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Hon. Christopher Wright

Secretary Department of Energy

[Federal Register :: Notice of Availability: A Critical Review of Impacts of Greenhouse Gas Emissions on the U.S. Climate](#)

Docket No. DOE-HQ-2025-0207

Re: Scientific Comment on Climate Working Group, “A Critical Review of Impacts of Greenhouse Gas Emissions on the U.S. Climate” (“CWG Report”)(July 23, 2025)

We appreciate the opportunity to comment on the CWG Report. We are career physicists with a special expertise in radiation physics, which describes how carbon dioxide and other GHGs affect heat flow in Earth's atmosphere. Our CVs are attached.

In our scientific opinion, the CWG Report by five distinguished scientists is extremely important. Congratulations!

It is particularly important because it applies what is rarely applied in climate science and is little known to most people: the scientific method, which is validating theoretical predictions with observations, and rejecting theories that do not work.

In contrast, climate science in our experience does not apply the scientific method but applies methods like consensus, 97% of scientists' opinions, uses models that do not work, cherry-picked, fabricated, and falsified data, omits contradictory science and data, and government opinion. Accordingly, this means there is no scientific knowledge underlining the theory that carbon dioxide, other GHGs and the use of fossil fuels cause catastrophic warming and extreme weather, nor underlining the Endangerment Finding and related regulations.

Thus we suggest there is an extraordinary opportunity for the final CWG Report to elevate the climate science debate to a much higher scientific level by explaining what many do not know and what is virtually never part of climate science debates: what is, and is not, science.

We have written on the subject before and thought that the rest of this paper may help.

Finally, it is also our opinion that the Nation is confronted with policies that will destroy western economies, impoverish the working middle class, condemn billions of the world's poorest to continued poverty and increased starvation, leave our children despairing over the alleged absence of a future, and will enrich the enemies of the West who are enjoying the spectacle of our suicide march.<sup>1</sup> The CWG Report will greatly help getting these disastrous policies reversed.

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<sup>1</sup> Richard Lindzen, *Manufacturing Consensus on Climate Change, The American Mind* (Nov. 21, 2024).

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## I. WHAT IS SCIENCE: Scientific Knowledge is Determined by the Scientific Method

As scientists, we totally agree with the Supreme Court: “‘scientific knowledge’ ... must be derived by the scientific method.” *Daubert v. Merrell Pharmaceuticals, Inc.*, 509 U.S. 579, 593 (1993).

What is the scientific method? Prof. Richard Feynman, a Nobel Laureate in Physics, provided an incisive definition:

"[W]e compare the result of [a theory's] computation to nature, ... compare it directly with observations, to see if it works. If it disagrees with experiment, it is wrong. In that simple statement is the key to science." *The Character of Physical Law* (1965), p. 150.

Agreement with observations is the measure of scientific truth. Scientific progress proceeds by the interplay of theory and observation. Theory explains observations and makes predictions of what will be observed in the future. Observations anchor understanding and weed out the theories that do not work. This has been the scientific method for more than four hundred years bequeathed to us by the Enlightenment and its forebears.

In science, "Progress often involves the killing of an exquisite theory by an ugly fact." Leon Lederman, a Nobel Laureate in Physics, *The God Particle* (1993), p. 256.

Thus, the scientific method is very simple and profound:

Does the theory work with observations? If not, it is rejected and not used.

## II. WHAT IS NOT SCIENCE

By contrast, the scientific method totally differs from methods of analysis used throughout climate science, the Endangerment Finding and related regulations. All are egregious violations of the scientific method.

### A. Consensus, 97% of Scientists' Opinions and *Ad Hominem* Attacks

Consensus and 97% of scientists' opinions is frequently cited as the scientific basis for arguing carbon dioxide and other GHG emissions and the use of fossil fuels must be reduced to net zero by 2050 to avoid catastrophic warming and extreme weather, as well as *ad hominem* attacks against those who disagree.

Since scientific knowledge is not determined by consensus and 97% of scientist's opinions,<sup>2</sup> but by the scientific method, nowhere in the CWG Report is there any citation to consensus or 97% of scientists' opinion.

