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November 30, 2023

Court of Appeals The Hague
The Hague
The Netherlands

Re: **Shell v. Milieudefensie et al. – Expert Opinion prepared for Foundation 'Environment and Man' (Stichting 'Milieu en Mens', M&M)**

This expert opinion has been prepared for the Foundation '*Environment and Man*' (Stichting 'Milieu en Mens', M&M) to be submitted to the Hague Court of Appeals in *Shell v. Milieudefensie et al*, in which M&M has intervened (the 'Climate Case'). This opinion was jointly authored and represents our joint opinion. Our time spent producing this opinion has been provided pro bono.

We are career physicists who have specialized in radiation physics, dynamic heat transfer and computer modelling for decades, subjects directly relevant to the global warming debate. Each of us has published over 200 peer-reviewed papers, many on the science of climate or closely related subjects. Our curricula vitae are attached in the appendix.

In our opinion, the District Court of The Hague findings that "dangerous" climate change and extreme weather are caused by CO_2 emissions from fossil fuels are contradicted by the scientific method and only supported by the unscientific methods of government opinions, consensus, peer review, and cherry-picked or falsified data.

Science demonstrates fossil fuels and CO_2 will not cause dangerous climate change. Rather, there will be disastrous consequences for people worldwide if fossil fuels and CO_2 emissions are reduced to "net zero," including mass starvation.

Specifically, our opinion is organized around the following key issues that have arisen in the District Court of The Hague in the Climate Case:

— First, there will be disastrous consequences for the poor, people worldwide, future generations, and the West if fossil fuel and CO_2 emissions are reduced to "net zero," including mass starvation and loss of reliable and inexpensive energy.

— This action will undermine human rights with which the Climate Case is concerned, and cripple the realization of the first three UN sustainable development goals (SDGs) -- no poverty, zero hunger, and good health and wellbeing.[1]

— Second, the Court in first instance equated the state of climate science with the reports of the Intergovernmental Panel on Climate Change (IPCC). In Part II we demonstrate the IPCC reports have no value as science because the IPCC is government controlled. Thus the IPCC represents only government opinions, not science, and thus provides no scientific basis for the Court's opinion.

— Third, this Court in first instance found that "dangerous" climate change and extreme weather are caused by CO_2 emissions from fossil fuels. We demonstrate in Part III these conclusions are contradicted by the scientific method and only supported by the unscientific methods of consensus, peer review, government opinions and cherry-picked or falsified data. Hundreds of research papers confirm the highly beneficial effects of increased concentrations of atmospheric CO_2, especially in dry farming areas.

[1] UN SDGs, https://sdgs.un.org/goals

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I. THERE WILL BE DISASTROUS CONSEQUENCES FOR THE POOR, PEOPLE WORLDWIDE, FUTURE GENERATIONS, AND THE WEST IF FOSSIL FUELS AND CO_2 EMISSIONS ARE REDUCED TO "NET ZERO"

A. CO_2 is Essential to Our Food, and Thus to Life on Earth.

Carbon dioxide is the miracle molecule of life. It is the basis for nearly all life on earth. We owe our existence to green plants that, through photosynthesis, convert CO_2 and water to carbohydrates and oxygen with sunlight. Land plants get the carbon they need from the CO_2 in the air. In turn, livestock depend on the availability of green plants to consume, so that humans can consume the livestock.

Without CO_2, there would be no food and thus no human or other life.

B. More CO_2, Including CO_2 from Fossil Fuels, Produces More Food.

Increasing CO_2 in the atmosphere increases the amount of food that plants produce, a phenomenon called "fertilization." Thousands of experimental results demonstrate that more CO_2 usually increases the amount of food that plants produce.[2] A graphic illustration of the response of plants to increases in CO_2 is shown below. Dr. Sherwood Idso grew Eldarica (Afghan) pine trees with increasing amounts of CO_2 in experiments, starting with an ambient CO_2 concentration of 385 ppm. He showed what happens when CO_2 is increased from 385 ppm to 535 ppm, 685 ppm and 835 ppm over 10 years:[3]

[2] *See, e.g.*, NIPCC, *Climate Change Reconsidered II: Biological Impacts* (2014); Craig Idso, "What Rising CO_2 Means For Global Food Security" CO_2 Coalition (2019); *Plant Growth Database*, CENTER FOR THE STUDY OF CARBON DIOXIDE AND GLOBAL CHANGE, http://www.CO2science.org/data/plant_growth/dry/dry_subject.php.

[3] Craig Idso, *Increased Plant Productivity: The First Key Benefit of Atmospheric CO_2 Enrichment,* MASTER RESOURCE (Apr. 21, 2022), https://www.masterresource.org/carbon-dioxide/increased-plant-productivity-the-first-key-benefit-of-atmospheric-co2-enrichment/; CO_2 COALITION, https://co2coalition.org/wp-content/uploads/2021/08/CO2_3.jpg.

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The "fertilization" effect varies significantly by type of plant. Dr. Craig Idso reported, "[s]ince the start of the Industrial Revolution, it can be calculated … that the 120-ppm increase in atmospheric CO_2 concentration increased agricultural production per unit land area" for various crops ranging from 28% to 70%, and averaging 46%.[4] He also reported "CO_2–induced activity productivity increase[d]" one of the varieties of rice by 263%![5]

He has also shown that a 300 ppm increase in CO_2 resulted in an average increase of 46%.[6] This implies that each 100 ppm increase of CO_2 "fertilization" results in a 15.3% (46%/3) increase, on average, in food supply worldwide.[7]

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[4] Nongovernmental International Panel on Climate Change (NIPCC), *Climate Change Reconsidered II: Biological Impacts* (2014), p. 322.

[5] Craig Idso, *Estimates of Global Food Production in The Year 2050: Will We Produce Enough to Adequately Feed the World?*, p. 31 (2011).

[6] Craig Idso, *The Positive Externalities of Carbon Dioxide*, CO_2 COALITION (2013) at 3 (discussed in GREGORY WRIGHTSTONE, INCONVENIENT FACTS 19 (2017)).

[7] Dr. Idso advised there is a linear relationship between CO_2 levels and the amount of food produced for most plants through 800 ppm. (Personal communication).

Using more recent data on the 140 ppm increase of CO_2 from 280 ppm in 1750 to 420 ppm today and the formula above, people worldwide benefitted from a 21% increase in agricultural productivity since 1750.

What if the Net Zero fossil fuels and CO_2 policy was in effect in 1750 and CO_2 did not rise from 280 ppm to 420 ppm? There would be 21% less food worldwide.

Also using the formula above, doubling CO_2 from 400 to 800 ppm would result in an additional increase of food worldwide of about 60% (4 x 15.3%).

Similarly, if the Net Zero fossil fuels and CO_2 policy goes into effect and CO_2 did not double to 800 ppm, there would be 60% less food worldwide (importantly note that it would take more than a century for CO_2 levels to reach 800 ppm).

Thus, more CO_2 means more food for people worldwide. Reducing CO_2 to "net zero" means less food for people worldwide.

Sylvan Wittwer, the father of agricultural research on this topic, emphasized the enormous benefits of rising CO_2 worldwide:

> "The rising level of atmospheric CO_2 could be the one global natural resource that is progressively increasing food production and total biological output … The effects know no boundaries, and both developing and developed countries are, and will be, sharing equally."[8]

C. More CO_2 Increases Food in Drought-Stricken Areas.

Another enormous social benefit of increasing CO_2 is that drought-stricken areas will have more food. In regions of the world suffering from drought, more CO_2 means there will be more food, because increasing CO_2 lessens water lost by plant transpiration:

At higher CO_2 levels, plants need less water because they grow leaves with fewer stomatal pores, and generally do not open their leaf stomatal pores as wide. The result is less water loss by transpiration. Plants need *less* water to produce the *same* — or an even *greater* — amount of biomass.[9]

On the other hand, Dr. Idso bluntly summarized the disastrous consequences if "net zero" fossil fuels and carbon dioxide policies are implemented on the food available to people worldwide:

> If proposed regulations restricting anthropogenic CO_2 emissions… are enacted, they will greatly exacerbate future food problems by reducing the CO_2-induced yield enhancements…. And as a result of such CO2 emissions regulations, hundreds of millions of the world's population will be subjected to hunger and malnutrition. Even more

[8] Quoted in NIPCC, *Climate Change Reconsidered II: Fossil Fuels* (2019), p. 322–23.

