aspects of America's oil and natural gas industry. Our industry supports nearly 11 million U.S. jobs and accounts for approximately 8 percent of U.S. GDP. API has nearly 600 members, from fully integrated oil and natural gas companies to independent companies, comprising all segments of the industry, including producers, refiners, suppliers, retail marketing, pipeline operators, and marine transporters, as well as service and supply companies that support all segments of industry. As producers, suppliers and retailers of transportation fuels that power the more than 99% of all vehicles covered by the proposed rule, API members have a significant interest in, and will be heavily impacted by, the vehicle emissions standards that would be imposed by the proposed rule.

API's *Climate Action Framework* reflects our policies and goals, which are incorporated in our comments below. The challenge of meeting the world's growing need for energy while simultaneously ushering in a lower-carbon future is massive, intertwined, and fundamental. It is the opportunity of our time – governments, industries, and consumers must act to solve it together. Our industry is at the center of this challenge. We share the goal of reduced emissions across the broader economy and, specifically, those from energy production, transportation and use by society.

API supports technology-neutral policies at the federal level that drive GHG emissions reductions in the transportation sector, taking a holistic "all-of-the-above" approach to fuels, vehicles, and infrastructure systems. Such policies include: 1) federal fuel standards, 2) a full lifecycle approach to vehicle standards, 3) optimization of fuel/vehicle systems to improve efficiency, and 4) supportive infrastructure measures. We have significant concerns that the

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HupmanWR@api.org

proposed rule does not include many of these elements. A few of these concerns are summarized below and our detailed comments are attached.

a. *API Supports Emission Reductions in the Transportation Sector.*

API is aligned with EPA's goal to address emissions in the transportation sector, and API members have similarly been working to advance the development, transmission, and use of lower carbon intensity and lower criteria pollutant fuels and technologies to provide choices for consumers.

b. *API Supports the Concepts of a Lifecycle Approach to Emissions Reductions.*

EPA should employ a technology-neutral approach that holistically encompasses the lifecycle emissions of both the fuel and the vehicle, rather than narrowly focusing on tailpipe emissions only.

c. *Both this Proposal and the Heavy-Duty Vehicle Proposal Miss the Mark.*

EPA's focus on zero-emission vehicle (ZEV) solutions, and specifically battery electric vehicles (BEVs), ignores fuel- and vehicle-based options that could better accomplish the agency's objectives to expeditiously achieve greater transportation sector-related emission reductions from the entire vehicle fleet (both new and in-use) at lower cost.

d. *EPA is not Taking a Realistic Approach.*

API is concerned that there is significant uncertainty with regard to technology and infrastructure readiness for the proposed 2027-2032 timeframe; further, the transportation industry will be competing for the same resources to successfully implement both the light- and medium-duty and heavy-duty proposed programs on the same timeframe.

e. *API Supports Consumer Choice for Vehicles.*

API is concerned that consumer choice and impacts are not fully reflected in EPA's analysis.

f. *Critical Minerals, Energy Security, BEV Supply Chains, Feasibility and Modeling.*

API is concerned that the proposed rule could negatively impact U.S. energy security if vehicle technologies are shifted to ZEVs at the exponential rate that the proposal would likely entail, as it would increase the country's dependence upon foreign sources for needed minerals forgoing the use of existing U.S. resources.

g. *Program Review.*

API recommends that EPA consider incorporating pre- and mid-program assessments into its final program, with sufficient lead time following review to adjust the standards if needed.

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h. *Legal Concerns.*

API is concerned that EPA is exceeding its statutory authority under the Clean Air Act by, among other things, mandating the production of ZEVs.

i. *Additional Concerns.*

EPA must address several aspects of their analysis of vulnerabilities associated with critical minerals as outlined in Appendix A and related to cost, modeling, and assumptions as outlined in Appendix B.

j. *Response to EPA Request for Information on Particulate Matter Fuel Controls.*

In Appendix C we respond to EPA's request to review the Agency's rationale for considering fuels controls in a future rulemaking to reduce PM emissions. API finds the Agency has not appropriately considered all data and issues raised by a potential rulemaking. Furthermore, EPA needs to reconsider their analytical conclusions, limitations of SimDis, refinery modeling specifications, and that tire wear and entrained road dust related PM emissions are significant. Please note that due to the compressed comment period for such a complex request for information, coupled with the lack of an extension, API may supplement the docket.

Thank you for the opportunity to provide our comments on this important rulemaking. If you have any questions, please do not hesitate to contact me.

Sincerely,

Will Hupman

c: Mr. Michael Safoutin, Office of Transportation and Air Quality, Assessment and Standards Division

Detailed Comments of API on "Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light- Duty and Medium-Duty Vehicles" (Docket ID No. EPA-HQ-OAR-2022-0829)

a. API Supports Emission Reductions in the Transportation Sector.

API appreciates EPA's efforts to address transportation sector emissions. As detailed in the API Climate Action Framework[1], we support technology-neutral policies at the federal level that drive GHG emissions reductions in the transportation sector and our members have committed to delivering solutions that reduce the risks of climate change while meeting society's growing energy needs. API members work to advance the development, transmission, and use of lower carbon intensity and lower criteria pollutant fuels and technologies to provide choices for consumers. Specifically, API members have made, and continue to make, significant investments in new technologies that reduce emissions in transportation, including:

GHG Emission Reduction

- Stand-alone production and coprocessing of bio-feedstocks to make renewable fuels.
- Manufacturing of low-carbon ethanol.
- Manufacturing of renewable natural gas from wastewater, landfill gas, and biodigesters at farms as fuel for compressed natural gas (CNG) vehicles.
- Production of blue and green hydrogen for transportation and stationary applications including building infrastructure.
- Direct air carbon capture.
- Carbon capture and sequestration of CO_2.
- Development of advanced plastics to meet auto industry standards and consumer expectations while mitigating environmental impact through emissions reduction and improved vehicle efficiency by light-weighting.
- Installation of electric vehicle charging stations.
- Installation of hydrogen fueling stations.

Criteria Pollutant Reduction

- Tier 3 gasoline sulfur standards
- MSAT II gasoline benzene standards
- Lower vapor pressure reformulated gasoline

API shares the goal of reduced emissions across the broader economy and, specifically, those from energy production, transportation and use by society. To achieve meaningful

[1] https://www.api.org/climate.

emissions reductions that meet the climate challenge, it will take a combination of policies, innovation, industry initiatives and a partnership of government and economic sectors. The objective is large enough that no single approach can achieve it.

b. API Supports the Concepts of a Lifecycle Approach to Emissions Reductions.

i. EPA should use a lifecycle assessment (LCA) approach vs. tailpipe only.

To effectively achieve emissions reductions in the transportation sector, technology-neutral solutions are needed, utilizing an approach that addresses fuels, vehicles, and infrastructure systems. This is best accomplished through holistic policy that encompasses the lifecycle emissions of both the fuel and the vehicle. This combination makes for the most effective reduction of transportation GHG emissions, as emissions occur at multiple stages of the lifecycle of internal combustion engine vehicles (ICEVs) and battery electric vehicles (BEVs) and the fuels used in them. Further, utilizing a lifecycle approach would enable quantification of the emissions associated with light- and medium-duty vehicles (LMDVs), and allow technologies to be identified that provide more expeditious and robust GHG emissions reductions.

Use of a lifecycle approach would better achieve the goals of the proposed rule, as it would allow the agency and stakeholders alike to fully identify and reduce transportation sector emissions and to identify and develop meaningful solutions. The reductions achieved by EPA's existing programs – including the Tier 3 Motor Vehicle Emissions and Fuel Standards, Heavy-Duty (HD) GHG Phase 2 standards, and HD engine and vehicle criteria pollutant standards – are due in large part to addressing emissions holistically, and utilizing all available and emerging technology to do so. The myopic focus on tailpipe emissions in the proposed rule essentially means that the rule would only address certain transportation emissions, while ignoring other sources of emissions and potential emissions reduction solutions. A lifecycle approach would allow EPA to quantify all of the emissions associated with LMDVs, and to mitigate those emissions more effectively.

EPA has set the GHG emissions standards as attribute-based, using vehicle footprint as the attribute. As per EPA, "footprint is defined as a vehicle's wheelbase multiplied by its average track width—in other words, the area enclosed by the points at which the wheels meet the ground. The standards are therefore generally based on a vehicle's size." In Draft Regulatory Impact Analysis (DRIA) Section 1.1.2, EPA states that "footprint does not have any relationship with tailpipe emissions from BEVs or any other zero-emission vehicle." Yet, the proposed footprint-based standards are based on a projected penetration rate of BEVs of greater than 50%. A footprint-based tailpipe emission standard where, for the majority of the fleet, there is "no relationship" between footprint and tailpipe emissions could drive undesirable behaviors. For example, the weight of BEVs increases as the footprint is increased. This increase in weight impacts the efficiency of larger BEVs. With BEVs on the same footprint curve as internal combustion engines (ICEs) (with a positive slope) in a tailpipe emission banking and trading system, larger BEVs will generate a larger credit relative to their footprint. This could incentivize the production of larger more inefficient BEVs, increasing the upstream electricity generation emissions. The largest potential credit generator based on the proposal would be large BEV trucks which are the most inefficient BEVs. While BEVs have zero tailpipe emissions, the upstream electricity production does generate GHG emissions. Analysis by Argonne National Laboratory[2] showed that a current midsize sedan with 200-mile range could achieve 124 mile per gallon gasoline equivalent (MPGge) while a heavier and larger 400-mile range small sport utility vehicle (SUV) could achieve 88 MPGge. This corresponds to cradle-to-grave lifecycle emissions of ~160 and 250 g CO_{2eq} / mile, respectively. For comparison, the same analysis found that a current midsize hybrid ICE would generate ~270 g CO_{2eq} / mile, similar to the 400-mile range SUV. The emissions from the hybrid ICE could be further reduced with lower-emission fuels. Under the current proposal, the hybrid ICE from this example would generate tailpipe emissions of 190 g CO_2 / mile, while the BEVs would generate zero tailpipe emissions. EPA should consider a rulemaking that accurately accounts for all emissions in the lifecycle of a vehicle.

By EPA's own account,[3] transportation pollution has been reduced significantly since the passage of the Clean Air Act – new passenger vehicles are 98-99% cleaner for most tailpipe pollutants compared to the 1960s, new vehicle estimated real-world CO_2 tailpipe emissions are at a record low,[4] and U.S. cities have much improved air quality, despite ever increasing population and increasing vehicle miles traveled. Criteria pollutant emissions have been mitigated via engine and after-treatment system improvements as well as through fuel quality improvements (e.g., low sulfur gasoline and ultra-low sulfur diesel). As noted in a study prepared for the Transportation Energy Institute, criteria pollutants are well controlled with the existing fleet, and ICEV emissions will continue to be reduced into the future as the ICEV fleet becomes more efficient (especially as high-emitting vehicles are replaced in the existing fleet).[5]

These reductions are due in large part to addressing emissions holistically and utilizing all available and emerging technology to do so. Use of a lifecycle approach would better achieve the goals of the proposed rule, as it would allow the agency and stakeholders alike to fully identify and reduce transportation sector emissions and to identify and develop meaningful solutions. The myopic focus on tailpipe emissions in the proposed rule essentially means that the rule would only address certain transportation emissions, while ignoring other sources of emissions and potential emissions reduction solutions. A lifecycle approach would allow EPA to quantify all emissions associated with light- and medium-duty vehicles[6] and more

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[2] Kelly, J. et al., "Cradle-to-grave lifecycle analysis of U.S. light-duty vehicle-fuel pathways: a greenhouse gas emissions and economic assessment of current (2020) and future (2030-2035) technologies", June 2022, ANL-22/27. https://greet.es.anl.gov/publication-c2g_lca_us_ldv.

[3] https://www.epa.gov/transportation-air-pollution-and-climate-change/history-reducing-air-pollution-transportation.

[4] 2022 EPA Automotive Trends Report – Executive Summary, December 2022, EPA-420-S-22-001. https://www.epa.gov/system/files/documents/2022-12/420s22001.pdf.

[5] "Decarbonizing Combustion Vehicles: A Portfolio Approach to GHG Reductions," study prepared for the Transportation Energy Institute by Stillwater Associates, July 2023. https://www.transportationenergy.org/research/reports/decarbonizing-combustion-vehicles-a-portfolio-approach-to-ghg-reductions/.

[6] EPA's proposed rule covers light-duty vehicles (i.e., less than 8,500 pounds gross vehicle weight rating) and medium-duty vehicles (i.e., up to 14,000 pounds GVWR), https://afdc.energy.gov/data/10380.

effectively mitigate those emissions.

ii. Zero emission vehicles also have emissions impacts.

As with ICEVs, ZEVs[7] have carbon emissions impact associated both with their production and throughout their lifetime which EPA should incorporate in its analysis. While ZEVs can be an important part of a diverse transportation future to reduce emissions, they do produce GHG emissions. For instance, BEV production, use, and the disposal of BEV batteries, are not zero-emission activities. Further, all fuels – whether conventional fuels or electricity – have associated carbon emissions regardless of their source. A study conducted by Ricardo, which is included in a report by the Transportation Energy Institute,[8] concludes that BEVs "have higher embedded GHG emissions" and therefore carbon intensity of the electricity mix also plays a vital role in defining the magnitude of carbon emissions in this phase. While meaningful reductions have historically been accomplished by focusing on tailpipe emissions from the vehicle, the growing market share of different technologies that include significant upstream emissions warrant inclusion of those emissions in the standard.

We encourage the agency to not only acknowledge and address the emissions of ZEVs, but to also continue to study the impacts. Failure to do both would be arbitrary and capricious. As noted below in these comments, and in our comments on the Heavy-Duty GHG Phase 3 proposed rule,[9] we strongly recommend that EPA include both a readiness assessment prior to program implementation as well as a program review once implementation begins. There will be CO_2 emissions associated with the production and use of BEVs,[10] and it is important to address these emissions to provide a full picture of the emissions impacts and mitigation needs.

c. Both this Proposal and the Heavy-Duty Vehicle Proposal Miss the Mark.

i. EPA is missing millions of vehicles that will contribute to emissions.

API is concerned that this proposal, as well as EPA's Heavy-Duty proposed[11] GHG rule, seriously miss the mark with respect to reducing emissions from the transportation sector. The proposals focus heavily on ZEV technologies, and specifically BEVs, for reductions in the 2027 to 2032 timeframe. Yet, EPA is leaving emissions reductions on the table for existing LMDVs, given the lifespan of these vehicles, as well as new ICE vehicles that will be sold between now and

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[7] In these comments, "ZEV" refers broadly to PHEVs, FCEVs and BEV refers specifically to battery electric vehicles.
[8] Ricardo, Inc. "Life Cycle Analysis Comparison: Electric and Internal Combustion Engine Vehicles", study prepared for the Transportation Energy Institute (formerly known as the Fuels Institute). January 2022. https://www.transportationenergy.org/research/reports/life-cycle-analysis-comparison-electric-and-internlife-cycle-analysis-comparison-electric-and-intern.
[9] API Comments on "Greenhouse Gas Emissions Standards for Heavy-Duty Vehicles—Phase 3", Document ID EPA-HQ-OAR-2022-0985-1423.
[10] Kelly, J. et al., "Cradle-to-grave lifecycle analysis of U.S. light-duty vehicle-fuel pathways: a greenhouse gas emissions and economic assessment of current (2020) and future (2030-2035) technologies", June 2022, ANL-22/27. Figure B.8. https://greet.es.anl.gov/publication-c2g_lca_us_ldv.
[11] 88 Fed. Reg. 25,926 (April 27, 2023).

2032. According to Oak Ridge National Lab (ORNL)[12] there were over 105 million cars and 148 million light trucks in the U.S. in 2020. In 2021, over 3.3 million new cars and over 11.2 million new light trucks were sold. The average age of a light-duty vehicle (LDV) is over 12 years. The U.S. Department of Energy's Energy Information Administration (EIA)[13] projects the stocks of light-duty internal combustion engines will exceed 247 million vehicles in 2050. EPA's overly limited focus on ZEVs, and specifically BEV solutions, ignores options that could better accomplish the agency's objectives to achieve greater transportation sector-related emission reductions at lower cost to society.

EPA's proposal extends to "medium-duty vehicles" (MDVs), previously referred to as "heavy-duty class 2b and 3 vehicles or heavy-duty pickups and vans."[14] Vehicles in this class may include large SUVs, heavy-duty pickups, utility vans, mini-buses, step vans, delivery vans, and light dump trucks (i.e., GVWR up to 14,000 pounds) which have different and diverse usage applications [15] compared to lighter LDVs and medium-duty passenger vehicles (MDPVs), which fall into EPA's LDV classifications of light-duty passenger cars and light-duty trucks. The MDV market (i.e., class 2b and 3 vehicles) is made up of purchasers that want to get "the right tool for the job" and often include service providers such as plumbers, landscapers, and utility company fleets.[16] Although there is little published regarding makeup, usage, and environmental impact of class 2b and class 3 vehicles, there are approximately 13 million class 2b and 3 million class 3 vehicles in the U.S. fleet and these vehicles may remain in fleets up to 15 years.[17] Purchasing decisions and usage of class 2b and class 3 vehicles are driven by demands of meeting commercial, business, and personal use and these vehicles are likely used in distinctly different applications compared to lighter LDVs covered by EPA's proposal. Accordingly, these vehicles should not be included in the LMDV program. Further, as discussed in Section h below, EPA exceeded its authority in changing the definitions.

ii. EPA failed to address emission reductions in the existing LMDV fleet to help achieve near-term emission reductions.

Fuel- and vehicle-based GHG emissions reduction solutions are currently available in the marketplace and could achieve nearer-term emission reductions from the existing light- and medium-duty vehicle fleet. A singular focus on future ZEV technologies does not seem to meet the stated goals of the proposed program. The proposal would require a significant ramp-up of electric vehicle production in relation to the scale of the current market, would depend on infrastructure that may not be readily available at the scale needed to meet the proposal's requirements, and would be on an extremely challenging (at best) timeline. Meaningful emission reductions are achievable sooner, and potentially at lower cost, via the use of proven

[12] "Transportation Energy Data Book: Edition 40", Oak Ridge National Laboratory. ORNL/TM-2022/2376. https://tedb.ornl.gov/.
[13] U.S. Energy Information Administration. "Annual Energy Outlook 2023." March 2023. https://www.eia.gov/outlooks/aeo/.
[14] 88 Fed. Reg. 29196 (May 5, 2023).
[15] Oak Ridge National Laboratory. "Electrification Beyond Light Duty: Class 2b-3 Commercial Vehicles." ORNL/TM-2017/744. 2017. https://info.ornl.gov/sites/publications/Files/Pub106416.pdf.
[16] Ibid.
[17] Ibid.

and available technology. For example, the U.S. Department of Energy (DOE) Co-Optimization of Fuels & Engines (Co-Optima) initiative examined fuels and engine/vehicle technologies simultaneously.[18] The combination of sustainable fuels uncovered by the Co-Optima research can reduce the emissions of vehicles now, while enabling a faster transition to net-zero-carbon emissions for on-road transportation in the future. The lifecycle GHG emissions of these studied fuels were found to be reduced by more than 60%.[19] Such an approach could be utilized by EPA to better achieve the stated goals of the agency. EPA must address this factor.

iii. Non-electrification solutions.

EPA's analysis is flawed in that it failed to account for non-electrification solutions.

1. Technology neutrality – all solutions should be allowed to compete.

In the preamble to the proposed rule, EPA states that "[t]he proposed standards are performance based and do not mandate any specific technology for any manufacturer or any vehicle type" and "[e]ach manufacturer is free to choose its own set of technologies with which it will demonstrate compliance…".[20] We disagree, as the stringency of the proposed standards – and even the technology mixes suggested by EPA in the proposal – essentially forces manufacturers to solely focus development efforts on BEVs.

Although EPA asserts that the proposed rule standards do not mandate any specific technology, EPA demonstrates compliance with its proposed standards by modeling new light-duty BEV sales that increase from 36% in 2027 to 67% in 2032. That means, within 5 years, the ratio of new BEV sales to total sales will increase from one third to two thirds of new car sales. For the MDV category, EPA[21] modelled compliance with average new sales reaching 46% in 2032, up from 17% in 2027. EPA modeling relies heavily on the electrification of vans, which reaches 98% by 2032. These compliance projections are much higher than sales of battery electric MDVs in 2020 of less than 1 percent.[22]

API strongly believes in an all-of-the-above strategy to reducing emissions, and we recommend that EPA adjust the standards to allow all solutions the ability to compete. Further, doing so would provide more time for other technologies to be proven with less risk to vehicle original equipment manufacturers (OEMs) and the public if electrification expansion of LMDVs does not pan out in the proposal's implementation timeframe.