Historically, the consensus of scientists has often turned out to be wrong. Many of the greatest scientists in history are great precisely because they broke with consensus. To quote the profoundly true observation of Michael Crichton:

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<sup>2</sup> Importantly, note the 97% number is false. “The figure of 97% is entirely discredited.” Andrew Montford, *Fraud, Bias and Public Relations: The 97% ‘Consensus’ and its Critics*, Global Warming Policy Foundation (2014), p. 12.

"Historically, the claim of consensus has been the first refuge of scoundrels...If it is consensus, it isn't science. If it's science, it isn't consensus."<sup>3</sup>

In science, the test is the scientific method, testing theory with observations, and rejecting theories not validated by observations, not consensus and 97% of scientists' opinions. And *ad hominem* attacks indicate the proponent knows no countervailing science.

## **B. Models That Do Not Work**

Models are a type of theory; they predict physical observations. The scientific method requires models to be tested by observations to see if they work. If a model's prediction disagrees with observations of what it purports to predict, it is wrong and never used as science.

The CWG Report pp. 24-45 details how the models supporting the climate-crisis narrative simply do not align with observations of the phenomena they are supposedly designed to predict. Instead, they consistently overestimate the warming effect of CO<sub>2</sub> emissions, often predicting two or three times more warming than has been observed.

Steven Koonin in his book *Unsettled* (2d ed. 2024) analyzes the models used to predict the effects of GHG emissions at length in his "Many Muddled Models" Chapter. We agree with his conclusions.

“Projections of future climate and weather events rely on models demonstrably unfit for the purpose. \*\*\*

“The uncertainties in modeling of both climate change and the consequences of future greenhouse gas emissions make it impossible today to provide reliable, quantitative statements about relative risks and consequences and benefits of rising greenhouse gases to the Earth system as a whole, let alone to specific regions of the planet.” *Id.* pp. 24, 96.

Accordingly, the models provide no scientific basis for concluding that CO<sub>2</sub>, other GHGs and fossil fuels will cause catastrophic climate change and extreme weather, and endanger the public health and welfare.

## **C. Cherry-Picked, Fabricated and Falsified Data**

Since theories are tested with observations, cherry-picking, fabricating and falsifying data to make a theory work is an egregious violation of the scientific method.<sup>4</sup>

One of us (Lindzen) observes: "Misrepresentation, exaggeration, cherry-picking, or outright lying pretty much covers all the so-called evidence" marshalled in support of the Net Zero Theory that carbon dioxide and other GHGs and the use of fossil fuels must be reduced to net zero by 2050 to avoid catastrophic warming and extreme weather.<sup>5</sup>

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<sup>3</sup> Michael Crichton, *Aliens Cause Global Warming*, Caltech Michelin Lecture (Jan. 17, 2003).

<sup>4</sup> David Goodstein, *On Fact and Fraud* p. 135 (2010). “Fabrication is making up data or results,” “falsification is ... changing or ignoring data or results.”

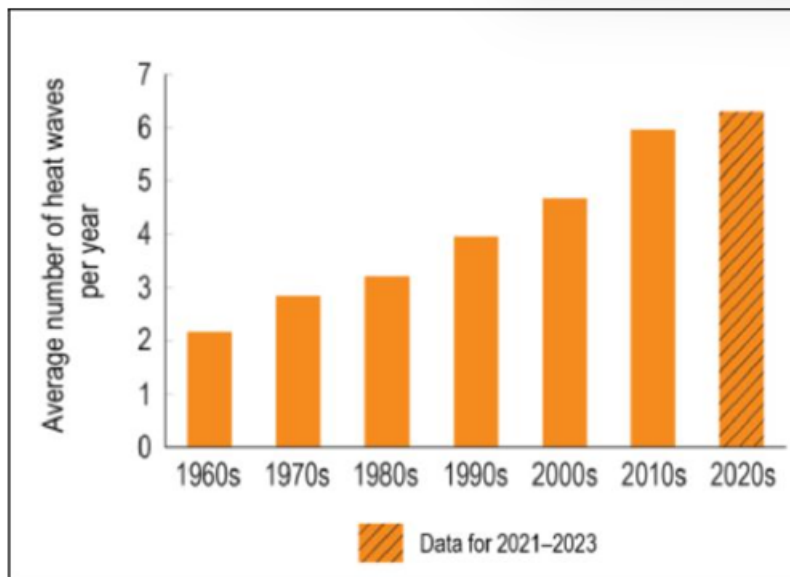
<sup>5</sup> Richard Lindzen, *Global Warming for the Two Cultures*, *Global Warming Policy Foundation* 10 (2018).