[9] Craig Idso, *What Rising CO_2 Means for Global Food Security*, CO_2 COALITION (2019), p. 13. *See also* CRAIG IDSO & SHERWOOD IDSO, THE MANY BENEFITS OF ATMOSPHERIC AND CO_2 ENRICHMENT (2011).

troubling is the fact that thousands would die daily as a result of health problems they likely would have survived had they received adequate food and nutrition.[10]

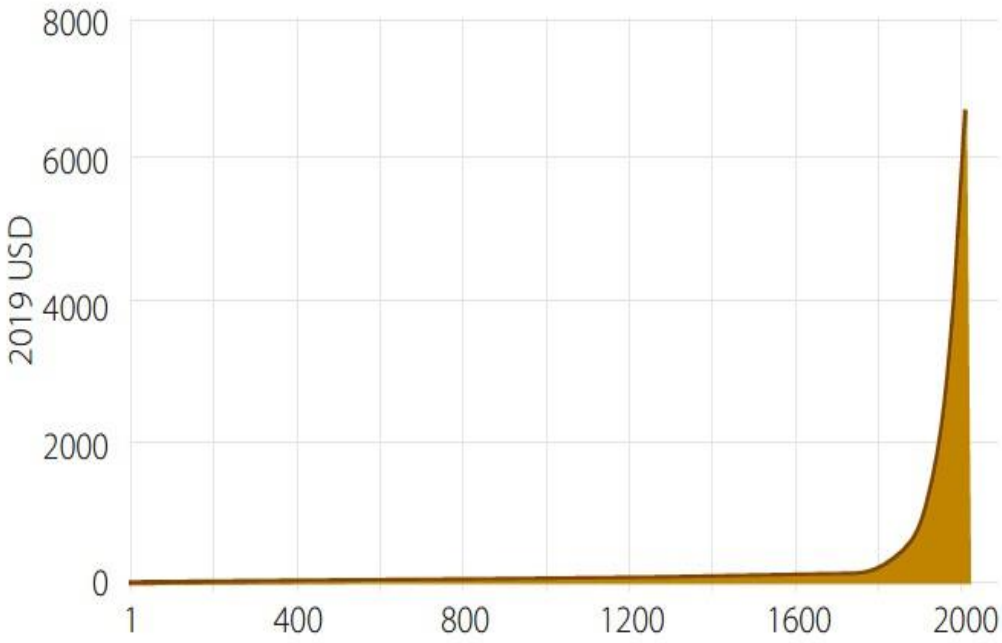
D. Greenhouse Gases Prevent Us from Freezing to Death

Greenhouse gases hinder the escape of thermal radiation to space. Water vapor, and clouds which condense from it, are the dominant greenhouse agents of Earth's atmosphere. CO_2 is a greenhouse gas, but only causes a small amount of warming. As a matter of radiation physics, CO_2 can only modestly increase the surface temperature of the earth. Longer growing seasons in a warmer globe also increases agricultural yields. We should be grateful. Greenhouse gases keep the Earth's surface temperature warm enough and moderate enough to sustain life on our verdant planet. Without them, we'd freeze to death.

E. Enormous Social Benefits of Fossil Fuels

Contrary to the incessant attack on fossil fuels, affordable, abundant fossil fuels have given ordinary people the sort of freedom, prosperity and health that were reserved for kings in ages past.

The following chart of the GDP per person for the last 2,000 years powerfully illustrates what has happened:[11]



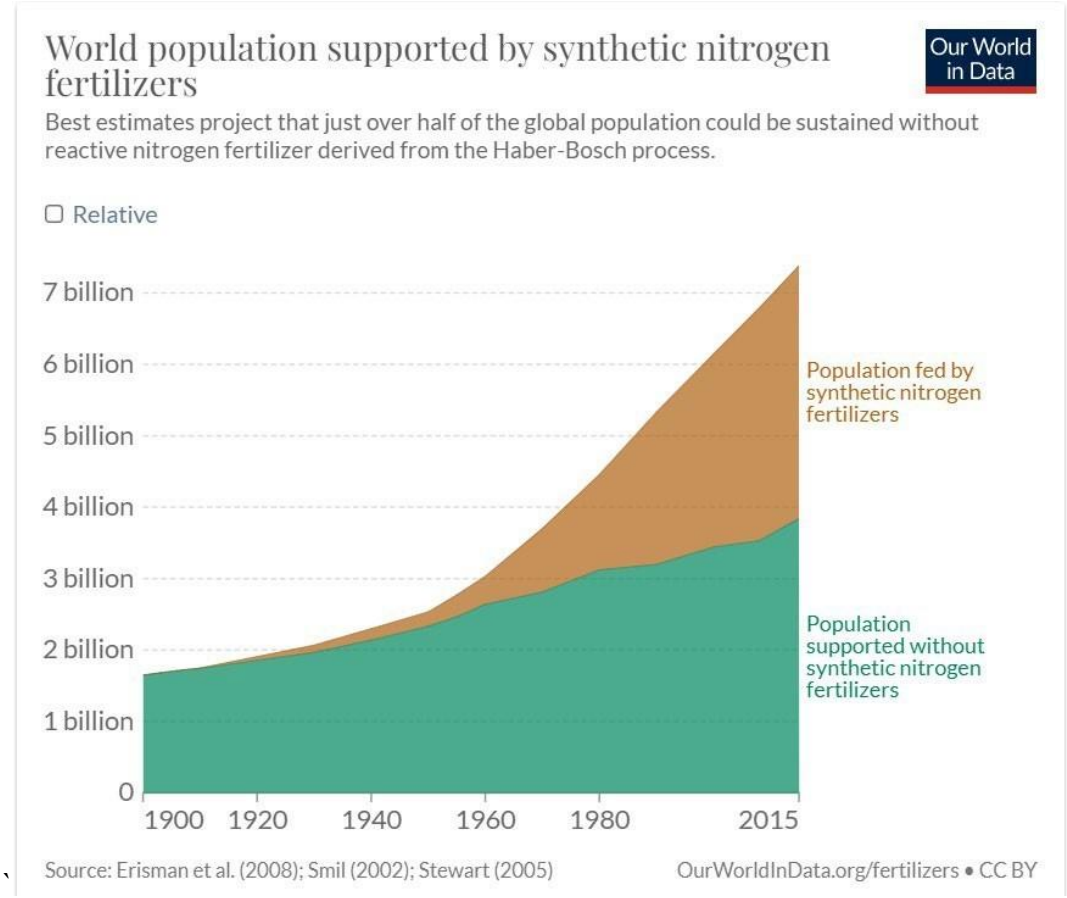
[10] Craig Idso, *Estimates of Global Food Production in The Year 2050: Will We Produce Enough to Adequately Feed the World?*, p. 31 (2011).

[11] Rupert Darwall, *Climate Noose: Business, Net Zero and the IPCC's Anticapitalism* Global Warming Policy Foundation, p. 21.

F. "Net Zeroing" Fossil Fuels Will Cause Massive Human Starvation by Eliminating Nitrogen Fertilizer

Food scarcity is an enormous global problem, as the UN has realized by including "zero hunger" among the top two sustainable development goals. Unfortunately, 2.3 billion people are moderately or severely food insecure today,[12] and 900 million are severely food insecure. Id.

