August 29, 2025

RE: Comment on DOE's *Critical Review of Impacts of Greenhouse Gas Emissions on the U.S. Climate*

Dear Secretary Wright:

We write in response to the Department of Energy's (DOE) request for comments on its *Critical Review of Impacts of Greenhouse Gas Emissions on the U.S. Climate (*henceforth referred to as the DOE report). We are professors and researchers at Carnegie Mellon University. Combined, we have decades of experience in climate science, energy system analysis, risk analysis, life cycle assessment, and public policy. Amongst our group, you will find a member of the National Academy of Sciences, a Lead Coordinating Author IPCC's 6th Assessment Report from Working Group III, a former Administrator of the Energy Information Administration, a former Principal Assistant Director in the White House Office of Science, Technology, and Policy, a former chair of the EPA Science Advisory Board, and a former member of the EPA's Clean Air Scientific Advisory Committee.

Our comments in this letter focus on the process the DOE followed in preparing the report and the statements presented in the report's Executive Summary. We recognize that many climate experts, including a group assembled by the U.S. National Academy of Sciences, will submit far more detailed responses that refute much of the highly skewed content in this DOE report. 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 Intergovernmental Panel on Climate Change (IPCC). Instead, our goal is to add to the chorus of outrage about the inappropriate way in which this report was prepared and the highly "cherry-picked" nature of some of the most egregious statements (which likely do not adhere to the 2019 DOE Information Quality Guidelines). We summarize our major concerns and provide citations to underscore why the report's claims are misleading and unscientific.

A Comment on the Process of Writing the Report

Climate science has advanced tremendously over the last three decades. The body of knowledge has grown, and the empirical evidence of climate change is now undeniable. Tracking and synthesizing this vast and evolving field of research is a monumental undertaking. The IPCC has carried out this effort through its Assessment Reports, the most recent being the Sixth Assessment Report (AR6), published between 2021 and 2023.

AR6 was organized under three working groups. Hundreds of scientists from around the world volunteered their time and expertise over a four-year period to author and review the reports. Table 1 highlights the scale of this collaborative process, including the number of scientists involved, the number of reviewer comments received at each stage, and the volume of scientific literature cited. Combined, the three reports totaled over 10,000 pages.

Table 1: IPCC AR6 Report by the Numbers

Report	WGI: The Physical Science Basis[1]	WGII: Impacts, Adaptation, and Vulnerability[2]	WGIII: Mitigation[3]
Author Team (Coordinating Lead Authors, Lead Authors, Review Editors)	234 (representing 66 countries)	270 (representing 67 countries)	278 (representing 65 countries)
Contributing Authors	517	675	354
Total Review Comments	78,007	62,418	59,212
First Order Draft (experts)	23,462	16,348	21,703
Second Order Draft (experts and government)	51,387	40,293	32,555
Final Draft (government)	3,158	5,777	4,954
Number of citations	14,000	34,000	18,000

By contrast, the Department of Energy's 150-page *Critical Review of Impacts of Greenhouse Gas Emissions on the U.S. Climate* (the DOE Report) stands in stark opposition to the standards of transparency, breadth, and rigor that define the IPCC process.

The Federal Advisory Committee Act, as amended in 5 U.S.C. chapter 10, requires that the membership of advisory committees "be fairly balanced in terms of the points of view represented and the functions to be performed by the advisory committee." For this report, you assembled an ad hoc committee, not a standing committee. We leave it to others with greater legal expertise to assess whether assembling such a committee in secrecy is compliant with the requirements of the law. However, whatever its legal status, it would be reasonable to expect a similar level of balance in such a committee. Many of the nation's leading climate experts are members of Section 16 (Geophysics) of the U.S. National Academy of Sciences. No member of that NAS Section was drawn upon to contribute to this review. The only NAS member of the ad hoc committee is a member of Sections 12 and 13 (Astronomy and Physics).