**1. Extreme Weather.** The CWG Report provides a classic example of how scientific method should be done analyzing extreme weather in chapters 6-8. It concluded:

Most types of extreme weather exhibit no statistically significant long-term trends over the available historical record... Extreme convective storms, hurricanes, tornadoes, floods and droughts exhibit considerable natural variability, but long-term increases are not detected... Wildfires are not more common in the U.S. than they were in the 1980s. Burned area increased from the 1960s to the early 2000's, however it is low compared to the estimated natural baseline level. U.S. wildfire activity is strongly affected by forest management practices. Id. p. 46.

**2. USGCRP.** The CWG Report provides an example of a very important agency, the U. S. Global Change Research Program (USGCRP) cherry-picking data for a short period of time, 1960s to 2020s, and not using complete data sets to make it appear that the average number of heat waves is going through the roof, p. 58-59:

The analysis of heatwaves is an example of why it is important to consider complete datasets and appropriate metrics. The NCA5 directs readers to .. Figure 6.3.7.



**Figure 6.3.7: Average number of urban heatwaves per year for 50 large U.S. metropolitan areas, a misleading metric for reasons explained in the text. From <https://www.globalchange.gov/indicators/heat-waves> (accessed May 22, 2025).**

The figure shows a monotonic increase in each decade from two occurrences per year in the 1960s to six in the 2020s. ...The definition of a heatwave used is an unusual but practical measure of human discomfort - a period of at least 2 consecutive days when the *minimum* apparent temperature (combination of temperature and humidity) exceeds the 85<sup>th</sup> percentile. Note too, the dataset is limited to the 50 largest U.S. cities.

Given the unusual heatwave definition and urban focus, these increasing values since 1960 presented in USGCRP (2023) are not informative about long term trends or the influence of GHG emissions.

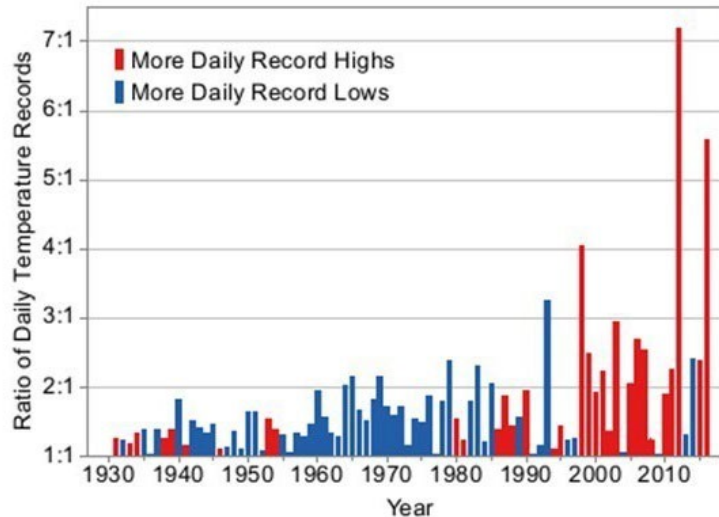
The CWG Report concluded the USGCRP heat waves data was misleading and not informative on either long-term trends or the influence of GHG emissions on heat waves.

USGCRP provided assessments the Endangerment Finding relied on, and five National Climate Assessments (NCAs).

Prof. Koonin did an extensive analysis of USGCRP's NCAs. He reported they had "shocking" fabrications and falsifications on heat waves, hurricanes, wildfires and sea levels that in science means that none of their assessments should ever be used as scientific knowledge.

For example, he showed that the USGCRP's Fourth National Climate Assessment (NCA4) includes a chart entitled "Record Warm Daily Temperatures Are Occurring More Often."<sup>6</sup>

Record Warm Daily Temperatures Are Occurring More Often



Prof. Koonin wrote the chart is "shockingly misleading." *Unsettled* (2d ed. 2024) p. 111. He explained:

"I suspect that most readers were shocked by that figure, as I was when I first saw it. Who wouldn't be? An attention grabbing title ('record warm daily temperatures are occurring more often') backed up by data with a hockey-stick shape veering sharply upward in recent years (and, in the original, years with more 'highs' portrayed in alarming scarlet). It sure looks like temperatures are going through the roof." *Id.* p. 106.

