Comment on the Notice of Proposed Rulemaking

"Reconsideration of 2009 Endangerment Finding and Greenhouse Gas Vehicle Standards"

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Dear EPA Administrator Zeldin,

Thank you for the opportunity to provide comments on the proposed rule reconsidering the 2009 Endangerment Finding and the Greenhouse Gas Vehicle Standards. We are professors at Carnegie Mellon University with expertise spanning air quality, climate modeling, environmental impacts, economics, vehicle technology, vehicle design and public policy over the past two decades. The statements expressed in this comment are provided based on our assessment of the proposed regulations as experts in these areas and are not intended to represent Carnegie Mellon University.

We reviewed the EPA's proposed rule titled Reconsideration of 2009 Endangerment Finding and Greenhouse Gas Vehicle Standards, and we offer our comments below on both (1) the rationale provided for rescission of the endangerment finding and for (2) the separate basis for proposed repeal of the GHG emission standards. In our view, the rationale for both of these proposals is fundamentally flawed and inconsistent with the scientific consensus.

We detail our concerns with the scientific arguments, inaccuracies, and underlying reports the agency relied upon in its proposed rule. We also provide several peer-reviewed scientific publications at the end of this comment that support our assessment, underscoring the robust scientific consensus that contradicts the rationale for the proposed reconsideration.

Thank you for considering these factors when making a determination about the final rule.

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1. The Rationale for Rescission of the Endangerment Finding is Flawed

The proposed rulemaking seeks to rescind EPA's 2009 endangerment finding based on two rationales: (1) the primary rationale that greenhouse gases (GHGs) do not qualify as air pollutants under the Clean Air Act, and (2) an alternative rationale that the scientific record is insufficient to justify regulation. Both rationales are fundamentally flawed and contradict the robust scientific record that GHGs are air pollutants that cause or contribute to air pollution endangering public health and welfare. We discuss and respond to each rationale in turn.

In the sections below, we note that the proposed rescission of the endangerment finding rests on scientifically flawed rationales, arbitrary legal distinctions, and rejection of authoritative scientific assessments in favor of a non-credible report. The robust scientific record confirms that greenhouse gas emissions endanger public health and welfare through multiple well-established pathways. The Clean Air Act provides clear authority to regulate these pollutants, and the scientific case for such regulation has only strengthened since the original 2009 finding.

The Primary Rationale for Rescission is Flawed – GHGs are Air Pollutants under the Clean Air Act Section 202(a)

The primary rationale for the proposed rescission of the endangerment finding rests on an assessment that greenhouse gas emissions do not qualify as air pollutants under the Clean Air Act (CAA) §202. Under the CAA, an air pollutant is defined as "any air pollution agent or combination of such agents" (U.S. Code 42 2025). The proposed rule argues for a narrower definition of air pollution than has been used in the past, which would limit the EPA to consider air pollutants that "cause or contribute to air pollution that itself endangers public health and welfare through local or regional exposures" (e.g., inhalation and dermal contact). However, this argument over the definition of air pollution is irrelevant to the EPA's authorization to regulate GHGs under the CAA, because GHGs contribute to local air pollution that endangers public health and welfare. Regardless of whether the broader or narrower definition is used, the overwhelming scientific consensus supports that GHGs are air pollutants under the definition provided in the CAA and that they cause, or contribute to, air pollution that endangers public health and welfare. The proposed rule also artificially distinguishes between air pollution that causes or contributes to public health or welfare damages through "direct" effects, such as local and regional exposures, versus "indirect" effects, such as increased global temperature, air quality effects, and changes in extreme weather events. This distinction is arbitrary, scientifically meaningless and inconsistent with CAA precedent. We discuss each of these issues in turn below.

GHGs are "agents of air pollution" under the Clean Air Act definition

Under the CAA, an air pollutant is defined as "any air pollution agent or combination of such agents." GHGs are released *into the air*, and it is this release into the air that leads to well-documented harmful consequences for public health and welfare in the scientific body of evidence, as documented in the following sections. Thus, GHGs are air pollutants under the Clean Air Act definition.

GHGs are "agents of air pollution" even under the more narrow definition proposed in EPA's reconsideration

EPA's proposed rule argues for a narrow definition of air pollution that would limit the EPA to consider air pollutants that cause, or contribute to, air pollution that itself causes harm through local or regional exposures (e.g., inhalation and dermal contact). This argument over the definition of air pollution is irrelevant to EPA's authorization to regulate GHGs under the CAA, because scientific evidence shows that GHGs affect local and regional air pollution exposure. Regardless of whether a narrow definition or a broader definition of air pollution is used, the overwhelming scientific evidence supports that GHGs cause or contribute to air pollution. Under a narrow definition focused on local and regional air pollution exposure, overwhelming scientific evidence supports that GHGs cause changes in ground-level air pollution, including photochemical ozone (Jacob and Winner 2009). Ground-level ozone, in turn, causes premature mortality (Bell et al. 2004; Lim et al. 2019) and reduced crop yields (Ainsworth 2017). This evidence is expansive, including experiments that identify the physical mechanisms by which photochemical smog forms, that these depend on weather and climate, particularly through temperature-dependent reactions, model simulations of the chemical system, and observational confirmation of these relationships. Each of these different approaches to investigating the issue supports a causal relationship between GHGs and ground-level air pollution, such as photochemical smog, and there is physical consistency between them.

