Environmental Protection Agency
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[EPA-HQ-OAR-2025-0194; FRL-12715-01-OAR]
RIN 2060-AW71

Attn.: Docket ID No. EPA-HQ-OAR-2025-0194
Subject: Public Comment on Reconsideration of 2009 Endangerment Finding and Greenhouse Gas Vehicle Standards

Professors Jeffrey Shrader and Matthew Gibson respectfully submit the following comments to the Environmental Protection Agency regarding the agency's proposal "Reconsideration of 2009 Endangerment Finding and Greenhouse Gas Vehicle Standards" (Docket ID No. EPA-HQ-OAR-2025-0194). Professor Shrader is an environmental economist at Columbia University's School of International and Public Affairs and Professor Gibson is an environmental economist at Williams College. We study the economics of climate change and regulatory policy and have published studies on the design of environmental policy, the economic effects of climate change, how the government should weigh evidence when evaluating policy, and other topics relevant to this regulatory analysis.[1]

These comments lay out our understanding of the state of the scientific literature on the impacts of climate change before and after 2009, the year of the original endangerment finding. We provide timelines for three domains: mortality, non-fatal health effects, and market impacts measured by GDP. In brief, the review shows that in all three domains, the evidence of climate change effects has become more robust and comprehensive over time. But the NPRM relies not upon new developments in relevant scientific literatures, but rather on the 2025 CWG Report, which is mentioned at least 28 times in the course of 78 pages. Even in the revised version of July 30, 2025, the CWG Report does not cite important literature on climate change impacts, nor does it accurately reflect the weight of evidence on the economics of climate change.

Finally, we conclude with direct comments on the content of the Draft RIA accompanying the proposed rule.

Mortality

The report's discussion of mortality in section 10.3 (starting on page 111) is incomplete and misleading. In particular, the report relies heavily on Zhao et al. 2021, Gasparini et al. 2015, and Lee and Dessler 2023 (as well as Ritchie 2024 which is not a published paper, does not present any novel estimates of climate change impacts, and does not comprehensively review the literature on climate change effects on mortality). This set of papers does not address the

[1] For more information on our research, please see our CVs at the following links: Gibson and Shrader.

projected effects of *climate change* on mortality. Rather, these citations discuss the current or recent historical effect of weather on mortality. The summary of the literature below provides multiple important references that do actually estimate the effect of climate change on mortality. This literature became especially common after the publication of Deschênes and Greenstone (2011), a crucial missing citation.[2]

State of the literature prior to 2009

Two review papers, Basu and Samet (2002) and Basu (2009), summarize epidemiology studies on the effect of ambient temperature on mortality published prior to 2009.[3] By that time, dozens of studies had established that suboptimal temperatures, whether hot or cold, lead to elevated mortality. Few studies, however, projected how mortality in the U.S. might change as the climate changes, and no study had done so comprehensively for the entire U.S. population. Basu (2009) cites just one study–Gosling et al. (2007)–with projections of how mortality in the U.S. might change under climate change. This study looked at six cities (Boston, Budapest, Dallas, Lisbon, London, and Sydney).[4] Additional research is reviewed in the WHO review McMichael et al. (2004).[5] The summarized research again focuses on effects for a relatively small number of cities.[6]

Important developments since 2009

Deschênes and Greenstone (2011) provided the first study, to our knowledge, that: (1) estimated the effect of temperature on comprehensive data on mortality in the U.S. from the universe of death certificate records and (2) projected changes in mortality due to climate change through the end of the century.[7] The analysis captures both the effects of increasing the frequency of hot days and decreasing the frequency of cold days, finding a net mortality increase of roughly 3% by

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[2] Deschênes, Olivier, and Michael Greenstone. "Climate change, mortality, and adaptation: Evidence from annual fluctuations in weather in the US." *American Economic Journal: Applied Economics* 3, no. 4 (2011): 152-185.

[3] Basu, Rupa, and Jonathan M. Samet. "Relation between elevated ambient temperature and mortality: a review of the epidemiologic evidence." *Epidemiologic Reviews* 24, no. 2 (2002): 190-202; Basu, Rupa. "High ambient temperature and mortality: a review of epidemiologic studies from 2001 to 2008." *Environmental Health* 8, no. 1 (2009): 40.