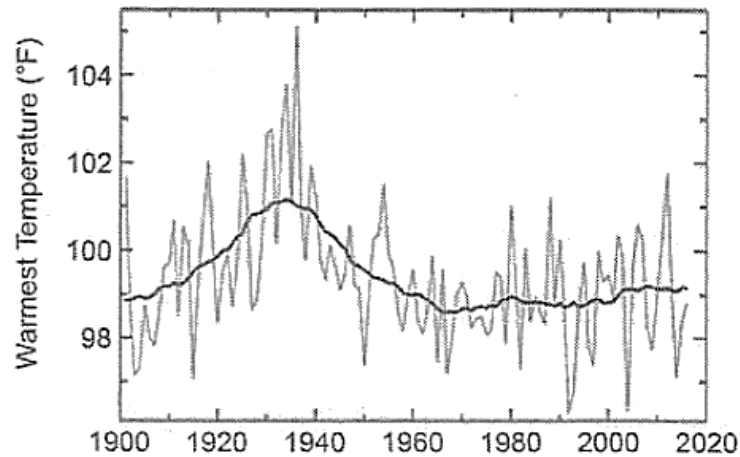
Note the chart does not show "daily temperatures." Instead, it shows a "ratio" of daily record highs to lows -- a number designed to create the impression that record-setting high temperatures are getting much more frequent.

He looked deeper and found daily temperature data buried on page 190 that totally contradicted the chart:<sup>7</sup>

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<sup>6</sup> NCA4 Climate Science Special Report (CSSR) (2017), p. 19, Fig ES.5.

<sup>7</sup> *Unsettled*, p. 106, NCA4 CSSR, p. 190, Fig. 6.3.



The spiked lines are yearly values. The dark line is the daily average temperatures over the last 120 years. This chart shows that:

- The hottest temperatures occurred during the Dust Bowl in the 1930s.
- Today the average warm temperature is about the same as it was in 1900.
- Warm temperatures are not occurring more often.

He asked:

“How could a report that proclaims itself ‘designed to be an authoritative assessment of the science of climate change’ so mischaracterize the data? After all, the [USGCRP] CSSR was subject to multiple reviews, including one by an expert panel convened by the National Academies of Sciences, Engineering and Medicine (NASEM).” Id. p. 107 (footnote omitted & emphasis added).

The USGCRP report’s ratio chart "Record Warm Daily Temperatures Are Occurring More Often" is what is called a "fabrication" in science.<sup>8</sup> Frankly, it is appalling that the thirteen federal agencies that make up the USGCRP, and that the National Academy of Sciences that convened the review, would publish such a false and fabricated climate assessment.

Further, the USGCRP is a repeat offender, cherry picking, fabricating and falsifying data. See our June 7 paper Part V. D.<sup>9</sup>

Accordingly, the scientific method requires that none of the National Climate Assessments and other USGCRP climate assessments be considered to have any scientific value, it is merely government opinion. Any government regulation or policy that relies on it is scientifically contaminated. Further, the USGCRP needs to be fundamentally changed scientifically to fulfill its Congressional purpose.

#### **D. Government Opinion**

Nobel physicist Richard Feynman put it unambiguously:

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<sup>8</sup> David Goodstein, *On Fact and Fraud*, p. 135 (2010) (“Fabrication is making up data or results.”).

<sup>9</sup> [Lindzen-Happer-GHGs-and-Fossil-Fuels-Climate-Physics-2025-06-07.pdf](#)

“No government has the right to decide on truth of scientific principles.”<sup>10</sup>

The importance of the scientific principle that government does not determine science was chillingly underscored in Russia under Stalin. Stalin made Trofim Lysenko the czar of Russian biology and agriculture. His false biology, which rejected well-established genetic science, prevailed for 40 years in the Soviet Union because Lysenko gained dictatorial control, providing one of the most thoroughly documented and horrifying examples of the politicization of science. Lysenko was strongly supported by "scientists" who benefitted from his patronage. Millions died because of his ruthless campaign against genetic science in agriculture.<sup>11</sup>

The most important example of a government-controlled organizations that only issues government opinions, not scientific knowledge except for independently verified data, is the Intergovernmental Panel on Climate Change (IPCC).