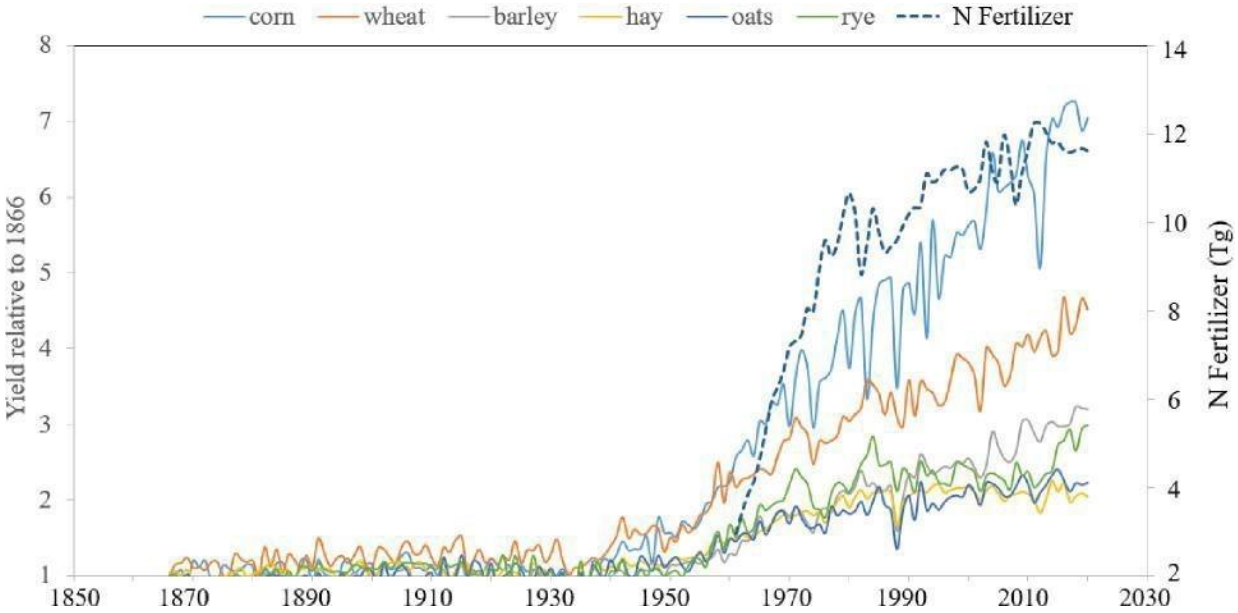
Nitrogen fertilizer, which is made from fossil fuels (natural gas), has greatly alleviated the problem of food scarcity. Nitrogen fertilizer now supports approximately half of the global population."[13]



[12] UNITED NATIONS, THE STATE OF FOOD SECURITY AND NUTRITION IN THE WORLD, p. xvii (2022).

[13] Hannah Ritchie, Max Roser and Pablo Rosado, *How Many People Does Synthetic Fertilizer Feed?*, OUR WORLD IN DATA (Nov. 7, 2017). See also Happer and Lindzen EPA Comment July 19, 2013, p. 15 Happer-Lindzen-EPA-Power-Plants-2023-07-9.pdf (co2coalition.org).

Cereal food production increased threefold after the widespread use of nitrogen fertilizer began around 1950 (see black dotted line):[14]



The "net zero" goal is to eliminate fossil fuels and thus natural gas. If fossil fuels and thus nitrogen fertilizer were reduced to "net zero," the left side of the chart shows what would happen -- food production would drop drastically, perhaps not quite to the yields before the widespread use of nitrogen fertilizer, since CO_2 fertilization, improved crop varieties and better agricultural practices would remain. But without nitrogen fertilizer, there would still be mass starvation.

There are two reasons for a significant risk of mass starvation:

First, the recent experience in Sri Lanka which eliminated the use of nitrogen fertilizer is unfortunately another example of "net zero" ideology trumping science. Sri Lankan President Rajapaksa in April 2021 banned "the importation and use of synthetic fertilizers and pesticides and ordered the country's 2 million farmers to go organic."[15] The result was disastrous. "Its rice production has dropped more than 50%, while domestic rice prices have increased more than 80%."[16] This is a real-life warning of the worldwide disaster that would result from eliminating fossil fuels.

Second, there is already a substantial decrease in the investments needed to find, produce and distribute fossil fuels, which creates the real risk there will not be enough capital-intensive capacity to fill natural gas requirements. For example, clean energy investments have been greater than fossil fuels investments since 2016, and the gap is accelerating. See International Energy Agency, *World Energy Investment 2023,* p.8.

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[14] William Happer, et al., Nitrous Oxide and Climate, CO_2 COALITION (Nov. 10, 2022), p. 39. See also Happer Lindzen EPA Comment, *supra*, pp. 13-14.

[15] Helen Raleigh, *Sri Lanka Crisis Shows the Damning Consequences of Western Elites Green Revolution*, FEDERALIST (July 15, 2022).

[16] *Id*.

IV. THE IPCC IS GOVERNMENT CONTROLLED AND THUS ONLY ISSUES GOVERNMENT OPINIONS, NOT SCIENCE, THUS PROVIDES NO SCIENTIFIC BASIS FOR THE COURT'S OPINION

The Court in first instance equated the state of climate science with the reports of the IPCC. However, as its name makes clear, it is the Intergovernmental Panel on Climate Change. As demonstrated next, the IPCC is government controlled and thus provides only government opinions, not science. Accordingly, the IPCC provides no scientific basis for the Court's opinion.

Specifically, IPCC governments, not scientists, meet behind closed doors and control what is published in its Summaries for Policymakers ("SPMs"), which controls what is published in full reports.

The picture below tells all.[17]

IPCC Summary for Policymakers writing meeting.

This is not how scientific knowledge is determined. In science, as the Lysenko experience chillingly underscores, and as Richard Feynman emphasized:

"No government has the right to decide on the truth of scientific principles."

The two IPCC rules are:

IPCC SPM Rule No.1: All Summaries for Policymakers (SPMs) Are Approved Line by Line by Member Governments

"IPCC Fact Sheet: How does the IPCC approve reports? 'Approval' is the process used for **IPCC Summaries for Policymakers (SPMs). Approval signifies that the material has been subject to detailed, line-by-line discussion, leading to agreement among the**

[17] Donna Laframboise. "US Scientific Integrity Rules Repudiate the UN Climate Process (January29, 2017) link US Scientific Integrity Rules Repudiate the UN Climate Process | Big Picture News, Informed Analysis.

participating IPCC member countries, in consultation with the scientists responsible for drafting the report."[18] (Emphasis added).

Since governments control the SPMs, the SPMs are merely government opinions. Therefore, they have no value as reliable science.

What about the thousands of pages in the IPCC reports? A second IPCC rule requires that everything in an IPCC published report must be consistent with what the governments agree to in the SPMs about CO_2 and fossil fuels. Any drafts the independent scientists write are rewritten as necessary to be consistent with the SPM.

IPCC Reports Rule No. 2: Government SPMs Override Any Inconsistent Conclusions Scientists Write for IPCC Reports

IPCC Fact Sheet: "'Acceptance' is the process used for the full underlying report in a Working Group Assessment Report or a Special Report after its SPM has been approved.... **Changes ...are limited to those necessary to ensure consistency with the Summary for Policymakers**." IPCC Fact Sheet, *supra*. (Emphasis added).

IPCC governments' control of full reports using Rule No. 2 is poignantly demonstrated by the IPCC's rewrite of 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 ("1995 Science Report").*

The draft by the independent scientists concluded:

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

"None of the studies cited above has shown clear evidence that we can attribute the observed [climate] changes to the specific cause of increases in greenhouse gases." Frederick Seitz, "A Major Deception on Climate Warming," *Wall Street Journal* (June 12, 1996). (Emphasis added).

However, the government written SPM proclaimed the exact opposite as to human influence:

"The balance of evidence suggests a discernible human influence on global climate." *1995 Science Report* SPM, p. 4. (Emphasis added).

What happened to the independent scientists' draft? IPCC Rule No. 2 was applied, and their draft was rewritten to be consistent with the SPM in numerous ways:

- Their draft language was deleted.

[18] Intergovernmental Panel on Climate Change, Principles Governing IPCC Work, the Procedures for the Preparation, Review, Acceptance, Adoption, Approval and Publication of IPCC Reports, Appendix A Sections 4.4-4.6, https://archive.ipcc.ch/news_and_events/docs/factsheets/FS_ipcc_approve.pdf; http://www.ipcc.ch/pdf/ipcc-principles/ipcc-principles-appendix-a-final.pdf (Emphasis added).

