Response to the Commodity Futures Trading Commission on Its Request for Information on Climate-Related Financial Risk

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This response is submitted to the Commodity Future Trading Commission on its request for information on "climate-related financial risk as pertinent to the derivatives markets and underlying commodities markets."[1] It is organized as follows:

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[1] The request for information was published at https://www.cftc.gov/LawRegulation/FederalRegister/final-rules/2022-12302.html.

Summary

Firm- or industry/sector-specific greenhouse gas (GHG) emissions, even if defined broadly, are not material information for participants or investors in derivatives and commodities markets because such firm- or industry/sector-specific emissions would yield future climate impacts effectively equal to zero. Even GHG emissions for the U.S. economy as a whole yield future impacts barely greater than the standard deviation of the surface temperature record. Accordingly, firm- or industry/sector-specific emissions cannot yield "risks" relevant for investors. Only under an assumption of government policies penalizing GHG emissions can such information be material, and such policies for the most part have not proven viable politically.

The estimation of climate "risks" attendant upon the operation of derivatives and commodities markets would be futile, politicized, distorted by an imperative to avoid regulatory and litigation threats, and largely arbitrary. Global GHG emissions can be material, but the model-driven estimation of global risks has proven difficult in the extreme, subject to profound disagreement in the peer-reviewed literature. That reality is demonstrated by the fact that the mainstream climate models used by the Intergovernmental Panel on Climate Change (IPCC) on average have overestimated the actual temperature record by a factor of over two.

The obvious effect of a prospective CFTC rule mandating the disclosure of climate "risks" would be creation of powerful incentives for suppliers of investment products in derivatives and commodities markets to undertake climate analysis driven not by the actual evidence and the peer-reviewed literature on climate phenomena. Instead, they will be driven to undertake such analysis, whether in response to regulatory directives or to political pressures, under assumptions and methodologies insulating them from adverse regulatory actions and litigation threats. This incentive structure would yield politicized analysis biased heavily toward published estimation of climate "risks" greater rather than smaller on the part of the suppliers of investment products in derivatives and commodities markets, with no material benefits for investors. This would provide regulators and other public officials a rationale for constraining capital access for disfavored firms and sectors, resulting in a misallocation of capital and a reduction in aggregate economic performance, with no measurable climate benefits. A possible future rule on such "risk" disclosures could not satisfy any plausible benefit/cost test, and should be discarded.

The litigation problem is created by virtually any "risk" analysis. Should, say, a severe storm follow a conclusion by a supplier of investment products in derivatives and commodities markets that climate risks are unimportant in its specific context, the plaintiff attorneys will not be far behind, even though attribution of a given weather event to GHG emissions generally, and *a fortiori* to emissions attributable to a given firm or industry/sector is deeply problematic. Should a supplier of investment products calculate its GHG emissions as high relative to other suppliers or sectors, it will expose itself to purported causes of action as a "cause" of the asserted costs of the anthropogenic climate change "crisis." A future CFTC rule would guarantee adverse litigation for the suppliers of investment products under almost any set of assumptions, an important economic cost that the CFTC must bear in mind.

No supplier of investment products covered by CFTC rules and few, if any, government administrative agencies are in a position to evaluate climate phenomena, whether ongoing or prospective, with respect to which the scientific uncertainties are vastly greater than commonly asserted. The range of alternative assumptions about central parameters is too great to yield clear implications for the climate "risks" facing specific commodity and derivatives markets, economic sectors, and geographic regions. Those central parameters include the choices among climate models, the assumed sensitivity of the climate system to increases in the atmospheric concentration of greenhouse gases (GHG), ensuing conclusions about the relative contributions of natural and anthropogenic influences upon climate phenomena, the assumed future increase in atmospheric GHG concentrations through, say, 2100, and the analytic assumptions underlying calculations of the effects of a large number of phenomena, and example of which is the impact of aerosol emissions on cloud formation, about which surprisingly little is known. That short list is very far from exhaustive.

This reality cannot be circumvented by a reliance on climate models however sophisticated. The certain emergence of climate consulting firms to "assist" in such "risk" analysis will not solve the underlying estimation problem because they will not have access to models or analytic expertise more useful than those available generally. Again: The mainstream climate models have a poor track record in terms of predicting the actual temperature trend of recent decades, having consistently overstated that trend by a factor of over two.