Many people believe that the IPCC provides the best climate science in the world. The IPCC at times does provide solid scientific data that can be relied on, but if and only if it is independently verified. The CWG Report does rely on such data.

However, it is little known that IPCC governing rules make clear it is controlled by its 195 governments who must approve “scientific” findings at two levels.

First, IPCC governing rules expressly require that the IPCC’s highly influential Summary for Policymakers (“SPMs”) be approved by all its governments after “line by line” review, not by scientists:

"Each Summary for Policymakers is approved line by line, and the underlying chapters then accepted by government delegations in formal plenary sessions." TSD, p. 4. (Emphasis added).

The picture below tells all.<sup>12</sup>



*IPCC Summary for Policymakers writing meeting.*

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<sup>10</sup> Richard Feynman, *The Meaning of It All* p. 57 (1998).

<sup>11</sup> William Happer, Chapter 1, Michael Gould. *Politicizing Science* pp. 29–35 (2003).

<sup>12</sup> Donna Laframboise. *US Scientific Integrity Rules Repudiate the UN Climate Process* (January 29, 2017) link [US Scientific Integrity Rules Repudiate the UN Climate Process](#) | [Big Picture News, Informed Analysis](#).

Since all of the SPMs are always reviewed line by line and approved by all the governments, not independent scientists, none of them have any value as scientific knowledge.

Thus, contrary to widespread use and understanding, the Summaries for Policymakers are merely 195 governments' opinions, not scientific knowledge determined by the scientific method.

Second, IPCC governing rules specifically require their full reports' scientific findings must be rewritten to "ensure consistency with" with the government determined SPMs.

This rule was used to make the most important change and falsification of science by the IPCC in history. Rule No. 2 was used by the IPCC's to completely reverse the scientific conclusions reached by independent scientists in their draft of Chapter 8 of the IPCC report *Climate Change 1995: The Science of Climate Change*. The scientists concluded that there was no scientific evidence that any climate warming could be attributed to human causes:

"No study to date has positively attributed all or part (of the climate warming observed) to (manmade) causes."

The government-written SPM proclaimed the exact opposite as to human influence:

"The balance of evidence suggests a discernible human influence on global climate." *Climate Change 1995, supra*, p. 4. (Emphasis added).

As a result, IPCC Rule No. 2 was applied. The scientists' draft was rewritten to be consistent with the SPM by deleting their draft language and inserting the SPM's opposite language in the published version of Chapter 8 on page 439:

"The body of statistical evidence in chapter 8 ... now points towards a discernible human influence on global climate." (Emphasis added).

The IPCC has reported the same false science about human influence on global climate repeatedly ever since. For example, the most recent IPCC report, *Climate Change 2021: The Physical Science Basis* cited the same false science six times: pages 182, 284, 312, 405, 425, 428.

Thus except for data that is independently verified, IPCC findings are merely the opinions of 195 governments rewritten, Lysenko-like, to comply with the IPCC governments' decreed "science" in the SPMs. They thus provide no scientific knowledge determined by the scientific method. Their widespread use underlying the Endangerment Finding and related other regulations by itself means these regulations are not supported by scientific knowledge. See our June 7 paper Part V. A, for details.

### **E. Ignoring Contradictory Science and Data**

Richard Feynman stated this fundamental principle of the scientific method:

"If you're doing an experiment, you should report everything that you think might make it invalid – not only what you think is right about it.... Details that could throw doubt on your interpretation must be given, if you know them."<sup>13</sup>

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<sup>13</sup> Richard Feynman, *Surely You're Joking, Mr. Feynman!* pp. 311–312 (1985).