- The SPM's opposite language was inserted in the published version of Chapter 8 in the *1995 Science Report,* on page 439: "The body of statistical evidence in chapter 8 ... now points towards a discernible human influence on global climate."
- The IPCC also changed "more than 15 sections in Chapter 8 of the report ... after the scientists charged with examining this question had accepted the supposedly final text." Seitz, *supra*. (Emphasis added).

As to the full IPCC reports, hundreds of world-class scientists draft some very good science. Should the IPCC reports be viewed as science? No. Use a presumption that anything in IPCC reports should be presumed to be government opinion with no value as reliable science, unless independently verified by the scientific method.

Also consider what would have happened if the IPCC accurately reported the science. The scientists concluded there was no science that attributed all or most of the climate warming observed to manmade causes. There would be no U.S. Supreme Court decision *Massachusetts v. EPA*, no "Green Deal," no "Net Zero" regulation, no efforts to eliminate fossil fuels, no huge subsidies of renewable energy and electric cars. For whatever reason, the IPCC as a government-controlled organization did not and has never followed the science that the facts contradict the theory of dangerous climate change caused by fossil fuels and other human emissions.

In conclusion, none of the IPCC SPMs, models, scenarios and other findings asserting that dangerous climate warming is caused by human CO_2 and GHG emissions and fossil fuels are reliable science, they are merely the opinions of IPCC governments. Therefore, as the Lysenko experience described below chillingly underscores, none can be used as science supporting the Court's opinion.

III. SCIENCE DEMONSTRATES FOSSIL FUELS AND CO_2 WILL NOT CAUSE DANGEROUS CLIMATE CHANGE AND EXTREME WEATHER

A. Reliable Science is Based on Validating Theoretical Predictions With Observations, Not Consensus, Peer Review, Government Opinion or Cherry-Picked or Falsified Data

Scientific Method. Scientific knowledge is determined by the scientific method. Prof. Richard Feynman, a Nobel Laureate in Physics, provided an incisive definition of the scientific method:

> "[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 don't work. This has been the scientific method for more than three hundred years.

It is astounding that one of the most complex questions in physics (namely, the behavior of a multi-phase, radiatively active, turbulent fluid) should be labeled by the government — and funding agencies it controls — to be so settled that skeptics are silenced. The models supporting the climate-crisis narrative make predictions that utterly fail to match the observations of what they purport to predict. This failure means in science they should

never be used. Unfortunately, this peculiar situation is particularly dangerous because many world leaders have abandoned the science and intellectual rigor bequeathed to us by the Enlightenment and its forebears.

Unscientific Method and Lysenko Science. Scientific knowledge is not determined by the unscientific methods underlying all "net zero" fossil fuels and carbon dioxide arguments and the Court's opinion: government opinion, consensus, peer review and cherry-picked or falsified data and omitted unfavorable observations.

Government Opinion. Nobel physicist Richard Feynman put it clearly:

> "No government has the right to decide on the truth of scientific principles." *The Meaning of It All* (1998), p. 57.

The importance of scientific principles that government does not determine science was chillingly underscored when Stalin made Trofim Lysenko the czar of Russian biology. False biology 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 as a result.[19]

Consensus. What is correct in science is not determined by consensus. but by experiment and observations. Historically, scientific consensuses have often turned out to be wrong. The greatest scientists in history are great precisely because they broke with consensus. The frequent assertion that there is a consensus behind the idea that there is an impending disaster from climate change is not how the validity of science is determined to quote the profoundly true observation of Michael Crichton:

> "If it's consensus, it isn't science. If it is science, it isn't consensus."

Peer Review. Peer review can be helpful in many areas of science, but it does not determine scientific validity. Agreement of theoretical predictions with observation or experiment, "the scientific method," is the real touchstone of truth in science.

In our decades of personal experience in the field we have been dismayed that many distinguished scientific journals now have editorial boards that further the agenda of climate change alarmism rather than objective science. Research papers with scientific findings contrary to the dogma of climate calamity are rejected by reviewers, many of whom fear that their research funding will be cut if any doubt is cast on the coming climate catastrophe. Journal editors have been fired for publishing papers that go against the party line of the climate-alarm establishment.

Alas, peer review of the climate literature is a joke. It is pal review, not peer review. The present situation violates the ancient principle "no man shall be a judge in his own cause." Accordingly, some peer reviewed climate publications are right, but many have serious problems with confirmation bias. All must be ultimately tested by the scientific method and rejected if their theories are not validated by observations.

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[19] William Happer, Chapter 1 "Harmful Politicization of Science," Michael Gough Ed., *Politicizing Science* (2003), pp. 29-35.

Cherry-Picked or Falsified Data and Omitted Unfavorable Observations. Since theories are tested with observations, fabricating and omitting unfavorable facts to make a theory work is an egregious violation of the scientific method.

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." 1974 Caltech commencement address, *Surely You're Joking, Mr. Feynman!* (1985), p. 311-12

In our experience, one of us (Lindzen) frankly explained: "misrepresentation, exaggeration, cherry picking, or outright lying pretty much covers all the so-called evidence"[20] marshalled in support of the theory of imminent "dangerous" climate change caused by fossil fuels and CO_2, and of the urgent need to achieve "net zero" fossil fuels and CO_2 emissions by 2050.

Thus, scientific knowledge is determined by the scientific method, testing theory with observations, not by consensus, government opinion, peer review or cherry-picked or falsified data.

Applying these fundamental principles of science and the scientific method, we demonstrate next as a matter of science that fossil fuels and CO_2 will not cause "dangerous" climate change and extreme weather.

B. The Models Predicting Catastrophic Warming and Extreme Weather Fail the Key Scientific Test: They Do Not Work and Would Never Be Used in Science.

The IPCC is the dominant source of the models used by everybody analyzing climate change, in our experience. However, CMIP model predictions (Coupled Model Intercomparison Project) do not reliably predict temperatures and bear no rational relationship to the reality they purport to represent. Therefore, they would never be used in science.

With rare candor, establishment climate scientists Tim Palmer and Bjorn Stevens state:

> "This status quo and the complacency that surrounds it give us cause to be deeply dissatisfied with the state of the scientific response to the challenges posed by global warming. Whereas present day climate models were fit for the purpose for which they were initially developed, which was to test the basic tenets of our understanding of global climate change, they are inadequate for addressing the needs of society struggling to anticipate the impact of pending changes to weather and climate."[21]

The importance of the scientific failure of the CMIP models underlying all "net zeroing" policies and the Court's opinion cannot be overemphasized. The models provide no scientific basis for concluding that fossil fuels and CO_2 will cause "dangerous" climate change and extreme weather.