There is no electric vehicle mandate implicating the major questions doctrine

The proposed rulemaking inaccurately claims that consideration of GHGs as air pollutants raises the major questions doctrine because vehicle GHG emission regulations mandate an increased and faster shift to electric vehicles (EVs). However, there is no EV mandate in the EPA's vehicle GHG emission regulations. This was shown in EPA's analysis for the rulemaking for model years 2027 and later, which demonstrated that "it would be technologically feasible to meet these standards without additional zero emission vehicles beyond the volumes already sold today" (Environmental Protection Agency 2024). In fact, the regulations are technology-neutral and do not prescribe any particular technology solution. They allow automakers to choose the best strategy for themselves to meet the fleet-average emissions rate target in the standards. Automakers are free to respond to the standards by improving the efficiency of gasoline vehicles, producing other non-gasoline vehicles such as hydrogen fuel cell vehicles, or by not changing anything in the vehicles they offer and instead purchasing credits from other automakers.

The distinction between "direct" and "indirect" damages to public health and welfare is artificial

The proposed rule argues that GHG emissions endanger public health and welfare "indirectly" through increased global temperature, air quality, extreme weather events, and other factors, and that this differs from local and regional air pollution. The distinction between "direct" and "indirect" effects in the proposed rule is artificial and inconsistent with CAA precedent. In any causal chain between pollutants and consequences for public health and welfare, the pollutants cause the consequences for public health and welfare, even if there is an intermediate variable between the cause and effects. For almost any causal relationship, an intermediate variable can be defined to label the effect "indirect." The causal chain between local/regional air pollution and human health and welfare effects also includes intermediate processes. For example, inhaling smog leads to airway inflammation that leads to an asthma attack that leads to death. Similarly, SO_2 emissions react in the atmosphere to form particulate matter, exposing populations downwind and increasing risks for cardiovascular and respiratory disease. Regardless of whether the effects are labeled as "indirect," the pollutants endanger American lives and the welfare of Americans.

The Clean Air Act has consistently regulated pollutants with "indirect" and non-local pathways. Ground-level ozone and much of $PM_{2.5}$ are secondary pollutants formed through atmospheric chemical reactions of precursor species. Similarly, the Mercury and Air Toxics Standards regulate atmospheric mercury, which comes in several forms: elemental gaseous (Hg^0), oxidized elemental

(Hg^{II}), and particulate Hg. Approximately 80% of global atmospheric mercury is elemental gaseous mercury with an atmospheric lifetime of approximately 1 year (Selin et al. 2007). An atmospheric lifetime of one year is sufficiently long that atmospheric mercury is transported on hemispheric scales. It is estimated that only 20% of mercury deposited in the United States originates from North American sources (Selin and Jacob 2008). Moreover, the health damages that result from atmospheric emissions are not through "local and regional exposure." Rather, a major source of mercury exposure is via eating oceanic fish (Selin and Jacob 2008). These examples highlight that the Clean Air Act has previously been used to regulate air pollution, where the health problems are indirect and via global exposure.

The proposed rule further argues that GHGs are "indirectly" harmful to public health and welfare based on elevated global concentrations in the upper atmosphere[1]. This statement is factually incorrect. Due to their long atmospheric lifetimes, greenhouse gases like carbon dioxide are well-mixed throughout the atmosphere, with mixing ratios nearly uniform globally. If anything, mixing ratios are slightly higher at ground level near emission sources. Since concentrations depend on atmospheric pressure, greenhouse gas concentrations are actually higher at Earth's surface than in the "upper atmosphere." Approximately 80% or more of atmospheric carbon dioxide resides in the lower atmosphere (troposphere), not the "upper atmosphere," and the overwhelming majority of both emissions and climate impacts occur at the surface.

For all of the reasons described above, the ability to break down a causal chain into intermediate steps and processes does not distinguish GHGs from local or regional air pollution and is irrelevant to the question of whether GHG emissions cause or contribute to public health or welfare dangers.

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[1] The proposed rulemaking does not define what constitutes the "upper atmosphere". Scientific usage of the term, "upper atmosphere", varies somewhat, but it frequently refers to the stratosphere and above (see for example 51 USC § 20162).

The Alternative Rationale for Rescission is Flawed – Climate Science is Well Established and Empirically Grounded

The alternative rationale provided for rescission is that even if the Clean Air Act Section 202(a) authorizes GHG standards, the scientific record itself is insufficient to justify regulation. This is not correct. It is still the scientific consensus that GHGs damage health and welfare via the pathways outlined in EPA's 2009 endangerment finding.

The Proposed Rulemaking Relies on Flawed Science

The proposed rulemaking suggests that the scientific record about the health and well-being impacts of greenhouse gas emissions-induced climate change is insufficient to regulate greenhouse gases under the Clean Air Act. Indeed, the proposed rulemaking asserts that "potential welfare effects [of greenhouse gas emissions and climate change] may be positive on balance." Given that human beings, human society, and natural ecosystems have evolved and are adapted to the current climate, the idea that welfare effects may be beneficial is highly unlikely. The IPCC AR6 projects that, under "business-as-usual" scenarios under which human society continues to emit GHGs, the global-average temperature will warm by 3 to 4.5 ℃ during the 21st century and will continue warming in the following centuries (IPCC 2021). To put this in perspective, the Earth has warmed by approximately 6 ℃ since the last Ice Age (Last Glacial Maximum, approximately 20,000 years ago) (IPCC 2021). The best projections of future warming due to unchecked GHG emissions, therefore, are comparable to the changes between the last Ice Age and now. It is unthinkable that this amount of warming will somehow not be heavily disruptive to human health and welfare. Moreover, the Clean Air Act frequently requires that, when accounting for the uncertainty inherent in any complex regulatory decision, the Administrator err on the side of allowing a "margin of safety".

Furthermore, the argument that greenhouse gas emissions and climate change could be beneficial to human well-being, on balance, is inaccurate and ignores the scientific consensus that GHGs damage health and welfare via the pathways outlined in EPA's 2009 endangerment finding.