In Albert Einstein's words: "The right to search for truth implies also a duty; one must not conceal any part of what one has recognized to be true."<sup>14</sup>

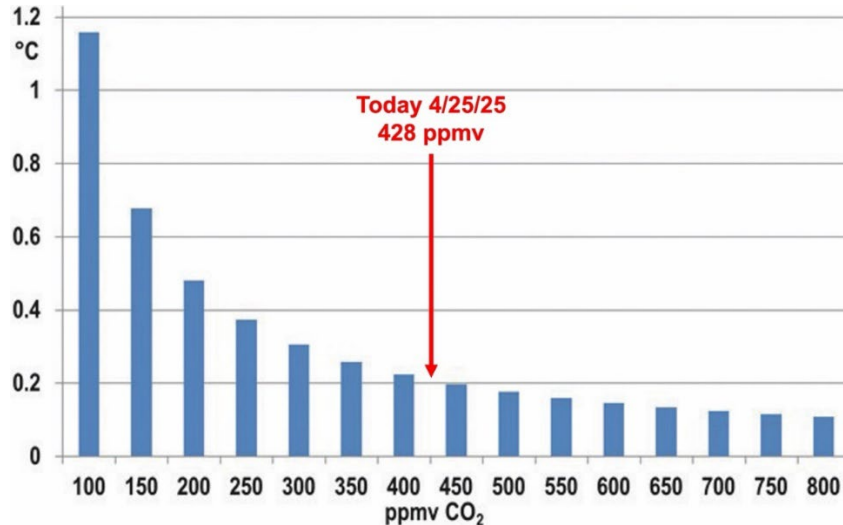
Ignoring contradictory science and data is epidemic in climate science in general and government regulation of carbon dioxide and GHGs in particular.

### **1. The Physics of Carbon Dioxide and GHGs Demonstrates They Cannot and Will Not Cause Catastrophic Warming and Extreme Weather**

One example among many is that the physics of carbon dioxide and GHGs demonstrates they cannot and will not cause catastrophic warming and extreme weather because they are what physics calls "saturated." As the amount of GHGs in the atmosphere increases, they lose their power to warm the planet.

Focusing on CO<sub>2</sub> because the warming effects of methane and nitrous oxide are small,<sup>15</sup> it becomes a less effective greenhouse gas at higher concentrations because of "saturation." Each additional increase of CO<sub>2</sub> in the atmosphere causes a smaller and smaller change in "radiative forcing," or in temperature. The saturation effect is shown in the chart below.<sup>16</sup>

Less Global Warming for Each Additional 50 Parts-Per-Million-By-Volume of CO<sub>2</sub> Concentration



How changes in atmospheric greenhouse gases affect radiation transfer are described by precise physical equations that have never failed to describe observations of the real world. We and Prof. van Wijngaarden applied these formulas to the enormous efforts by the U. S. and

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<sup>14</sup> Albert Einstein, *The Ultimate Quotable Einstein* p. 480 (2010).

<sup>15</sup> Williaam van Wijngaarden & William Happer, *Instantaneous Clear Sky Radiative Forcings of Halogenated Gases* (June 23, 2023), : <https://arxiv.org/pdf/2306.13642>; William van Wijngaarden and William Happer, "Methane and Climate" (2019), <https://co2coalition.org/wp-content/uploads/2021/08/Methane-and-Climate.pdf>, p. 4.

<sup>16</sup> Gregory Wrightstone, *Inconvenient Facts* (2017) p. 7 (updated).

worldwide to reduce CO<sub>2</sub> emissions to Net Zero by 2050 in a paper that we recommend to those with a technical background.<sup>17</sup>

We show that all these efforts to achieve Net Zero emissions of carbon dioxide, if fully implemented, will have a trivial effect on temperature:

- United States Net Zero by 2050 — only avoids a temperature increase of 2/100 °F (0.02 °F) with no positive feedback, and only 6/100°F (0.06 °F) with positive feedback of 4 that is typically built into the models of the United Nations International Panel on Climate Change (IPCC).
- Worldwide Net Zero by 2050 — only avoids a temperature increase of 13/100 (0.13 °F), or 50/100 °F (0.50 °F) with a factor of 4 positive feedback.