[4] Gosling, Simon N., Glenn R. McGregor, and Anna Páldy. "Climate change and heat-related mortality in six cities Part 1: model construction and validation." *International Journal of Biometeorology* 51, no. 6 (2007): 525-540.

[5] McMichael, Anthony J., Diarmid Campbell-Lendrum, Sari Kovats, Sally Edwards, Paul Wilkinson, Theresa Wilson, Robert Nicholls, Simon Hales, Frank Tanser, David Le Sueur, Michael Schlesinger and Natasha Andronova. *Comparative Quantification of Health Risks Global and Regional Burden of Disease Attributable to Selected Major Risk Factors Volume 1.* Ezzati, Majid , Alan D. Lopez, Anthony Rodgers and Christopher J.L. Murray. eds. World Health Organization (2004): 1543–1649.

[6] *Ibid* at 1629-1630.

[7] Deschênes, Olivier, and Michael Greenstone. "Climate change, mortality, and adaptation: Evidence from annual fluctuations in weather in the US." *American Economic Journal: Applied Economics* 3, no. 4 (2011): 152-185.

2100 under a high-emissions scenario. Subsequent work has built on this analysis to incorporate adaptation and to extend the analysis globally.[8]

Non-fatal Health Effects

Morbidity is only mentioned once in the report, on page 113. As the review below highlights, there has been a substantial increase in research on non-fatal health impacts of climate change over the last decade which the report should cite.

State of the literature prior to 2009

McMichael et al. (2004) summarized the state of the literature on morbidity effects of climate change as follows:

> There is little published evidence of an association between weather conditions and measures of morbidity such as hospital admissions or primary care consultations (Barer et al. 1984; Ebi et al. 2001; Fleming et al. 1991; McGregor et al. 1999; Rothwell et al. 1996; Schwartz et al. 2001). A study of general practitioner consultations among the elderly in Greater London found that temperature affected the rate of consultation for respiratory diseases but not that for cardiovascular diseases (Hajat et al. 2001). However, it is not clear how these end-points relate to quantitative measures of health burden.[9]

Important developments since 2009

Comprehensive estimates of non-fatal health effects from climate change are challenging due to the large number of possible different effects that could be studied and the lack of a nationwide database of effects, in contrast to the universe of mortality records maintained by the CDC. Despite these challenges, substantially more research on non-fatal health effects has been published since 2009. The following is not a comprehensive review, but it highlights the development in the literature.

Weinberger et al. (2016) projected changes in emergency department (ED) visits based on data from Rhode Island.[10] White (2017) estimated effects of temperature on ED visits in California,

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[8] Carleton, Tamma, Amir Jina, Michael Delgado, Michael Greenstone, Trevor Houser, Solomon Hsiang, Andrew Hultgren et al. "Valuing the global mortality consequences of climate change accounting for adaptation costs and benefits." *Quarterly Journal of Economics* 137, no. 4 (2022): 2037-2105.

[9] McMichael et al. (2004) at 1563.

[10] Kingsley, Samantha L., Melissa N. Eliot, Julia Gold, Robert R. Vanderslice, and Gregory A. Wellenius. "Current and projected heat-related morbidity and mortality in Rhode Island." *Environmental Health Perspectives* 124, no. 4 (2016): 460-467.

finding that hot temperatures have an especially severe effect.[11] White and Mullins (2019) found hot temperatures increased ED visits for mental health conditions, while cold temperatures decreased them.[12] Salas et al. (2024) used nationwide data on ED visits from Medicare participants to study the effect of climate shocks.[13] Chen et al. (2024) used California ED data to study the effects of both temperatures and wildfires.[14]

Market Impacts Measured by GDP

Section 11.1.2 (starting on page 119) again fails to cite important references and thus misrepresents the weight of the evidence on the estimated effects of climate change on gross domestic product (GDP). Importantly, the report fails to cite a recent review of climate-GDP impacts studies from Kopits et al. (2025).[15]

State of the literature prior to 2009

Prior to 2009, no study had empirically estimated the relationship between climate change and GDP. Existing evidence on such a relationship came from climate integrated assessment models (IAMs) that combined evidence on market impacts on agriculture, coastal infrastructure, and other areas of the economy.