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[18] U.S. Department of Energy Office of Energy Efficiency & Renewable Energy, "The Road Ahead Toward a Net-Zero-Carbon Transportation Future Findings and Impact, FY15–FY21." https://www.energy.gov/sites/default/files/2022-06/beto-co-optima-fy15-fy21-impact.pdf.

[19] Gaspar, Daniel J., West, Brian H., Ruddy, Danial, Wilke, Trenton J., Polikarpov, Evgueni, Alleman, Teresa L., George, Anthe, Monroe, Eric, Davis, Ryan W., Vardon, Derek, Sutton, Andrew D., Moore, Cameron M., Benavides, Pahola T., Dunn, Jennifer, Biddy, Mary J., Jones, Susanne B., Kass, Michael D., Pihl, Josh A., Pihl, Josh A., Debusk, Melanie M., Sjoberg, Magnus, Szybist, Jim, Sluder, C S., Fioroni, Gina, and Pitz, William J. 2019. "Top Ten Blendstocks Derived From Biomass For Turbocharged Spark Ignition Engines: Bio-blendstocks With Potential for Highest Engine Efficiency". United States. https://doi.org/10.2172/1567705.

[20] 88 Fed. Reg. 29329 (May 5, 2023).

[21] 88 Fed. Reg. 29331 (May 5, 2023).

[22] Table 3-1. "Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles - Draft Regulatory Impact Analysis", EPA-420-D-23-003. April 2023.

To that end, various studies have highlighted the importance of allowing all technologies to be utilized to reduce emissions faster, more effectively, and at a lower cost.[23,24] By limiting the scope to tailpipe emissions, the proposal is inherently not technology neutral. Setting strict tailpipe-only standards results in a limited, prescribed solution set.

2. Current and future solutions – lower carbon fuels, hydrogen, ICE-based solutions.

As previously noted in our comments, lower-carbon options currently exist and could be used for near-term reductions. Lower carbon fuels are available in the market now, and research and development to bring costs down and improve operability is ongoing.

While still in the early stages and very small market penetration (in model year 2021 there were three hydrogen FCEV models produced, but they were only available in the state of California and Hawaii and in very small numbers[25]), hydrogen-based vehicles are a promising technology that many stakeholders are considering.[26] As acknowledged by EPA in the DRIA,[27] modeled compliance relied on the assumption that 55% of new sales of class 2b and class 3 vehicles would be BEV or FCEV. Furthermore, hydrogen fueling infrastructure is covered by the Bi-partisan Infrastructure Law (BIL) and the Inflation Reduction Act (IRA) funding. API members are engaged in hydrogen projects to support development of hydrogen focused technology. Companies[28] are partnering with OEMs to explore commercial business opportunities to build demand for vehicles powered by hydrogen.

As noted by the American Trucking Associations (ATA), in testimony before the U.S. Senate Committee on Environment and Public Works:[29]

> When battery electric vehicles are not the answer, federal support should refrain from playing favorites, and instead assist in the buildout of alternative fuel facilities. Proposals for hydrogen infrastructure for trucks need to ensure that the infrastructure is in place where that technology best fits in supply chains. Where lifecycle emissions can be reduced by deploying renewable diesel and renewable natural gas, those fuel stocks

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[23] National Academy of Sciences. "Cost, Effectiveness, and Deployment of Fuel Economy Technologies for Light-Duty Vehicles." 2015. https://nap.nationalacademies.org/download/21744.

[24] National Academy of Sciences. "Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy 2025-2035." 2021. https://nap.nationalacademies.org/download/26092.

[25] "Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles - Draft Regulatory Impact Analysis." EPA-420-D-23-003. April 2023.

[26] Morales, M. (April 25, 2023). "Automakers deeply invested in hydrogen-powered cars." *TopSpeed*. https://www.topspeed.com/automakers-invested-hydrogen-powered-cars/.

[27] Ibid.

[28] https://corporate.exxonmobil.com/what-we-do/lower-emission-transportation/emerging-vehicle-and-fuel-technology/exxonmobil-and-porsche-strategic-collaboration;https://www.chevron.com/newsroom/2021/q2/chevron-toyota-pursue-strategic-alliance-on-hydrogen; https://www.bp.com/en/global/corporate/news-and-insights/press-releases/bp-and-daimler-truck-ag-to-accelerate-the-deployment-of-hydrogen-infrastructure.html.

[29] U.S. Senate Committee on Environment and Public Works, hearing on "The Future of Low Carbon Transportation Fuels and Considerations for a National Clean Fuels Program", February 15, 2023. https://www.epw.senate.gov/public/index.cfm/2023/2/the-future-of-low-carbon-transportation-fuels-and-considerations-for-a-national-clean-fuels-program.

need to be available for trucking.

While this statement is in relation to heavy-duty vehicles, the issues are the same for light- and medium-duty vehicles. Infrastructure readiness and reduction of lifecycle emissions without picking one technology over others should be EPA's focus for the proposed program.

Bio and renewable fuels can and should be considered as part of an "all-of-the-above" approach to decarbonization of the transportation sector, including biocircularity. As previously noted, API members are currently investing heavily in renewable fuel production – continued investment and development will increase the available volumes of such fuels in the marketplace and allow them to serve both as a viable lower carbon solutions leading up to the start of the EPA proposed rule, throughout implementation, and beyond.

Further, EPA's LCA modeling for the proposal is based on biocircularity with atmospheric CO_2 consumed by biomass, resulting in zero tailpipe carbon emissions if the combusted biofuels were made from renewable biomass. The agency is thus not taking the source of carbon into account and is classifying all carbon tailpipe emissions as the same related to their atmospheric GHG impact.

d. EPA is Not Taking a Realistic Approach.

i. EPA's limits are not set on a realistic scientific based approach.

EPA's proposed standards are based on projected ZEV penetration rates based on OEM stated ambitions and on California ZEV mandates and states that follow California rules under Section 177 of the Clean Air Act. These ambitions are stretch goals that OEMs may not reach. Further, EPA should consider a lifecycle approach that would accurately capture all the emissions associated with the life of a vehicle and capture the efficiency differences of different technologies in different applications.

ii. Criteria pollutants proposed stringency of requirements do not factor non-BEV technologies.

EPA proposes to reduce[30] the NMOG+NOx standard by 60% from the current 30 mg/mile level to 12 mg/mile in 2032. We do not believe this reduction is justified either on a health benefit or a cost-effectiveness basis. Furthermore, the criteria pollutant proposal for NMOG+NOx is another example of setting a performance standard that can only be met by a specific vehicle technology. EPA has not demonstrated a technically feasible path for OEMs to meet NMOG+NOx standards with a mixed vehicle fleet comprised of large and small light-duty vehicles with ICE technologies. The examples given in the DRIA (Table 3-14) for vehicles that currently meet less than 15 mg/mile NMOG+NOx is limited to sedans and smaller SUVs, but do not include pick-up trucks and full-size SUVs. Trucks and SUVs represent a significant portion of

[30] In its recent Advanced Clean Cars II regulation, the California Air Resources Board has maintained a 30 mg/mile NMOG+NOx standard.

OEM fleets.[31] EPA instead anticipates and sets the standard to require the use of BEVs by OEMs to sell large SUVs and trucks, instead of allowing for a choice of technology paths which could include ICE vehicles in the fleet. This is arbitrary and capricious and could likely have implications for consumers choice and costs. Moreover, only 19 vehicles were certified below 15 mg/mi that rely only on ICE technologies out of the approximately 299 carline models certified by EPA in 2021.

EPA has also not demonstrated that a particulate matter (PM) 0.5 mg/mi limit is technologically feasible on the basis of measurement capabilities and test procedure. EPA has stated that the agency is not reopening the test procedures, nor does the agency believe that test procedure changes are required, to PM for the proposed PM standards. The agency fails in justifying this decision. The EPA needs to reconsider if it is possible to measure PM emissions of 0.5 mg/mile accurately with current methods. The test set utilized in the NPRM to suggest that test-to-test repeatability is sufficiently precise to support a 0.5 mg/mile standard was noted to use an aerosol generator, presumably to generate PM. In contrast an actual engine will produce PM with more composition and concentration variability, which could impact repeatability. Further, FCA reported[32] the challenges of measuring 1 mg/mile of PM. It can be assumed that these uncertainties would only increase for a PM target of 0.5 mg/mile "[a]s the PM standard is transitioning to 1 mg/mile, this study showed that the net PM mass on the filter will be approaching tunnel ambient background levels. At these net filter PM mass levels, the sources of errors in measurement are numerous. If these sources of errors are not mitigated, the uncertainty can be substantial exceeding the PM limit of 1 mg/mile." It is important to highlight that the 2023 EPA certification vehicle test data shows that there were approximately 83 carline models (out of approximately 376 carlines tested on US06) that achieved a certification level of emissions of 0 gm/mile (and a rounded emission test results level below 0.5 mg/mile) of PM on the US06 drive cycle.

Another issue with the proposed PM standards is related to the new testing requirement at -7°C in the Federal Test Procedure (FTP) cycle. In the NPRM EPA states "as was the case for light-duty vehicles, the -7°C FTP cycle is crucial because it differentiates Tier 3 levels of PM from GPF-level PM and because -7°C is an important real-world temperature that addresses uncontrolled cold PM emissions in Tier 3." The temperature selection of -7°C (19.4°F) is arbitrary and capricious because it is not a real-world temperature applicable to a large portion of the U.S. National Oceanic and Atmospheric Administration (NOAA) data of winter temperature averages for every state from 1971 to 2000[33] suggests that only Alaska, North Dakota, Minnesota, Maine, Wisconsin and Vermont have average winter temperatures below -7°C.[34] The winter average of all 50 states is 0.1 °C (32. °F), which further suggests that a

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[31] Henry, J. (January 3, 2022). "Light Trucks Now Outselling Cars 3-to-1". *Forbes.com.* Retrieved June 30, 2023. https://www.forbes.com/wheels/news/light-trucks-now-outselling-cars/.

[32] Yassine, M., "Challenges in PM Measurement at 1 mg/mile and Tunnel Background Correction," SAE Technical Paper 2023-01-0370, 2023, https://doi.org/10.4271/2023-01-0370.

[33] "Winter Temperature Averages for Every State": https://www.currentresults.com/Weather/US/average-state-temperatures-in-winter.php.

[34] According to the U.S. Census Bureau, these states account for less than 5% of the population of the United States ("State Population Totals and Components of Change: 2020-2022": https://www.census.gov/data/tables/time-series/demo/popest/2020s-state-total.html).

temperature of -7°C is not a real-world temperature.

EPA fails to properly account for all of the cost increases associated with the enforcement of gasoline particulate filter (GPF) technologies. The GPF cost model is described in DRIA Chapter 3.2 and GPF cost is included in the OMEGA model. The model anticipates the direct manufacturing cost (DMC) for a bare downstream GPF, which ranges from $51 dollars for a 1.0-liter engine using a relatively low GPF 249 volume to engine displacement ratio, up to $166 dollars for a 7.0 liter engine using a relatively high GPF volume to engine displacement ratio. In the DRIA (page 3-60) GPF cost is based on the ICCT 2011 work, which is now over 10 years old. Further, the EPA assumes that the GPFs that OEMs will utilize to meet more stringent PM and GHG targets will be those new generation of MY 2022 GPFs with "high filtration efficiencies generally over 95 percent" and low backpressure. The assumed costs for MY 2022 GPF with higher efficiency appear to be unreasonably low and caused the modeling to overestimate feasibility. Furthermore, it is not clear if the associated equipment for effective operation of the GPF such as associated sensors and controllers are included in the cost assessment performed by EPA. The agency should reevaluate its assessment based on more realistic efficiency levels to avoid arbitrary and capricious action.

iii. Review of Annual Energy Outlook (AEO) data and projections.

EPA's BEV projections differ significantly from other federal agencies and reflect that EPA is improperly mandating that a significant proportion of new LDV and MDV must be powered by electric drivetrains and setting unrealistic tailpipe emission standards. The EIA published market share projections for light-duty BEV and PHEV sales in its Annual Energy Outlook[35] 2023 (AEO 2023). The AEO 2023 Reference Case modeling includes laws, such as the IRA and the BIL, and other adopted regulations in its analysis. The AEO 2023 incorporates the IRA by adjusting EV purchase prices to account for the Clean Vehicle Credit using official estimates of vehicles that will be eligible for tax credits. In addition to the Reference Case, the AEO conducts a range of scenario modeling, that considers different assumptions and uncertainties. Across the range of modelled scenarios in AEO 2023, EIA[36] concluded that sales of BEVs and PHEVs do not exceed 29% and the share of the on-road light-duty vehicle stocks comprised of BEVs and PHEVs did not exceed 26%, over the projection period to 2050.

Analysis of BEV-only[37] sales data from the AEO 2020 (pre-COVID) and 2023 (most recent) editions indicate BEVs sales are projected to increase in comparison to the respective Reference Cases. For example, in 2032, BEV sales are projected to reach 13% in the AEO 2023 Reference Case up from 5% in the AEO 2020 Reference Case. Increased BEV sales in AEO 2023 compared to AEO 2020 likely reflect emerging trends, technological improvements, relative manufacturing costs and purchase prices, subsidies, consumer behavior, and other factors. Also, minimum

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[35] U.S. Energy Information Administration. "Annual Energy Outlook 2023." March 2023. https://www.eia.gov/outlooks/aeo/.

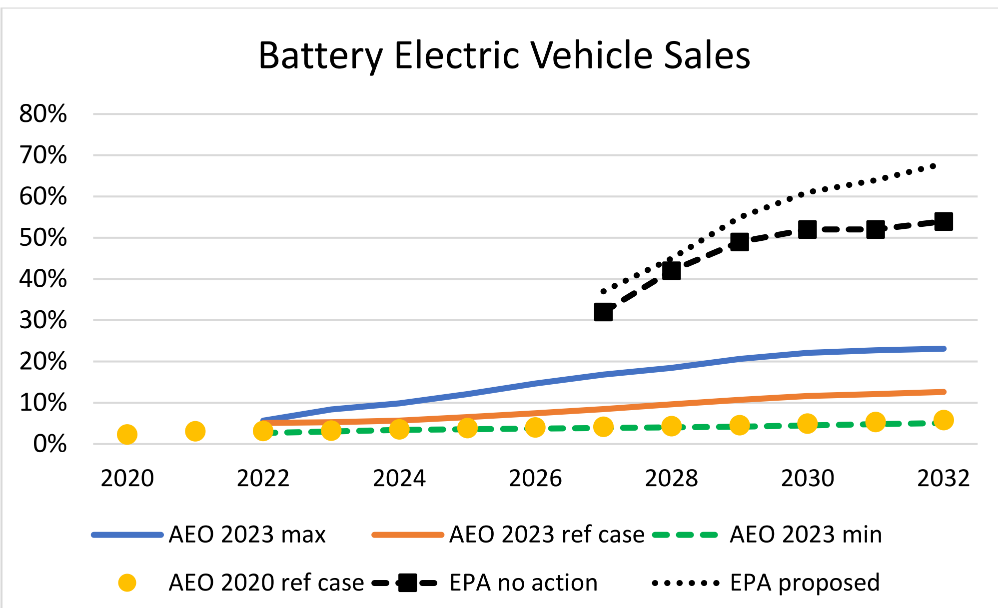
[36] U.S. Energy Information Administration. "Incentives and lower costs drive electric vehicle adoption in our Annual Energy Outlook." *Today in Energy*. Accessed May 15, 2023. https://www.eia.gov/todayinenergy/detail.php?id=56480.

[37] Transportation supplemental tables for AEO 2020 and AEO 2023 can be found here: https://www.eia.gov/outlooks/aeo/.

projections for BEV sales in the AEO 2023 are nearly identical to the AEO 2020 Reference Case (see chart below). However, projections for maximum BEV sales in AEO 2023 reach only 23% in 2032. Figure 1 below illustrates BEV sales across a wide range of scenarios as projected by EIA.

BEV sales projected by EPA,[38] under a scenario to meet the proposed standards and a "no action" scenario, are included in the chart. BEV sales required to meet EPA's proposed standards or "no action" scenario are significantly higher than any scenario projected by EIA in its AEO 2023 analysis. Differences in trajectories between EPA's proposed standards and the AEO projections illustrate EPA selecting and essentially forcing one technology over others and setting an unrealistic stringency for tailpipe emission standards. Although EIA has projected BEV sales to increase (i.e., AEO 2023 vs. AEO 2020) because of recently enacted federal subsidies and expenditures (i.e., BIL and IRA), along with technological advancements, 2032 BEV sales are projected to reach to only 13% in the AEO 2023 Reference Case compared to EPA's proposed standard at 67%. This is a significant difference in projected BEV sales and the agency has not provided adequate information to explain this major difference. EPA must explain why its projections differ so significantly from its sister agency with far more expertise in such projections than EPA.

Figure 1. Battery Electric Vehicle Sales Projected by EIA and EPA



iv. Vehicle readiness.

1. Technology readiness.

The proposed rule identified various LMD ZEVs available in the marketplace or in production, as well as select manufacturer goals and commitments to producing LMD ZEVs by a

[38] Table 108, 88 Fed. Reg. 29335 (May 5, 2023).

certain timeframe. However, there is significant uncertainty regarding EPA's expectation for rapid availability of ZEV powertrains on the proposed rule's timeline. OEM goals and commitments, coupled with IRA/BIL funding may help to increase the availability of LMD ZEVs; however, it will be extremely challenging to meet the proposal's implementation schedule. Based on EIA projections, it seems highly unlikely that vehicles will be available at the rates EPA is projected for the 2027-2032 timeframe.

Even with a fully stocked LMD ZEV market, key barriers to entry include customer uptake, capital costs to purchase vehicles, and infrastructure readiness.

2. ZEV penetration/customer uptake and adoption rates.

LMD ZEVs are currently not available in sufficient quantities or at affordable levels to significantly displace ICEVs. Given the lower costs, current ICEV owners may choose to continue to use and extend the life of their ICEVs to avoid these issues. EPA must address the potential impacts of this likelihood on its emissions projections.

3. Compounding concern resources will also be used for HDV, on the same timeframe.

EPA released the proposals for LMDV and HDV simultaneously – and the programs have the same proposed implementation timeline of 2027-2032. API has serious concerns about the implications of this timing. Both proposed programs are significantly flawed in that they rely on resources and infrastructure that are not yet ready. Even with EPA's projections regarding the use of BIL and IRA funding, the transportation industry will be competing for the same resources to successfully stand up both programs simultaneously. Furthermore, the availability of and process for obtaining such funding is not certain.

v. Infrastructure.

1. Leadtime and deployment.

API, and many other stakeholders, are concerned about the lack of infrastructure for the LMD ZEV market.[39] Even coupled with significant tax credits and incentives, consumers likely will not purchase new LMD ZEVs in the volumes that would be required by the proposal without a reliable charging infrastructure.

EPA notes in the proposal various partnerships and plans to build battery manufacturing plants in the U.S., taking advantage of incentives such as the IRA, one must view these as highly complex projects – in addition to siting and construction, it will take time for these new battery manufacturing facilities to be up and running to ramp up to full production. Further, there is the probability that not all announced projects will materialize.

2. The electricity grid and charging.

In the DRIA, EPA estimates that by 2050, the proposed rule would drive annual electricity demand higher by 430 terawatt hours (TWh). This number represents 10% of today's electricity demand. EPA makes the claim that it is relatively small in the context of total

[39] Khan, Hafiz Anwar Ullah; Price, Sara; Avraam, Charalampos; Dvorkin, Yury. "Inequitable Access to EV Charging Infrastructure." New York University, Tandon School of Engineering. February 2022. https://rosap.ntl.bts.gov/view/dot/61454.

electricity demand in 2050 (4.4%). EPA does not include in its assessment a clear explanation on how this estimate was obtained and, accordingly, has not provided meaningful opportunity for the public to comment. API requests further clarification on the assessment of electricity demand projections by EPA. The past two decades have seen an annual growth in energy generation (i.e., total electricity consumption, or load, and system losses) averaging 30 TWh.[40] Historically, the U.S. electric power system has evolved over time to accommodate new energy demand. However, the rapid pace at which BEVs will have to be in the market to comply with the proposed rule, in addition to the HD GHG Phase 3 rule proposed ZEV deployment, poses several potential challenges at the distribution level that warrant further analysis[41]:

- Distribution capacity expansion could present additional costs. Areas that should be assessed are: (a) high power charging of light-duty EVs (at 150kW and above), (b) high-power charging of medium- and heavy-duty vehicles (potentially at over 1 MW), (c) legacy infrastructure constraints in dense urban areas, and (d) low-power charging of light-duty EVs on distribution systems.
- Transmission constraints must be assessed. Transmission expansions must be deliberate as these investments in the U.S. power system are costly and time consuming.
- Ramping up capabilities of the generating fleet of the bulk power system should be considered for BEVs at scale.
- Analysis of medium- and heavy-duty EV market growth scenarios are needed to assess the impact on energy generation and generation capacity.