This is a complex system, and the idea that one variable, globally average temperature, is changed primarily by one thing, manmade CO<sub>2</sub>, is baseless. As one of us (Lindzen) has explained:

"The climate system consists of two turbulent fluids interacting with each other, [ocean and atmosphere]. They are on a rotating planet that is differentially heated by the sun. A vital constituent of the atmospheric component is water in the liquid, solid, and vapor phases, and the changes in phase have vast energetic ramifications. The energy budget of this system involves the absorption and remission of about 200 watts per square meter. Doubling CO<sub>2</sub> involves a two percent perturbation to this budget. So do minor changes in clouds, ocean circulations, and other features, and such changes are common. In this complex multifactor system, what is the likelihood that the climate (which itself consists of many variables not just globally averaged temperature anomalies) is controlled by a two percent perturbation in the energy budget due to just one of the numerous variables, namely CO<sub>2</sub>? Believing this is pretty close to believing in magic."<sup>18</sup>

Saturation also explains why temperatures were not catastrophically high over the hundreds of millions of years when CO<sub>2</sub> levels were 10 to nearly 20 times higher than they are today, shown in the chart in our June 9 paper Part III.C.

In conclusion, since CO<sub>2</sub> is now a weak GHG, and the warming effects of the other GHGs, including methane and nitrous oxide are so small, as a matter of physics there is no risk GHGs, and fossil fuels will cause catastrophic global warming and extreme weather. It will only result in a negligible increase in temperature and more food for people worldwide. See our June 7 paper Part III for more details.

## **2. EPA's Own MAGICC Model Confirms Carbon Dioxide and Other GHGs Will Have Only a Negligible Impact on Temperature.**

The Environmental Protection Agency uses the Model for Assessment of Greenhouse Gas-Induced Climate Change (MAGICC) to predict temperatures and sea level rise from the level of CO<sub>2</sub> and other GHGs in the atmosphere.

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<sup>17</sup> Richard Lindzen, William Happer and William van Wijngaarden, *Net Zero Avoided Temperature Increase*, ([Net Zero Averted Temperature Increase – CO<sub>2</sub> Coalition](http://arxiv.org/abs/2406.07392); <http://arxiv.org/abs/2406.07392>)

<sup>18</sup> Richard Lindzen, *Straight Talk About Climate Change*, " *Acad. Quest.* (2017), p. 432.

The MAGICC model confirms that the U.S. achieving Net Zero CO<sub>2</sub> and other GHG emissions to Net Zero by 2100 would cause negligible changes in Earth's surface temperature. Reducing them to Net Zero would reduce global temperatures by less than 1° C (1.8°F) by 2100.<sup>19</sup>

Thus the EPA's own MAGICC formula confirms that, since CO<sub>2</sub> is now and at higher levels a weak GHG, there is no risk CO<sub>2</sub>, other GHGs and fossil fuels will cause catastrophic global warming and extreme weather, and confirms there is no scientific knowledge that supports the Endangerment Finding and related rules. d Climate Change (MAGICC)here.

The MAGICC model confirms that the U.S. achieving Net Zero CO<sub>2</sub> and other GHG emissions to Net Zero by 2100 would cause negligible changes in Earth's surface temperature. Reducing them to Net Zero would reduce global temperatures by less than 1° C (1.8°F) by 2100.<sup>20</sup> See our June 7 paper Part III.B for more details.

**3. The Miraculous Benefits of Fossil Fuels.** Secretary Wright explained “modern energy [is] ...nothing short of miraculous. It powers every aspect of modern life, drives every industry, and has made America an energy powerhouse with the ability to fuel global progress” and that, “the rise of human flourishing over the past two centuries is a story worth celebrating.” further, that “media coverage often distorts the science.” CWG Report p. viii. We totally agree. See also our June 7 paper Parts IV. B, C, D, E, H.

**4. There Will Be Disastrous Consequences for Americans, America, the Poor and People Worldwide If Carbon Dioxide, Other GHGs and Fossil Fuels Are Reduced to Net Zero.**

See our June 7 paper Parts IV. A, F, G.

## CONCLUSION

In our scientific opinion, the CWG Report by five distinguished scientists is extremely important. It is particularly important because it applies in its over 140 pages what is rarely applied in climate science and is little known to most people: the scientific method, which is validating theoretical predictions with observations, and rejecting theories that do not work.

In contrast, climate science in our experience does not apply the scientific method but uses models that do not work, consensus, 97% of scientists' opinions, cherry-picked, fabricated, and falsified data, omits contradictory science and data, and government opinion.

Hence we suggest there is an extraordinary opportunity for the final CWG Report to elevate the climate science debate to much needed and higher scientific level by explaining what many do not know and what is virtually never part of climate science debates: what is, and is not, science.