The three most recent, authoritative reports on climate change (the Intergovernmental Panel on Climate Change Sixth Assessment Report (IPCC AR6), the Fifth National Climate Assessment of the U.S. Global Change Research Program (NCA5), and the 2025 report on Effects of Human-Caused Greenhouse Gas Emissions on U.S. Climate, Health, and Welfare from the U.S. (National Academies of Sciences 2025) already synthesized the evidence about these impacts. The IPCC AR6, NCA5, and NASEM reports are premier scientific summaries representing the consensus of the U.S. and global climate science community. They undergo rigorous peer review and uphold the highest scientific standards. In addition, the NCA is produced in adherence to the Federal Information Quality Act Guidelines and OMB Requirements for Peer-Review (USGCRP 2023). The proposed rulemaking briefly asserts that unspecified "public watchdog organizations" have criticized NCA5 but does not provide any substantiation of these claims. The proposed rulemaking does not explain how the NCA5, if it were so fundamentally flawed as it claims, commands widespread respect in the scientific community; nor does it explain why the opinion of unnamed public watchdog organizations should outweigh the opinions of established scientists, including the long list of eminent scientists who are co-authors of the NCA5 and AR6 reports.

Instead of relying on the IPCC and NCA5 report, the proposed rulemaking cites the CWG Draft Report at least 20 times. This represents a fundamental departure from rigorous scientific assessment and U.S. Information Quality Act guidelines. The CWG Draft Report does not command respect from the scientific community, is scientifically unrigorous, and likely violates the provisions of the Federal Advisory Committee Act. Many of the signatories of this comment submitted comments on the CWG Draft Report. We include those comments as an attachment. We concluded therein that the CWG Draft Report "... is not a credible scientific assessment using the best available peer-reviewed science as required by the 2019 DOE Information Quality Act Guidelines. Instead, it uses selective citations and arguments to misrepresent overwhelming evidence of a rapidly changing climate. While such misrepresentations are politically convenient, they pose increasing and consequential risks to U.S. health, safety, and economic well-being."

The Scientific Record Establishes that GHGs Damage Health and Welfare

It is not our intention here to conduct a comprehensive synthesis review of climate science and its impacts; that work has already been carried out with rigor and transparency by the IPCC, the NCA5, and the U.S. National Academy of Sciences, Engineering and Medicine (National Academies of Sciences 2025). Here, we summarize the established science on the causal pathways through which greenhouse gas emissions affect human health and welfare.

Air Quality Impacts: As noted earlier in this document, greenhouse gases affect air quality, particularly through photochemical ozone formation, which in turn causes premature mortality and reduced crop yields (Jacob and Winner 2009; Bell et al. 2004; Lim et al. 2019; Ainsworth 2017). Climate change can also affect air quality through its wildfire impacts. Table TS.5 in the IPCC AR6 report from Working Group I finds medium or high confidence that fire weather will increase in the future in all regions of North America (IPCC 2021). It also finds that fire weather is already increasing in several regions of North America, including, importantly, Western North America.

Increasing wildfire emissions in the United States are already degrading our air quality and eroding earlier progress on $PM_{2.5}$ concentrations (Burke et al. 2023).

Extreme weather events: The IPCC's report notes that "Human-caused climate change is already affecting many weather and climate extremes in every region across the globe. This has led to widespread adverse impacts and related losses and damages to nature and people (high confidence)" (IPCC 2021) Similarly, the NCA5 notes that U.S. "homes and property are at risk from sea level rise and more intense extreme events," while "infrastructure and services are increasingly damaged and disrupted by extreme weather and sea level rise" (USGCRP 2023).

Climate change is driving an increase in the frequency and intensity of extreme weather events in the U.S. Such extreme weather events include storms, droughts, and floods, which in turn lead to death, injury, illness, exacerbation of underlying medical conditions, and adverse effects on mental health (Ebi et al. 2021). NOAA has also documented that the number and costs of billion-dollar disasters in the United States have risen markedly since 1980 (National Centers for Environmental Information (NCEI) 2025). Even after adjusting for inflation, the costliest years all occur after 2000. While increasing exposure and vulnerability certainly play a role, NOAA attributes part of the rise to the increased frequency and intensity of some types of extreme events caused by human-induced climate change.

Extreme Temperatures: Extreme temperatures are the leading weather-related cause of death in the United States, claiming more lives annually than hurricanes, floods, and tornadoes combined (Narayanan and Keellings 2025). A substantial body of research has established clear dose-response relationships between temperature extremes and mortality, with both hot and cold temperatures contributing to excess deaths. Days above 90°F are associated with statistically significant increases in annual mortality rates, while days below 40°F also demonstrate excess mortality, though of smaller magnitude than heat-related deaths (Deschenes 2014; Khatana et al. 2022). Recent analyses also demonstrate that heat-related mortality is increasing across nearly all U.S. climate regions (Narayanan and Keellings 2025). Current projections indicate that temperature-related mortality will likely represent the leading economic cost of climate change, with the burden of human-induced warming on mortality already detectable in existing data (Gould et al. 2025).

Beyond mortality, recent research suggests that extreme temperatures create substantial burdens on healthcare systems. While both mortality and hospitalization rates follow a U-shaped relationship with temperature extremes, emergency department visits show a linear increase with rising temperatures, indicating that even moderately warm conditions strain healthcare resources (Gould et al. 2025).

As documented in the IPCC and NCA5 reports, human-induced climate change is already affecting the frequency and intensity of extreme temperature events globally. Since 1950, the frequency and intensity of hot extremes, including heatwaves, have increased while cold extremes have decreased. Human-induced greenhouse gas forcing is the main driver of these observed changes in hot and cold extremes globally and across most continents (IPCC 2021). Climate modeling also projects that hot extremes will continue to increase in frequency and intensity while cold extremes will continue to decrease at global and continental scales across nearly all inhabited regions as global warming progresses (IPCC 2021).