Additional factors such as utilities' readiness for the installation of new capacity, sufficient utility labor, capital, land use, other environmental regulations, reliability requirements, and the policy environment must be taken into consideration.[42]

BEV impact on the order of 2-4% increased electricity demand may appear "modest" in an aggregate sense, but EPA has failed to include in their assessment that grid supply-demand strain is a localized phenomenon (both spatially and temporally). Add on the increased demand from electrification ambitions and the system becomes more tenuous and requires additional consideration. While the light-duty and medium-duty NPRM[43] notes "vehicle-to-grid software and systems that allow management of vehicle charging time and rate have been found to create value for electric vehicle drivers, electric grid operators, and ratepayers;" however, we submit that vehicle to grid (V2G) technology is still a topic of active research and development activity and early pilot demonstrations and will take years[44] for effective widespread deployment to help with load-balancing. Depending on the time of day and the extent of renewable electricity in the grid mix for a given

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[40] Energy Information Administration. "Monthly Energy Review." *Total Energy.* June 2023. https://www.eia.gov/totalenergy/data/monthly/.
[41] USDRIVE. "Summary Report on EVs at Scale and the U.S. Electric Power System." November 2019. https://www.energy.gov/eere/vehicles/articles/summary-report-evs-scale-and-us-electric-power-system-2019.
[42] Ibid.
[43] 88 Fed. Reg. 25983 (April 27, 2023).
[44] Deloitte. "2023 power and utilities industry outlook." https://www2.deloitte.com/content/dam/Deloitte/tw/Documents/energy-resources/2023-power-and-utilities-industry-outlook-en.pdf.

location, it should be noted that the carbon intensity of the electricity that gets consumed by these vehicles may also fluctuate depending upon fluctuation of renewable energy availability.[45,46]

Upgrades to the typical duration of an electricity transmission system capital project timeline would need to be accelerated from roughly 10-year timelines to have a chance to support the proposed ZEV demand, while current large-scale electric generation and storage projects are increasingly facing backlogs year-on-year due to long lead times for permitting and approvals, supply chain shortages, and shortage of skilled workers. While government programs have recently been put in place to help overcome some of these hurdles, they will take time for the benefits of those programs to be realized.[47,48,49]

EPA's proposal indicates that by 2035, the "power sector modeling results showed that non-hydroelectric renewables (primarily wind and solar) will be the largest source of electric generation (approximately 46 percent of total generation), and they would account for more than 70 percent of generation by 2050." This will primarily be driven by the incentives included in the IRA. If these projections become a reality, further analysis and consideration should be given to the intermittency of a grid primarily powered by these sources of energies. As indicated by a study[50] conducted by the National Renewable Energy Laboratory (NREL), dramatically accelerating electrification of sectors such as transportation, may make it more difficult to decarbonize the electricity system due to the higher rate of generation and transmission capacity additions needed. Wood Mackenzie's[51] forecasts for BEV sales includes the projection that charging will account for about 4% of total U.S. retail electricity sales in the early 2030s. Faster growth in BEV sales would likewise result in greater demands on the grid, and at a time when the power industry is also under pressure to cut its own greenhouse gas emissions.

[45] Salma Elmallah et al. December 2022. "Can Distribution Grid Infrastructure Accommodate Residential Electrification and Electric Vehicle Adoption in Northern California?" Energy Institute at Haas. WP 327R. https://haas.berkeley.edu/wp-content/uploads/WP327.pdf).

[46] Davidson, F. T., D. T., Rhodes, J., & Nagasawa, K. December 4, 2018. "Switching to electric vehicles could save the US billions, but timing is everything." *The Conversation*. Retrieved June 30, 2023, from https://theconversation.com/switching-to-electric-vehicles-could-save-the-us-billions-but-timing-is-everything-106227.

[47] McKinsey. "Upgrade the grid: Speed is of the essence in the energy." 2022. www.mckinsey.com/~/media/mckinsey/business%20functions/operations/our%20insights/gii/voices/upgrade%20the%20grid%20speed%20is%20of%20the%20essence%20in%20the%20energy%20transition/upgrade-the-grid-speed-is-of-the-essence-in-the-energy-transition.pdf.

[48] Deloitte. "2023 power and utilities industry outlook." https://www2.deloitte.com/content/dam/Deloitte/tw/Documents/energy-resources/2023-power-and-utilities-industry-outlook-en.pdf.

[49] Rocky Mountain Institute. "Increasing Equitable EV Access and Charging: A Path Forward for States." 2022. https://rmi.org/insight/increasing-equitable-ev-access-charging/.

[50] Denholm, Paul, Patrick Brown, Wesley Cole, et al. 2022. "Examining Supply-Side Options to Achieve 100% Clean Electricity by 2035." National Renewable Energy Laboratory. NREL/TP-6A40-81644. https://www.nrel.gov/docs/fy22osti/81644.pdf.

[51] Crooks, E. April 13, 2023. "The EPA plans to rev up US EV sales." Wood Mackenzie. https://www.woodmac.com/news/opinion/the-epa-plans-to-rev-up-us-ev-sales/.

Another critical aspect to be considered is that normal BEV charging behavior will put extra load pressure[52] on the grid, especially at peak hours. As a general practice, a passenger BEV user will charge the vehicle during the evening, which is also the time that electricity demand from the residential sector generally peaks. EV charging at peak hours is anticipated to be more expensive, as additional generation capacity may be required. Moreover, the current consumer trend toward acquiring larger vehicles, which typically have lower battery efficiency and further charging requirements, suggests increasing energy consumption per mile. We believe that electricity demand from BEVs should not cause additional burden to other electricity users, especially during emergencies. However, EPA has not provided an adequate analysis of the feasibility of the proposed regulation given the significant increase of charging infrastructure, electrical generation and transmission and distribution infrastructure that would be required to support a significant shift in the national fleet from ICEVs to BEVs. Furthermore, in its cost-benefit analysis of the proposed standards, EPA has failed to account for the full costs associated with the charging infrastructure and grid infrastructure upgrades that would be necessary. It is also important to note that increased use of high-capacity battery storage and high-voltage upgrades to the grid's electrical distribution and transmission infrastructure may lead to increased risk of wildfires in certain areas of the country, which would have an impact on fire response and other emergency services.

EPA has failed to adequately address the major impacts of the proposed rule on the electricity grid and charging infrastructure. It would be arbitrary and capricious for EPA not to adjust its analysis to take into account these factors.

e. API Supports Consumer Choice for Vehicles.

API[53] supports the concept that different vehicle technologies that reduce greenhouse gas emissions should be allowed to compete equally for consumer and market acceptance and growth. However, API has concerns with regards to the EPA's approach and its effect on consumer choice.

The stringency of the proposed standard is essentially forcing electrification of the transportation sector and is not in alignment with most Americans that, according to a Pew Center survey,[54] favor "using a mix of energy sources to meet the country's needs" and a majority of survey respondents oppose phasing out gasoline powered vehicles by 2035. Concerns with charging availability[55] could be relieved with vehicle technologies (e.g., PHEVs[56])

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[52] United Nations Industrial Development Organization. "Best Practices in Electric Mobility." Discussion Paper. 2019. https://www.unido.org/sites/default/files/files/2019-09/EMG%20Discussion%20Paper.pdf.

[53] https://www.api.org/news-policy-and-issues/blog/2021/05/18/us-consumers-need-balance-choice-in-transportation-policy.

[54] Tyson, A. et al. "Gen Z, Millennials Stand Out for Climate Change Activism, Social Media Engagement With Issue." Pew Research Center. May 2021. https://www.pewresearch.org/science/2021/05/26/gen-z-millennials-stand-out-for-climate-change-activism-social-media-engagement-with-issue/.

[55] Noblet, S. "Closing The Great EV Charging Gap." August 2021. *Forbes.* https://www.forbes.com/sites/stacynoblet/2021/08/10/closing-the-great-ev-charging-gap/?sh=6cf9107f73f4.

[56] EPA is proposing a fleet utility factor (FUF) curve that will increase CO_2 compliance values for PHEVs. 88 Fed. Reg. 292557 (May 5, 2023).

where the length of an average daily trip is approximately 30 miles.[57]

A critical part of relying on an EV for transportation is the ability to charge the battery. According to J.D. Power,[58] EV owners in markets with a high volume of EVs are experiencing problems with charging. Even with the high growth rate of EV chargers, satisfaction has flat-lined and a "shortage of public charging availability" is the main reason car buyers avoid EVs.

The AEO 2023[59] contains long term projections based on current laws and regulations in place at the time of modeling. As part of that modeling, the AEO includes projections for vehicle sales and vehicle sales projections include consumer choice modeling[60]. EIA's consumer choice modeling includes fuel choice, sales penetration among similar technologies, market share among different technology sets, and vehicle attributes (i.e., sales price, fuel economy, battery replacement costs, range, etc.). EIA reported that for the first time since 2010, critical mineral prices increased "significantly" in 2022 resulting in the first year to year increase in electric vehicle battery prices. According to AEO projections, which consider current policies and regulations, and consumer choice, BEV sales penetration remains well below EPA's estimates in the proposed rule, which are induced by its proposed stringent standards. EPA must explain why its projections differ so significantly from EIA. Furthermore, EIA[61] projects electric vehicles to be less competitive from a cost standpoint than gasoline powered vehicles in the much larger non-luxury market.

Vehicles powered by internal combustion engines (ICE) offer "outstanding "drivability and reliability" according to the Department of Energy[62] and "increasing the efficiency of internal combustion engines (ICEs) is one of the most promising and cost-effective approaches to dramatically improving the fuel economy of the on-road vehicle fleet in the near- to mid-term." Increasing sales of EVs does not necessarily mean they are more reliable. According to this survey data[63] "[e]lectric cars are less reliable" than cars powered by petroleum, where software related problems cause reliability issues for consumers. In a Consumer Reports survey,[64] data reported by EV owners indicate that EVs, as a category, have "more frequent problems" compared to conventional vehicles. EPA should take into account these factors in their analysis.

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[57] 2019 Bureau of Transportation data indicates 49% of 2019 national trips by distance were less 25 miles.
[58] J.D. Power. "Growing Electric Vehicle Market Threatens to Short-Circuit Public Charging Experience, J.D. Power Finds." August 2022. https://www.jdpower.com/business/press-releases/2022-us-electric-vehicle-experience-evx-public-charging-study.
[59] U.S. Energy Information Administration. "Annual Energy Outlook 2023." March 2023. https://www.eia.gov/outlooks/aeo/.
[60] https://www.eia.gov/outlooks/aeo/assumptions/pdf/TDM_Assumptions.pdf
[61] U.S. Energy Information Administration. "Issues in Focus: Inflation Reduction Act Cases in the AEO2023." March 2023. Annual Energy Outlook 2023. https://www.eia.gov/outlooks/aeo/IIF_IRA/.
[62] U.S. Energy Information Administration. "Transportation Demand Module Assumptions." March 2023. https://www.energy.gov/sites/default/files/2015/11/f27/QTR2015-8C-Internal-Combustion-Engines.pdf.
[63] Hull, R. "Electric cars are LESS reliable than petrols and diesels with nearly a third reporting faults taking longer to fix - and Tesla is rated worst overall, says Which?" March 2022. *Daily Mail*. https://www.dailymail.co.uk/money/cars/article-10569557/Electric-cars-reliable-petrol-diesel-says-Which.html.
[64] Tucker, S. December 2022. "Consumer Reports: EVs Less Reliable Than Gas-Powered Cars." *Kelley Blue Book*. https://www.kbb.com/car-news/consumer-reports-evs-less-reliable-than-gas-powered-cars/.

f. Critical Minerals, Energy Security, BEV Supply Chains, Feasibility and Modeling.

i. Critical minerals.

Reliance on a limited number of technologies (e.g., ZEVs) on the timeline required by the proposed rule will likely result in a non-resilient transport sector that is vulnerable to unexpected disruptions. Both the federal government and the private sector have recognized that critical minerals are essential to the future of ZEV technology, and likewise, that unstable critical mineral supply chains could disrupt this future.

BEV battery supply chains, including critical minerals and precursors are controlled by a small number of countries, some with unsustainable environmental and human rights practices, and geopolitical concerns. The mining sector will need to grow exponentially to meet demand, and mining is an energy- and environmental-intensive activity. The accelerated BEV technology penetration rate required under EPA's proposal poses significant challenges for best practices to be widely and fully deployed in the timeframe anticipated by the proposed rule.

Regarding the availability of critical minerals, especially those essential to the manufacturing of a Li-ion battery, the supply is dominated by three lithium producing countries — Australia, Chile and China, which account for nearly 90 percent of the global market.[65] While 70% of global cobalt production comes from the Democratic Republic of Congo,[66] most of the mines are owned/operated by China and more than 60 percent of cobalt processing is located in China. China produces 67 percent of the world's graphite.[67] The U.S. imports most of its manganese from Gabon, a less geopolitically stable country, providing 65 percent of the United States' supply.[68] Electricity networks need a large amount of copper and aluminum. The need for grid expansion that would result from this rapid increase in electricity demand underpins a doubling of annual demand for copper and aluminum.[69] China possesses over half of the entire world's aluminum smelting capacity.

There are sources that indicate a shortage of critical minerals as well as volatility in critical mineral prices. U.S. energy security would also undergo a dramatic paradigm shift if vehicle technologies were shifted from ICEVs to ZEVs in the exponential rate that the proposal contemplates. Domestic production of critical minerals required for battery production is insufficient to meet the projected demands. Although Congress and the Administration have

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[65] "The Role of Critical Minerals in Clean Energy Transitions", International Energy Agency World Energy Outlook Special Report. May 2021. https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf.

[66] Ibid.

[67] Robinson, G.R., Jr., Hammarstrom, J.M., and Olson, D.W., 2017, Graphite, chap. J of Schulz, K.J., DeYoung, J.H., Jr., Seal, R.R., II, and Bradley, D.C., eds., Critical mineral resources of the United States—Economic and environmental geology and prospects for future supply: U.S. Geological Survey Professional Paper 1802, p. J1–J24, https://doi.org/10.3133/pp1802J.

[68] https://oec.world/en/profile/bilateral-product/manganese-ore/reporter/usa

[69] "The Role of Critical Minerals in Clean Energy Transitions", International Energy Agency World Energy Outlook Special Report. May 2021. https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf.

taken significant steps to accelerate this activity by funding, facilitating, and promoting the rapid growth of U.S. supply chains for these products through the IRA, BIL, and numerous Executive Branch initiatives, more will still be needed given the proposed increase in demand. Further, EPA failed to consider all the complexities, such as federal permitting, National Environmental Protection Act reviews, and the supply chains for these critical materials in their technology feasibility assessment. API requests that EPA include a thorough evaluation of the full supply chains for each critical mineral/material in their final proposal and their implications on energy security, factoring in sensitivity cases and acknowledging potential disruptions in the supply chain. Please see Appendix A for more discussion regarding our concerns on critical minerals.

ii. Energy Security.

API has concerns with EPA's projections that the proposed standards would increase U.S. energy security because "[a] reduction of U.S. net petroleum imports reduces both financial and strategic risks caused by potential sudden disruptions in the supply of petroleum to the U.S., thus increasing U.S. energy security."[70] EPA's treatment of "energy security" is overly focused on oil imports, petroleum markets and consumption of refined products. Especially in the context of EPA's proposed rule which will require a significant increase in production of batteries. The agency should focus on the energy security implications beyond liquid fuels.

Mineral security and energy security, defined as "the uninterrupted availability of energy sources at affordable prices"[71] are essentially interchangeable concepts because the proposed rule will require affordable supplies of critical minerals, that while available within the U.S., are largely inaccessible due to permitting challenges.[72]

According to the Congressional Research Service,[73] the U.S. has a heavy dependence on imported critical minerals and for the five critical minerals used in battery production there is a "higher potential" for disruptions to the supply chain. In addition to domestic reserves of critical minerals where it may not even be economical to produce,[74] there is a lack of liquidity[75] in global markets that are highly concentrated. Markets for critical minerals are "small, thin, and opaque"[76] and inefficient which is crippling to development and advancement of critical minerals.

U.S. energy security would also undergo a dramatic paradigm shift if vehicle technologies were shifted from ICEVs to ZEVs in the exponential rate that the proposal would likely entail. The U.S. would move from being energy secure to being dependent largely upon foreign sources for the minerals needed to make ZEV technologies such as batteries.

[70] 88 Fed. Reg. 29,345 (May 5, 2023).
[71] 88 Fed. Reg. 29,388 (May 5, 2023).
[72] The Martec Group, "Electric vehicle growth in the U.S.: A look Into the EV Battery Supply Chain", March 2022, https://martecgroup.com/electric-vehicle-battery-supply-chain/.
[73] Tracy, B. S. (2022). "Critical Minerals in Electric Vehicle Batteries" (CRS Report No. R47227). https://crsreports.congress.gov/product/pdf/R/R47227.
[74] Ibid.
[75] Hendrix, C. December 2022. "Markets for Critical Minerals Are Too Prone to Failure." *Barron's*. https://www.barrons.com/articles/markets-critical-minerals-lithium-cobalt-copper-51671227168.
[76] Ibid.

iii. BEV Supply Chains.

Given the market and domestic resource challenges identified above, the EPA has failed to properly address effects on energy security of the U.S. The proposed rule would make the U.S. more reliant on imported critical minerals that are subject to supply disruptions and market concentrations. As EPA mentions, disruptions in petroleum supply chains and critical mineral supply chains are not perfectly comparable; however, similarities should not be ignored.

We also have concerns with the methodology EPA uses to estimate energy security benefits which were originally developed by Oak Ridge National Laboratory's (ORNL) 2008 study entitled, "The Energy Security Benefits of Reduced Oil Use, 2006-2015"(Draft RIA Section 7.3.5). Portions of this methodology are outdated and are no longer applicable given the current structure of global oil markets.

In ORNL's study, a significant portion of the estimated security premium is the potential reduction of "the transfer of U.S. wealth to foreign producers" which "can lead to macroeconomic contraction, dislocation, and GDP losses" during an oil supply disruption. In 2008, when ORNL calculated energy security premiums, net U.S. crude and product imports were over 50 percent of U.S. liquid petroleum consumption. However, since ONRL's calculations the U.S. has become, and is projected to be, a net oil and product exporter, thus an increase in global oil prices would likely lead to a net transfer of wealth to the U.S. not away from it. Without modifications that account for the transfer of wealth to the U.S. during a supply disruption, EPA's calculated energy security premium estimates are likely overstated and not meaningful.

iv. Feasibility and Modeling.

A review of EPA's modeling cost and assumptions for battery costs, critical minerals, battery raw materials, and impacts of federal incentives calls into question EPA's approach and conclusions regarding feasibility of the proposed standards.

- The cost reduction model used in the analysis seems to be based on a model used for part cost reductions driven by improved economies of scale on fixed capital equipment. Given that raw materials make up a significant portion of battery costs, EPA should also use a raw material supply cost model that considers the increasing costs for raw materials with increased supply.
- Cost and price are concepts that the agency uses interchangeably in the regulation. The true cost of the regulation is not fully calculated since the portion of the consumer-facing price is paid for by the government. The agency should fully account for the technical feasibility of any CO_2-reducing technology on a cost basis as defined in the CAA regardless of governmental taxation breaks for electric vehicle technology production and sale.
- The cost impact of "fueling" the significant number of electric vehicles assumed in the regulation (67% implied EV share by 2032) is not fully calculated or considered as part of the technical feasibility analysis and cost for the technology. The costs of adding additional solar, wind, and hydropower plants should be considered in the regulation as they are a necessary part of bringing electric vehicles to market.

These topics are further addressed in Appendix B.

g. Program Review.

i. Assessment of both vehicle and infrastructure development/deployment progress.

The design of a program with heavy reliance on infrastructure that may not be widely available on the timeline proposed is optimistic at best. The proposal appears premature on the stated timeline, and essentially in conjunction with the HD GHG Phase 3 program, which would be competing for the same resources. If EPA is not willing to adjust the timeline and/or standards of the proposed programs, API requests that the agency consider incorporating a pre-program assessment as well as a program progress assessment. It is imperative that EPA provide a real-world evaluation, with an honest assessment provided to the public, regarding progress on infrastructure readiness and ZEV technology deployment. The opportunity for stranded investments by all stakeholders impacted by this program is just too great not to incorporate pre- and mid-program reviews.

For a mid-program assessment, EPA could consider something akin to the Midterm Evaluation that was finalized in the 2012 joint agency rulemaking establishing the MY 2017-2025 LD GHG standards.[77] Further, we recommend that EPA engage a broad stakeholder community to identify necessary elements to incorporate into such an assessment.

ii. Future program incentives and program adjustment of standards.