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<sup>19</sup> Benjamin Zycher, *The Case for Climate-Change Realism*, pp. 107-09; Benjamin Zycher, Stmt. U.S. Senate Budget Comm. Hrg. “Left Holding the Bag: The Cost of Oil Dependence in a Low-Carbon World” (March 29, 2023).

<sup>20</sup> Benjamin Zycher, *The Case for Climate-Change Realism*, pp. 107-09; Benjamin Zycher, Stmt. U.S. Senate Budget Comm. Hrg. “Left Holding the Bag: The Cost of Oil Dependence in a Low-Carbon World” (March 29, 2023).

## CURRICULUM VITAE

### **Richard Lindzen, Ph.D.**

I am an Alfred P. Sloan Professor of Atmospheric Science Emeritus at MIT. After completing my doctorate at Harvard in 1964 (with a thesis on the interaction of photochemistry, radiation and dynamics in the stratosphere), I did postdoctoral work at the University of Washington and at the University of Oslo before joining the National Center for Atmospheric Research as a staff scientist. p. the end of 1967, I moved to the University of Chicago as a tenured associate professor, and in 1971 I returned to Harvard to assume the Gordon McKay Professorship (and later the Burden Professorship) in Dynamic Meteorology. In 1981 I moved to MIT to assume the Alfred P. Sloan Professorship in Atmospheric Sciences. I have also held visiting professorships at UCLA, Tel Aviv University, and the National Physical Laboratory in Ahmedabad, India, and the Hebrew University in Jerusalem, the Jet Propulsion Laboratory in Pasadena, and the Laboratory for Dynamic Meteorology at the University of Paris.

I developed our current understanding of the quasi-biennial oscillation of the tropical stratosphere, the current explanation for dominance of the solar semidiurnal and diurnal tides at various levels of the atmosphere, the role of breaking gravity waves as a major source of friction in the atmosphere, and the role of this friction in reversing the meridional temperature gradient at the tropopause (where the equator is the coldest latitude) and the mesopause (where temperature is a minimum at the summer pole and a maximum at the winter pole). I have also developed the basic description of how surface temperature in the tropics controls the distribution of cumulus convection and led the group that discovered the iris effect where upper-level cirrus contract in response to warmer surface temperatures. I have published approximately 250 papers and books. I am an award recipient of the American Meteorological Society and the American Geophysical Union. I am a fellow of the American Meteorological Society, the American Geophysical Union and the American Association for the Advancement of Science, and a member of the National Academy of Sciences and the American Academy of Arts and Sciences.

I have served as the director of the Center for Earth and Planetary Sciences at Harvard and on numerous panels of the National Research Council. I was also a lead author on the Third Assessment Report of the UN's Intergovernmental Panel on Climate Change – the report for which the IPCC shared the Nobel Peace Prize with Al Gore.

**William Happer, Ph.D.**

I am a Professor Emeritus in the Department of Physics at Princeton University.

I began my professional career in the Physics Department of Columbia University in 1964, where I served as Director of the Columbia Radiation Laboratory from 1976 to 1979. I joined the Physics Department of Princeton University in 1980.

I invented the sodium guidestar that is used in astronomical adaptive optics systems to correct the degrading effects of atmospheric turbulence on imaging resolution. I have published over 200 peer-reviewed scientific papers, am a Fellow of the American Physical Society, the American Association for the Advancement of Science, and a member of the American Academy of Arts and Sciences, the National Academy of Sciences and the American Philosophical Society.

I served as Director of Energy Research in the U.S. Department of Energy from 1991 to 1993. I was a co-founder in 1994 of Magnetic Imaging Technologies Incorporated (MITI), a small company specializing in the use of laser-polarized noble gases for magnetic resonance imaging. I served as Chairman of the Steering Committee of JASON from 1987 to 1990.

I served as Deputy Assistant to the President and Senior Director for Emerging Technologies at The National Security Council in the White House from 2018 to 2019.

I am the Chair of the Board of Directors of the CO<sub>2</sub> Coalition, a nonprofit 501(c)(3) organization established in 2015 to educate thought leaders, policy makers and the public about the vital contribution made by carbon dioxide to our lives and our economy.