The DOE report was produced in just two months by five individuals with long records of selectively denying key elements of mainstream climate science. The report cites only 350 references, of which roughly 10 percent are the authors' own publications[4]. Furthermore, many of the authors of the cited papers have publicly stated that their findings were misrepresented in the DOE report.[5]

Unlike the IPCC reports, which undergo years of open peer review and incorporate tens of thousands of comments from experts and governments worldwide, the DOE report was drafted on an accelerated timeline, behind closed doors, and without the safeguards of inclusive and transparent

[1] https://www.ipcc.ch/site/assets/uploads/2021/08/IPCC_WGI-AR6-Press-Release_en.pdf
[2] https://www.ipcc.ch/report/ar6/wg2/downloads/press/IPCC_AR6_WGII_PressRelease-English.pdf
[3] https://www.ipcc.ch/site/assets/uploads/2022/04/IPCC_AR6_WGIII_PressRelease_English.pdf
[4] https://interactive.carbonbrief.org/doe-factcheck/index.html
[5] https://www.wired.com/story/scientists-say-new-government-climate-report-twists-their-work/

scientific review. The result 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.

Comments on the Contents of the Executive Summary

Comment on "CO_2 Enhances Plant Growth and Greening"

The report's suggestion that elevated CO_2 concentrations enhance plant growth and therefore increase agricultural productivity presents an overly simplistic and misleading picture. While CO_2 can act as a plant fertilizer for C4 plants (many of which are invasive species) under controlled conditions, real-world agricultural systems are shaped by complex climate dynamics. The IPCC's Working Group I report[6] shows that the impacts of climate change on crop yields over the past 20–50 years vary greatly by crop and region. Some positive effects have been identified, such as on rice and wheat yields (both of which are C3 plants) in parts of Eastern Asia and Northern Europe. However, driven by changes in precipitation, heat stress, and other factors, the dominant trend has been negative in most regions, including Sub-Saharan Africa, South America and the Caribbean, Southern Asia, and large parts of Europe. For example, in West Africa, just 1°C of warming appears to have already reduced yields by 10–20% for millet and 5–15% for sorghum. In Australia, declining rainfall and rising temperatures have reduced wheat yields by 27%. In Southern Europe, warming has caused yield stagnation across nearly all major crops. These findings demonstrate that the DOE report's claim ignores the significant and region-specific damages that outweigh any fertilization effect from CO_2.

The claim that increased CO_2 contributes to "greening" the environment is also misleading. While satellite observations do show changes in vegetation, the IPCC's synthesis makes clear that these shifts are not uniformly beneficial. Instead, they include biome shifts, woody encroachment into grasslands and savannas, and tree mortality in temperate and boreal forests. These structural changes often degrade ecosystem services such as climate regulation, water availability, and biodiversity. By framing "greening" as a positive effect, the DOE report disregards the cascading consequences of these changes for ecosystems, agriculture, and human well-being.

In sum, the DOE report's portrayal of CO_2 as a simple driver of agricultural gains and environmental greening is scientifically inaccurate. It overlooks the overwhelming evidence that climate change has already reduced yields in most regions and is destabilizing ecosystems (in part, for example, through the differential response of C3 and C4 plants) in ways that threaten long-term food security and environmental resilience.

Comment on "Ocean Acidification and the Great Barrier Reef"

The report states that ocean acidification lowers pH and that this is "possibly detrimental" to coral reefs, but that the recent rebound of the Great Barrier Reef (GBR) suggests otherwise. This framing is misleading and inconsistent with the scientific evidence.

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[6] IPCC, 2022: *Climate Change 2022: Impacts, Adaptation, and Vulnerability*. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., doi:10.1017/9781009325844.

A recent comprehensive review of climate change impacts on the GBR identifies seven climate-related drivers of reef degradation.[7] The authors conclude that most damage to GBR ecosystems is currently caused by extreme weather events, but that progressive climate change factors, particularly ocean acidification, are already altering ecosystem functions and may push the GBR past critical thresholds within decades. These changes are already causing selective mortality and shifts in community composition, even during periods when coral cover appears to rebound.