Application of the Environmental Protection Agency climate model suggests strongly that climate policies, whether implemented by the U.S. government alone or as an international cooperative policy, would have temperature effects by 2100 that would be virtually undetectable or very small. Such policies cannot satisfy any plausible benefit/cost test.

If the suppliers of the relevant investment products are driven to use the same (or similar) sets of assumptions about central parameters, a very real danger would arise of more-or-less homogeneous predictions inconsistent with historical, ongoing, and prospective climate phenomena. If they opt to use sets of assumptions that differ in important dimensions, the ensuing predictions about future climate phenomena ("risks") would vary substantially, yielding very large uncertainties in terms of the "information" (assertions) made available to participants in commodities and derivatives markets.

It is reasonable to hypothesize also that the aggregate benefits (that is, positive "risks") of increasing GHG concentrations, as reported by the National Oceanic and Atmospheric Administration and in the peer-reviewed literature, will be excluded from such analytic efforts. It is reasonable to hypothesize further that such analyses will exclude the risks of climate policies, prominent among which are the large and adverse implications of artificial increases in energy costs. Such policy risks are likely to be greater when implemented by bureaucracies insulated from democratic accountability.

Anthropogenic climate change is "real" in that increasing atmospheric concentrations of GHG have yielded effects that are detectable. But they are much smaller than commonly asserted; and there is no evidence in support of the ubiquitous assertions of a climate "crisis," whether ongoing or looming, and no evidence in support of the even more extreme "existential

threat" argument. Moreover, the available analysis suggests that the economic risks of anthropogenic climate change in the aggregate are much smaller than many assert: Both the central integrated assessment model and the IPCC in its most alarmist analyses calculate that anthropogenic climate change unmitigated by policy initiatives would reduce global per capita incomes by less than 1.5 percent by the end of this century, a figure almost certainly not statistically significant, and in any event at a time when the world is certain to be vastly wealthier than currently.

Because the perceived "climate "risks" confronting commodities and derivatives markets are dependent upon crucial choices among alternative assumptions, the evaluation of such "risks" would be largely arbitrary given that the "correct" assumptions are very far from obvious. This means that a future CFTC requirement, whether formal or informal, that climate "risks" be reported to investors would yield no useful information at best, and confusion for at least some.

"Materiality" in the CFTC context must mean the provision of ("risk") information directly relevant to the ongoing or prospective returns to the investment instruments under consideration. When "risk" analysis becomes an arbitrary function of choices among assumptions complex, opaque, and far from obvious, the traditional materiality standard inexorably will be diluted and rendered far less useful for the commodities and derivatives markets, an outcome diametrically at odds with the ostensible objectives of those advocating the evaluation of climate "risks." Moreover, the "risks" of anthropogenic climate change are far from the only such mass-geography "risks." A bias toward focusing only on climate "risks" would distort the allocation of capital.

Note that the concept of "risk" by its very nature implies a range of possible outcomes delineated by a statistical distribution of likelihoods around some mean and with some standard deviation. "Uncertainty" clearly is a more accurate term than "risk" in this context, in that the mean and/or standard deviation of the relevant statistical distributions are very unlikely to be known. The reality is that a "climate risk" disclosure requirement would be deeply speculative, and the level of detail and the scientific sophistication that would be needed to satisfy such a requirement is staggering. Such "disclosures" and supporting analysis and documentation would take up thousands of pages, with references to thousands more, and the premise that this "disclosure" requirement would facilitate improved decision making by investors in instruments covered by CFTC rules is difficult to take seriously.

The combination of very great climate uncertainties and the litigation threat will create a demand from the suppliers of the investment products covered by CFTC rules for detailed regulations on how to structure the analysis of climate risks. Because the uncertainties attendant upon the future effects of increasing atmospheric concentrations of GHG are so great, a top-down regulatory approach for the evaluation of any attendant "risks" is itself very risky. A wiser approach would entail allowing market forces to make such "risk" determinations in a bottom-up fashion without regulatory mandates, thus avoiding an obvious politicization of the allocation of capital.

The proposed rule would distort the allocation of capital away from economic sectors disfavored by certain political interest groups pursuing ideological agendas. This would represent

the return of Operation Choke Point, an illegal past attempt to politicize access to capital, one deeply corrosive of our legal and constitutional institutions.