While the decrease in cold extremes might suggest some reduction in cold-related mortality, epidemiological studies suggest that “risk increases slowly and linearly for cold temperatures below the minimum mortality temperature,” while “risk generally escalates quickly and non-linearly at high temperatures" (Gasparrini et al. 2015). Consequently, the net impact of changing extreme temperature patterns will most likely result in increased overall deaths (Khatana et al. 2024; Masselot et al. 2025).

Vector-borne and fungal diseases: Climate change is expanding the geographic range of disease-carrying insects and mosquitoes while extending their active periods (IPCC 2022). For example, the mosquito that transmits dengue fever, a potentially fatal disease, was historically limited to tropical environments but has now been found in the United States as far north as San Francisco. In 2024, locally acquired dengue cases were identified in Florida, California, and Texas (CDC 2025).

Similarly, tick populations have expanded their ranges significantly in recent decades. The blacklegged tick can now be found throughout the eastern United States, while the ranges of the lone star tick and Gulf Coast tick are expanding northward. The invasive Asian longhorned tick, discovered in New Jersey in 2017, appears to be spreading in multiple directions (Molaei et al. 2022). This expansion has led to increased cases of Lyme disease across a larger geographic area. Research by Couper et al. (2022) also demonstrated that climate served as a predictor of year-to-year variation in Lyme disease incidence across all U.S. regions with established vector species, even after controlling for potentially confounding factors and spurious relationships (Couper et al. 2021). Climate change is also driving changes in fungal diseases that affect human populations (George et al. 2025).

Food security impacts: Climate change poses significant risks to global food security and agricultural economies through widespread disruption of food systems. These impacts are already materializing worldwide. According to the IPCC 6th Assessment reports, climate change has negatively affected crop yields across Sub-Saharan Africa, South America, the Caribbean, Southern

Asia, and large parts of Europe over the past 20-50 years (IPCC 2022). In West Africa, just 1°C of warming has reduced millet yields by 10-20% and sorghum by 5-15%. Australian wheat yields have dropped 27% due to declining rainfall and rising temperatures, while Southern Europe faces yield stagnation across nearly all major crops (IPCC 2022).

The United States food system is not immune to these global risks. The NCA5 report warns that "disruptions to food systems are expected to increase." A 2015 review noted that U.S. food systems are vulnerable to climate change and that the geographic concentration of American agricultural production actually heightens such vulnerability (Lengnick 2015). The authors note that vegetable and fruit production in the Pacific states faces threats from reduced water supplies and changing seasonal patterns. Great Plains and Midwest grain production is vulnerable to increasingly variable weather, heat waves, and flooding from heavy rains. Concentrated livestock operations in the southern Great Plains and Southeast are also vulnerable to extreme weather and supply chain disruptions affecting feed, water, and power supplies. These climate stresses are already imposing economic costs on American agriculture (Lengnick 2015). U.S. farmers and ranchers report that increased weather variability and extreme events are raising production costs and operational complexity, demonstrating that climate change threatens both global food security and domestic agricultural economic stability.

Impacts on water security: Access to clean water is crucial for human well-being. It is well-documented that climate change will affect water availability patterns. For example, the IPCC's 6th Assessment report by working group II (IPCC 2022) notes that while drought trends are regionally variable, there is medium confidence that increased atmospheric evaporative demand is intensifying surface aridity during recent droughts, particularly in the U.S. Southwest. The ongoing multi-decadal drought in the Colorado River Basin is as severe as any in the past 1,000 years, underscoring the extraordinary nature of current conditions.

Beyond water availability, climate change is also expected to degrade water quality. The IPCC report (IPCC 2022) notes that there is medium evidence and high agreement that climate change has already affected water quality as a result of "increased eutrophication at higher temperatures or release of contaminants due to extreme floods." The report also notes that "wildfires, along with heavy rainfalls and floods, can also affect turbidity, which increases drinking water treatment challenges and has been linked to increases in gastrointestinal illness." Droughts also "reduce river dilution capacities and groundwater levels, increasing the risk of groundwater contamination." Evidence of these impacts is already available for the U.S. For example, a recent study found that "strong evidence of multi-year water quality degradation following wildfires" in the Western U.S. (Brucker et al. 2025).

In sum, climate science is well established and empirically grounded. The proposed rule ignores the established scientific record, citing unspecified critiques from unnamed "public watchdog organizations," and relies heavily on a flawed draft report that does not represent the scientific consensus, is not a credible scientific assessment using the best available peer-reviewed science, as required by the 2019 DOE Information Quality Act Guidelines, does not command respect from the scientific community, is scientifically unrigorous, and likely violates the provisions of the Federal Advisory Committee Act. A final rule should be based on the full scientific record.

2. The Separate Bases for Repeal of GHG Emission Standards are Flawed

The proposed rule claims a separate basis for repealing the light, medium and heavy duty vehicle GHG emissions standards independently from the endangerment finding status. This basis is based on three claims: (1) no requisite technology, (2) futility, and (3) market effects. All three of these rationales are flawed. We comment on each in turn.