The IPCC Working Group II report[8] provides high-confidence evidence that ocean acidification decreases calcification rates in corals and other reef-building organisms, reduces coral settlement, and increases bioerosion and dissolution of reef substrates. These effects directly undermine the long-term resilience of coral reef ecosystems.

While short-term rebounds in coral cover can occur following disturbances, they do not negate the underlying vulnerabilities created by ocean acidification and other climate-driven stressors. Instead, they mask the fact that reefs are increasingly fragile and less capable of sustaining ecosystem functions and services over time. In fact, there is some evidence that disturbance frequency, severity, and duration are reducing the capacity for rebound.[9]

The DOE report's suggestion that the recent rebound of the GBR undermines concern about ocean acidification is, at best, misleading. The preponderance of available science shows that ocean acidification is already harming reef systems, and its long-term impacts are projected to be severe without rapid mitigation of greenhouse gas emissions. Beyond corals, growing acidification is also beginning to have negative impacts on shell-forming marine organisms, including marine foundational species upon which much of the rest of the marine ecosystem depends.

Comment on "Climate Models Run Too Hot and Overstate Future Warming"

The report asserts that global climate models (GCMs) exaggerate warming by overstating both past temperature changes and future projections. It argues that widely used emissions scenarios are implausible and that models are overly sensitive to CO_2, yielding exaggerated warming outcomes. This claim flatly misrepresents climate science.

A recent peer-reviewed study by researchers at the National Oceanic and Atmospheric Administration (NOAA)[10] demonstrates that climate models, from the earliest versions in the 1970s to today's state-of-the-art, have successfully captured many of the large-scale responses to rising greenhouse gases. These include the observed rise in global mean temperature, stronger warming over land and in the Arctic, stratospheric cooling, and tropospheric warming with an enhanced signal in the tropical upper troposphere. They have also reproduced more detailed features of the climate system. For example, observations have exhibited an intensification of the seasonal cycle of sea surface temperature (SST) in the Northern Hemisphere mid-latitudes, which has also been captured in models. In many regions, models also represent the observed rise in temperature extremes over land reasonably well. These successes demonstrate that models robustly reproduce

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[7] Katharina E. Fabricius, et al., The seven sins of climate change: A review of rates of change, and quantitative impacts on ecosystems and water quality in the Great Barrier Reef. *Marine Pollution Bulletin*, Volume 219, 2025, 118267. https://doi.org/10.1016/j.marpolbul.2025.118267.

[8] Ibid 2

[9] Emslie, Michael J., Murray Logan, Peran Bray, Daniela M. Ceccarelli, Alistair J. Cheal, Terry P. Hughes, Kerryn A. Johns, et al. 2024. " Increasing Disturbance Frequency Undermines Coral Reef Recovery." *Ecological Monographs* 94(3): e1619. https://doi.org/10.1002/ecm.1619

[10] Isla R. Simpson *et al.,* Confronting Earth System Model trends with observations. *Sci Adv.* **11**, eadt8035 (2025). DOI:10.1126/sciadv.adt8035

the qualitative features of climate change. At the same time, important quantitative mismatches remain, and if anything, models often underestimate some observed changes. For example, while models reproduce Arctic sea ice loss, they generally only do so under scenarios with greater global warming than what is now observed, which suggests that, in this case, they may underestimate the magnitude of Arctic amplification in recent decades. Similarly, models consistently project a rise in top-of-atmosphere radiative imbalance, but the observed increase since 2001 has been larger than simulated. The tropical troposphere remains a particular area of disagreement, as observational datasets typically show less warming than expected. However, this discrepancy reflects a combination of measurement uncertainties, internal variability, biases in external forcing, and potentially overestimated climate sensitivity in some models, rather than a fundamental failure of the modeling framework.