Note also that the implicit premise that market forces will not induce the full disclosure of even material risks as a matter of competitive market outcomes in the absence of regulatory mandates is not correct. It ignores the powerful long-term incentives of the suppliers of investment products — always interested in maximizing the value of the instruments that they offer — to preserve their credibility by offering full and truthful information to the capital market. It is perhaps unsurprising that regulators might view market incentives as insufficient to engender an efficient outcome in terms of resource allocation, and that a regulatory strengthening of such incentives automatically would yield an allocational improvement. That stance is very far from obviously correct.

Protection of those institutions is consistent only with formal policymaking by the Congress through enactment of legislation, rather than with powerful pressures, whether formal or informal, exerted by the CFTC or other regulatory agencies. This institutional protection would preserve the traditional roles of the private sector and of the government, respectively, as part of the larger permanent objectives of maximizing the productivity of resource use under free market competition, and of preserving the political accountability of the policymaking process under the institutions of democratic decisionmaking as constrained by the constitution.

I. Climate Uncertainties and Choices Among Crucial Assumptions

Notwithstanding ubiquitous assertions that climate science is "settled," that a crisis is upon us or looming large, and that government policies must address the "existential threat" posed by anthropogenic climate change, in reality the uncertainties attendant upon the prospective effects of increasing atmospheric concentrations of greenhouse gases (GHG) are very substantial.[2] Moreover, no evidence supports the "crisis" narrative, as discussed below. These realities are illustrated by the ranges of various estimates published by the Intergovernmental Panel on Climate Change (IPCC) in its most recent Assessment Reports, by the wide range of temperature paths projected by the mainstream climate models, and by the scientific literature more generally.[3]

The evaluation of climate "risks" afflicting the relevant investment instruments would require choices among the available climate models — as noted above, the "safe" choice for firm managers would be the EPA model — choices among alternative assumptions about the path of

[2] See, e.g., Benjamin Zycher at https://www.nationalaffairs.com/publications/detail/the-case-for-climate-change-realism.

[3] See, e.g., Box SPM.1 on alternative paths for future temperature changes in the IPCC Sixth Assessment Report, at https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf; and Figure 2.5 in the IPCC Fifth Assessment Report (2013), at https://www.ipcc.ch/report/ar5/syr/synthesis-report/. On the wide range of temperature projections yielded by the mainstream climate models, see Figure 2 in the testimony of John R. Christy before the U.S. House Committee on Science, Space, and Technology, March 29, 2017, at https://science.house.gov/imo/media/doc/Christy%20Testimony_1.pdf?1. On the general state of scientific uncertainty in the context of climate phenomena, see e.g., Judith Curry, "Uncertainty About the Climate Uncertainty Monster," *Climate Etc.*, May 19, 2017, at https://judithcurry.com/2017/05/19/uncertainty-about-the-climate-uncertainty-monster/.

future atmospheric concentrations of GHG, choices among assumptions about the effect of increasing GHG concentrations upon the climate system, that is, the "sensitivity" of the climate system and thus the relative importance of natural and anthropogenic influences upon climate phenomena, and deeply problematic assumptions about such feedback effects as cloud formation and precipitation dynamics, which are understood only poorly.[4] That list is very far from exhaustive.

The mainstream climate models have found it very difficult to predict the historical and current climate record even in terms of global averages; as an example, the models have been unable to explain the warming observed from 1910-1945.[5] That period of warming cannot have been the result of increased atmospheric concentrations of GHG, in that such concentrations had increased only from about 278 ppm in 1750 to about 300 ppm by 1910, and 310 ppm by 1945.[6]

Another example: Every climate model predicts that increasing atmospheric concentrations of GHG should result in an enhanced heating effect in the mid- and upper troposphere over the tropics. The satellite, weather balloon (radiosonde), and reanalysis data for the most part do not show that effect; some analyses find it, but at a level orders of magnitude smaller than predicted by the models.[7] In the latest iteration (CMIP-6) of the suite of climate models, applied in the 6th Assessment Report, the average predicted tropospheric temperature increase for 1979-2019 is 0.40 degrees C per decade. (The CMIP-5 suite of models on average predicted 0.44 degrees C per decade for 1979-2019; accordingly, there has been little improvement in the average performance of the models over the past eight or so years despite substantial expenditures on such research.) The actual record as measured by the satellites: 0.16 degrees C per decade.[8] The climate models on average have overstated the temperature record by a factor of more than two.