The Rationale of No Requisite Technology is Flawed - Reducing Emissions Reduces Damages to Health and Welfare

The proposal estimates that eliminating GHG emissions from light- and medium-duty vehicles in the United States would result in a 1.8% decrease in global GHG emissions and a 3% reduction in predicted warming trends. The proposal argues that this amount is too small to be measured (within the bounds of measurement uncertainty) and that, therefore, any light and medium duty vehicle technology – even one that reduces emissions to zero – cannot be considered a "requisite technology." This logic is flawed for four reasons:

1. **Multiple Sources of Pollution are Common:** The contribution of multiple sources to pollution is not unique to greenhouse gas emissions. Many pollution problems regulated by the EPA involve multiple sources, and the proposal does not identify any wording in the CAA that prohibits the EPA from regulating some of the contributing sources if it cannot regulate all of the contributing sources. The proposal does not point to any examples of the EPA refusing to regulate pollution in other domains because of an inability to regulate all possible contributing sources. As noted above, mercury is a clear example of a pollutant regulated by the EPA under the CAA that causes local impacts from a blend of global sources, many of which lie outside

the jurisdiction of the United States. The contribution of global sources outside the United States is not a coherent or consistent rationale for failure to regulate.

2. **Measurement Resolution Does Not Imply Meaningfulness of Impact:** The only rationale offered for claiming that 3% is below the threshold of "meaningful" is the assertion global warming trends from 1979 to 2023 have been measured to a precision of ±15%. This rationale is flawed because measurement error is not a valid basis for determining the meaningfulness of an effect. Measurement error, fundamentally, is limited by our technology; we are better at measuring some things than others. There may be meaningful effects on public health and welfare that are difficult to measure simply because we lack technical skill with today's technology. If we took the rationale in the proposed rulemaking seriously, some people would have an incentive to avoid collecting more precise data about global warming trends so as to avoid regulatory action. But doing so would not lessen the magnitude of the impacts. The proposal also does not establish this measurement threshold criteria as being used to determine whether to regulate other pollutants.

3. **Past Measurement Resolution Does Not Imply Inability to Measure Future Effects**: Measurement error in specific years from 1979 does not imply an inability to measure statistically significant effects over multiple years in the future, both because technology improvements can be expected to improve measurement resolution over time and because the ability to statistically distinguish trends increases as more years of data are observed.

4. **Some Vehicle Technologies Can Have Net Negative Emissions:** The thought experiment proposed by EPA attempts to leverage an extreme example of reducing transportation emissions from current levels to zero, but this is not actually a proper bound on the emissions effects of vehicle technology transition. Several recent studies (attached) show that

transitioning portions of the vehicle fleet from gasoline to electric can induce changes in the power system that reduce electricity emissions intensity both at times that EVs are charging and at times when EVs are not charging (Hanig et al. 2025; Bhandarkar et al. 2025). EPA's Draft Regulatory Impact Assessment emphasizes the potential for EV load to delay retirement of existing fossil generators, which is possible, but it ignores the potential for this load to increase construction of new capacity that lies lower on the dispatch curve than fossil generators. Our estimates, using the ReEDS model from the National Renewable Energy Laboratory, find that the net effect of this load is a reduction in power systems emissions intensity, not an increase (Hanig et al. 2025). When more electric vehicles charge, incentives to build new power plant capacity increase, and because of cost competitiveness, most of those new power plants would be solar, wind, battery storage and natural gas plants, depending on the region. Once wind and solar capacity is built, it is cheaper to operate than coal, oil and gas, because utilities do not need to buy and burn more fuel to make more electricity. This cost advantage means wind and solar energy takes priority when dispatching electricity, so it can displace fossil-fuel generation even when EVs aren't charging. Because of this effect, when EV charging is timed to minimize costs (which consumers and utilities have economic incentives to implement) the effects on reducing power system emissions can be so large that the net effect of *adding* EV charging load is to *reduce* total power system emissions – thus electric vehicles can have net negative charging emissions (Chen et al. 2025).

The Rationale of Futility is Flawed – Reducing Emissions Addresses Risks Even if it Does Not Eliminate Risks

The proposal uses the same argument from the "requisite technology" section to argue that eliminating GHG emissions from all motor vehicles would be futile because "even a complete elimination of all GHG emissions from new motor vehicles and engines would not address the risks attributed to elevated global concentrations of GHGs." This is incorrect. The United States is the second largest emitter of GHGs after China; transportation is the single largest source of U.S. GHG emission; and emissions from light-duty vehicles comprise the majority of U.S. transportation emissions. While it is true that eliminating GHG emissions from new motor vehicles would not eliminate climate consequences entirely, it would nevertheless "address the risks" by reducing them and thereby save lives and improve the quality of life of Americans. The effects of GHG emissions and concentrations on public health and welfare is a continuous process, not an all-or-nothing effect. The fact that U.S. motor vehicles cannot single-handedly solve the climate crisis does not imply that reducing emissions from U.S. motor vehicles would "not address the risks attributed to elevated global concentrations" and is not a valid rationale for claiming futility.

The Rationale of Market Effects is Flawed – Effects of New Car Regulation on Used Car Emissions are Muted

The proposal argues that the regulation of new vehicles raises their prices, causing consumers to hold on to old vehicles longer. Since older vehicles tend to be less efficient and higher emitting, regulating new vehicles can increase the size and GHG emissions from the used vehicle fleet. There is empirical evidence in the literature supporting this effect; however, this concern does not provide an adequate rationale for eliminating GHG emission standards for three reasons:

1. **Export Markets:** If new vehicle regulation is reduced, if new vehicles become less expensive, and if used vehicles are retired early, as proposed, these marginal earlier-retired used vehicles will be more likely than average to be sold in export markets (because they have higher value than average, by definition), where they will continue to be used overseas

and continue to produce greenhouse gas emissions. Thus, reducing new vehicle regulation in an attempt to encourage early vehicle retirement and turnover may not reduce greenhouse gas emissions from these used vehicles but, rather, simply shift the location from which they are emitted.