In the development of the program, EPA needs to consider future program incentives such as adoption of a lifecycle approach, combined with fuel carbon intensity reductions. Such an approach would provide a broad spectrum of industries that power the transportation system (e.g., OEMs, petroleum refiners, power generators, and renewable fuel manufacturers) with incentives to reduce emissions.

In addition, we also request that the agency report on the findings following review with enough time to adjust the standards if needed. Adequate lead time must be provided to the regulated community to allow for necessary adjustments to regulatory compliance strategies, and to avoid stranded investments as much as possible. A proposal based on stretch goals must incorporate an "offramp" or some opportunity to pivot if the essential elements of the program, such as charging/fueling infrastructure, do not materialize.

iii. Impacts of IRA.

The NPRM cites the Inflation Reduction Act (IRA – enacted in 2022) as key legislation that will support the domestic supply chain for battery and electric vehicle production, subsidize EV purchases, and incentivize the build-out of charging infrastructure and renewable power production. However, as outlined below, EPA overstates the potential impacts of the IRA.

The EPA makes misleading claims regarding the ability of the IRA's Clean Vehicle Credits

[77] "Midterm Evaluation of Light-Duty Vehicle Greenhouse Gas Emissions Standards for Model Years 2022-2025." https://www.epa.gov/regulations-emissions-vehicles-and-engines/midterm-evaluation-light-duty-vehicle-greenhouse-gas.

to "incentivize the growth and manufacturing capacity of onshore sourcing of critical minerals."[78] While critical minerals, from any origin, can be used for manufacturing battery electric vehicles, the IRA establishes restrictive domestic content requirements for tax credit eligibility. In other words, the IRA tax credits are not a subsidy or policy that directly remove "potential barriers to wider adoption of PEVs,"[79] but rather potentially only provide tax credits if domestic content requirements are met.[80]

According to the National Mining Association:[81] demand for minerals is souring and policies in the U.S. are lagging; scaling up the U.S. supply chain requires increased extraction and processing; withdrawing federal leases covering reserves of nickel, cobalt, and copper are described as "self-sabotage"; and "permitting delays have been, and continue to be, one of the most significant risks to meeting domestic mineral production goals." According to NMA testimony, automakers are "warning with ever greater frequency that the coming battery material shortfall could stop the EV revolution" and a shortage of batteries could arrive as early as 2024. The NMA reports new mining is needed to meet demand, but it takes, on average, 7 to 10 years to secure permits to open or expand a mine. Even as the NMA acknowledges domestically mined minerals are incentivized,[82] the NMA indicates the mine permitting process is "unwieldly" and discourages[83] investment in domestic mining.

The IRA places income and purchase price limits on tax credit eligibility, along with foreign content restrictions beginning in 2024. Overall, according to the Center for Strategic and International Studies (CSIS)[84], it could be "impossible" for a battery electric vehicle to obtain the full value of the tax credit (i.e., $7,500) in the near term.

h. **Legal Concerns.**

The aggressive push to electrify the LDV and MDV fleet is the defining characteristic of the Proposed Rule from a legal standpoint. EPA explains that its "feasibility assessments in past rulemaking were predominantly based on ICE-based technologies that provided incremental tailpipe GHG reductions." 88 Fed. Reg. at 29238. Here, in contrast, EPA projects that the

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[78] 88 Fed. Reg. 29195 (May 5, 2023).
[79] 88 Fed. Reg. 29346 (May 5, 2023).
[80] Center for Strategic and International Studies. Tax credits are also subject to other requirements – "An Electric Debate: Local Content Requirements and Trade Considerations." October 2022. https://www.csis.org/analysis/electric-debate-local-content-requirements-and-trade-considerations.
[81] "Unleashing American Energy, Lowering Energy Costs, and Strengthening Supply Chains.", United States House of Representatives Committee on Energy & Commerce, Testimony of Katie Sweeney, Executive Vice President & General Counsel National Mining Association, February 7, 2023.
[82] National Mining Association. "The Future of Mining Rests on the Actions of Today." September 2022. https://nma.org/2022/09/22/future-of-mining/.
[83] Legislative Hearing, United States House of Representatives Committee on Natural Resources, Testimony of Rich Nolan, President & CEO, National Mining Association, February 28, 2023. https://nma.org/wp-content/uploads/2023/02/National-Mining-Association-2-28-23-Nolan-Testimony.pdf.
[84] Center for Strategic and International Studies. "An Electric Debate: Local Content Requirements and Trade Considerations." October 2022. https://www.csis.org/analysis/electric-debate-local-content-requirements-and-trade-considerations.

Proposed Rule at full implementation would result in the electrification of 67% of the LDV fleet – over 25% more than the 39% penetration rate that EPA projects in the no action base case. *Id*. at 29329. EPA similarly projects that 46% of the MDV fleet will be electrified, reflecting 98% electrification of all vans. *Id*. at 29331. These numbers make it clear that the Proposed Rule would establish a legal mandate effectively requiring that electric vehicles must comprise a significantly greater proportion of the LDV and MDV fleet than otherwise would be the case. While BEVs can and should be a choice available to manufacturers and vehicle purchasers, we disagree that EPA should impose a binding mandate for the production of BEVs and outline why such a mandate exceeds EPA's authority under the Clean Air Act (CAA).

i. EPA does not have authority to impose standards that are only achievable through the use of BEV technology because there is no clear statement in the Clean Air Act authorizing EPA to mandate a shift away from internal combustion engines.

The Proposed Rule marks a shift in EPA's approach to regulating emissions from LDVs and MDVs. EPA, consistent with the Clean Air Act, has traditionally established standards based on technology that can control the amount of emissions from LDVs and MDVs. EPA deviated from this approach in its 2021 GHG standards, setting standards based on a formula that the agency estimated would increase the market share for electric vehicles from 3.6% to 7% for model year 2023 and 17% for model year 2026. But even then, EPA contended that its "assessment, consistent with past EPA assessments, shows that the final standards can largely be met with increased sales of advanced gasoline vehicle technologies, and projects modest (17 percent) penetration rates of electrified vehicle technology" by 2026. 86 Fed. Reg. 74434, 74484 (Dec. 30, 2021). And EPA argued that it relied on advances in internal combustion engine ("ICE") powertrains to achieve the required GHG reductions and purported not to push for a shift from ICE powertrains to electrified vehicles.

Here, EPA goes even further and seeks to totally transform the transportation sector. It proposes standards that would effectively require that BEVs must comprise two-thirds of the LDV fleet and nearly half of the MDV fleet at full implementation, which is a substantially greater proportion of the fleet any prediction of the market demand would support. Indeed, according to EPA, "[in] MY 2032 when the proposed standards reach the lowest level, it is possible that only BEVs and PHEVs are generating positive credits, and all ICE vehicles generate varying levels of deficits." 88 Fed. Reg. at 29342. In other words, EPA predicts that manufacturers will not be able to comply with the proposed rule without producing significant numbers of electric vehicles. EPA thus seeks to require a fundamental transformation of the LDV fleet from ICE powertrain technology to electric vehicles.

Such a shift from ICE powertrains to electric powertrains would be truly transformative. BEVs require fundamentally different vehicle technologies than those used on conventionally fueled vehicles – e.g., electric motors instead of internal combustion engines, batteries to store power rather than on-board fuel tanks. Moreover, BEVs rely on a wholly different infrastructure (e.g., electric power generation and distribution, charging stations, battery manufacturing) – much of which does not yet exist or exists only in limited form. Additionally, switching to BEVs will fundamentally change the manner in which vehicles are used, for example requiring careful scheduling of vehicle operations to accommodate the long periods needed to adequately charge the vehicles. Lastly, a BEV mandate would produce widespread effects on the national economy, such as the reduced need for oil and gas production, gas processing, changes to petroleum refining, and distribution. Such changes are extraordinary and far more expansive than those caused by EPA's LDV and MDV GHG standards up to now.

EPA asserts that the BEV mandate is authorized under Clean Air Act ("CAA") Sections 202(a)(1) and (2). 88 Fed. Reg. at 29231. EPA claims that these provisions "are technology forcing when EPA considers that to be appropriate." *Id*. at 29232. EPA further asserts that "Section 202 does not specify or expect any particular type of motor vehicle propulsion system to remain prevalent." *Id*. The Agency also asserts that its extraordinary new interpretation of the statute is supported by legislative history claiming that Congress understood that powertrain technologies might evolve over time and quotes Representative Pallone as opining that the "recently enacted [Inflation Reduction Act] "reinforces the longstanding authority and responsibility of [EPA] to regulate GHGs as air pollutants under the Clean Air Act," 204 and "the IRA clearly and deliberately instructs EPA to use" this authority by "combin[ing] economic incentives to reduce climate pollution with regulatory drivers to spur greater reductions under EPA's CAA authorities."" *Id*. at 29233.

But the U.S. Supreme Court has concluded that such an "extraordinary" claim of authority exists only when there is "clear congressional authorization." *West Virginia v. EPA*, 142 S.Ct. 2587, 2609 (2022). CAA §§ 202(a)(1) and (2) contain no such clear authorization. At their core, CAA §§ 202(a)(1) and (2) authorize EPA to establish "standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines, which in [the Administrator's] judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare." Because this provision includes no clear statement that EPA may mandate a fundamental shift in propulsion technology, EPA lacks authority to impose emissions limitations that effectively will require the production and sale of electric vehicles. EPA cannot rely on the views of individual Members who participated in the CAA or the IRA to claim vast new authority from long extant statutory provisions.

The lack of a clear statement is particularly notable given that Congress's most recent efforts to address GHG emissions – the Inflation Reduction Act and the Bipartisan Infrastructure Act – almost exclusively consisted of economic incentives and pointedly gave EPA no new or expanded authority to substantively regulate GHG emissions. If Congress had intended to give EPA authority to mandate a fundamental shift in powertrain technology, surely it would have done more than create consumer facing incentives. Moreover, EPA's claim of authority plainly conflicts with other relevant statutes, such as the Renewable Fuel Program, under which Congress mandated that significant and increasing volumes of renewable fuels should be blended into that national motor fuel supply. In contrast, the Proposed Rule is designed to significantly reduce the amount of motor fuel consumed by the light and medium duty fleet. The Proposed Rule thus would frustrate Congressional intent by reducing rather than expanding the volume of renewable fuel consumed by motor vehicles in the U.S.

It also is telling that EPA has abandoned any pretense of "co-regulating" with NHTSA, the national regulatory authority that actually has been authorized by Congress to establish motor vehicle fuel efficiency standards. *Id.* at 29227 n. 384. Among other things, this is a clear attempt to free EPA from unambiguous statutory obligations that otherwise would constrain a joint rulemaking (e.g., NHTSA "may not consider "the fuel economy (i.e., the availability) of dedicated alternative fueled automobiles – including battery-electric vehicles – in any model year for which standards are being set." 87 Fed. Reg. 25710, 25994 (May 2, 2022)). It is simply not plausible that the general standard-setting authority of CAA § 202(a) can be construed to confer omnibus authority for EPA to effectively rewrite directly relevant statutory directives.

ii. EPA's authority under CAA §§ 202(a)(1) and (2) to prescribe emissions standards for vehicles and engines does not extend to a mandatory shift in powertrain technology.

As explained above, the Proposed Rule would effectively require that a significant proportion of new LDV and MDV must be powered by electric drivetrains. That proportion significantly exceeds the level of new vehicle electric vehicle sales that otherwise would occur. As a result, the Proposed Rule would constitute a mandate to produce electric vehicles.

Moreover, electric vehicles are not just another form of conventional diesel or gasoline fueled ICE-driven vehicles. For example, a BEV cannot be produced by modifying a conventional ICE drivetrain (e.g., by changing combustion conditions) or by adding pollution control technology to a conventional ICE drivetrain (e.g., catalytic converter or gasoline particulate filter). Rather, BEVs employ wholly different propulsion technology as compared with conventional ICE drivetrains. BEVs use electricity and batteries rather than liquid fuels stored in fuel tanks and employ electric motors for propulsion rather than ICE engines.

EPA asserts that CAA §§ 202(a)(1) and (2) authorize the imposition of an electric vehicle mandate. But for the following four reasons, EPA does not have authority under CAA §§ 202(a)(1) and (2) or under any other CAA provision to impose such a fundamental and mandatory shift in powertrain technology.

First, EPA may regulate a class of motor vehicles under CAA § 202(a)(1) only if emissions from that class of vehicles "cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare." EPA treats BEVs as if they do not have emissions for the purposes of this proposal. 88 Fed. Reg. at 29297. As a result, under EPA's rationale, BEVs do not emit the pollutants that are the object of the Proposed Rule and cannot cause or contribute to the endangerment that EPA asserts as the basis for its authority to regulate here under CAA § 202(a)(1). Thus, it is beyond EPA's authority to include electric vehicles in its regulations under § 202(a) or to impose an electrification mandate.

Second, CAA § 202(e) – entitled "New power sources or propulsion systems" – states that EPA may defer the certification for a new motor vehicle employing a new power source or propulsion system until after the Agency has "prescribed standards for any air pollutants emitted by such vehicle or engine which in [the Administrator's] judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger the public health or welfare but for which standards have not been prescribed under [CAA § 202(a)]." Thus, EPA must take two actions when assessing a new power source or propulsion system. EPA first must determine whether emissions from the new power source or propulsion system cause or contribute to air pollution that endangers public health or welfare. If the answer is yes, EPA must then establish new emissions standards for the new power source or propulsion system or, alternatively, determine that appropriate standards have already been established.

BEVs clearly constitute a new power source or propulsion system. As a result, before certifying any BEVs, CAA § 202(e) requires that EPA determine whether emissions from BEVs cause or contribute to air pollution that endangers public health or welfare. But, EPA treats BEVs as if they do not have emissions. Consequently, EPA cannot determine that emissions from BEVs cause or contribute to any endangerment caused by emissions and, therefore, the Agency has no need or authority to impose emissions standards on BEVs prior to certifying them.

Third, CAA § 202(a)(1) authorizes EPA to establish "standards applicable to the emission of any air pollutant from any ***class or classes*** of new motor vehicles or new motor vehicle engines." CAA § 202(a)(1) (emphasis added). This provision requires EPA to define appropriate classes of vehicles for purposes of making the cause/contribute finding and in subsequently establishing emission standards.

From the outset of its CAA-based motor vehicle regulatory program, EPA has properly distinguished between fundamentally different powertrain technologies – e.g., regularly developing and issuing separate standards for gasoline-powered vehicles and diesel-powered vehicles. In contrast, EPA here combines all powertrain types into the same classes for purposes of imposing emission standards. That is contrary to the statute, arbitrary, and capricious because conventionally powered vehicles have fundamentally different emissions characteristics than electric powered vehicles. See also CAA § 202(e) (requiring EPA to separately evaluate emissions from "a new power source or propulsion system.")

As demonstrated by EPA's prior LDV GHG standards, there is a wide variety of emissions control techniques that may be applied to conventionally powered LDV to reduce GHG emissions – including such things as improved engine efficiency, better aerodynamics, and lower rolling resistance. Applying such measures to BEVs does not affect their GHG emissions profile because, by EPA's definition, BEVs do not emit GHGs. This shows that conventionally powered vehicles and BEVs should not occupy the same class under these rules because wholly different regulatory approaches are needed to appropriately control GHG emissions from these two fundamentally different types of vehicles.

Fourth, EPA's regulatory approach is unlawful because it treats BEVs as if their powertrain were an emissions control technology and then mandates the use of that purported emission control technology. EPA claims throughout the proposed rule that its proposed standards do not require manufacturers to implement any specific technology and, instead, that they retain flexibility to comply with the rule in whatever manner they deem appropriate. *See, e.g.,* 88 Fed. Reg. at 29232. But the proposed rule inescapably will require a significant industry-wide shift from internal combustion to BEVs. A particular manufacturer may avoid producing a BEV though creative use of the ABT provisions, but the industry as a whole will have no choice but to produce increasing numbers of BEVs over time. This is contrary to CAA § 202(a), which authorizes EPA to set emissions standards, but does not authorize EPA to mandate the use of any particular emissions control technology in meeting those standards.

iii. EPA has no authority under CAA §§ 202(a)(1) and (2) to establish emissions standards based on credit trading among manufacturers.

The Proposed Rule is fundamentally different from prior LDV GHG rules in that EPA factors credit trading among manufacturers into its standard setting analysis. EPA explains that "[i]n light of the evidence of increased adoption of trading as a compliance strategy, EPA has included the ability of manufacturers to trade credits as part of our central case compliance modeling for this proposal, rather than as a sensitivity analysis as we did in the modeling for the 2021 rule." 88 Fed. Reg. at 29343. So, rather than allowing for credit trading as a "compliance flexibility" for purposes of implementing the standards, credit trading is included in setting the standards in the first instance.

The use of credit trading in standard setting is legally flawed for two reasons. First, it is true that EPA has long used credit trading as a compliance method under its vehicle emissions standards. But here EPA is doing more – EPA uses credit trading in setting the standards themselves. EPA provides no explanation of its legal authority for this novel approach.

Second, CAA § 202(a)(2) requires EPA to consider cost and technical feasibility in setting emissions standards. By factoring credit trading into standard setting, EPA unreasonably is diluting the cost impact of the Proposed Rule on manufacturers that opt not to engage in credit trading. As EPA notes, "trading is an optional compliance flexibility." 88 Fed. Reg. at 29343. And EPA acknowledges "that automakers may choose to use it in their compliance strategies to varying degrees." *Id*. But rather than assess the costs of compliance for manufacturers that choose not to engage in credit trading, EPA asserts without analysis or other support that "reduced use of credit trading may result in somewhat higher costs for the program, but we do not believe it would alter our conclusion that the standards are feasible." *Id*. An agency "belief" that is untethered to facts or analysis does not provide an adequate basis for EPA to conclude that the proposed emissions standards are cost effective in the absence of trading. EPA thus fails to satisfy its clear statutory obligation to factor costs into the proposed emissions standards.

iv. EPA exceeded its authority by ignoring the distinctions Congress made between heavy duty vehicles and light-duty vehicles and commingling them in the same averaging, banking, and trading (ABT) program with smaller vehicles.

EPA explains in the Proposed Rule that "[l]ight-duty trucks (LDTs) that have gross vehicle weight ratings above 6,000 pounds and all MDVs are considered ''heavy-duty vehicles'' under the CAA." 88 Fed. Reg. at 29226 n. 382. This comports with CAA § 202(b)(3)(C), which defines the term "heavy duty vehicle" to mean "a truck, bus, or other vehicle manufactured primarily for use on the public streets, roads, and highways (not including any vehicle operated exclusively on a rail or rails) which has a gross vehicle weight (as determined under regulations promulgated by the Administrator) in excess of six thousand pounds." This definition communicates Congress's clear intent that heavy-duty vehicles should be regulated as a distinct class of vehicles, separate from light-duty vehicles.

The Proposed Rule violates this obligation by regulating certain heavy-duty vehicles as light-duty vehicles and by commingling these two classes in the same averaging, banking, and trading program (which, as addressed in subsection iii, above, is unlawfully considered in formulating the proposed emissions standards).

The problem here involves "medium duty vehicles" ("MDV"), which EPA defines to mean Class 2b and 3 vehicles. 88 Fed. Reg. at 29226. EPA explains that it "has not previously used the MDV nomenclature, referring to these larger vehicles in prior rules as either heavy-duty Class 2b and 3 vehicles or heavy-duty pickups and vans." EPA further explains that it previously "addressed medium-duty vehicle emissions as part of regulatory programs for GHG emissions along with the heavy-duty sector." *Id*. at 29227. The exception was "medium duty passenger vehicles" ("MDPV") which EPA previously has defined as "vehicles between 8,501 and 10,000 pounds GVWR designed primarily for the transportation of persons." *Id*. at 29226 n. 382. According to EPA, "[w]hen [it] established its GHG standards in 2010, EPA included MDPVs in the light-duty vehicle GHG program as well," such that "[e]ssentially, MDPVs are heavy-duty vehicles that are included in light-duty vehicle programs." *Id*. at 29278.

EPA here proposes to expand the definition of MDPV in two ways: (1) "EPA is proposing to include in the MDPV definition any passenger vehicles at or below 14,000 pounds GVWR with a work factor at or below 5,000 pounds except for pickups with an open bed interior length of eight feet or larger which would continue to be excluded from the MDPV category"; and (2) EPA proposes "to include in the MDPV category any pickups with a GVWR below 9,900 pounds and an interior bed length less than eight feet regardless of whether the vehicle work factor is above 5,000 pounds. Pickups at or above 9,900 pounds up to 14,000 pounds GVWR with a work factor above 5,000 pounds would be included as MDPVs only if their interior bed length is less than six feet." *Id*. EPA proposed these changes out of concern that "potential market changes [] could move passenger vehicles out of the LD regulatory class." *Id*.