Consider only the effect of varying assumptions about the future path of atmospheric GHG concentrations. IPCC in the 5th (2013) Assessment Report used four such alternative paths:

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[4] See, e.g., Judith Curry, "The Cloud-Climate Conundrum," *Climate Etc.*, June 2, 2016, at https://judithcurry.com/2016/06/02/the-cloud-climate-conundrum/.

[5] See the HadCRUT5 reconstructions of temperature anomalies at https://crudata.uea.ac.uk/cru/data/temperature/. Interestingly enough, the Russian climate models from the Institute for Numerical Mathematics (models INM-CM4 and INM-CM4.8) do the best job of predicting the past and the present. See http://www.glisaclimate.org/node/2220 and https://www.researchgate.net/publication/329748540_Simulation_of_the_modern_climate_using_the_INM-CM48_climate_model.

[6] See the NOAA reconstruction of carbon dioxide emissions and concentrations for 1750-2019 at https://www.climate.gov/sites/default/files/CO2_emissions_vs_concentrations_1751-2019_lrg.gif.

[7] The tropics for the most part are water, and emissions of additional GHG would warm the earth slightly, resulting in an increase in ocean evaporation. In the climate models, as the water vapor rises into the mid troposphere, it condenses, releasing heat. This seems straightforward, but efforts to demonstrate this phenomenon with satellite measurements have proven very difficult. See Ross McKitrick and John R. Christy, "Pervasive Warming Bias in CMIP6 Tropospheric Layers," *Earth and Space Science*, Vol. 7, Issue 9 (September 2020), at https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2020EA001281; and Ross McKitrick, "New Confirmation That Climate Models Overstate Atmospheric Warming," *Climate Etc.*, August 25, 2020, at https://judithcurry.com/2020/08/25/new-confirmation-that-climate-models-overstate-atmospheric-warming/.

[8] See the Coupled Model Intercomparison Project, Phase 6, at https://pcmdi.llnl.gov/CMIP6/. See also, e.g., the recent presentation by Professor John R. Christy at https://www.youtube.com/watch?v=D2Cd4MLUoN0.

Representative Concentrations Pathways 2.6, 4.5, 6, and 8.5.[9] The 6th Assessment Report replaces the RCPs with "Shared Socio-Economic Pathways (SSPs) that for benefit/cost analytic purposes do not differ in any material dimension from the RCPs; instead IPCC claims that the SSPs "look at a far greater range of options/scenarios" with "a greater focus on lower degrees of warming … like 1.5°C and 2°C."[10] The IPCC characterization of warming of 1.5°C and 2°C as "lower" is laughable, in that the satellite temperature record for the middle troposphere for 1979-2021 shows a warming trend of about 0.16°C per decade, or 1.6°C per century.[11] The following table illustrates the range of temperature effects ("anomalies") by 2100 under the four RCPs.

Central Parameters of IPCC AR5 RCP Scenarios

	-------Representative Concentration Pathway------			
Year 2100	2.6	4.5	6	8.5
GHG concentration (ppm)	490	650	850	1370
Average increase 2018-2100 (ppm)	1.1	3.0	5.5	11.9
Temperature anomaly 2100 (°C)	1.5	2.4	3.0	4.9

Source: G.P. Wayne, "The Beginner's Guide to Representative Concentration Pathways," *Skeptical Science*, August 2013.
Note: RCP 2.6 (sometimes denoted RCP3PD) predicts radiative forcing of 3 Wm^2 before 2100, declining to 2.6 Wm^2 by 2100. "PD" stands for "peak and decline."