Important developments since 2009

In 2009, the first study estimating the relationship between climate change and GDP was published in the *American Economic Review Papers and Proceedings*, a non-peer reviewed conference proceeding.[16] The first peer-reviewed study of this relationship was published in 2012.[17] This literature has subsequently grown to encompass many papers. A recent review of

[11] White, Corey. "The dynamic relationship between temperature and morbidity." *Journal of the Association of Environmental and Resource Economists* 4, no. 4 (2017): 1155-1198.
[12] Mullins, Jamie T., and Corey White. "Temperature and mental health: Evidence from the spectrum of mental health outcomes." *Journal of Health Economics* 68 (2019): 102240.
[13] Salas, Renee N., Laura G. Burke, Jessica Phelan, Gregory A. Wellenius, E. John Orav, and Ashish K. Jha. "Impact of extreme weather events on healthcare utilization and mortality in the United States." *Nature Medicine* 30, no. 4 (2024): 1118-1126.
[14] Chen, Chen, Lara Schwarz, Noam Rosenthal, Miriam E. Marlier, and Tarik Benmarhnia. "Exploring spatial heterogeneity in synergistic effects of compound climate hazards: Extreme heat and wildfire smoke on cardiorespiratory hospitalizations in California." *Science Advances* 10, no. 5 (2024): eadj7264.
[15] Elizabeth Kopits et al., "Economic Damages from Climate Change to U.S. Populations: Integrating Evidence from Recent Studies" *NCEE Working Paper*, no. 25-01 (2025).
[16] Dell, Melissa, Benjamin F. Jones, and Benjamin A. Olken. "Temperature and income: reconciling new cross-sectional and panel estimates." *American Economic Review P&P* 99, no. 2 (2009): 198-204.
[17] Dell, Melissa, Benjamin F. Jones, and Benjamin A. Olken. "Temperature shocks and economic growth: Evidence from the last half century." *American Economic Journal: Macroeconomics* 4, no. 3 (2012): 66-95.

empirical estimates of the effect of climate change on U.S. GDP can be found in Kopits et al. (2025).[18]

In addition to GDP impacts, research since 2009 has found climate change impacts across a wide range of other areas. Multiple review papers summarize this large literature, much of which emerged after the original endangerment finding.[19] Rigorous meta-analyses of climate damages and expert judgement from academic economists who study the topic also consistently report that climate change is—and will be—damaging to the economy.[20]

Comments on the Draft RIA

We first offer general comments, then proceed section by section.

General comments

- *Rigor and compliance with relevant guidance.* 63 pages are far too few to study carefully a change of this magnitude. This draft RIA points repeatedly to "Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles: Regulatory Impact Analysis", EPA-420-R-24-004, March 2024; and "Greenhouse Gas Emissions Standards for Heavy-Duty Vehicles: Phase 3: Regulatory Impact Analysis, EPA-420-R-24-06, March 2024." These documents are 884 pages and 961 pages, respectively. Even allowing for incorporation of earlier material by reference, the brevity of this draft RIA makes it very unlikely that it exhibits the care required by Circular A-4 and executive orders related to benefit-cost analysis.
- *The social costs of emissions changes.* Appendix A.1 purports to use the methods from the RIAs for EPA-420-R-24-004 and EPA-420-R-24-06. A comparison of Table A-1 with the corresponding Table 9-19 from the RIA for EPA-420-R-24-004 is instructive. First, this RIA either excludes some changes, like "Congestion Costs" and "Noise Costs," from consideration or groups them non-transparently. A reader cannot tell because of labels like "Fuel, Repair, Maintenance, Insurance, etc." This use of "et cetera" introduces

[18] Elizabeth Kopits et al., "Economic Damages from Climate Change to U.S. Populations: Integrating Evidence from Recent Studies" *NCEE Working Paper*, no. 25-01 (2025).