The inclusion of heavy-duty vehicles (i.e., "a truck, bus, or other vehicle manufactured primarily for use on the public streets, roads, and highways … which has a gross vehicle weight … in excess of six thousand pounds," CAA § 202(b(3)(C)) in the same class as light-duty vehicles for purposes of setting emissions standards violates EPA's obligation to regulate heavy-duty vehicles and light-duty vehicles as separate classes under CAA § 202. This fundamental error is magnified by the current proposal to expand the category of MDPVs to include both heavier vehicles and an expanded range of lighter vehicles.

v. The use of BEV technology is not an emissions standard under CAA §§ 202(a)(1) and (2).

By factoring BEVs into the proposed emission standards, EPA effectively is treating BEVs as an emissions control technology that can form the basis of an emission standard. This exceeds EPA's authority under CAA § 202(a).

CAA § 202(a)(1) authorizes EPA to prescribe "standards applicable to emissions." In other words, EPA is authorized to prescribe emission standards for motor vehicles. The term "emission standard" means a requirement "which limits the quantity, rate, or concentration of emissions of air pollutants." CAA § 302(k).

The problem with EPA's regulatory approach here is that a BEV is not an emissions control technology for a conventionally powered vehicle. A BEV does not and cannot limit the "quantity, rate, or concentration" of air pollutant emissions from a conventionally powered vehicle. Rather, a BEV represents an entirely different type of propulsion system and powertrain. The existence of BEVs has no bearing on the relative emissions from conventionally powered vehicles.

Consequently, a BEV powertrain is not an emissions reduction technology applicable to conventionally powered vehicles and cannot form the basis of emission standards applicable to conventionally powered vehicles.

vi. The Clean Air Act already expressly provides a regulatory scheme for Clean Fuel Vehicles in Part C of Title II. That regulatory scheme precludes the regulation of BEVs together with internal combustion engines.

CAA § 242(a) requires EPA to "promulgate regulations under this part containing clean-fuel vehicle standards for the clean-fuel vehicles specified in this part." A clean fuel vehicle is one that is powered by a "clean alternative fuel," which is defined to include electricity. CAA § 241(2). The state implementation plan for areas designated in severe or greater nonattainment with ozone National Ambient Air Quality Standards must include a clean-fuel vehicle program. CAA § 182(c)(4). The program must apply to centrally fueled fleets. *Id*. at § 246.

EPA cites the Clean Fuel Vehicles program as an indication that Congress generally intended to "promote further progress in emissions reductions." 88 Fed. Reg. at 29233. EPA thus points to the Clean Fuel Vehicles program as supporting its proposed interpretation that CAA §§ 202(a)(1) and (2) authorize EPA to mandate the production and sale of BEVs. But in doing so, EPA fails to address the regulatory program required under the Clean Fuel Vehicles program and fails to reconcile the particular requirements of that program with the CAA § 202(a) general rulemaking authority on which it relies as the primary authority for the Proposed Rule.

The Clean Fuel Vehicles program plainly requires EPA to establish a separate regulatory scheme for clean fuel vehicles, including electric powered vehicles. "Clean-fuel vehicles . . . subject to standards set forth in this part shall comply with all motor vehicle requirements of this subchapter. . . which are applicable to conventional gasoline-fueled vehicles of the same category and model year . . . except to the extent that any such requirement is in conflict with the provisions of this part." CAA § 242(b), 42 U.S.C. § 7582(b). This provision clearly signals that Congress intended for EPA to develop specific standards for clean fuel vehicles (including BEVs) and also ensure that those clean fuel vehicles comply with the separate emissions standards set for ICE powered vehicles. In the very least, Congress's explicit inclusion of electric powered vehicles in the Clean Fuel Vehicles program and its exclusion of any mention of electric powered vehicles in Section 202 must be given meaning. *Compare* 42 U.S.C. § 7581 *with* 42 U.S.C. § 7521(a), (e); *Bittner v. United States*, 143 S. Ct. 713, 720 (2023) ("When Congress includes particular language in one section of a statute but omits it from a neighbor, we normally understand that difference in language to convey a difference in meaning (*expressio unius est* *exclusio alterius*).") This Clean Fuel Vehicles Program would be rendered meaningless if, as in the Proposed Rule, EPA were to consider conventionally fueled vehicles together with clean fuel vehicles (including BEVs) in developing and implementing emissions standards.

Moreover, the Clean Fuel Vehicles program is narrowly targeted to the worst ozone nonattainment areas and to the pollutants that contribute to ambient ozone levels. The program also imposes important constraints on how vehicles may be regulated (for example, as explained above, it dictates separate emissions standards for clean fuel vehicles). These detailed and prescriptive requirements demonstrate that Congress intended EPA to regulate clean fuel vehicles only in particular ways. EPA's claim in the Proposed Rule of omnibus authority to regulate clean fuel vehicles along with conventionally fueled vehicles cannot be reconciled with the targeted and carefully crafted regulatory scheme set out in the Clean Fuel Vehicles program.

In sum, the CAA clearly instructs EPA as to where and how clean fuel vehicles should be regulated. Those specific requirements displace any authority EPA might otherwise have had to regulate clean fuel vehicles under the general authority of CAA §§ 202(a)(1) and (2). EPA is thus mistaken in asserting that CAA §§ 202(a)(1) and (2) authorize the proposed LDV and MDV emissions standards. In addition, by failing to explain the legal basis on which EPA purports to fulfil its obligations under CAA §§ 202 and 242, the Proposed Rule fails to provide adequate notice and opportunity to commenters on the important legal questions surrounding the scope and extent of the Clean Fuel Vehicles program and how the specific regulatory scheme established under that program can be reconciled with EPA's claim of authority under CAA §§ 202(a)(1) and (2).

vii. The proposed emissions standards are unfounded because EPA fails to explain its rationale for selecting the proposed emissions control levels.

EPA provides an expansive explanation of the Proposed Rule in the 263-page Federal Register notice. But noticeably missing is any explanation of how EPA derived the numeric emissions standards that the Proposed Rule would establish. The "footprint-based standard curve coefficients" for cars and light trucks are clearly presented in the proposal. 88 Fed. Reg. at 29236. While EPA describes these curves as "targets, rather than standards," the curves effectively represent the emissions standards because the enforceable obligation for each manufacturer is derived by summing the actual sales-weighted values derived through application of the curves. *Id*. at 29236 n. 405. Because of the ABT compliance provisions, a manufacturer can demonstrate compliance for its fleet even if each of its vehicles does not meet the emissions limit applicable to that vehicle according to the curves. But each manufacturer must meet an enforceable in-use emissions standard for each vehicle type based on the level of emissions to which the vehicle is certified.

In presenting the curves, EPA discusses a wide variety of relevant factors -- including the upper and lower cutpoints, the slope of the curve, incentives/disincentives for consumer choice of larger vehicles (and the resulting impact on overall GHG emissions reductions), the impact of BEVs, and the relationship between the car and truck curves (the latter Including consideration of load and towing capacity). In addition, the preamble includes extensive discussion of the predicted costs of the Proposed Rule and technical feasibility. But nowhere does EPA explain how the numeric values of the curves (i.e., the actual GHG emissions rate that would be applied to each vehicle upon application of the curve) were derived and how those particular values are justified.

It is bedrock administrative law that an "agency must examine the relevant data and articulate a satisfactory explanation for its action including a rational connection between the facts found and the choice made." *Motor Vehicle Mfrs. Assn. of the United States, Inc. v. State Farm Mut. Automobile Ins. Co.,* 463 U.S. 29, 43 (1983). EPA's failure to do so here renders the Proposed Rule fatally arbitrary and capricious.

Additionally, the lack of explanation violates EPA's procedural obligation to develop a statement of basis and purpose that, among other things, explains "the factual data on which the proposed rule is based" and "the methodology used in … analyzing the data." CAA § 307(d)(3). Unless that failure is corrected, API and other interested parties do not have adequate notice of and opportunity to comment on one of the most fundamental aspects of the Proposed Rule.

viii. EPA lacks authority to set limits on aromatics and other high-boiling material.

The proposed rule asks for comments on whether EPA should engage in a rulemaking to address potential limits on aromatics and high-boiling material as fuel standards under CAA § 211(c). Although EPA has not proposed to engage in a rulemaking at this time, API urges the agency to avoid a costly and burdensome rulemaking effort that would exceed its authority.

The proposed rule acknowledges that fuel standards would not assist the new vehicle fleet to comply with the new standards, but suggests the agency is thinking about them to reduce particulate matter from the existing fleet. However, EPA lacks authority to set fuel standards to address vehicle emissions from the existing vehicles, which are already able to comply with their applicable particulate matter standards.

EPA's authority to regulate vehicle emissions applies only prospectively. EPA may only set standards for classes of "new motor vehicles." CAA § 202(a)(1). In turn, EPA may only consider controlling or regulating fuel after it has determined there are no other "economically feasible means of achieving emissions standards under section [202]." Regulating fuel cannot be needed to achieve the Section 202 standards for existing vehicles because those vehicles already meet their applicable particulate matter standards without any additional fuel regulation. Any attempt to rely on the inability of existing vehicles to comply with the particulate matter standards for new vehicles because of lack of alternative controls would be contrary to the Act's focus on prospective standards.

In any event, EPA may not issue standards under CAA § 211(c) at this time because, as the proposed rule readily admits, EPA has not "considered all relevant medical and scientific evidence available to [it], including consideration of other technologically or economically feasible means of achieving" the standards under section 202. *See* § 202(c)(2)(A). Unless and until EPA completes that analysis and allows stakeholders an opportunity to comment on it, EPA may not set new standards under CAA § 211(c).

i. Additional Concerns.

EPA must address several aspects of their analysis of vulnerabilities associated with critical minerals as outlined in Appendix A and related to cost, modeling, and assumptions as outlined in Appendix B.

j. **Response to EPA Request for Information on Particulate Matter Fuel Controls.**

In Appendix C we respond to EPA's request to review the Agency's rationale for considering fuels controls in a future rulemaking to reduce PM emissions. API finds the Agency has not appropriately considered all data and issues raised by a potential rulemaking. Furthermore, EPA needs to reconsider their analytical conclusions, limitations of SimDis, refinery modeling specifications, and that tire wear and entrained road dust related PM emissions are significant. Please note that due to the compressed comment period for such a complex request for information, coupled with the lack of an extension, API may supplement the docket.

APPENDICES

Appendix A: Critical Minerals Assessment
Appendix B: Detailed Look at the Assumptions Used in the EPA Analysis in the NPRM and the DRIA – Assessment Prepared by Martec
Appendix C: Consideration of Potential Fuels Controls for a Future Rulemaking

Appendix A:

Critical Minerals Assessment

There are hurdles to address in order to support the scale-up adoption of BEV. These hurdles include impacts on supply chains, energy resilience and the environment. Consideration to both the hurdles and mitigation measures should be given to inform responsible and effective implementation of vehicle standards.

Reliance on a limited number of technologies (e.g., BEVs) on the timeline required by the proposed rule will likely result in a non-resilient transport sector that is vulnerable to unexpected disruptions. Both the federal government and the private sector have recognized that critical minerals are essential to the future of BEVs, and likewise, that unstable critical mineral supply chains could disrupt this future. A BEV passenger car requires six times[85] more minerals than a conventional gasoline car. A PHEV requires just one-sixth the critical minerals compared to a BEV, making it a more achievable bridge while the industry scales.[86] We understand that EPA's current analysis does not include PHEV in their technology penetration rates, and that EPA plans to incorporate these technologies in the final rule. API recommends the critical minerals section of the rule be revisited considering PHEV in the assumptions and analysis. Additionally, EPA needs to explain why more of the total electrical vehicle miles travelled (VMT) could not be satisfied by PHEV, which would allow supply chains to better accommodate the demand for critical minerals and hence lower potential global environmental risk.

I. Mineral availability and mining.

BEV battery supply chains, including critical minerals and precursors are controlled by a small number of countries, some with unsustainable environmental and human rights practices, and geopolitical concerns. The mining sector would need to grow exponentially to meet the proposed rule's demands. According to a forecast by BMI, at least 384 combined new mines for graphite, lithium, nickel, and cobalt are required to meet the global demand by 2035.[87] These numbers highlighted by the BMI report were derived prior to EPA releasing the new rule proposals, which will significantly increase the need for new mines.

Mining is an energy- and environmental-intensive activity. Critical minerals for electric batteries such as lithium and copper are particularly vulnerable to water stress given their high-

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[85] International Energy Agency. "The Role of Critical World Energy Outlook Special Report Minerals in Clean Energy Transitions." 2022. https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf.

[86] Pratt, G. "Carbon is our enemy: Let's Use Everything We've Got To Fight It." *Toyota Times*. September 2021. https://toyotatimes.jp/en/spotlights/172.html.

[87] More than 300 new mines required to meet battery demand by 2035: https://source.benchmarkminerals.com/article/more-than-300-new-mines-required-to-meet-battery-demand-by-2035.

water requirements.[88] Over 50 percent of today's lithium and copper production is concentrated in areas with high water stress levels. Activities associated with mining produce GHG emissions, as well as particulate matter emissions, nitrogen oxide emissions, and other air pollutant emissions from mining equipment. A strong focus on environmental and ethical best practices in this sector are needed to safeguard natural lands, biodiversity, sustainable water use, indigenous peoples' rights, and labor protections.[89]

Regarding the availability of critical minerals, especially those essential to the manufacturing of a Li-ion battery, the supply is dominated by three lithium producing countries — Australia, Chile and China, which account for nearly 90 percent of the global market. While 70% of global cobalt production comes from the Democratic Republic of Congo,[90] most of the mines are owned/operated by China and more than 60 percent of cobalt processing is located in China. China produces 67 percent of the world's graphite.[91] The U.S. imports most of its manganese from Gabon, a less geopolitically stable country, providing 65 percent of the United States' supply.[92] Electricity networks need a large amount of copper and aluminum. The need for grid expansion that would result from this rapid increase in electricity demand underpins a doubling of annual demand for copper and aluminum.[93] China possesses over half of the entire world's aluminum smelting capacity.

II. Supply chain resilience.

Looking forward toward 2030, based on current and anticipated global production plans, a global supply shortfall is likely to begin toward the end of the decade. If planned mining projects do not deliver as expected, some critical minerals could face shortages as early as next year.[94] Globally, it takes on average over 16 years to move mining projects from first discovery to production.[95] The ability to quickly scale minerals production is further affected by ore quality, which in recent years has been declining and thus requires more material to be mined,

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[88] International Energy Agency. "The Role of Critical Minerals in Clean Energy Transitions", International Energy Agency World Energy Outlook Special Report. https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf.

[89] The Global Investor Commission on Mining 2030: https://mining2030.org/.

[90] International Energy Agency. "The Role of Critical Minerals in Clean Energy Transitions", International Energy Agency World Energy Outlook Special Report. https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf.

[91] "Graphite," Professional Paper 1802-J, US Geological Survey. https://pubs.er.usgs.gov/publication/pp1802J#:~:text=China%20provides%20approximately%2067%20percent%20of%20worldwide%20output,costs%20and%20some%20mine%20production%20problems%20are%20developing.

[92] Observatory of Economic Complexity: https://oec.world/en/profile/bilateral-product/manganese-ore/reporter/usa.

[93] International Energy Agency. "The Role of Critical Minerals in Clean Energy Transitions", International Energy Agency World Energy Outlook Special Report. https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf.

[94] L. Lee, Energy Intelligence "Mining the Gap to a Net-Zero Future," May 15, 2023. https://www.energyintel.com/00000188-1e5f-d806-ad9f-5edfeb1d0000?utm_campaign=website&utm_source=sendgrid.com&utm_medium=email.

[95] "International Energy Agency. "The Role of Critical Minerals in Clean Energy Transitions", International Energy Agency World Energy Outlook Special Report. https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf.

more resources such as water in stressed areas for processing, and ultimately greater environmental impacts.

EPA also fails to consider the value chain before the battery cell production. The domestic supply chain is in its early stages and to meet the proposed goals, automakers and battery manufacturers will still need to rely on foreign sources of critical materials and precursors. For instance, BMI foresees a 77 percent deficit in domestic available cathode active material to meet 2035 demands in North America. This estimate was done prior to the proposal. This step in the value chain will require import/export until it is further built out, which will add to cost to the battery pack.[96] Although Congress and the Administration have taken significant steps to accelerate this activity by funding, facilitating, and promoting the rapid growth of U.S. supply chains for these products through the IRA, BIL, and numerous Executive Branch initiatives, more will still be needed given the increase in demand.

For any one of these minerals, this regulation, taken to its logical end, puts the U.S into a situation resembling the oil embargoes of the 1970s, where foreign actors control majorities of the critical raw material supplies used in the manufacture of fuels, battery, and motor components designed to provide transportation mobility services for the U.S. consumer. Compared with fossil fuel supply, the supply chains for clean energy technologies can be even more complex (and in many instances, less transparent).[97, 98]

EPA failed to consider all the hurdles and complexities such as federal permitting, National Environmental Policy Act reviews, and the supply chains for these critical materials in their technology feasibility assessment. API requests EPA include a thorough evaluation of the full supply chains for each critical mineral/material in their final proposal and their implications on energy security.

III. Operational inefficiency of battery production facilities.

While many OEMs and battery manufacturers have announced plans to build gigafactories in North America, taking advantage of incentives such as the IRA, one must view these as highly complex projects. It should also be noted that it will take time for these new battery manufacturing facilities to ramp up to full production. Capacity gives a reflection of what a plant could potentially produce; capacity reflects ambition. EPA notes in the DRIA that "the Department of Energy estimates that recent plant announcements for North America to date could enable an estimated 838 GWh of capacity by 2025, 896 GWh by 2027, and 998 GWh by 2030, the vast majority of which is cell manufacturing capacity." This assumes battery manufacturing capacity at initial opening or at mature stage at 100% scale. This is not accurate. In their early years, battery factories will likely operate at approximately 50 percent production

[96] Benchmark Minerals Intelligence, BMI (*see* Charts 2, 3 & 4): https://source.benchmarkminerals.com/article/ambition-versus-reality-why-battery-production-capacity-does-not-equal-supply.

[97] International Energy Agency. "The Role of Critical Minerals in Clean Energy Transitions", International Energy Agency World Energy Outlook Special Report. https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf.

[98] SAFE. "The Commanding Heights of Global Transportation," https://secureenergy.org/wp-content/uploads/2020/09/The-Commanding-Heights-of-Global-Transportation.pdf.

capacity. Mature battery factories today rarely operate above 80 percent utilization rates.[99] The EPA projects a ten-fold increase in North American battery manufacturing capacity in just eight years, from 90 gigawatt hours per year in 2022, to 998 GWh/year in 2030, with the great majority of that sited in the U.S. Wood Mackenzie projects U.S. capacity of less than half that level, at 422 GWh/ year in 2030.[100] Given the disparity in forecasts from different reputable sources, EPA's technology feasibility assessment should factor sensitivity cases and acknowledge potential disruptions in the supply chain.

IV. Raw materials are specialty chemicals, not commodities.

To meet the ambitions that OEMs have set forth in terms of percentage of BEV entering the market, they must secure adequate amounts of raw materials. With the projected supply and demand gap that many analysts foresee, as mentioned earlier, pricing of critical minerals could remain volatile as we have seen through the early 2020s. There are varying views by different analysts on the direction of critical mineral pricing scenarios. Morgan Stanley estimates BEV manufacturers will need to increase prices by 25 percent to account for rising battery prices.[101] Battery raw materials are not commodities, they are classified as specialty chemicals, and pricing should be analyzed as such as they will not follow traditional commodity pricing structures, especially given where these supplies are geographically concentrated in areas with geopolitical instabilities.

V. Recycling of batteries and related electrical components is in its infancy.

Another critical aspect to be considered with this proposal is that recycling of the battery and related electrical components of BEVs are in a state of infancy and poses unique materials handling and safety challenges. The environmental profiles of both BEVs and ICEVs should be considered in light of the production, operation, and disposal of the vehicle (its useful life). Electric battery disposal-related issues are likely to impact the environment and need to be addressed in EPA's proposal:

- Battery packs could contribute 250,000 metric tons of waste to landfills for every 1 million retired BEVs.[102]
- Less than five percent of lithium-ion batteries, the most common batteries used in BEVs, are currently being recycled "due in part to the complex technology of

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[99] Xiao, Maya, "Lithium-ion battery production goes global," January 26, 2022. https://www.controleng.com/articles/lithium-ion-battery-production-goes-global/.