2. **Effect Magnitude:** Our attached study by Forsythe, Jha, Michalek, and Whitefoot, in press at the *Journal of the Association of Environmental and Resource Economists* empirically estimate the effects of policy-induced changes in used vehicle scrappage on fleet travel and fuel consumption (Forsythe et al. 2022). The study finds that the fleet-size elasticities of fleet travel distance and fleet gasoline consumption are both well below 1. This means that when a change in policy (such as weakening standards for new vehicles) causes consumers to hold on to used vehicles longer before scrapping them, we cannot assume that those used vehicles would be driven as much as other vehicles. Policies that affect the size of the vehicle fleet affect travel distance and fuel consumption proportionally less than fleet size.
3. **Temporary Effect:** The effects of regulation on used vehicle fleet dynamics are important, but they are temporary over a period that is small relative to the timeline of climate change. New vehicles sold today will eventually become part of the used vehicle fleet, so standards affecting new vehicles today will affect the efficiency and emissions of the used vehicles of tomorrow.

3. Errors in the Notice of Proposed Rulemaking (NPRM) and Draft Regulatory Impact Analysis (DRIA)

The NPRM and DRIA contain errors in their characterization of past EPA rulemakings, the scientific literature, and the science of global warming, which we discuss below.

The Characterization of PFCs and SF_6 in the NPRM is Misleading

The NPRM discusses that the "air pollution' 'identified as endangering public health or welfare in the 2009 endangerment finding included PFCs and SF_6. Finally, the proposed rulemaking finds fault in the 2009 endangerment finding because PFCs and SF_6 were not emitted by CAA section 202(a) sources, arguing that "that difference is material, as PFCs and SF_6 are asserted to have many times the global warming potential of CO_2." This statement should not be used to imply that PFCs and SF_6 have many times the effects on public health or welfare as CO_2, which is a fundamental misunderstanding of the scientific concept of global warming potential. Global warming potentials reflect the amount of warming caused by a unit mass of a greenhouse gas over a given time horizon. While a given mass of either PFCs or SF_6 warms the Earth more than the same mass of CO_2, naturally, it is of vital importance to account for how much of each is being emitted to the atmosphere. The scientifically relevant metric that accounts for both the amount of a greenhouse gas in the atmosphere and its potency is radiative forcing. The radiative forcing due to SF_6 is only around 0.2% of total radiative forcing caused by human emissions (Simmonds et al. 2020). Similarly, the total radiative forcing from PFCs is estimated to be about 0.3% of the corresponding value for CO_2 alone (Tables AIII.1a and AIII.1b from IPCC AR6 Working Group 1 report) (IPCC 2021). In short, choosing global warming potential for a unit of mass as the basis for comparison between PFCs, SF_6, and CO_2 is mistaken and misleading.

The Characterization of Climate Models in the NPRM is Not Correct

The proposed rulemaking criticizes climate models. However, the criticisms themselves reveal a profound misunderstanding as to how climate models work. The proposed rulemaking writes that "However, the data relied upon as inputs to these models may be based on inaccurate assumptions." It proceeds to cite several examples of what it calls inaccurate inputs (Northern Hemisphere winter snow cover, predictions of coral decline, etc.) First, the proposed rulemaking cherry-picks model errors and ignores successful model predictions. Second, what are cited as errors in model inputs are, in fact, predictions (outputs) of climate models. More fundamentally, the implication is that we should never make use of models that have any inaccuracies at all, either in their inputs or model specification. This is a wildly unrealistic standard for science; if we adopted it universally, we would have no scientific models at all, no weather forecasts, no computer-aided design of automobiles, aircraft, etc.

The "missing costs" for electric vehicles used in the DRIA are too high and may actually be missing benefits

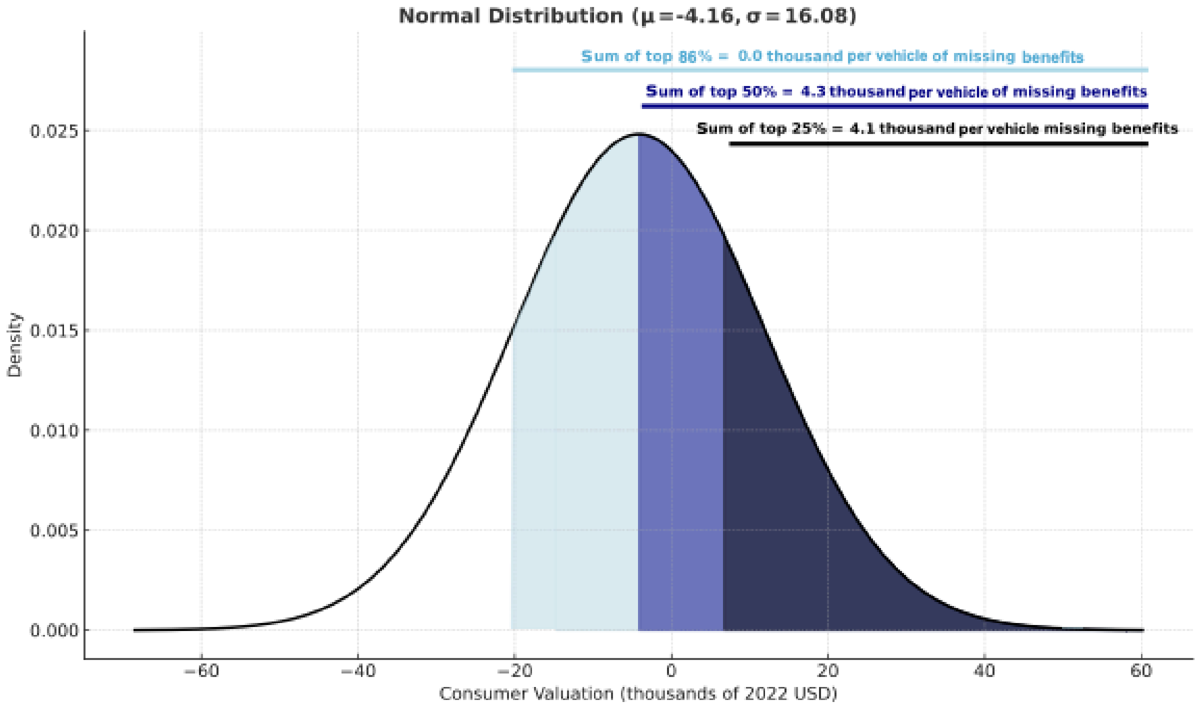
The first method used in the draft regulatory impact assessment (DRIA) to estimate the impacts of repealing the 2024 vehicle rulemakings assumes that consumers only value 21% of the fuel savings of a vehicle over its lifetime. The remaining 79% is assumed to represent "missing costs" or consumer preferences indicating a dislike of vehicle technologies separate from the price or fuel savings of these technologies, including hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), and battery-electric vehicles (BEVs). This assumed value for missing costs is too large compared to recent estimates in the scientific literature of consumer valuation of HEVs, PHEVs, and BEVs relative to conventional gasoline vehicles (Forsythe et al. 2023). Moreover, there is evidence that, because there is consumer heterogeneity in the valuation of these vehicle technologies, the missing costs may actually be missing benefits for a larger percentage of the population (Forsythe et al. 2023), which we describe in detail below.