[19] Dell, Melissa, Benjamin F. Jones, and Benjamin A. Olken. "What do we learn from the weather? The new climate-economy literature." *Journal of Economic literature* 52.3 (2014): 740-798;Carleton, Tamma A., and Solomon M. Hsiang. "Social and economic impacts of climate." *Science* 353.6304 (2016): aad9837; National Academies of Sciences, et al. *Valuing climate damages: Updating estimation of the social cost of carbon dioxide*. National Academies Press, 2017; Auffhammer, Maximilian. "Quantifying economic damages from climate change." *Journal of Economic Perspectives* 32.4 (2018): 33-52; Hogan, Dylan, and Wolfram Schlenker. "Empirical approaches to climate change impact quantification." *Handbook of the Economics of Climate Change*. Vol. 1. No. 1. North-Holland, 2024. 53-111.

[20] Howard, Peter H., and Thomas Sterner. "Methodology Matters: A Careful Meta-Analysis of Climate Damages." *Environmental and Resource Economics* (2025): 1-39; Howard, Peter Harrison, and Derek Sylvan. "Wisdom of the experts: Using survey responses to address positive and normative uncertainties in climate-economic models." *Climatic Change* 162.2 (2020): 213-232.

problematic ambiguity. Second, and more importantly, Table 9-19 makes clear that the agency expected the large majority of benefits to flow from reductions in PM2.5 and GHG emissions. This RIA assigns certain zero values to the emissions increases that will result from the 2025 proposed rule. In the case of GHGs, this appears to be motivated by the CWG Report, which has been widely rejected by the scientific community.[21] In the case of PM2.5, the RIA assumes that because the PM2.5 standard will survive, no changes in PM2.5 emissions will occur. That could be correct, but the RIA provides no supporting evidence for such an assumption. The RIA also makes no effort to value changes in other criteria air pollutants, which was identified as a need in the 2024 RIA: "A chief limitation to using PM2.5-related BPT values is that they do not reflect benefits associated with reducing ambient concentrations of ozone, direct exposure to NO2, or exposure to mobile source air toxics, nor do they account for improved ecosystem effects or visibility. The estimated benefits of the standards would be larger if we were able to monetize these unquantified benefits at this time."

- *EIA fuel price forecasts.* "Specifically, we examine a $1.00/gallon lower gasoline cost and a $0.25/gallon lower diesel cost as compared to the AEO 2023 gasoline reference fuel cost." This choice requires supporting evidence. The maximum difference across AEO 2023 and AEO 2025 is given by the RIA at 87 cents (in the year 2050), and the average difference is much less. There is no evidence to suggest a one-dollar reduction in gasoline price is a reasonable forecast. In addition, the AEO includes several scenarios that go unmentioned in the RIA, including for example a high-oil-price scenario. If uncertainty is a concern, the RIA should also consider these.

Changes in assumptions related to customers' interest in purchasing electric vehicles

- "Chapter 2 summarizes information which has become available since the spring of 2024 regarding changes in consumers' and commercial purchasers' interest in batteryEVs…" The RIA presents no evidence that an unusually large change in consumer preferences occurred from 2024 to 2025. Does EPA propose to reevaluate all of its consumer demand models every 1 to 1.5 years?
- "There is indication that consumer/purchaser demand for LD, MD, and HD EVs has decreased below the levels projected in the 2024 vehicle rulemakings. Recent uncertainty related to the continued existence of tax credits established by the IRA have also led to reduced projections of demand for these EVs." This passage, and others in the RIA, confuse a change in the market demand curve with movement along that curve. Changes in tax credits, for example, influence equilibrium quantity demanded because they increase price. That is different from a change in consumer preferences leading to a different quantity demanded at a given price.

[21] National Academies of Sciences, Engineering, and Medicine. 2025. Effects of Human-Caused Greenhouse Gas Emissions on U.S. Climate, Health, and Welfare. Washington, DC: The National Academies Press. https://doi.org/10.17226/29239.