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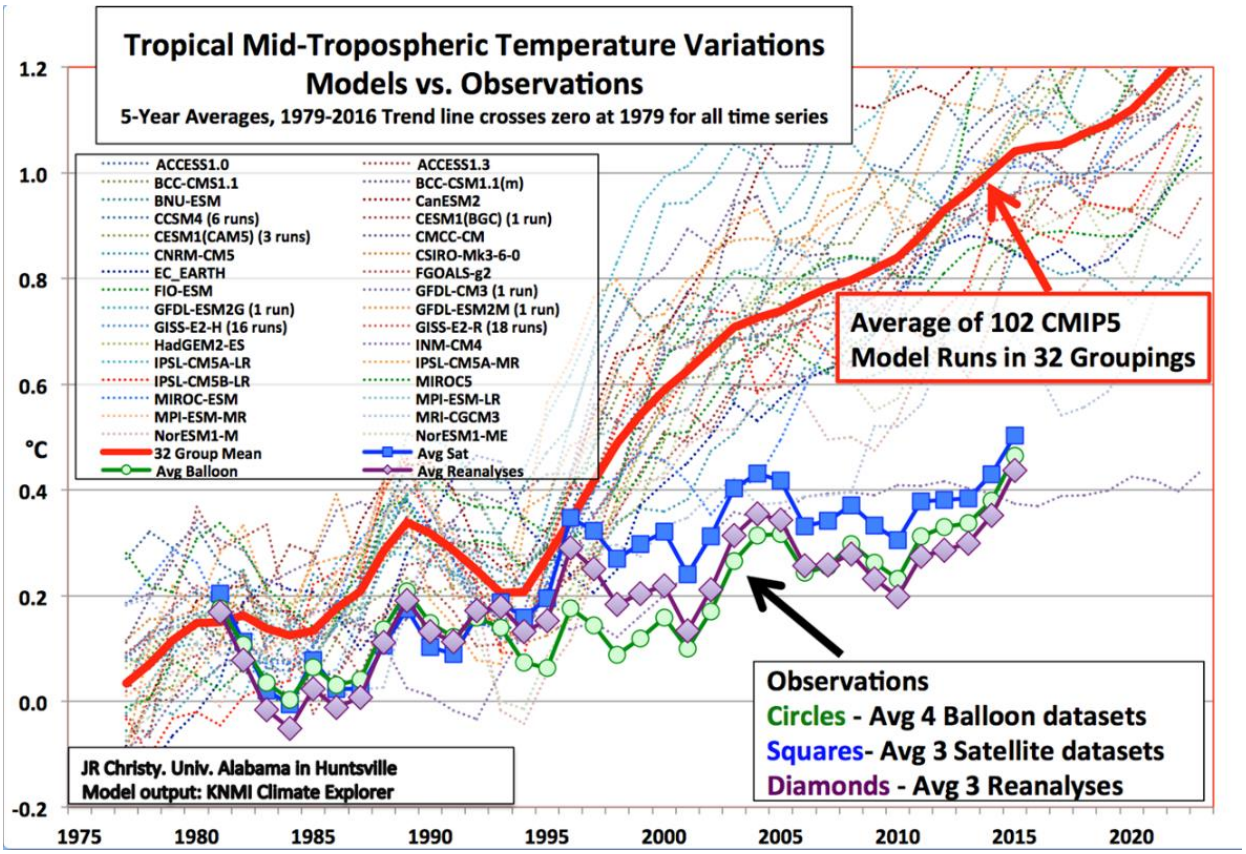
[20] Lindzen, "Global Warming for the Two Cultures," Global Warming Policy Foundation (2018), p. 10. *Accord* Lindzen, "The Absurdity of the Conventional Global Warming Narrative (April 20, 2022) & "Straight Talk About Climate Change," Acad. Quest (2017), p. 419.

[21] T. Palmer and B. Stevens, *The scientific challenge of understanding and estimating climate change*.

Here are the scientific details:

CMIP5. John Christy, Ph.D., Professor of Atmospheric Science at the University of Alabama, applied the scientific method to CMIP5's 102 predictions of temperatures from 1979 to 2016 by models from 32 institutions.

He explained he used "the traditional scientific method in which a claim (hypothesis) is made and is tested against independent information to see if the claim can be sustained," and produced the following chart:[22]



At the bottom, the blue, purple and green lines show the actual reality -- temperature observations against which the models' predictions were tested.

The dotted lines are 102 temperature "simulations" (predictions) made by the models from 32 institutions for the period 1979–2016.

The red line is the consensus of the models, their average.

In his opinion and ours, the graph clearly shows 101 of the 102 predictions by the models (dotted lines) and their consensus average (red line) fail miserably to predict reality. Focusing on the red consensus line, Dr. Christy concluded, and we agree:

> "When the 'scientific method' is applied to the output from climate models of the IPCC AR5, specifically the bulk atmospheric temperature trends

[22] John Christy, House Comm. Science, Space and Technology (Mar. 29, 2017), pp. 3, 5.

since 1979 (a key variable with a strong and obvious theoretical response to increasing GHGs in this period), . . . the consensus of the models [red line] fails the test to match the real-world observations by a significant margin. As such, the average of the models is untruthful in representing the recent decades of climate variation and change, and thus would be inappropriate for use in predicting future changes in the climate or related policy decisions."[23]

Thus, in his opinion and ours, the models that produced the 101 predictions failed the Feynman test under the scientific method. They do not work, and bear no rational relationship to the reality they purport to represent. Thus, CMIP5 provides no reliable scientific evidence for "net zero" policies and the Court's opinion.

Nor does the later version, CMIP6, pass this basic test of science. In the recent book, *Unsettled,* by one of us (Steven Koonin), the assertions of CMIP6 were carefully reviewed in the chapter, "Many Muddled Models."[24] We all agree with the conclusions of that chapter:

"One stunning problem is that … the later generation of [CMIP] models are actually more uncertain than the earlier one[s].

"The CMIP6 models that inform the IPCC's upcoming AR6 [Climate Change reports] don't perform any better than those of CMIP5."[25]

Representative examples of CMIP6's failure to use the scientific method are:

- "An analysis of 267 simulations run by 29 different CMIP6 models created by 19 modeling groups around the world shows that they do a very poor job [1] describing warming since 1950 and … [2] underestimate the rate of warming in the early twentieth century."[26]
- "Comparisons among the [29] models [show] … model results differed dramatically both from each other and from observations ... [and] disagree wildly with each other."[27]
- "One particularly jarring failure is that the simulated global average surface temperature … varies among models … three times greater than the observed value of the twentieth century warming they're purporting to describe and explain."[28]
- As to the early twentieth century warming when CO_2 levels only increased from 300 to 310 ppm, "strong warming [was] observed from 1910 to 1940. On average, the models give a warming rate over that period of about half what was

[23] *Id.* at 13 (emphasis added).

[24] STEVEN KOONIN, UNSETTLED (2021).

[25] *Id.* at 87, 90 (emphasis added).

[26] *Id.* at 90.

[27] *Id*.

[28] *Id.* at 87.

actually observed. That the models can't reproduce the past is the big red flag -— it erodes confidence in their projections of future climate."[29]

Thus, the CMIP6 models also fail the fundamental test of the scientific method: they do not work, and thus do not provide reliable scientific evidence for the Court's opinion. These models would never be used in science. For this reason alone, there is no risk CO_2 and fossil fuels will cause catastrophic global warming.

C. 600 Million Years of CO_2 and Temperature Data Contradict the Theory That High Levels of CO_2 Will Cause Catastrophic Global Warming.

The chart below shows 600 million years of CO_2 levels and temperature data.[30] It usually shows an inverse relationship between CO_2 and climate temperatures during much of Earth's history over the last 600 million years.

The higher levels of CO_2 correlate with lower temperatures and vice versa. Although the data are based on various proxies, with the attendant uncertainties, they are good enough to demolish the argument that atmospheric CO_2 concentrations control Earth's climate and the theory that fossil fuels and CO_2 will cause catastrophic global warming. They will not.

The blue line shows CO_2 levels.