The DOE report's suggestion that models run "too hot" and exaggerate future warming is misleading because it disregards decades of evidence demonstrating that models have skillfully predicted observed temperature increases and spatial patterns. By undermining trust in models, the report obscures their proven value in understanding climate dynamics and informing policy. In reality, climate models remain indispensable tools, validated by history, for assessing both current risks and future scenarios.

Comment on "No Long-Term Trends in Extreme Weather"

The report claims that most extreme weather events in the United States show no long-term trends and that there is no evidence supporting increased frequency or intensity of hurricanes, tornadoes, floods, or droughts. This claim misrepresents the scientific evidence.

According to the most recent IPCC Working Group II report[11], North America is already experiencing significant and detectable changes in extreme events. Annual precipitation has increased in recent decades across much of the northern and eastern United States, while declines have occurred in the West. Heavy precipitation events have very likely increased in frequency and intensity across most of the country since the mid-20th century, contributing to heightened flood risk in many regions. Flooding along the Pacific coast has been linked to increasingly intense atmospheric rivers, even if long-term trend detection remains challenging.

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.

While the evidence on hurricanes (tropical cyclones) is somewhat mixed, work by leading U.S. tropical cyclone expert (and NAS member) Kerry Emanuel shows that while their frequency may not have increased, in the Atlantic, warmer sea surface temperatures have contributed to stronger hurricanes.[12] Furthermore, there is medium confidence that the proportion of the most intense hurricanes has increased globally over the past 40 years, and that the forward speed of hurricanes making U.S. landfall has slowed since 1900. Both changes contribute to greater rainfall and flooding during landfalling storms. There is high confidence that anthropogenic climate change intensified the extreme rainfall associated with Hurricane Harvey in 2017, illustrating the link between warming and damaging extremes.

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[11] Ibid 2

[12] See for example Emanuel, K. (2005). Increasing destructiveness of tropical cyclones over the past 30 years. *Nature*, *436*(7051), 686-688.

Beyond the IPCC, NOAA has documented that the number and costs of billion-dollar disasters in the United States have risen markedly since 1980. 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.

By ignoring these findings, the DOE report creates a misleading impression that extreme weather in the United States has not changed in response to climate change. The evidence is clear: many extremes, including heavy precipitation, drought severity, the strength of hurricanes, and billion-dollar disasters, already show detectable changes linked to human influence on a changing climate, with profound consequences for communities, infrastructure, and the economy.

Comment on an Overly Short-term Focus

The DOE report does correctly note that carbon dioxide warms the planet and that once carbon dioxide enters the atmosphere, much of it remains there for many hundreds of years. What the DOE report does not do is adequately note the implications of these two facts. The more carbon dioxide that is added to the atmosphere, the larger the current and future changes in the Earth's climate, creating an ever-growing problem for future generations of Americans.

Comment on "Economic Damages of Climate Change"

The report claims that the economic damages from CO_2-induced warming may be less severe than commonly believed, and that aggressive mitigation policies could cause more harm than good. This assertion ignores mounting evidence of the profound and growing economic risks associated with climate change.

First, NOAA data demonstrate that the number and cost of billion-dollar weather disasters in the United States have increased significantly since 1980. Even after adjusting for inflation and growing assets at risk, the most expensive years have all occurred since 2000. This trend reflects not only increased exposure and vulnerability but also the rising frequency and intensity of certain climate-driven extreme events.

Second, indirect costs are already emerging. What is happening in the property insurance market is an example of these growing indirect costs. A recent JP Morgan report[13] found that since 2018, home insurance inflation has risen by 49%, with climate-related losses making coverage increasingly unprofitable for providers. As a result, insurers are retreating from some markets and issuing more policy non-renewals, leaving households exposed to financial risk. A report from First Street[14] further projects that by 2055, the U.S. could face $1.47 trillion in net property value losses.