- "For LD vehicles, a recent survey from the American Automobile Association (AAA) representing the U.S. population indicates that fewer adults in 2024 reported they were 'likely' to purchase a BEV compared to the previous year." The underlying citation is a press release from the American Automobile Association. The underlying analysis has not undergone peer review, and the release does not provide sufficient detail to evaluate its credibility. There are only two paragraphs on methodology, the first of which follows: "The survey was conducted March 6-10, 2025, using a probability-based panel designed to be representative of the U.S. household population overall. The panel provides sample coverage of approximately 97% of the U.S. household population. Most surveys were completed online; consumers without Internet access were surveyed over the phone." Selection and non-response are acute problems in online surveys.[22] "Designed to be representative" may mean results were re-weighted based on the observable characteristics of respondents, but selection on characteristics not used to calculate weights remains a plausible problem.
- The RIA also cites a J. D. Power poll that also isn't peer reviewed. J. D. Power does not disclose any methodological information. One cannot assume that these results are nationally representative. The RIA accurately reports the poll's finding that "the percent [sic] of vehicle shoppers who are at least somewhat interested in buying an EV in early 2025 is the same as a year ago, and that EV sales have increased compared to last year." This appears to contradict the argument that consumer preferences have changed substantially.
- Even if one overlooks the problems of these particular AAA and J. D. Power surveys, the more general problems of stated preferences remain. A large literature in economics and survey methods has found that survey respondents do not transparently reveal their preferences in response to non-incentivized questions. All else equal, revealed-preference methods should be preferred.[23]
- The cited "study" from the Princeton ZERO lab is a deck of 16 slides that have not been peer reviewed. Even if one takes these projections at face value, they say simply that making something more expensive leads consumers to demand less of it. This is commonly called the "law of demand" in economics. It is not evidence of a change in consumer preferences. Similarly the "study" by the Salata Institute is an 11-page policy brief. Neither the Salata report nor the CALSTART report has been peer reviewed.
- The pattern of citations to press releases and non-peer-reviewed reports raises the question of compliance with the Information Quality Act.

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[22] Duda, Mark Damian, and Joanne L. Nobile. "The fallacy of online surveys: No data are better than bad data." *Human Dimensions of Wildlife* 15.1 (2010): 55-64.

[23] Loomis, John. "What's to know about hypothetical bias in stated preference valuation studies?." *Journal of Economic Surveys* 25.2 (2011): 363-370. Murphy, James J., et al. "A meta-analysis of hypothetical bias in stated preference valuation." *Environmental and Resource Economics* 30.3 (2005): 313-325. Carlsson, Fredrik, Mitesh Kataria, and Elina Lampi. "Demand effects in stated preference surveys." *Journal of Environmental Economics and Management* 90 (2018): 294-302.

Impact of EVs on the power generation sector and major changes since the 2024 vehicle rulemakings

- The RIA does not consider the possibility that current trends in AI-driven electricity demand might not continue. This could occur if, for example, a technological change permitted AI models to be trained in a more energy-efficient manner. It also fails to consider evolving state policies around power purchasing by data centers.

How do car and light truck buyers value improved fuel economy?

- "Historically, the published literature has offered little consensus about consumers' willingness to pay for greater fuel economy, and whether it implies over-, under- or full-valuation of the expected discounted fuel savings from purchasing a model with higher fuel economy." The RIA does not cite several important papers in this literature.[24] Gerarden et al (2017) observe: "That said, studies of vehicle fuel economy provide some support for the hypothesis of bounded rationality. First, experimental evidence has revealed that consumers systematically misperceive the information contained in fuel economy ratings, due to the inverse relationship between gasoline consumption and miles per gallon ("the MPG illusion") (Larrick and Soll 2008; Allcott 2013). Other research has shown that stated preferences for cars of various efficiencies depend on the metric and scale of information provided on energy labels (Camilleri and Larrick 2014). Translations of fuel economy into multiple perfectly correlated metrics (that is, gallons per mile, estimated annual fuel cost, and greenhouse gas rating) alter stated preferences (Ungemach et al. forthcoming)."[25]
- "These studies point to a somewhat narrower range of estimates than suggested by previous cross-sectional studies; more importantly, they consistently suggest that buyers value a large proportion—and perhaps even all—of the future savings that models with higher fuel economy offer." Table 1 includes 20 non-empty cells. Of those, 12 give points or ranges that are not consistent with 100% capitalization. The presentation of the Busse et al (2013) results as ranges is misleading, as it implies that all estimates within these ranges are equally likely (a uniform sampling distribution of the estimator). Sampling distributions of such estimators typically follow a non-uniform distribution, e.g. a normal, chi-squared or F distribution.
- "Manufacturers have consistently told the Agency that new vehicle buyers will pay for about two or three years' worth of fuel savings before the price increase associated with providing those improvements begins to affect sales. …The modeling conducted for the scenarios in Appendix A assumes that the value consumers are willing to pay for fuel