[100] Wood Mackenzie: https://identity.woodmac.com/sign-in?goto=https%3A%2F%2Fmy.woodmac.com%2Fdocument%2F150115630

[101] Thornhill, J. "Morgan Stanley Flags EV Demand Destruction as Lithium Soars," see Chart 7. *Bloomberg*. March 24, 2022. https://www.bloomberg.com/news/articles/2022-03-25/morgan-stanley-flags-ev-demand-destruction-as-lithium-soars#xj4y7vzkg.

[102] Kelleher Environmental. "Research Study on Reuse and Recycling of Batteries Employed in Electric Vehicles: The Technical, Environmental, Economic, Energy and Cost Implications of Reusing and Recycling EV Batteries." September 2019. https://www.api.org/oil-and-natural-gas/wells-toconsumer/fuels-and-refining/fuels/vehicle-technology-studies.

the batteries and cost of such recycling."[103]

- Economies of scale will play a major role in improving the economic viability of recycling, which currently cost is the main bottleneck. Increasing collection and sorting rates is a critical starting point.[104]
- The cathode is where much of the material value in a Lithium-ion battery is concentrated. Currently, there are numerous cathode chemistries being deployed. Each of these chemistries needs to be known, and then the appropriate method of recycling identified, which poses a challenge, as batteries pass through a global supply chain and all materials are not well tracked.
- Lithium can be recovered from existing Lithium-ion recycling practices, but it is not economical at current lithium prices. Cobalt, one of the highest supply risk materials for BEV in the short- and medium-term, is currently being profitably recovered.
- Benchmark forecasts near-term recyclers are likely to use scrap material from the increasing number of gigafactories coming online versus used electric vehicle batteries. Scrap material is anticipated to account for 78 percent of recyclable materials in 2025.[105]
- In 2022, Benchmark expected over 30 gigawatt hours of process scrap to be available for recycling, growing ten-fold across the next decade. Loss rates vary by region and tend to be higher in earlier years of a gigafactory.[106]
- EV batteries are high-cycle batteries and are made to function for approximately 10 years, shorter time for a medium-duty vehicle. Many 'spent' EV batteries still have 70-80 percent of their capacity left, which is more than enough to be repurposed into other uses such as energy storage and other lower-cycle applications.[107] This will extend the time that batteries and raw materials remain in use.
- Repurposing used EV batteries could generate significant value and help bring down the cost of residential and utility-scale energy storage to bring forth

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[103] Harper, G., Sommerville, R., Kendrick, E. et al. Publisher Correction: "Recycling lithium-ion batteries from electric vehicles." *Nature* 578, E20 (2020). https://doi.org/10.1038/s41586-019-1862-3.

[104] International Energy Agency. "The Role of Critical Minerals in Clean Energy Transitions", International Energy Agency World Energy Outlook Special Report. https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf.

[105] BMI (see Chart 8): https://source.benchmarkminerals.com/article/battery-production-scrap-to-be-main-source-of-recyclable-material-this-decade.

[106] BMI: https://source.benchmarkminerals.com/article/battery-production-scrap-to-be-main-source-of-recyclable-material-this-decade.

[107] Engel, H., Hertzke, P., & Siccardo, G. (2019, April). Second-life EV batteries: The newest value pool in Energy Storage. McKinsey Center for Future Mobility. https://www.mckinsey.com/~/media/McKinsey/Industries/Automotive%20and%20Assembly/Our%20Insights/Second%20life%20EV%20batteries%20The%20newest%20value%20pool%20in%20energy%20storage/Second-life-EV-batteries-The-newest-value-pool-in-energy-storage.pdf.

further penetration of renewable power to electricity grids. Initial trials are underway.[108]

- Clear guidance on repackaging, certification, standardization, and warranty liability of spent EV batteries would be needed to overcome safety and regulatory challenges reuse poses at scale.[109]
- Recycling BEV batteries to recover high-value metals has not been proven at commercial scale. Many analysts are aligned that recycling will not become an integral supplier of raw materials until the 2030s, and at that point, only will provide approximately 20 percent of demand.[110]

[108] "The Role of Critical Minerals in Clean Energy Transitions", International Energy Agency World Energy Outlook Special Report. https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf.
[109] Ibid.
[110] BMI: https://source.benchmarkminerals.com/article/battery-production-scrap-to-be-main-source-of-recyclable-material-this-decade.

Appendix B:
Detailed Look at the Assumptions Used in the EPA Analysis in the NPRM and the DRIA – Assessment Prepared by Martec

EPA referred to the proposed rule[111] as "the most ambitious pollution standards ever for cars and trucks," while also saving the "average consumer $12,000 over the lifetime of a light-duty vehicle." EPA has also estimated that the benefits of the proposed standards would exceed costs by at least $1 trillion. In reaching its conclusions, the agency also expects the proposed regulations would require "67% of new light-duty sales" to be solely powered by batteries and new power generation facilities to "fuel" these new BEVs. These changes would require significant changes in the way vehicles are designed, built, and fueled. However, as these changes occur, the agency has promised large savings to the consumer and a net positive impact on the U.S. economy. The following is a detailed look at the assumptions used in the EPA analysis in the NPRM and the DRIA to determine if the claims made are valid.

EPA has failed to adequately explain several aspects of their analysis. In order to provide the public with meaningful ability to comment there are several aspects that need further clarification:

- The cost reduction model used in the analysis seems to be based on a model used for part cost reductions driven by improved economies of scale on fixed capital equipment. Given that raw materials make up a significant portion of battery costs, EPA should also use a raw material supply cost model that considers the increasing costs for raw materials with increased supply.
- Cost and price are concepts that the agency uses interchangeably in the regulation. The true cost of the regulation is not fully calculated since the portion of the consumer-facing price is paid for by the government. The agency should fully account for the technical feasibility of any CO_2-reducing technology on a cost basis as defined in the CAA regardless of governmental taxation breaks for electric vehicle technology production and sale.
- The cost impact of "fueling" the significant number of electric vehicles assumed in the regulation (67% implied EV share by 2032) is not fully calculated or considered as part of the technical feasibility analysis and cost for the technology. The costs of adding additional solar, wind, and hydropower plants should be considered in the regulation as they are a necessary part of bringing electric vehicles to market.

[111] https://www.epa.gov/regulations-emissions-vehicles-and-engines/proposed-rule-multi-pollutant-emissions-standards-model.

Battery Cost Modeling

The NPRM includes several citations[112] of battery cost analysis used by the EPA in developing the technical feasibility of the regulation based on Argonne National Laboratory's BatPaC Model Software. This software includes an analysis of several different battery chemistries and a breakdown of the individual costs for various components needed to manufacture an automotive battery at scale.[113] Argonne's assessment of the 2022 battery cost concludes that 63% of the total battery cost is from raw materials on the anode and cathode of the individual cells. This is an important fact for EPA to consider in the assessment of long-term battery cost modeling as the model for parts and raw materials are fundamentally different.

The NPRM then applies a modeling equation to these initial cost/kWh values to develop long-term costs on a year-by-year basis. This model is detailed in the DRIA in section 2.5.2.1.3.[114]

1) Calculate the cumulative GWh needed by BEVs placed into the analysis fleet through the last model year.

2) Calculate the cost reduction factor due to learning:

factor = 4.1917 × (cumulative GWh through last year) $^{-0.225}$

3) Calculate battery cost in the base year, as a function of pack kWh, according to the equation in RIA 2.5.2.1.2: $\$/kWh$ = 261.61 × (gross kWh) $^{-0.184}$

4) Multiply the result of Step 3 by the result of Step 2.

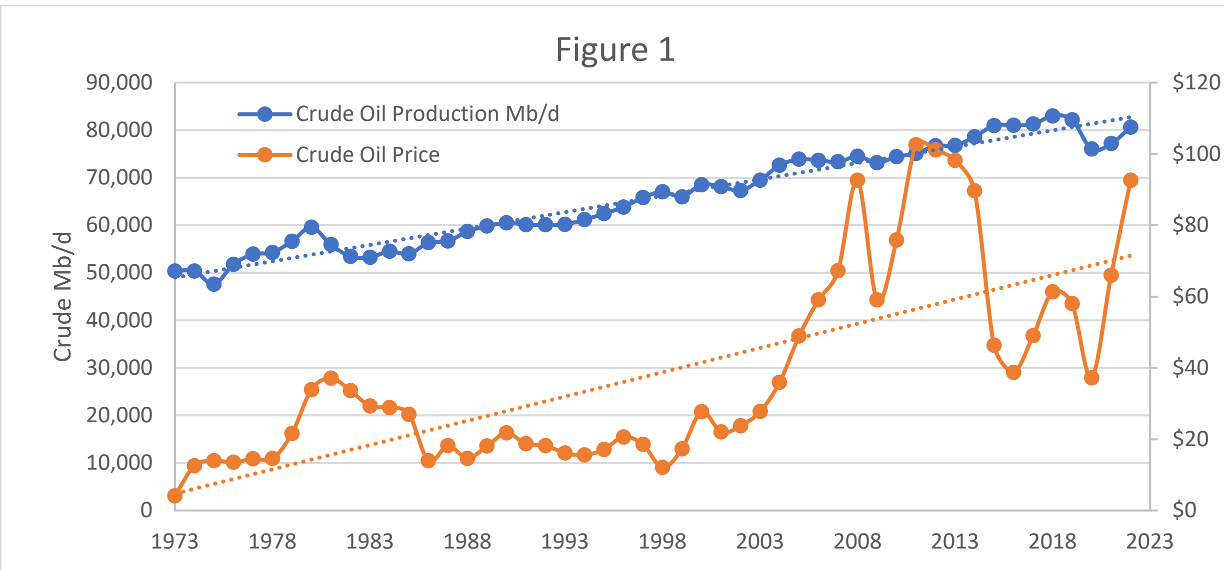
This model makes several unrealistic assumptions:

- No lower bound with increasing volume – at some point in the future, the real cost of battery cells will be $0.00 based on the model used in the NPRM due to cumulative GWh production.
- Cumulative GWh calculation based on production of batteries in the U.S. but it needs to be based on the global production of batteries to establish a baseline.
    - It is global economics that support the costs of battery production, not the economics of the U.S. alone.
    - Global battery volume is expected to rise from ~700GWh to 5,300GWh by 2035.[115]
- $75/kWh was selected for 2035; however, the modeling cited above implies a $46/kWh value based on the model parameters.
    - The cost model cited in the NPRM appears to be voided by several assumptions for cost reduction milestones in section 2.5.2.1.3.

[112] 40 CFR Parts 85, 86, 600, 1036, 1037, and 1066 [EPA–HQ–OAR–2022–0829; FRL 8953–03– OAR] pages 29295, 29299, 29301, 29302.
[113] https://www.anl.gov/cse/batpac-model-software.
[114] Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles - Draft Regulatory Impact Analysis (EPA-420-D-23-003, April 2023).
[115] https://emobilityplus.com/2023/04/21/global-electric-vehicle-battery-market-to-reach-616-billion-by-2035-report/.

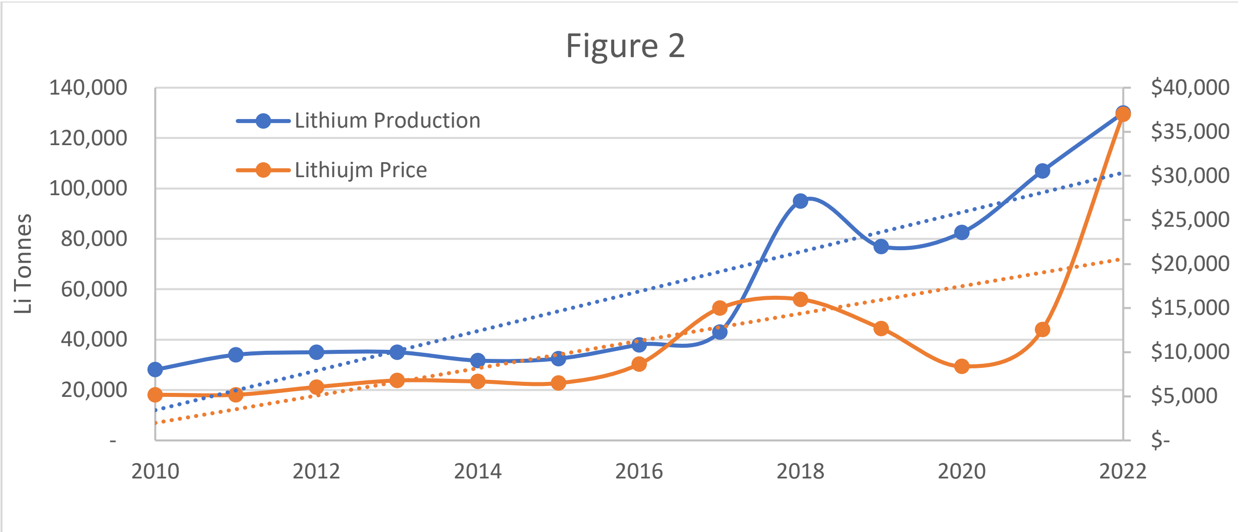
- Manufacturing battery cells operates on the same cost curve as manufacturing standard automotive parts - the cost of the materials in manufacturing battery cells operates on a different cost curve to standard automotive part production and this is not accounted for in the model.
    - Resource modeling is not capital-dependent but resource dependent. This curve follows an increasing cost as production levels are increased and not a reduction as cited in the regulatory framework of the NPRM.
- Biasing the model with the initial development phase will not represent the long-term trend and therefore a more appropriate model should be used to represent real-world costs and volume impacts.

Since Argonne has established a 63% critical raw material value in their development of the BatPaC, it is important for the regulation to follow the economics of raw materials rather than capital depreciation and learning models for purposes of accuracy. Perhaps following the economics of oil production would be more representative of modeling the costs of 63% of the batteries in automotive applications.

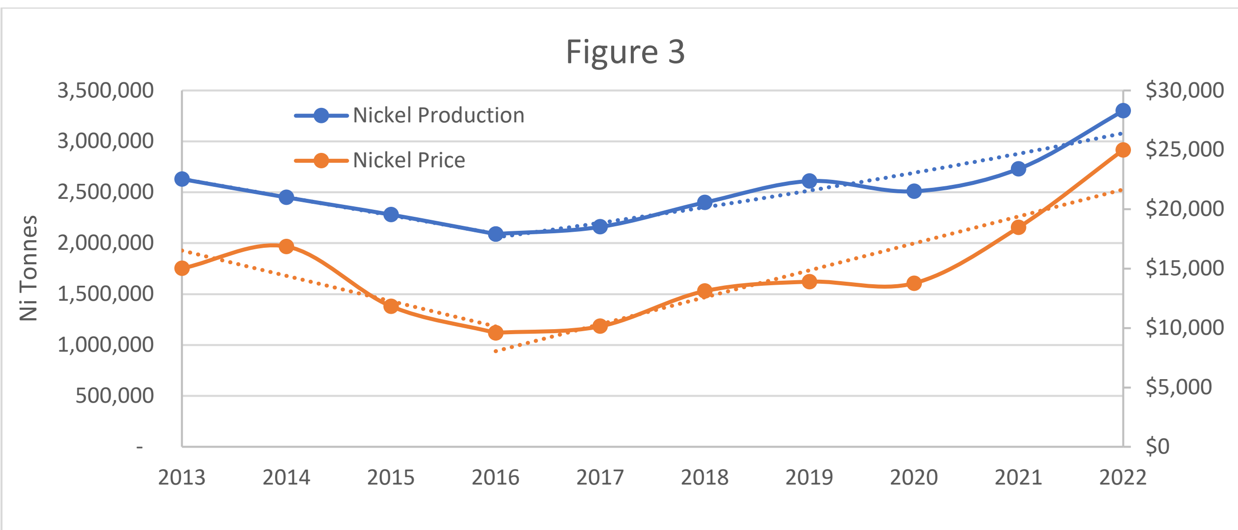


As shown in Figure 1, over the last 40 years the global supply of oil has increased by ~50%.[116] During that same period, the price increased by ~200%.

[116] EIA Global crude oil production and price sourced in May 2023.



As shown in Figure 2, lithium has followed a similar trend to oil – Global production[117] is up 400%, and prices are up 600%.



Nickel also follows a similar trend shown in Figure 3. Rising in price with increased demand and falling with reduced demand over the last 10 years.[118]

These examples show how real-world resource costs are impacted by demand. Unlike the automotive parts model used in the regulation, price and volume tend to move in the same direction for critical battery raw materials. This is because these raw materials are produced in the lowest-cost locations, to begin with, and then move to higher-cost locations to meet demand over time. We see this with oil resources as well. The lowest cost-to-produce sources are used first and only after those sources are at capacity are the higher cost sources then

[117] USGS Global lithium production and price sourced in May 2023.
[118] USGS Global nickel production and price sourced in May 2023.

consumed by the market. We fully expect to see the same trend with all critical raw materials for battery production long term, contrary to the assumptions in the NPRM.

Based on the Argonne value of 63% raw material cost in an average automotive battery, we suggest the agency develop a new costing model to properly account for the 63% resource-based costs and use the current model only for the remaining 37% to account for the capital depreciation and learning on the remaining value of the battery.

Battery Raw Materials

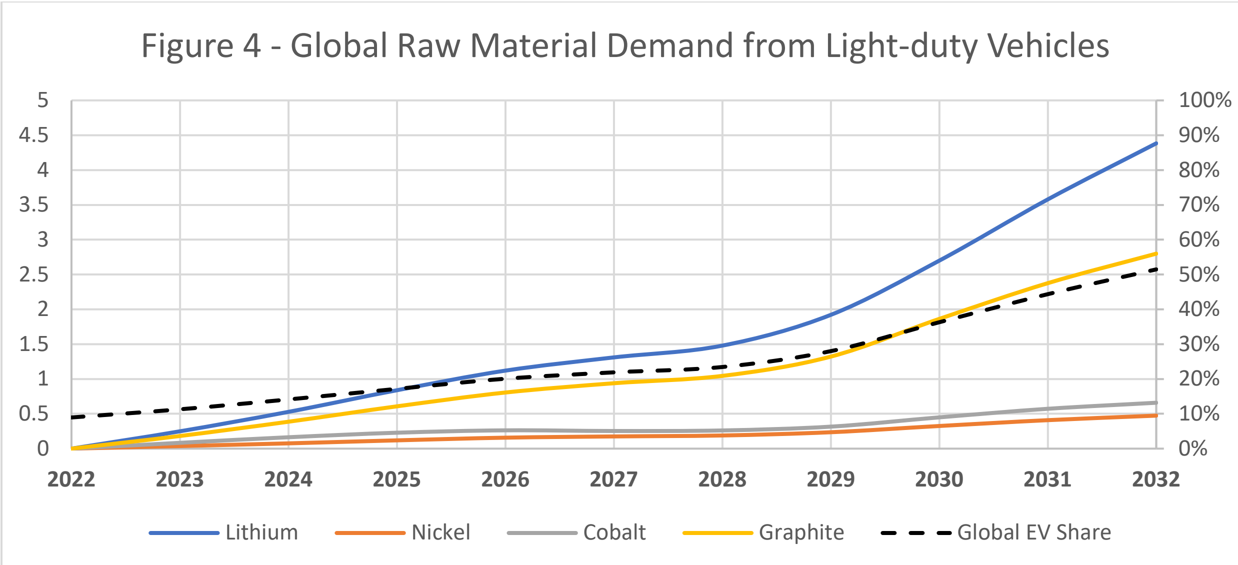
Global demand for critical raw materials has been increasing with the increase in demand for automotive batteries as shown in Table 1. The key raw materials of interest for batteries are lithium, nickel, cobalt, and graphite. The production of these materials has increased by 18% to 251% over the last 10 years.[119]

Table 1

Raw Material (1000 tons)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	% Increase
Lithium	37	35	36	32.5	35	43	96	87.1	83.2	107	130	251%
Graphite	1100	1190	1170	1190	1200	1200	930	1100	1100	1130	1300	18%
Nickel	2100	2490	2400	2530	2250	2100	2300	2610	2500	2730	3300	57%
Cobalt	110	120	112	124	123	110	140	144	140	165	190	73%

If we assume that the global production of electric light-duty vehicles grows to ~50% by 2032 and that technological improvements will be made in battery cell chemistry consistent with known publicly available technology announcements, the demand for these critical raw materials will continue to increase by 47% to 438% by 2032.[120] The output of this analysis is that there will be significant pressure on the mining industry to develop and process the raw materials to meet automotive battery demand.

[119] USGS Global material production sourced in May 2023.
[120] Martec Group study on raw material demand from light-duty vehicles – 2022.