It is important to note that insurance and property devaluation represent just one example of the indirect costs of climate change. Other costs arise from increased mortality and morbidity due to extreme heat and degraded air quality, the destabilizing effects of migration and displacement, the heightened risks of conflict and insecurity in vulnerable regions, among others. Taken together, these costs underscore that the economic risks of climate change extend far beyond direct damages from extreme events and will compound over time.

[13] https://privatebank.jpmorgan.com/nam/en/insights/markets-and-investing/ideas-and-insights/how-climate-risk-and-losses-are-creating-high-prices-for-home-insurance#id10

[14] https://assets.riskfactor.com/media/The%2012th%20National%20Risk%20Assessment.pdf

By contrast, the investments needed to mitigate climate change are manageable in scale. The IPCC's Working Group III[15] reports that the annual financial flows required in North America to meet the climate goals set forth in the Paris Agreement are approximately $500 billion. This figure is a fraction of the projected economic losses from unmitigated climate change. In other words, the costs of action are significantly lower than the costs of inaction.

It is also worth noting that climate mitigation requires the development and commercialization of new technologies, which in turn present tremendous economic opportunities. According to the International Energy Agency[16], the global market for clean technologies in 2023 totaled US$700 billion. The agency projects that this market will grow to more than US$2 trillion by 2035, the equivalent of the total value of the world's crude oil market in recent years. The U.S., to its own economic detriment, has ceded its technological leadership to other countries (particularly China).

The DOE report's suggestion that warming will be economically benign and that mitigation will be more harmful than helpful is both misleading and dangerous. The evidence is clear: climate change is already driving substantial economic costs through disasters, insurance pressures, property devaluation, health impacts, and systemic risks. Strong mitigation is not only environmentally necessary but also economically prudent.

Comment on "U.S. Policy Has Minimal Impact on Global Climate"

The report claims that U.S. policy actions will have "undetectably small" direct impacts on the global climate and that any effects will only emerge after long delays. This framing is nonsensical and ignores the fundamental dynamics of climate change as a global commons problem.

Climate change is driven by cumulative global greenhouse gas emissions, and every country's contribution matters. The United States is the single largest contributor to cumulative emissions over the past 150 years and continues to be the second largest emitter today. To suggest that U.S. action is irrelevant ignores these facts.

Moreover, climate mitigation requires collective action. While a coalition of several of the world's largest contributors could go a long way to addressing the issue, no single country can "solve" climate change alone, and no global solution will be possible without the United States. Dismissing U.S. efforts as inconsequential undermines international cooperation and erodes trust in global climate negotiations. Far from being powerless, U.S. action has an outsized influence: it demonstrates leadership, accelerates technological innovation, and shapes global markets in ways that ripple far beyond national borders.

If the United States is to claim exceptionalism, it should exercise leadership rather than retreat. The argument that there is "nothing we can do" is both illogical and defeatist. In truth, U.S. engagement is essential to mobilizing the scale of collective action needed to address the climate crisis.

Closing Statement

In sum, this report is deeply flawed. It misrepresents the scientific consensus on the most basic facts about the causes and implications of climate change, minimizes the risks of climate change, and

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[15] IPCC, 2022*: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926

[16] https://www.iea.org/news/global-market-for-key-clean-technologies-set-to-triple-to-more-than-2-trillion-over-the-coming-decade-as-energy-transitions-advance

distorts the evidence in ways that undermine sound policy. It does not provide the U.S. government with a sound basis for informed decision-making. By relying on selective interpretations, misleading claims, and the voices of a small group of contrarians, the report fails to meet even the most basic standards of scientific rigor. Far from providing credible guidance, it risks misleading policymakers and the public at a moment when clarity and leadership are urgently needed. This is not a serious assessment of climate science; it is an ideologically driven document that serves the short-term interests of a few who stand to benefit from continued inaction. It does a disservice to the Department of Energy, to the scientific community, and to the American people.

Sincerely,

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