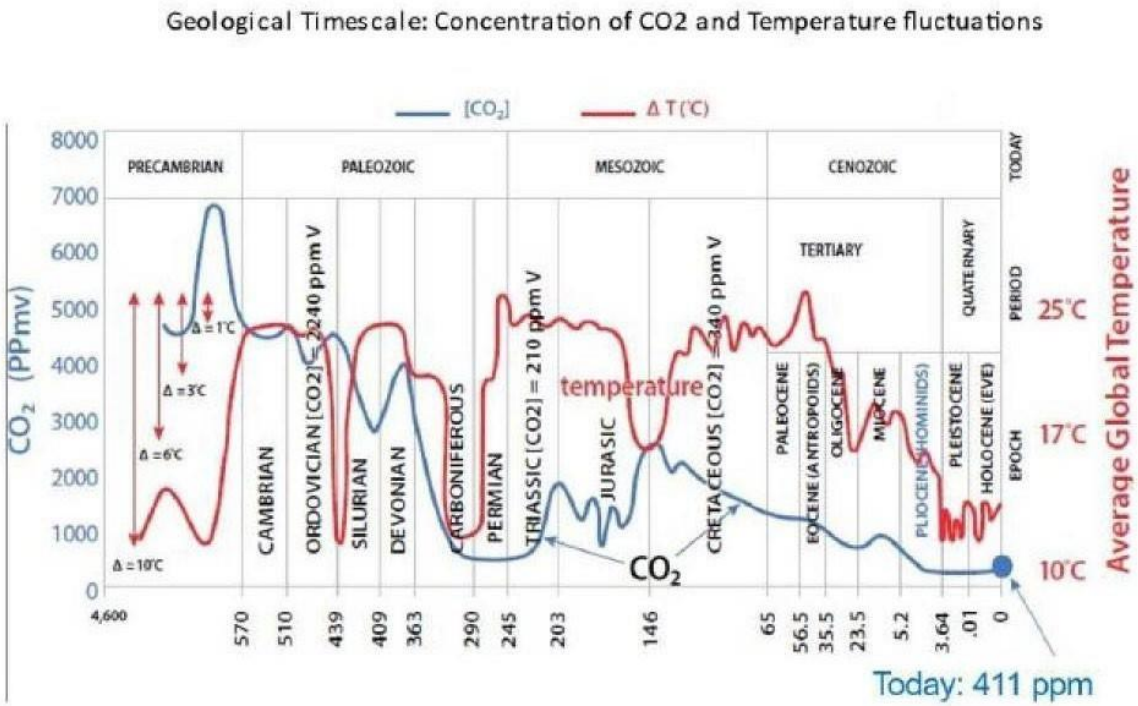
The red line shows temperature.

Specifically, the chart shows:

- When CO_2 was at a record high at about 7,000 ppm, temperatures were at a near-record low.
- CO_2 levels were low when temperatures were at the highest they have ever been, about 60 million years ago.
- CO_2 levels have been relatively low for the last 300 million years and have been declining from 2,800 ppm to today's 420 ppm over the last 145 million years.
- Temperatures have been higher than today over most of the 600 million years and life flourished (but not in the Ice Ages).

[29] *Id.* at 88, 95.

[30] Nasif Nahle, *Geologic Global Climate Changes*, BIOLOGY CABINET J. (Mar. 2007).



1- *Analysis of the Temperature Oscillations in Geological Eras* by Dr. C. R. Scotese © *2002*. 2. Ruddiman, W.F. 2001. *Earth's Climate: past and future* W.H. Freeman & Sons. New York, NY. 3 - Mark Pagani *et al.* *Marked Decline in Atmospheric Carbon Dioxide Concentrations During the Paleocene.* Science; Vol. 309, No. 5734; pp. 600-603. 22 July 2005. *Corrected on 07 July 2008 (CO2: Ordovician Period).*

Reconstructed atmospheric carbon dioxide concentrations (Berner, 2001) & global mean surface temperature (Scotese, 1999) over the last 550 million years

Thus, CO_2 concentrations and temperatures are usually inversely related over 600 million years. For hundreds of millions of years, temperatures were low when CO_2 levels were high, and temperatures were high when CO_2 levels were low.

At the same time, no scientist familiar with radiation transfer denies that more carbon dioxide is likely to cause only small and benign warming. In fact, history shows that warmings of a few degrees Celsius -- which extended growing seasons -- have been good for humanity. The golden age of classical Roman civilization occurred during a warm period as did the first great civilizations during the Bronze Age in the Minoan Warm Period.

Thus, applying the scientific method to the 600 million years of omitted and not considered data contradicts the theory that fossil fuels and CO_2 will cause catastrophic global warming. The theory does not agree with the facts, and the scientific method requires the theory to be rejected. For this reason alone, there is no risk CO_2 and fossil fuels will cause catastrophic global warming and no scientific support for the Court's opinion.

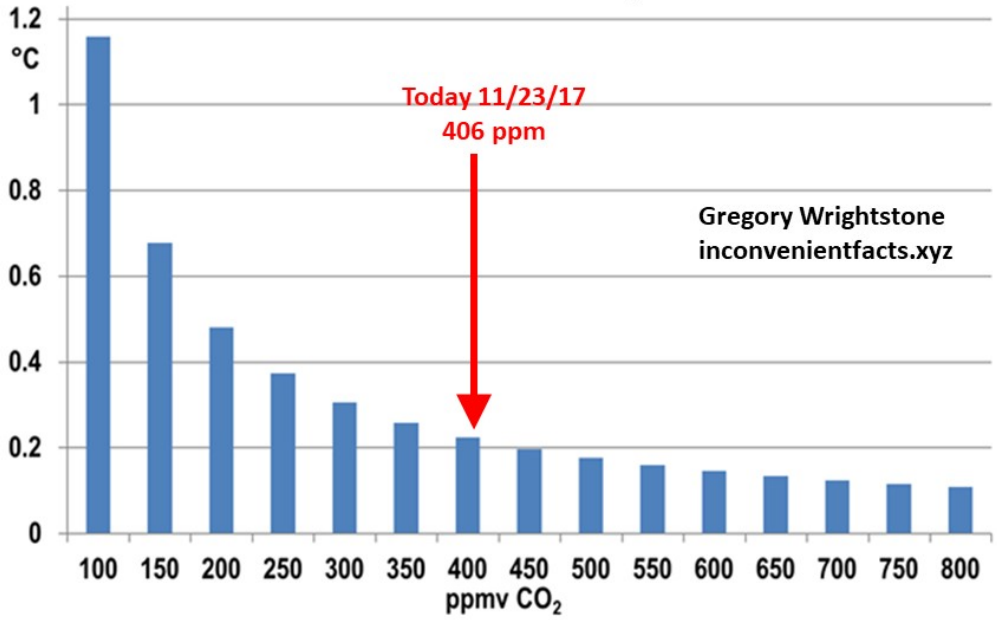
D. Atmospheric CO_2 Is Now "Heavily Saturated," Which in Physics Means More CO_2 Will Have Little Warming Effect.

All of us have special expertise in radiation transfer, the prime mover of the greenhouse effect in Earth's atmosphere. Radiation physics explains the effect of adding CO_2 to the atmosphere.

CO_2 becomes a less effective greenhouse gas at higher concentrations because of what in physics is called "saturation." Each additional increase of CO_2 in the atmosphere causes a smaller

and smaller change in "radiative forcing," or in temperature. The saturation effect is shown in the chart below.[31]

Figure I-3: Less global warming for each additional 50 parts-per-million-by-volume of CO_2 concentration



(Graph calculated using IPCC's formula $\Delta T_0 = \frac{5.35}{3.2} ln \frac{C}{C_0}$;

AR3, Ch. 6.1. Courtesy Monckton 2017)

Moreover, saturation also explains why temperatures were not catastrophically high over the hundreds of millions of years when CO_2 levels were 10 to nearly 20 times higher than they are today, shown in the previous chart covering 600 million years.

Thus, saturation means that from now on, CO_2 emissions from burning fossil fuels can have little impact on global warming. We could double atmospheric CO_2 to 840 ppm and have little warming effect. Since CO_2 at today's level is "saturated," for this reason alone there is no risk that the continued use of fossil fuels, and even a doubling of atmospheric CO_2, will cause "dangerous" climate change and catastrophic global warming.

Nor is there any scientific basis for the United Nation and IPCC repeated warnings that carbon emission reductions are urgently necessary to avoid "dangerous" climate change. Our scientific opinion is that there is no urgency to act.

Doubling CO_2 levels from today's 420 ppm to 840 ppm would take more than a century to happen. CO_2 concentrations grow about 2.5 ppm annually. See https://gml.noaa.gov/ccgg/trends/ In 100 years, CO_2 would only increase 250 ppm.

[31] GREGORY WRIGHTSTONE, INCONVENIENT FACTS 7 (2017).

In conclusion, for saturation reasons alone, there is no risk CO_2 and fossil fuels will cause "dangerous" climate change and catastrophic global warming and thus there is no scientific support for the Court's opinion.