In Figure 4 above, the increase in global production of raw materials for just light-duty vehicles is calculated based on the assumed global demand of 50% BEVs by 2032. The global average kWh per vehicle is assumed to be 71kWh and battery chemistry is expected to be ~30% LFP and 70% NMC battery types. This analysis then calculates the amount of raw material per kWh based on these inputs.[121]

What the outputs show is that lithium will need to increase the amount of mined material by more than 4 times in the next 10 years to keep up with just global light-duty automotive demand. Graphite is also expected to need ~3 times the amount currently produced globally. Nickel seems to be a low number at only a 50% increase from the 2022 production level however, nickel is already consumed in large quantities for other applications. This 50% increase represents ~1.6M tons of nickel while the 400% increase in lithium is only 400k tones.

The agency must consider the global demand for these raw materials in the final regulatory impact assessment and the associated increase in costs to develop supply for these raw materials that are more in line with market forces rather than assuming the cost of these raw materials will decrease with increasing production as stated in the DRIA.[122]

No-Action EV Scenario Assumption

The regulation accepts as a baseline a 40% BEV share of new vehicle sales by 2030 as part of the assumed no-action scenario.[123] This scenario appears to be driven by OEM announcements for future technology penetration for vehicles sold in the U.S.[124]

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[121] https://www.nature.com/articles/s43246-020-00095-x#Sec16 Supplementary Table 23.
[122] Draft Regulatory Impact Analysis EPA-420-D-23-003 April 2023, Figure 2-24.
[123] Draft Regulatory Impact Analysis EPA-420-D-23-003 April 2023, Table 13-67.
[124] 40 CFR Parts 85, 86, 600, 1036, 1037, and 1066 [EPA–HQ–OAR–2022–0829; FRL 8953–03– OAR] page 29192 Table 1.

Table 13-67: Projected BEV Penetrations, No Action - Combined

Manufacturer	2027	2028	2029	2030	2031	2032
BMW	30%	35%	42%	43%	42%	42%
Ford	29%	26%	32%	35%	36%	36%
General Motors	22%	29%	33%	38%	38%	37%
Honda	30%	35%	40%	42%	41%	40%
Hyundai	29%	36%	42%	43%	43%	42%
JLR	26%	32%	37%	38%	38%	38%
Kia	30%	36%	42%	43%	43%	42%
Mazda	28%	34%	40%	42%	41%	40%
Mercedes Benz	29%	35%	41%	42%	42%	41%
Mitsubishi	26%	33%	39%	41%	40%	39%
Nissan	29%	34%	40%	42%	41%	41%
Stellantis	20%	28%	34%	37%	37%	37%
Subaru	25%	33%	39%	41%	40%	39%
Tesla	100%	100%	100%	100%	100%	100%
Toyota	29%	32%	38%	40%	39%	39%
Volvo	26%	33%	39%	41%	40%	39%
VW	31%	36%	41%	43%	42%	42%
TOTAL	**27%**	**32%**	**37%**	**40%**	**40%**	**39%**

Table 1. Example of U.S. electrified new sales percentages implied by OEM announcements for 2030 or before

2022 U.S. Sales Rank	OEM	Share of Total 2022 U.S. Sales (1)	Stated EV Share in 2030 (2)	Powertrain (3)	Implied OEM Contribution to 2030 Total PEV Market Share
1	General Motors	16.4%	50%	PEV	8.2%
2	Toyota	15.4%	33% (4)	BEV	5.1%
3	Ford	13.1%	50%	BEV	6.5%
4	Stellantis	11.2%	50%	BEV	5.6%
5	Honda	7.2%	40%	BEV	2.9%
6	Hyundai	5.7%	50%	BEV	2.8%
7	Nissan	5.3%	40%	BEV	2.1%
8	Kia	5.0%	45%	BEV	2.3%
9	Subaru	4.1%	40%	BEV	1.6%
10	Volkswagen, Audi	3.6%	50%	BEV	1.8%
11	Tesla	3.4%	100%	BEV	3.4%
12	Mercedes-Benz	2.6%	100%	BEV	2.6%
13	BMW	2.6%	50%	BEV	1.3%
14	Mazda	2.1%	25%	BEV	0.5%
15	Volvo	0.8%	100%	BEV	0.8%
16	Mitsubishi	0.6%	50%	PEV (5)	0.3%
17	Porsche	0.5%	80%	BEV	0.4%
18	Land Rover	0.4%	60%	BEV	0.3%
19	Jaguar	0.07%	100%	BEV	0.07%
20	Lucid	0.02%	100%	BEV	0.02%
	TOTAL	100.0%			**48.6%**

OEM technology announcements have not always translated to implementation. For example:

- GM had made the claim in 2007 that they would have 1 million fuel cells on the road by 2012.[125]
    - This claim was never reached, and only limited fuel cell vehicles have ever been produced by GM.
- Ford made the claim in 2001 that their SUVs would increase their fuel economy by 25% by 2005.[126]
    - This claim was only reached after the global recession in 2008 forced buyers out of choosing the larger vehicles they were consuming prior to the recession.

Even the President of the United States isn't the best source of forecasting automotive technology. In the 2011 State of the Union speech, President Obama claimed that there would be 1 million EVs on the road by 2015.[127] The reality was only ~200,000 electric vehicles were on the roads in 2015 and it would take another 6 years (2021) for the 1 million EV goal to finally be reached.

Furthermore, we also question the agency's use of these forward-looking statements as a basis of fact when establishing the baseline cost assumption. The forward-looking statements on BEV penetration rates by the OEMs are predicated on expectations of potential regulatory standards set by the agency. This circular reasoning cannot support EPA's proposal here as the referenced forward-looking statements are largely a function of OEMs striving to create certainty and minimize risk as they attempt to comply with forthcoming regulations.

13.1.2.1 Proposed GHG Standards

Incremental costs per vehicle for the proposed standards (compared to the No Action case) are summarized by regulatory class in Table 13-45 and by body style in Table 13-46.

Table 13-45: Projected Manufacturing Costs Per Vehicle, Proposed Standards

	2027	2028	2029	2030	2031	2032
Cars	$249	$102	$32	$100	$527	$844
Trucks	$891	$767	$653	$821	$1,100	$1,385
Total	**$633**	**$497**	**$401**	**$526**	**$866**	**$1,164**

We question the rationale for requiring 67% BEV sales for compliance by 2032 but not accounting for the cost of these BEVs over the existing regulation as part of the regulatory impact analysis. Using Argonne's battery cost values from BatPaC we would expect an average cost of ~$12,000 for the battery system to be accounted for in the analysis. Additionally, the agency also assumes a cost of ~$3,500 for electric drive units, inverters, and charging systems. Removing the cost of the ICE powertrain and components from the vehicle would leave ~$7,500 to be accounted for in the regulation. With a 67% BEV market share assumption, this would be

[125] https://www.reuters.com/article/us-gm-fuelcells/gm-aims-to-be-first-to-make-1-million-hydrogen-cars-exec-idUSSHA9988820071114.
[126] https://www.autoweek.com/news/a2108121/fords-goal-boosting-suv-fuel-economy-2005-proves-elusive/.
[127] https://www1.eere.energy.gov/vehiclesandfuels/pdfs/1_million_electric_vehicles_rpt.pdf.

~$5,000 compliance cost, not $1,164 as shown in the DRIA.

The agency needs to fully account for the costs of the regulation requiring 67% of BEVs to be sold by 2032 and not use incremental costs above the assumed volume of BEVs by the automakers themselves.

Fueling the BEVs

Section 5 of the DRIA discusses the electrical infrastructure impacts of the regulation forcing 67% BEV market share for new vehicles by 2032.[128]

Table 5-13: IPM results for net export of electricity into the contiguous United States for the proposal.*,†

	2028	2030	2035	2040	2045	2050
Net US Exports (GWh)	-28,312	-23,879	-24,877	-8,809	-4,453	-22
US Electricity Demand (GWh)	4,403,327	4,545,283	4,971,619	5,371,913	5,753,443	6,117,592
Net US Exports as a Percentage of Total Demand (%)	-0.64%	-0.53%	-0.50%	-0.16%	-0.08%	0.00%

Table Notes:
* Negative net exports represent imports of electricity
† International dispatch to the contiguous United States only occurred over the U.S. - Canada border.

This table shows an increase in power generation capacity of 968,586 GWh per year by 2040 due to the impact of the proposed rulemaking. However, this section does not consider the additional costs to the power generation market as a result of this regulation, merely the net increase in total power generation. The agency states:

- "However, as the expected increase in electricity generation associated with the proposal relative to a no-action case is relatively small – approximately 4.4 percent increase in 2050 – we do not expect the U.S. electric power distribution system to be adversely affected by the projected additional number of charging electric vehicles."

Since the proposed rule now requires BEVs as part of the assumed technology needed to meet the proposed standards, the agency should also now account for the additional costs borne by the power generation market to meet the requirements of the standard. Ignoring the costs is not valid since the proposed rule forces market penetrations higher than would otherwise be natural.

Based on publicly available information[129] and the agency's assumed path of new power generation sources from wind and solar, the average cost of building the infrastructure required to support the assumed BEVs in operation by 2040 is ~$1,800/kWh. This means that there could be ~$200B of infrastructure cost that is ignored by the agency as "relatively small." The financial

[128] Draft Regulatory Impact Analysis EPA-420-D-23-003 April 2023, Table 5-13.
[129] https://proest.com/construction/cost-estimates/power-plants/.

burden placed on the power generation industry is not small and should be accounted for accurately in the final regulatory impact analysis.

Required Updates

EPA must accurately assess the financial costs the proposed regulation would impart on the U.S. consumer. Accordingly, EPA should:

- Use a raw material supply cost model that considers the increasing costs for raw materials with increased supply. Automotive battery costs are largely driven by raw materials (63% of total cost) and sources for these raw materials are becoming increasingly more expensive.
- Include the cost of all vehicles that are needed to meet the regulation not merely the additional volume of vehicles needed to meet the regulation over the assumed electric vehicle volumes of the automakers.
- Fully account for the technical feasibility of any CO_2-reducing technology on a cost basis as defined in the CAA regardless of governmental taxation breaks for electric vehicle technology production and sale.
- Consider the costs of adding additional solar, wind, and hydropower plants in the regulation as they are a necessary part of bringing electric vehicles to market as described by EPA.

Failure to do so would be arbitrary and capricious.

Appendix C:

Consideration of Potential Fuels Controls for a Future Rulemaking

EPA notes in the NPRM that the Agency "…has not undertaken sufficient analysis to propose changes to fuel requirements…"[130] and has not provided enough support to set limits at this time. In reviewing EPA's rationale for considering fuels controls in a future rulemaking to reduce PM emissions, API finds the Agency has not appropriately considered all data and issues raised by a potential rulemaking. In the ten sections below, API provides detailed comments on EPA's analysis, finding generally that such a rulemaking on potential fuels controls is unnecessary. If EPA plans to continue to review this issue, API and its members would like the opportunity to meet with the agency to work on this topic.

1. Impacts of High-Boiling Components on Emissions

   In its analysis of the available research studies, EPA has overstated both the certainty in the findings and the leverage of high-boiling components on PM emissions. Fuels quality can enable and support vehicle emissions systems performance. Fuels quality contributions, however, are smaller than those achieved by vehicle technologies.

2. Survey of High-Boiling Materials in Market Gasoline

   EPA's survey of high-boiling components and PMI of market gasoline (which does not identify its data sources) overstates the current number of high-PMI gasolines. API member experience finds the presence of high-PMI gasolines in the market to be significantly less than EPA estimates. Moreover, PMI equations were developed on early, light duty vehicles with Tier 2 technology. PMI calculations are not necessarily correlated with modern vehicle technology.

3. Sources of High-Boiling Compounds in Gasoline Production and How Reductions might Occur – Refinery Impacts

   EPA's analysis of high-boiling components in gasoline production is over-simplified and neglects significant effects of proposed reduction technologies. Segregation of gasoline heavy-ends to distillates presents specification-compliance challenges for diesel and jet fuel, replacement of octane is more complex than claimed. Reducing the gasoline high boiling point as a surrogate for heavy aromatic content would also cut a significant amount of the gasoline pool that is not contributing to PM generation. This would translate into both economical and logistical impacts (e.g., alternate disposition, or blending into diesel pool) that would ultimately impact costs to consumers.

4. Methods of Compliance Determination

   EPA's proposed use of ASTM D7096 Simulated Distillation by gas chromatography is

[130] 88 Fed. Reg. 29397 (May 5, 2023).

inappropriate as a control method on gasoline heavy-ends because (1) SimDis is not well correlated with the better (yet still imperfect) PMI by detailed hydrocarbon analysis and (2) SimDis is not adequately precise to use as a control method.

5. Statutory Authority

   EPA lacks authority to set fuel standards to address vehicle emissions from the existing vehicles, which are already able to comply with their applicable particulate matter standards. We also question the Agency's legal authority to move forward with these fuel controls, which would appear to have no environmental benefit for new motor vehicles.

6. Structure and Level of the Standard

   As EPA notes in the NPRM, it is difficult to effectively comment on structure and level of a standard in the absence of a compliance method; however, any standard based on SimDis will be challenging to implement because of the method's low precision and absence from current rules and specifications. Averaging, banking, and trading would be preferrable to a price per gallon cap which could be difficult to both measure and design controls to ensure operations are below the required threshold.

7. Impact of PMI on Engine Design and Efficiency

   The low-speed-preignition (LSPI) phenomenon is complex with some mechanisms strictly related to lubricants formulation. EPA overstates the potential impact of fuel specification changes in reducing LSPI occurrences.

8. Cost and Impacts on Refining

   EPA's use of refinery LP models is inadequately described and oversimplified in the analysis presented. EPA's analysis neglects the uniqueness and complexity needed in LP models to accurately represent a specific refinery, focuses on a single refinery configuration and neglects important alternatives, lacks appropriate constraints, and appears to neglect impacts of decreased light-end utilization that would result from a heavy-ends control limit.

9. Estimated Emissions and Air Quality Impacts

   EPA overestimates the impact of reducing gasoline vehicle tailpipe PM emissions to improve air quality and health, especially as compared to other vehicle related PM emissions such as tire wear and entrained dust.

10. Analysis of EPA References to CRC Studies

    In this section API presents counterpoint interpretations of the CRC studies citied in EPA's analysis, especially concerning the impacts of heavy-boiling components on PM emissions.

The following sections cover the raised issues above more in detail.

1. Impacts of High-Boiling Components on Emissions

EPA acknowledges that fuel standards would not assist the new vehicle fleet comply with the new standards, but suggests the agency is thinking about reducing particulate matter from the existing fleet, which are already able to comply with their current particulate matter standards. While vehicle technologies have proven to be the primary means to control vehicle emissions, fuels quality can enable and support vehicle emissions systems performance. Fuels quality contributions, however, are smaller than those achieved by vehicle technologies. For instance, Tier III engine technologies such as higher fuel injection pressures, for gasoline direct injection (GDI), and future technologies with gasoline particulate filter (GPF), that can be used for both GDI and port-fuel injection (PFI), are capable to meet the very stringent 2025 LEV III 1 mg/mi mass particulate emissions standards or beyond[131]. Current vehicle technologies, without a GPF, are capable of reducing significantly PM emissions, and further constraints on the fuel will have limited impact on further reducing these emissions. The 2023 EPA certification vehicle test data shows that there were approximately 83 carline models (out of approximately 376 carlines tested on US06) that achieved a certification level of emissions of 0 gm/mile (and a rounded emission test results level below 0.5 mg/mile) of PM on the US06 drive cycle. These carlines were able to meet a 0.5 mg/mile PM emissions level using current certification gasolines, without the need for specialty lower PMI fuels. Additionally, newer vehicle technologies without GPFs have been demonstrated to have minimal sensitivity to fuel changes.[132] In regard to future vehicles, EPA's DRIA states that GPF technologies are more effective at reducing PM emissions than fuel controls (e.g., PMI limit or T99 limits). Specifically, Figure 3-19 of the DRIA describes that PM emissions can be reduced by 99%, 96% and 96% for the testing cycles -7°C FTP, 25°C FTP, and US06, respectively. In contrast when considering a fuel control approach, the NPRM points to studies where it was found that there was a 1-2 percent PM emissions increase for each percent PMI increase. When assessed together, fewer PM emission reductions are gained through fuel controls compared to vehicle hardware approaches.

Furthermore, even if fuel controls were required to significantly reduce PM emissions from existent and future vehicles, which they are not, EPA's proposed methodology is flawed. PMI equations were developed on early, light duty vehicles with Tier 2 technology. New Tier 3 vehicles used advancements in fuel pressure, injector nozzle design and combustion strategy. PMI calculations are not necessarily correlated with modern vehicle technology. PMI equations were developed on Tier 2 gasolines, current EPA gasoline would not be expected to have the same emissions profile.

PM indices also have proven biased for alcohol molecules and are not accurate for current vehicle and fuels technologies. "PMI was found to perform well if the fuels being evaluated had the same ethanol content, but it proved to be a biased indicator when applied to

[131] https://doi.org/10.1016/j.scitotenv.2022.161225.

[132] Citation: Singh, R., Voice, A., Fatouraie, M., and Levy, R., "Fuel Effects on Engine-out Emissions Part 1 - Comparing Certification and Market Gasoline Fuels," SAE Int. J. Adv. & Curr. Prac. in Mobility 3(6):3121-3137, 2021, https://doi.org/10.4271/2021-01-0541.

groups of fuels with varying ethanol content – i.e., E0 (neat), E10 (10% ethanol by volume), and higher ethanol-content fuels. LA92 Phase I PM emissions from fuels with ethanol were found to be consistently greater than emissions from nonoxygenated fuels of the same PMI" [CRC Project No. RW-107-2].

A study[133] presented at the 33rd CRC Real World Emissions Workshop[134], demonstrated and concluded that PMI was not predictive of engine out (or tailpipe) PM emissions. Further, it was concluded that FBP performed somewhat better predictor than PMI, but was still a weak indicator.

2. Survey of High-Boiling Materials in Market Gasoline

EPA discusses their assessment of the trends of T90 from ASTM D86 (high-boiling material) over the past two decades, followed by a summary of available PMI data.

The PMI Profile of Market Gasoline discussion in this section also points out that median PMI is 1.6 for US fuels with 10% remaining above 2.0, suggesting an opportunity to reduce PMI. However, Figure 42[135] in the NPRM shows two-time frames (2008-12) and (2021-2022) but no source for the data. When conducting industry projects (i.e., CRC) where higher PMI fuels are being solicited, it has become almost impossible to find these in real-world fuels.[136]

3. Sources of High-Boiling Compounds in Gasoline Production and How Reductions might Occur – Refinery Impacts

EPA's analysis of high-boiling components in gasoline production is over-simplified and neglects significant effect of proposed reduction technologies. It should be pointed out that high boiling point does not necessarily mean high aromatic content. Reducing the gasoline high boiling point as a surrogate for heavy aromatic content would cut a significant amount of the gasoline pool that is not contributing to PM generation. This would translate into both economical and logistical impacts (e.g., alternate disposition, or blending into diesel pool). that would ultimately impact costs to consumers. Segregation of gasoline heavy-ends to distillates may impact octane, and replacement of octane is more complex than claimed. A potential impact resulting in a reduction of octane would reduce vehicle fuel economy limiting the advantages of higher octane. Work from the Department of Energy's Co-optima concluded, for downsize boosted engine technology, RON and octane sensitivity (enabled through high aromatic fuels) have the most potential to improve efficiency among all fuel properties.[137] For naturally aspirated, port fuel-

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[133] "Can modern vehicle emissions be predicted from fuel properties?," Voice, Alexander, Chanel Sitto, Aramco Americas – Transport Technology, March 2023.
[134] The 33rd Real World Emissions Workshop, March 26-29, 2023, Long Beach, CA. (https://crcao.org/33rd-crc-real-world-emissions-workshop/)
[135] 88 Fed. Reg. 29397 (May 5, 2023).
[136] One API member recently surveyed its gasoline BOB production (i.e., gasoline prior to blending ethanol) and found 95% of BOBs with PMI below 2.0.
[137] https://doi.org/10.1016/j.pecs.2020.100876.

injected legacy vehicles, CRC[138] showed that decreases in energy consumption of up to 2% for a small SUV was possible through the use of a 97 RON fuel compared to 91 RON fuel on a US06 drive cycle.

Shifting boiling points of naphtha produced on the fluid catalytic cracker (FCC), reformer, and coker to produce lighter distillate or kerosene may cause potential market issues, including:

- Overall gasoline production may fall if fuel producers are required to shift gasoline molecules to distillates, which may lead to higher gasoline prices for consumers.
- There may be equipment constraints that prevent shifting of the cut point without restricting overall refining capacity, which could lead to higher consumer prices if overall production falls.
- The value of alkylate and ethanol (non-aromatic high octane blend components) may increase. The alkylate production would probably fall if FCC units were constraint because of tightened specifications.
- There may also be constraints in aromatics content and cetane number for putting these aromatic molecules into jet fuel or distillate, which may further reduce capacity or cause increased shipping of diesel blend components to maintain distillate specifications.
- There are some capital projects that refiners may pursue to help mitigate the impacts, but these too could result in increased cost of supply to gasoline consumers.