[24] Gillingham, Kenneth, and Karen Palmer. "Bridging the energy efficiency gap: Policy insights from economic theory and empirical evidence." *Review of Environmental Economics and Policy* (2014).
[25] Gerarden, Todd D., Richard G. Newell, and Robert N. Stavins. "Assessing the energy-efficiency gap." *Journal of Economic Literature* 55.4 (2017): 1486-1525.

economy improvements is equal to the savings from the first 2.5 years of reduced fuel costs in all components of the analysis that reflect consumer decisions regarding LD and MD vehicle purchases and retirements." This assumes that manufacturers 1) know how much buyers value fuel economy; and 2) that they transparently reveal this knowledge to the agency. The RIA presents no evidence for 1). Assumption 2) is at odds with a large literature on strategic motives in communication between firms and agencies.[26]

Summary of results

- Tables 2 and 3 suggest that the proposed rule will reduce welfare under plausible assumptions. Only under a capitalization assumption from outside the scientific literature, and a price projection below even the low-price scenario in the AEO, does the RIA show positive net benefits. And that is under the underlying assumption–lacking support in the economics literature–that the social cost of carbon is a certain zero.

Appendix B: Results using a revealed preference approach

- The RIA repeatedly describes the method of Appendix B as applying "revealed preference." This inaccurately implies that EPA's previous approach was somehow divorced from revealed preference. In fact many of the underlying studies and methods in the 2024 RIAs employ revealed-preference approaches, which are standard in economics. Choosing an example near to hand, the 2024 RIA mentions: "The EVI-X modeling framework conducts charging simulations that incorporate regional differences in EV adoption, vehicle type preferences, home ownership, weather conditions, and travel patterns. These demonstrative results reflect how in ERC_WEST, EV adoption is projected to be low (due to limited population and revealed vehicle preferences) leading to a reduced demand for homebased charging while public DCFC demands for long-distance travel within the region (e.g., road trips) are amplified."
- Appendix B relies heavily on a 2020 CEA report and a 2023 Fitzgerald and Mulligan working paper. To the best of our knowledge, neither has undergone peer review, and the latter has not been accepted for publication.
- "The 2021 and 2024 vehicle rulemakings quantified such opportunity costs by assuming that the rules would have little effect on electricity prices or average costs." The previous RIAs modeled changes in electricity costs. One might quarrel with the models, but changes were not *assumed* to be small.
- Figure RIA-2: This figure is a highly simplified vision of an electricity market, ignoring for example the need for constant market clearing and the dispatch process for power

[26] See for example Bailey, Peter D., Gary Haq, and Andy Gouldson. "Mind the gap! Comparing ex ante and ex post assessments of the costs of complying with environmental regulation." *European Environment* 12.5 (2002): 245-256.

plants. For an example of best practices in modeling of electricity markets, see Cicala (2022).[27]

- "The discount rate for comparing near- and long-term costs and benefits should reflect the intertemporal prices that households and businesses trade at, rather than a government bond yield." This ignores the large literature on social discount rates going back to Frank Ramsey in the 1920s. US government bonds are often used as a benchmark because it is thought they reflect little or no risk premium.

[27] Cicala, Steve. "Imperfect markets versus imperfect regulation in US electricity generation." *American Economic Review* 112.2 (2022): 409-441.