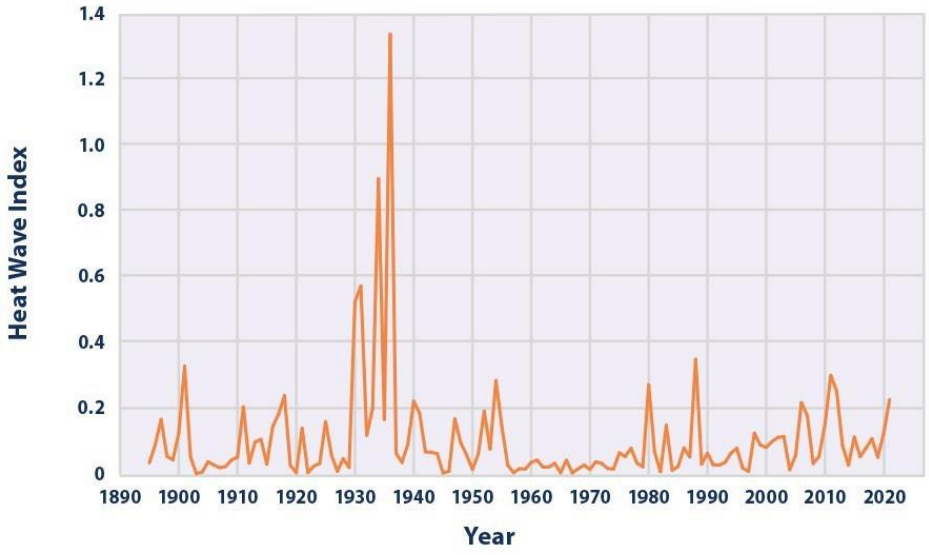
E. The Theory Extreme Weather is Caused by Fossil Fuels and CO_2 is Contradicted by Observations and Thus is Scientifically Invalid

The first five chapters of *Unsettled* review the application of the scientific method to analyzing extreme weather, including heat waves, hurricanes, sea level rise, wildfires, floods, droughts and precipitation shifts. We all agree with the following conclusions:

> "Observations extending back over a century indicate that most types of extreme weather events don't show *any* significant change – and some such events have actually become less common or severe – even as human influences on the climate grow."
>
> "The bottom line is that the science says that most extreme weather events show no long term trends that can be attributed to human influence on the climate." Id. pp. 97, 99 (emphasis added).[32]

Heat Waves. On extreme temperatures in the U.S., we all agree: "*The annual number of high temperature records set shows no significant trend over the past century*, *nor over the past 40 years."* Koonin, *supra*, p. 110.

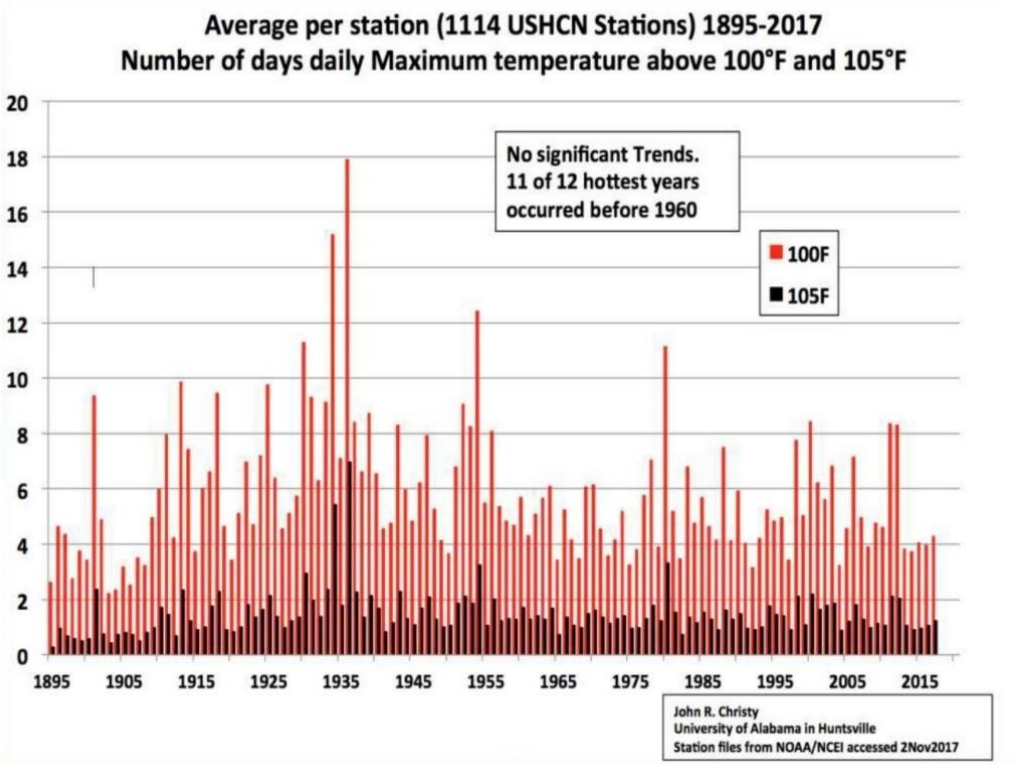
The U.S. Environmental Protection Agency confirms this in the graph below, which uses an index of heat waves from 1890 to 2020 that shows there is nothing out of the ordinary about recent heatwaves relative to the 130 years and shows the hottest temperatures were during the Dust Bowl in the U.S in the 1930s, not recently:[33]



[32] Reaffirmed by IPCC, *Climate Change 2021: The Physical Science Basis*, AR6, Table 12.12

[33] EPA, *U.S. Annual Heat Wave Index 1895–2015* (2016), fig. 3, https://www.epa.gov/climate-indicators/climate-change-indicators-heat-waves.

Similarly, below is a chart that Dr. John Christy prepared showing the number of days of daily maximum temperatures above 100° F and 105° from 1895 to 2015. Days with temperatures of at least 105° F peaked in the 1920s and 1930s.[34]



The scientific method, focused on observations, shows that there is no risk of increased damage by high temperatures as a result of increasing atmospheric CO_2 from fossil fuels. High temperatures may continue to cause damage, but the resulting financial losses will have nothing to do with fossil fuels and increases in CO_2.

Hurricanes. Chapter 6 of *Unsettled* deals with the assertion, "Storms are becoming more common and more intense and rising greenhouse gas emissions are going to make it all a lot worse." Id. p. 111.

A deep analysis of the facts reveals that "the data and research literature are starkly at odds with this message" -- "hurricanes and tornadoes show no changes attributable to human influences." Id. pp. 111-12.

Further, "There has been no significant trend in the global number of tropical cyclones nor has any trend been identified in the number of U.S. land-falling hurricanes." U.S. Global Climate Research Program, 3rd National Climate Assessment, Appendix 3, p. 769 (footnotes omitted).

[34] *US Extreme High Temperatures Chart*, DR. ROY SPENCER, US-extreme-high-temperatures-1895-2017.jpg (3000×2250) (drroyspencer.com)

Sea Levels. "Sea Level Scares" is the subject of Chapter 8 in U*nsettled*.

As background, the chapter summarizes the geological record of sea level. Over hundreds of thousands of years, the sea level has risen as much as 400 feet (120 meters), and fallen 400 feet (120 meters). Since the Last Glacial Maximum 22,000 years ago, the sea level has risen 400 feet (120 meters). Id. p. 151.

Since 1880, the sea level has risen 10 inches (250 mm), with the annual rate of increase varying substantially and averaging .07 inches (1.8 mm) per year. Between 1925-1940 and between 1993-2013 the average rate of increase was the same, .12 inches per year (3mm). Id. p. 154.

Then *Unsettled* analyzes the rising sea level "scares" made by various organizations. For example, the "IPCC's 2019 Special Report on the Ocean and Cryosphere in a Changing Climate Report (SROCC) expresses high confidence that the satellite data from 1993 to 2015 shows an acceleration (that is, the rate of rise is increasing)." Koonin, *supra*, p. 156 (emphasis added).

What about longer periods of time than just 1993-2015? *Unsettled* explains:

> "The rate of rise over the most recent twenty-five-years should be compared to that other twenty-five-year period [also .12 inches/year (3 mm)] to understand just how significant the recent rate is." Id. p. 158.