4. Methods of Compliance Determination

ASTM D7096 Simulated Distillation by GC Analysis: EPA proposes to use ASTM D7096 simulated distillation by gas chromatography (SimDis) to control / reduce gasoline particulate matter index (PMI) because the actual analytical method needed to calculate PMI --- detailed hydrocarbon analysis (DHA) --- is too costly and time-consuming to use as a production control. While API members agree that DHA is inappropriate for the reasons cited by the Agency, our experience indicates SimDis is not a reasonable alternative because (1) SimDis cannot distinguish between heavy gasoline constituents that contribute to PMI from those that do not, (2) SimDis results are not well correlated to PMI by DHA, and (3) SimDis is not adequately precise to use as a control method.

ASTM D7096 SimDis identifies the carbon number of hydrocarbons and estimates boiling point ranges, but it does not differentiate molecules that contribute highly to PM emissions (and PMI) from molecules in the same boiling point range that have minimal contribution to PM emissions. If EPA were to place limits on gasoline blending by using a SimDis constraint, a significant part of the available gasoline pool would be eliminated without sound technical reasoning.

Measurements by API members shows poor correlation between PMI and/or C10+

[138] https://crcao.org/wp-content/uploads/2020/12/CRC-Project-AVFL-20a_SAE-Paper-2020-01-5117.pdf.

aromatics and Simulated Distillation Endpoint, T98, T95, or T90. While the heavy aromatics which contribute to PM emissions are in the high end of the distillation, many other non-PM formers are also present. Consequently, SimDis is too crude in its selectivity to use as a control method for reducing PMI.

ASTM D7069-19 states reproducibility of the method to be 8.3°F for T95 and 18.5°F for FBP. At EPA's proposed control point of T99 by SimDis, the reproducibility would be more closely represented by that of FBP stated in the method. Subsequently, a fuel specification with a SimDis T99 cut-off of 450 °F or 425 °F would result in an indefinite and inconsistent portion of heavy gasolines removed from the gasoline pool. From a compliance standpoint, fuel qualities that can be measured with greater precision are optimal because they can be tightly correlated with unit operations.

VUV Methods: EPA's analysis of VUV as a compliance tool contains errors regarding the appropriate methods, and inappropriately dismisses VUV as being insufficiently available for use as a control method.

EPA cites ASTM D8071 as the applicable method to substitute for DHA and use in PMI calculation, but this is incorrect. The D8071 method only gives compound classifications, not detailed component analysis needed for PMI calculation. The most suited VUV method for this application is D8369.

API disagrees with EPA's finding that VUV is insufficiently mature and available for consideration as a method to quantity gasoline PMI. When using the appropriate method D8369, API members find the VUV results are equivalent to PMI calculated from DHA but at a fraction of the analysis cost and time. In addition, most API members companies and many commercial laboratories have already implemented VUV analysis.

5. Statutory Authority

The proposed rule asks for comments on whether EPA should engage in a rulemaking to address potential limits on aromatics and high-boiling material as fuel standards under CAA § 211(c). Although EPA has not proposed to engage in a rulemaking at this time, API urges the agency to avoid a costly and burdensome rulemaking effort that would exceed its authority.

The proposed rule acknowledges that fuel standards would not assist the new vehicle fleet to comply with the new standards, but suggests the agency is thinking about them to reduce particulate matter from the existing fleet. However, EPA lacks authority to set fuel standards to address vehicle emissions from the existing vehicles, which are already able to comply with their applicable particulate matter standards.

EPA's authority to regulate vehicle emissions applies only prospectively. EPA may only set standards for classes of "new motor vehicles." CAA § 202(a)(1). In turn, EPA may only consider controlling or regulating fuel after it has determined there are no other "economically feasible means of achieving emissions standards under section [202]." Regulating fuel cannot be needed to achieve the Section 202 standards for existing vehicles because those vehicles already meet their applicable particulate matter standards without any additional fuel regulation. Any attempt to rely on the inability of existing vehicles to comply with the particulate matter standards for new vehicles because of lack of alternative controls would be contrary to the Act's focus on prospective standards.

In any event, EPA may not issue standards under CAA § 211(c) at this time because, as the proposed rule readily admits, EPA has not "considered all relevant medical and scientific evidence available to [it], including consideration of other technologically or economically feasible means of achieving" the standards under section 202. *See* § 202(c)(2)(A). Unless and until EPA completes that analysis and allows stakeholders an opportunity to comment on it, EPA may not set new standards under CAA § 211(c).

Please note that due to the compressed comment period for such a complex request for information, coupled with the lack of an extension, API may supplement the docket.

6. Structure and Level of the Standard

As mentioned at the beginning of Appendix C, vehicle technologies have proven to be the primary means for controlling vehicle emissions. Fuels quality can improve vehicle emissions systems and help achieve air quality objectives, but fuels contributions are smaller than those achieved by vehicle technologies.

To the extent a structure and level of standard may be considered, an averaging, banking, and trading solution has worked well for mogas sulfur and benzene. Much like a Low Carbon Fuels Standard program, it allows the industry to meet the goals of the program at the lowest possible cost while providing flexibility to blend fuel under abnormal operations. This would be preferrable to a price per gallon cap which could be difficult to both measure and design controls to ensure operations are below required thresholds.

7. Impact of PMI on engine design and efficiency

EPA mentions that another potential reason to consider a PMI limit is related to low-speed preignition (LSPI) and requests comments on the impact of PMI on engine design and efficiency. References below point to other factors that impact LSPI that need to be considered. Fuel specification changes may not be sufficient to reduce LSPI occurrences.

CRC Project CM-137-17-1[139] (Review of Low-Speed Pre-Ignition Literature) makes clear that one single LSPI initiation mechanism cannot be derived from the published literature. However, the report did allow for the general statement that "improved oil formulation and oil ignitability as well as a design that leads to reduced oil intrusion from, for example, the crankcase ventilation system or past the piston rings is of benefit. Further the report went on to

[139] "REVIEW OF LOW-SPEED PRE-IGNITION LITERATURE," CRC Report No. CM-137-17-1, June 2019, (https://crcao.org/wp-content/uploads/2019/07/CM-137-17-1_FinalReport-June-2019.pdf).

indicate that low calcium and High ZNDTP or MODTC oil formulations are linked to low LSPI counts.

ILSAC GF-6A and GF-6B[140] specifications represent the latest performance requirements for gasoline engine oils set by the International Lubricant Specification Advisory Committee (ILSAC). GF-6A and GF-6B were introduced in May 2020 and are designed to provide protection against low-speed pre-ignition (LSPI) in engines operating on ethanol-containing fuels up to E85. For automotive gasoline engines, the latest engine oil service category includes the performance properties of each earlier category. Therefore, the latest engine oil specifications will provide full protection for automotive engines where an earlier oil category is recommended by the engine manufacturer.

SAE paper 2017-24-0061[141] shows that high aromatic and high sensitivity fuels help to mitigate knock under high load for boosted SI engines. Similarly, in SAE paper 2011-01-0342[142] low-aromatics fuel blends showed an increase tendency to auto-ignition and knock (traditional engine knock, not LSPI) characterized by the presence of a low-temperature heat release regime prior to the main combustion phase. It should be noted that LSPI, autoignition, and knock are different phenomenon and not related.

The LSPI phenomenon is complex with some mechanisms strictly related to lubricants formulation. Fuel specification changes may not reduce LSPI occurrences. Proposed PMI limits could reduce the aromatic content of the gasoline pool and potentially result in an unintentional increase of knock or autoignition events for the current on-road carpark.

8. Cost and Impacts on Refining

EPA's qualitative description of refining impacts from restriction of gasoline heavy-boiling components is over-simplified and incomplete. EPA asserts an easy shift of gasoline heavy-ends to distillates; in the experience of API members, it is often challenging to make such shifts while keeping distillate fuel properties on specification, especially flashpoint. In addition, EPA's analysis focuses on octane loss as the only detriment to segregating heavy-ends from the gasoline pool, neglecting the value of these components' low volatility as a volatility "sink" which allows blending of butanes and other light components. Eliminating heavy-ends would result in a significant loss of light components to the gasoline pool as well to meet maximum RVP requirements. Finally, EPA considers only one refinery configuration where fluid catalytic cracking (FCC) dominates gasoline production, augmented by alkylation to upgrade FCC light olefins. Among API member refineries are plants which have neither FCC or alkylation units; impacts on these refineries are neglected in EPA's analysis.

[140] ILSAC Standard For Passenger Car Engine Oils. (https://www.api.org/products-and-services/engine-oil/eolcs-categories-and-classifications/oil-categories#tab-ilsac).
[141] Szybist, J., Wagnon, S., Splitter, D., Pitz, W. et al., "The Reduced Effectiveness of EGR to Mitigate Knock at High Loads in Boosted SI Engines," SAE Int. J. Engines 10(5):2305-2318, 2017, https://doi.org/10.4271/2017-24-0061.
[142] Amann, M., Mehta, D., and Alger, T., "Engine Operating Condition and Gasoline Fuel Composition Effects on Low-Speed Pre-Ignition in High-Performance Spark Ignited Gasoline Engines," SAE Int. J. Engines 4(1):274-285, 2011, https://doi.org/10.4271/2011-01-0342.

EPA correctly identifies LP optimization as a useful tool for estimating refinery cost impacts of process changes, and provides results from a Haverly optimization program. Unfortunately, the Agency does not describe how it modeled the single refinery configuration considered. Although challenging to review without knowing key assumptions, correlations, and constraints used in the Haverly model, the results presented raise several concerns to API members. Among these concerns are the apparent lack of proper constraints, allowing the LP to make up lost gasoline heavy-ends with increased isomerization and alkylation; in practice, these units are likely fully utilized without headroom for increased production. Also, the results fail to discuss the light-ends utilization impact from eliminating the heavy-ends as RVP soak. Finally, the results are again limited to a single, simple refinery configuration. API members routinely use LP models for refinery planning and preliminary optimization, but the models required to accurately represent a real refinery are highly complex and unique to a specific plant; a one-size-fits-all Haverly model is highly insufficient to quantify refining impacts of EPA's proposed restriction of gasoline heavy-ends blending. EPA should provide access to the model files with the assumed correlations to allow the public to fully analyze the results.

While the preliminary results suggest some directional relationship, API has concerns with:

(1) The accuracy of the correlation between PMI and the 99% SimDis by D7096; and

(2) Whether the minimum distillate flash and minimum gasoline T50 limits were modeled sufficiently.

Adding a restrictive max 99% point specification to gasoline, which already has a limiting minimum T50 specification, puts gasoline blending in a tight box which has the potential to increase costs to society. Similarly, our ability to shift transitional molecules from gasoline to distillate is limited by the flash specification.

EPA states, "The estimated costs for the 5°F, 10°F, and 15°F reductions in T90 were 0.5, 2.2, and 3.0 cents per gallon, respectively." These relative costs are questionable, as the cost per degree should be monotonically increasing as the reduction becomes more severe. An economic model should be graduated, beginning with the lower-cost steps first. The EPA model seems to contradict this economic fundamental when its 5°F to 10°F reduction costs 1.7 cpg (=2.2-0.5), while the 10°F to 15°F reduction costs only 0.8 cpg (=3.0-2.2).

The proposed 99% SimDis specification would significantly reduce the molecules that can swing between gasoline and diesel, which is the primary model the industry uses to adapt to changing demands and inventory imbalances. With reduced blending flexibility, refiners will have much less ability to increase gasoline yields. Restricting gasoline end points could lead to gasoline price spikes in periods of market volatility.

9. Estimated Emissions and Air Quality Impacts

EPA has failed to assess particulate matter impacts from tire wear or entrained road dust. Tire wear and entrained road dust emissions account for a majority of the total $PM_{2.5}$

emissions associated with traffic.[143] There is a high correlation between both tire wear, and entrained road dust emissions, and vehicle weight. Studies have also found electric vehicles to be heavier than the equivalent class/size of ICEVs due to the inclusion of the battery. Therefore, converting ICEVs to ZEVs, as a result of the proposed regulation on "Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light- Duty and Medium-Duty Vehicles" would significantly increase the average vehicle weight on roadways, which in turn would increase tire, brake, and entrained road dust emissions. Including these emissions[144, 145, 146,147] in the analysis could potentially change EPA's conclusions and significance findings in the DRIA. Hence, EPA must evaluate these emissions and their impacts.

There are several sources in the literature that raise questions as to the absolute and relative magnitude of the potential reductions to PM concentrations, and subsequent health benefits, that reducing PMI could have that are not included in the proposed rule: that EPA needs to evaluate:

- The 2019 OECD report lays out the relative contribution of primary PM emissions from road transport, showing approximately 1/3 $PM_{2.5}$ from non-exhaust (tires, brakes, road wear) in 2014[148] (Figure 2.1).
- The 2019 OECD report also includes data from EPA (2019 NEI) that shows that less than half of primary PM2.5 from road transportation is from vehicles, and this represents 3% of total primary PM2.5. See Table 2.3
- Total PM 2.5 is a combination of primary PM 2.5 emissions plus secondary species (inorganic and organic). Secondary aerosols often dominate. Primary PM can range from 10% to 70%, and is often less than 50%.[149,150]
- Mobile sources of secondary organic aerosols are a small fraction of the total in both absolute and population weighted terms.[151] On-road sources already a generally small fraction without limiting to just light duty/passenger (Figure 7).[152]

143 https://www.epa.gov/air-emissions-inventories.
144 https://ww3.arb.ca.gov/ei/areasrc/fullpdf/2021_paved_roads_7_9.pdf.
145 https://doi.org/10.1016/j.scitotenv.2022.156961.
146 http://dx.doi.org/10.1016/j.atmosenv.2016.03.017.
147 https://doi.org/10.1016/j.scitotenv.2022.161225.
148 OECD (2020), Non-exhaust Particulate Emissions from Road Transport: An Ignored Environmental Policy. Challenge, OECD Publishing, Paris, https://doi.org/10.1787/4a4dc6ca-en.
149 https://www.science.org/doi/10.1126/science.1180353.
150 https://www3.epa.gov/ttnchie1/conference/ei13/mobile/hodan.pdf.
151 https://acp.copernicus.org/articles/21/17115/2021/acp-21-17115-2021.pdf.
152 https://www.science.org/doi/10.1126/science.1180353.

10. Analysis of the references to CRC studies

Comments on references used in Section IX[153]: Consideration of Potential Fuels Controls for a Future Rulemaking.

Proposed Rule Statement:

Statement: "*Numerous emissions studies have associated high-boiling compounds in gasoline with increased tailpipe PM emissions.*"[154]

Statement references[155]:

868 Coordinating Research Council, "Evaluation and Investigation of Fuel Effects on Gaseous and Particulate Emissions on SIDI In-Use Vehicles," Report No. E–94–2, March 2016.

869 USEPA "Assessing the Effect of Five Gasoline Properties on Exhaust Emissions from Light-Duty Vehicles Certified to Tier 2 Standards: Analysis of Data from EPAct Phase 3 (EPAct/V2/E–89)," April 2013. Document EPA–420–R–13–002.

Background: references 868 (CRC report E-94-2) and 869 (EPA EPAct study) refer to large fuel effects-emissions studies seeking to determine what gasoline properties drive vehicle emissions (mainly PM). E-94-2 looked at emissions across a mix of Tier 2, GDI vehicles (12) running match-blended gasoline fuels that approximated market gasoline fuels (PMI, AKI, and ethanol levels were varied). In the EPAct work, ethanol, T50, T90, aromatics, and RVP were varied. For the study, 27 fuels were developed (i.e., match-blended) and tested in 15 light-duty vehicles (Tier 2, MY2008, **all PFI**).

API Comment: Although PMI was strongly correlated with increasing PM emissions in E-94-2, PM increased with increasing C10+ aromatics in EPAct, both studies contain faults. E-94-2, for example, used match-blended fuels, which received criticism when the final report was released for not being representative of market fuels. In addition, EPAct results are no longer relevant due to the MY2008 test fleet. In short, the references are dated, and more-recent attempts by CRC to study emissions impacts of newer, Tier 3 vehicles with injection pressures approaching 350 bar are inconclusive, warranting further study. Generally, higher injection pressures lower PM emissions; and the positive correlation between PMI and PM is less clear (CRC E-135).

Statement: "*…analysis of a large number of market fuel samples has shown that the high-boiling tail of gasoline contains a high proportion of aromatics, and that the heaviest few percent of this material has very high leverage on PM emissions.*"[156]

Statement references:

870 Chapman E., Winston-Galant M., Geng P., Latigo R., Boehman A., "Alternative Fuel Property Correlations to the Honda Particulate Matter Index (PMI)," SAE Technical Paper

[153] **The focus of section IX is PM emissions reduction, and therefore will serve as the focus of comments.
[154] 88 Fed. Reg. 29398 (May 5, 2023).
[155] Statement reference numbers refer to footnote numbering in the proposed rule.
[156] 88 Fed. Reg. 29398 (May 5, 2023).

2016–01–2550, 2016.

871 Ben Amara A., Tahtouh T., Ubrich E., Starck L., Moriya H., Iida J., Koji N., "Critical Analysis of PM Index and Other Fuel Indices: Impact of Gasoline Fuel Volatility and Chemical Composition," SAE Technical Paper 2018–01–1741, 2018.

872 Sobotowski R.A., Butler A.D., Guerra Z., "A Pilot Study of Fuel Impacts on PM Emissions from Light-duty Gasoline Vehicles," SAE Int. J. Fuels Lubr. 8(1):2015.

873 Aikawa, K., Sakurai K., Jetter J.J., "Development of a Predictive Model for Gasoline Vehicle Particulate Matter Emissions," SAE Technical Paper 2010–01–2115, 2010.

Background: Honda published the SAE paper introducing the PMI concept in 2010 (873), and while it took a few years to gain notoriety, its dependency on DHA has motivated others to find alternative, easier pathways towards a predictive PM emissions metric (GM in 870; Toyota in 871). Regardless of metric, heavier fuel components tend to lead to higher PM emissions.

API Comment: So much of the supporting work is based on assessments using Tier 2 technology. We know Tier 3 vehicles are transitioning to higher injection pressures (which lowers PM, generally), but many fuel effects studies are ongoing or in development. Lastly, it would be unfortunate if some type of fuel distillation cut limited potential use of low-carbon feedstocks for future fuels.

Statement: *PMI has been used in several emission studies and modeling analyses correlating fuel parameters to PM, and our assessment of potential impacts of fuel formulation changes on PM emission inventories, presented in Section IX.7, rely heavily on PMI."*[157]

Statement references:

879 Butler A.D., Sobotowski R.A., Hoffman G.J., and Machiele, P., "Influence of Fuel PM Index and Ethanol Content on Particulate Emissions from Light-Duty Gasoline Vehicles," SAE Technical Paper 2015–01–1072, 2015.

880 Coordinating Research Council, "Alternative Oxygenate Effects on Emissions," Report No. E–129–2, October 2022.

Background: Reference 879 refers to an SAE paper authored by EPA staff members involved in the EPAct study (2015-01-1072). The authors work to integrate PMI into the EPAct data, while also observing ethanol-PM interactions. 10 of 15 vehicles used in the EPAct study showed a correlation between PM and PMI; in addition, the authors postulated that ethanol addition appears to exacerbate the inability of heavier components to volatilize, resulting in increased PM (it should be noted that the remaining 5 vehicles did not exhibit any PM sensitivity to PMI or ethanol). Reference 880 is a CRC report covering results from E-129-2, a program run out of NREL on a single cylinder research engine running a couple of base gasolines (low- and high-PMI) blended with various alcohols. The primary objective of this program was to develop data to better understand competing effects between heat of vaporization (as mentioned above in reference to the EPAct study) and dilution (i.e., diluted gasoline results in lower emissions). While PM emissions generally increased with increasing PMI, correlation

[157] 88 Fed. Reg. 29398 (May 5, 2023).

strength was highly variable across multiple test conditions.

API Comment: While PMI has become the most ‘robust’ parameter for indicating a fuel’s propensity for PM formation, it has limitations. For example, in E-129-2, ethanol blended into the ‘low’ PMI (1.21) fuel appeared to show HOV effects dominated. In the ‘high’ PMI blend (2.75), HOV effects dominated at the high-speed condition, but dilution seemed to dominate at the low-speed condition (i.e., PM decreased with increasing ethanol content). The choice to include this reference is interesting as the results are far from absolute, and beg more questions for future study. For the SAE EPA paper (reference 879), I have concerns with the age of the vehicle fleet used in the study (MY2008), technology (PFI), as well as 1/3 of the fleet exhibiting no sensitivity to PMI and/or ethanol with respect to PM emissions.