A recent study published in the Proceedings of the National Academies of Sciences estimated consumer valuation of HEVs, PHEVs, and BEVs using a choice experiment with U.S. consumers in the market for a new car or SUV, with a sample that was weighted to be representative of the U.S. new car and SUV buying population (Forsythe et al. 2023). The study estimated the distribution of consumer valuation of these vehicle technologies across the population, accounting for heterogeneity across U.S. consumers. The study indicates that, for U.S. new passenger car consumers, the average valuation of HEVs, 20-mile-range PHEVs, and 40-mile-range PHEVs relative to conventional gasoline vehicles with all the same observed attributes (e.g., price, acceleration, brand, etc.) is not statistically significantly different from zero and has a positive point estimate. For U.S. SUV buyers, the average estimates were also not statistically significantly different from zero, with positive point value estimates for HEVs and negative point value estimates for PHEVs (approximately -$500 for 40-mile-range PHEVs and -$1,400 for 20-mile-range PHEVs). This supports that the missing costs considered in the DRIA for these vehicles are not statistically significantly different from zero and possibly would have positive benefits rather than costs for passenger car consumers as well as HEV SUV consumers.

The estimates for consumer valuation of 300-mile-range BEVs indicate that the average U.S. new car buyer values these vehicles approximately $3,000 to $4,000 less relative to a conventional gasoline vehicle with all the same observed attributes (e.g., price, acceleration, brand, etc.), with approximately 40% of the population valuing these BEVs more than the conventional gasoline vehicle. Both the mean and normal standard deviation estimates were found to be statistically significantly different from zero. This supports that the missing costs for passenger car 300-mile-BEVs are only $3-4 thousand dollars for the average consumer and that 40% of consumers have missing benefits, rather than missing costs, for purchasing a 300-mile-BEV relative to a conventional gasoline vehicle.

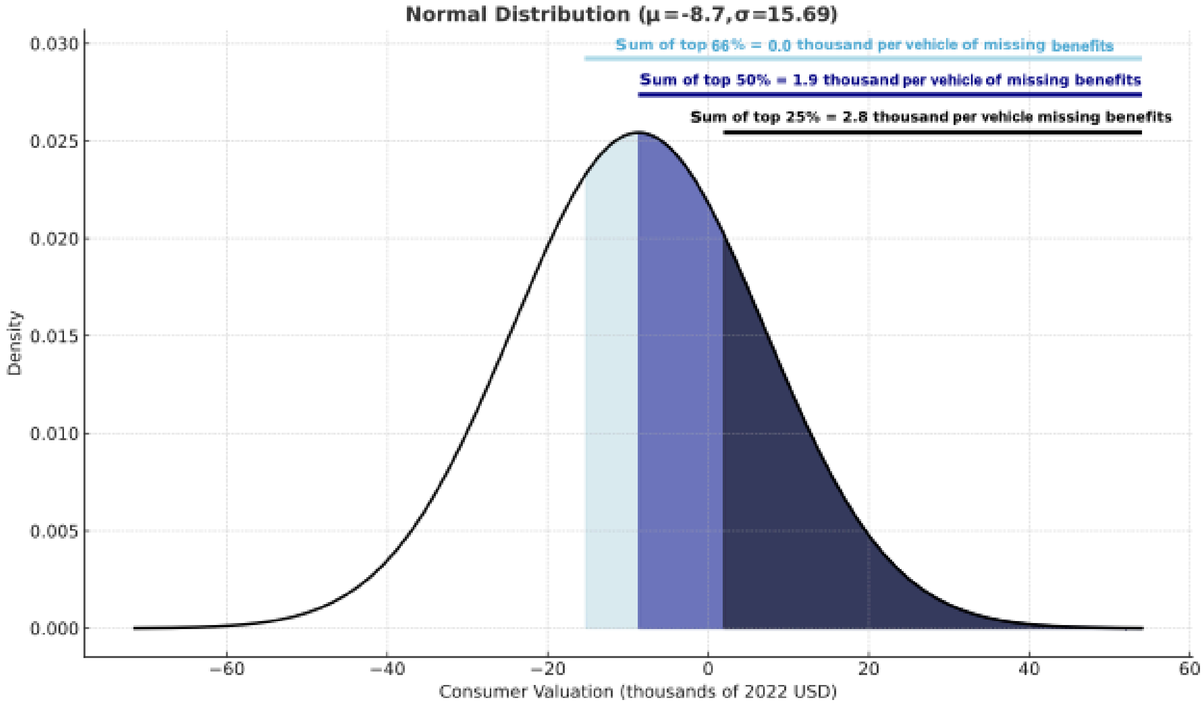
This latter point is an important distinction, because U.S. consumers that have a positive valuation of BEVs relative to conventional gasoline vehicles are more likely to purchase BEVs. So, for example, if automakers choose to comply with the 2024 rulemakings by offering these 40% of consumers a 300-mile-range BEV version of the passenger car they otherwise would have purchased in the absence of the rulemakings, the missing costs across U.S. new passenger car consumers would instead be missing benefits (i.e., negative costs). In fact, because this percentage of consumers receives positive benefits, these positive values offset the negative values for other consumers, such that net missing costs considered in the DRIA would instead be missing benefits at an even larger share of consumers. For example, if the top 50% of consumers purchased a 300-mile range BEV version of the passenger car they otherwise would have purchased absent the rulemakings, the average value of missing benefits across the population would be approximately $4,300 per new passenger car (approximately $8,600 of missing benefits on average for this top 50% of consumers, with the remaining 50% unaffected). As Figure 1 shows, this could continue up to the top 86% of new passenger car consumers, and the average value of missing costs across the population would instead be missing benefits.