The IPCC unscientifically cherry-picked the sea level increase between 1993–2013, but totally ignored the same increase 1925-1940.

Thus we all agree with the statement in *Unsettled*:

> "[Many] assessments discussions of sea level rise omit important details that weaken the case for the rate of rise in recent decades being outside the scope of historical variability and, hence, for attribution to human influences. There is little doubt that by contributing to warming we have contributed to sea level rise, but there is also scant evidence that this contribution has been or will be significant, much less disastrous." Id. p. 165 (emphasis added).

The scientific method shows that there is no risk of increased damage from rising sea levels because of increasing atmospheric CO_2 from fossil fuels. Sea levels may rise and cause damage, but the resulting increased financial losses will have nothing to do with fossil fuels and increases in CO_2.

Wildfires. There is a powerful new source of data on wildfires, "Sophisticated satellite sensors first began monitoring wildfires globally in 1993." Id. p. 142.

The result of this new source of data is totally contrary to what is in the news. *Unsettled* cites NASA data and others that show the global area burned by fires declined each year from 1998 to 2015:

> "Unexpectedly, this analysis of the images shows that the area burned annually declined by about 25% from 1998 to 2015." Further, "Despite the very destructive wildfires in 2020, that year was among the least active globally since 2003." Id. p. 142.

We all agree with the statement in *Unsettled* that this should change "the conversation about wildfires [from] only one of unavoidable doom due to 'climate change,'" to a

conversation about how "to take steps that would more directly curtail these catastrophes" as "we have significant power to address … human factors." Id. P. 144.

In summary, the scientific method shows that there is no risk of increased damage by wildfires because of increasing atmospheric CO_2 from fossil fuels. Wildfires will cause damage, but the resulting increased financial losses will have nothing to do with fossil fuels and increases in CO_2.

Flooding, Droughts and Other Precipitation Perils. Chapter 7 of *Unsettled*, "Precipitation Perils – From Floods to Fires," deals with various weather events related to precipitation.

Flooding: US data shows "modest changes in US rainfall during the past century haven't changed the average incidence of floods."

Globally, data from the IPCC shows that there is "*low confidence* regarding the sign of trend in the magnitude and/or frequency of floods on a global scale."

We all agree with the summary in *Unsettled*: "we don't know whether floods globally are increasing, decreasing, or doing nothing at all." Id. p. 137.

Thus, the scientific method shows that there is no risk of increased damage by flooding because of increasing atmospheric CO_2 from fossil fuels. Flooding will cause damage, but the resulting increased financial losses will have nothing to do with fossil fuels and increases in CO_2.

Droughts. *Unsettled* cites data in the US from 1895 to 2015 on the severity of droughts and finds "it's difficult to see much long-term change." Id. p. 138.

Globally, the IPCC data showing "pretty much the same thing for the globe as a whole, expressing… '*Low confidence* in a global-scale trend in drought or dryness since the middle of the twentieth century," and also noting "the current impact of human influences seems weak in comparison with natural variability." Id. p. 140.

Droughts have been more severe and longer lasting in the past, citing data from both the IPCC and a 2009 National Climate Assessment. According to the IPCC in 2014: "There is high confidence for droughts during the last millennium of greater magnitude and longer duration than those observed since the beginning of the twentieth century in many regions." And the U.S. Global Research Program's National Climate Assessment in 2009 "data reveal that some droughts in the past have been more severe and longer lasting than any experienced in the last 100 years." Koonin, *supra*, p. 140.

In summary, the scientific method shows that there is no risk of increased damage by droughts because of increasing atmospheric CO_2 from fossil fuels. Droughts will cause damage, but the resulting increased financial losses will have nothing to do with fossil fuels and increases in CO_2.

Climate-Related Deaths, Agricultural and Economic Disasters. Chapter 9 of *Unsettled*, "Apocalypses that Ain't," scientifically analyzes the facts regarding three other theories about extreme weather.

"One is 'climate-related deaths,' a menace based on speculation, strained assumptions and incorrect use of data. The second is a future agricultural 'disaster' that is belied by the evidence and requires acrobatic distortions to even detect. And the third is purportedly

enormous economic costs – which turns out, even based on the data presented, to be minimal, if not too small to measure." Id. p. 167.

Thus, none of the three theories are supported by the facts. The scientific method proves there is no risk of increased damage by any of these three theories as a result of increasing atmospheric CO_2 from fossil fuels.

Extreme Weather Events Conclusion. The enormously important good news from *Unsettled*, admittedly contrary to conventional government and media wisdom, is that using the rigorously applied the scientific method to assess numerous extreme weather theories shows that there are no climate-related financial risks caused by fossil fuels and CO_2 that justify regulatory or court action.

We all agree with the summary statement, "science says that most extreme weather events show no long-term trends that can be attributed human influence on the climate." Id. p. 99.

CONCLUSIONS

In our scientific opinion as career scientists, there is no scientific basis for the findings and assumptions made by the District Court of The Hague in the Climate Case that:

1) a "net zero" reduction of fossil fuels and CO_2 is necessary to prevent any "dangerous" climate change.
2) the IPCC reports represent the state of climate science,
3) the IPCC CMIP models provide reliable projections of future states of the climate, and
4) fossil fuels and related CO_2 emissions cause more frequent and more intense extreme weather and "dangerous" climate change,

Moreover, contrary to what is commonly reported, CO_2 is essential to life on earth. Without CO_2, there would be no plant food and thus no human or animal life. "Net zeroing" CO_2 will reduce the amount of food available for the poor and people worldwide, without fossil fuels there will be no nitrogen fertilizer and thus mass starvation, and no low-cost energy worldwide.

A summary of our conclusions:

— There will be disastrous consequences for the poor, people worldwide, future generations and the West if fossil fuels and CO_2 emissions were reduced to "net zero," including mass starvation and loss of reliable and inexpensive energy.

— Further, this action will undermine human rights with which the Climate Case is concerned, and cripple the realization of the first three UN sustainable development goals (SDGs) -- no poverty, zero hunger, and good health and wellbeing.[35]

— The IPCC is government controlled, and thus provides government opinions, not science. Thus the IPCC provides no scientific basis for the Court's opinion.

— Science demonstrates fossil fuels and CO2 will not cause "dangerous" climate change and extreme weather.

[35] UN SDGs, https://sdgs.un.org/goals

Respectfully submitted,

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CURRICULUM VITAE

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 for 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 CO2 Coalition, a non-profit (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.

Steven E. Koonin

I am a University Professor at New York University, where I hold appointments as a Professor of Information, Operations, and Management Sciences in the Stern School of Business and a Professor of Civil and Urban Engineering in the Tandon School of Engineering.

In 2022 I joined the Hoover Institute as a Senior Fellow.

I served as Undersecretary for Science at the U.S. Department of Energy from May 2009, following my confirmation by the U.S. Senate, until November 2011.

Prior to joining the government, I spent five years, from March 2004 to May 2009, as Chief Scientist for BP, p.l.c.

From September 1975 to July 2006, I was a professor of theoretical physics at Caltech and was the institute's Provost from February 1995 to January 2004.

I was a director of CERES, Inc., a publicly traded company pursuing genetically enhanced bioenergy crops, from 2012 to 2015 and have been a Director of GP Strategies since 2016.

My memberships include the U.S. National Academy of Sciences, the American Academy of Arts and Sciences, the Council on Foreign Relations. I am a former member of the Trilateral Commission. I am a member of the JASON advisory group from July 1988 to

May 2009, and from November 2011 to present, and served as the group's chair from 1998 to 2004.

I have served as an independent governor of the Los Alamos and Lawrence Livermore National Security LLCs since July 2012 and of the Sandia Corporation from 2016 to 2017 and was a member of the Secretary of Energy's Advisory Board from 2013 to 2016.

I hold a B.S. in Physics from Caltech and a Ph.D. in Theoretical Physics from MIT and have been a Trustee of the Institute for Defense Analyses since 2014.

Richard Lindzen, Ph. D

I am 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.

At 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, 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.