Figure 1: Distribution of U.S. new passenger car consumer valuation of 300-mile-range BEVs relative to conventional gasoline vehicles with the same observed attributes (Forsythe et al. 2023), showing that the "missing costs" considered in the DRIA are actually "missing benefits" when the top 86% or less of consumers purchase 300-mile-range BEV versions of the conventional gasoline vehicles they would have purchased otherwise (e.g., absent the 2024 GHG vehicle rulemaking).



The situation with U.S. new SUV buyers is similar but with a shifted distribution of consumer valuation of BEVs. Estimates for consumer valuation of 300-mile-range BEVs indicate that the average U.S. SUV buyer values these vehicles approximately $8,000 to $9,000 less relative to a conventional gasoline vehicle with all the same observed attributes (e.g., price, acceleration, brand, etc.), with approximately 30% of the population valuing these BEVs more than the conventional gasoline vehicle. Both the mean and normal standard deviation estimates were found to be statistically significantly different from zero. This supports that the missing costs for SUV 300-mile-BEVs are $8,000 to $9,000 for the average consumer and that 30% of consumers have missing benefits, rather than missing costs, for purchasing a 300-mile-BEV relative to a conventional gasoline vehicle (Figure 2). If automakers choose to comply with the 2024 rulemaking by offering the top 50% of new SUV consumers a 300-mile-range BEV version of the vehicle they would have purchased absent the rulemaking, the "missing costs" considered in the DRIA would instead be missing benefits (i.e., negative costs), with an average of approximately $1,900 of missing benefits per new SUV across this consumer population (approximately $3,800 of missing benefits on average for this top 50% of SUV consumers, with the remaining 50% unaffected). As Figure 2 shows, this percentage could increase up to the top 66% of new SUV consumers purchasing a 300-mile-range BEV version of the vehicle they would have purchased absent the regulations, and the missing costs considered in the DRIA would be approximately zero (or be positive benefits if less than the top 66% of consumers).

Figure 2: Distribution of U.S. new SUV consumer valuation of 300-mile-range BEVs relative to conventional gasoline vehicles with the same observed attributes (Forsythe et al. 2023), showing that the "missing costs" considered in the DRIA are actually "missing benefits" when the top 66% of consumers or less purchase 300-mile-range BEV versions of the conventional gasoline vehicles they would have purchased otherwise (e.g., absent the 2024 GHG vehicle rulemaking).



The assumption that compliance costs are convex in the DRIA is not correct

The second method used in the DRIA to estimate the impacts of repealing the 2024 vehicle rulemakings (the "Revealed Preference Model") assumes that per-vehicle compliance costs are necessarily convex with the regulatory stringency for vehicles produced in different model years (MY2016-MY2032, or MY2017-MY2032, or MY2025-MY2032, depending on the vehicle class) and that a linear relationship is a lower bound. This is not a correct assumption, because it confuses (1) compliance costs for the same model-year vehicles under different hypothetical standards with (2) changes in compliance costs that may occur over time across different model years. While economic theory may support convex compliance costs that increase at an increasing rate with the potential stringency of a regulation for a given model year (as a first-order approximation, not accounting for other flexibilities available in the regulation), it does not mean that compliance costs increase convexly or linearly with stringency applied across different model-years. This is because other factors—including economies of scale, learning-by-doing, and exogenous factors such as reductions in technology production costs because of technical advances and increased production in global markets outside of the United States—decrease technology costs over time. There is a large body of evidence showing that reductions in battery production costs over time have been considerable and are expected to continue to fall in the future. The cost in $ per kWh of the volume-weighted average lithium-ion battery pack dropped 57% between 2017 and 2024, from $266 per kWh to $115 per kWh in real 2024 USD (BloombergNEF 2024). A recent Argonne National Laboratory report estimated that a further approximately 20-40% cost reduction is expected through 2035, depending on the battery chemistry and size in kWh (Knehr et al. 2024). These cost reductions are expected to bend the compliance cost curve down, such that it has a decreasing rate of change, even when the stringency of the standard increases over time. The methodology used to estimate future compliance costs in this analysis in the DRIA relies on the assumption that compliance costs are linear or convex with stringency across different model-years, and because this is an incorrect assumption, the estimation approach is not valid.

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