Neither the CFTC nor other government agencies nor the suppliers of investment products are in a position to evaluate the strengths and weaknesses of alternative RCP assumptions, or of the other crucial parameters underlying climate projections — "risks" — in the context of GHG emissions.[12] The IPCC in the 2013 Assessment Report provides a range of estimates for the "likely" equilibrium sensitivity of the climate system of 1.5 degrees to 4.5

[9] The figures (2.6, etc.) are not temperature effects; they are theoretical calculations of "radiative forcings" in watts per square meter. For an introduction, see G.P. Wayne, "The Beginner's Guide to Representative Concentration Pathways," *Skeptical Science*, August 2013, at https://skepticalscience.com/docs/RCP_Guide.pdf.
[10] See https://www.ipcc.ch/site/assets/uploads/2021/06/Fact_sheet_AR6.pdf.
[11] See https://www.drroyspencer.com/latest-global-temperatures/ and the links shown for the respective atmospheric layers. See also CMIP-5 at https://pcmdi.llnl.gov/mips/cmip5/; and CMIP-6 at https://pcmdi.llnl.gov/CMIP6/.
[12] Note that RCP8.5 is a popular assumption among those advocating strong climate policies, but it is a scenario essentially impossible. Under RCP8.5, atmospheric concentrations of GHG rise at almost 12 parts per million (ppm) through 2100 as an annual average; the average for 1985-2019 was about 1.9 ppm, and the single largest increase was about 3 ppm in 2016. See the data reported by NOAA at https://www.esrl.noaa.gov/gmd/ccgg/trends/global.html. See Kevin Murphy, "Reassessing the RCPs," *Climate Etc.*, January 28, 2019, at https://judithcurry.com/2019/01/28/reassessing-the-rcps/; and Judith Curry, "Is RCP8.5 An Impossible Scenario?", *Climate Etc.*, November 24, 2018, at https://judithcurry.com/2018/11/24/is-rcp8-5-an-impossible-scenario/.

degrees, with a mean of 3 degrees.[13] Many of the more extreme or "alarmist" assertions of the effects of anthropogenic climate change assume RCP8.5 and a climate sensitivity of 4.5 degrees (or even higher). The numerous estimates reported in the peer-reviewed literature do not support that assumption, instead supporting an assumption of 2 degrees or even less; the range estimated from the actual data is 1.5 to 2.3 degrees C.[14] IPCC in the AR6 changed the "likely" ECS range to 2.5-4 degrees, with a median of 3.25 degrees, higher than in the AR5, despite the findings in the recent peer-reviewed literature.[15]

Again with respect to the enormous complexities inherent in the analysis of climate phenomena and "risks": Neither the CFTC nor other government agencies nor the suppliers of the relevant investment products are in a position to evaluate them in ways that would yield useful information for investors. Even government agencies and international bodies wholly dedicated to such analyses find the task daunting, yielding formidable scientific complexities and controversies. Instead, the suppliers will be driven to adopt assumptions — actually, to retain consultants who will do so — minimizing the degree to which their analyses might subject them to political attacks, adverse regulatory actions, and litigation.[16] This is very different from an objective effort to evaluate climate phenomena and to estimate a reasonable range of prospective effects of increasing GHG concentrations, that is, climate "risks."

The combination of very great climate uncertainties and the litigation and regulatory threats will create a demand from the business sector for detailed regulations on how to structure the analysis of climate risks. Regulatory agencies are hardly better suited to conduct such analysis in an objective and neutral manner. Both the suppliers of investment products and government agencies will have powerful incentives to use the EPA climate model, used by most federal agencies to evaluate the effects of climate policies; precisely because it is the U.S. government model, it would be difficult to attack the suppliers of investment products, or their consultants, for choosing it.[17] For the earlier suite of climate models (CMIP-5), the EPA model provided predictions close to the average of those models under a given set of underlying assumptions, equilibrium climate sensitivity in particular. For the new suite (CMIP-6), the EPA model provides predictions cooler than the average of those models, not because the EPA model now is providing predictions more consistent with the historical evidence, but because the CMIP-6 models have incorporated a range of climate sensitivity assumptions and estimates higher on

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[13] The equilibrium sensitivity of the climate system is the temperature increase that would result from a doubling of atmospheric concentrations of GHG, after the climate system were to adjust fully.

[14] See Patrick J. Michaels and Paul C. Knappenberger, *Lukewarming: The New Climate Science That Changes Everything*, Washington D.C.: Cato Institute, 2016; and the recent presentation by Professor John R. Christy at https://www.youtube.com/watch?v=D2Cd4MLUoN0.

[15] See p. 93 at https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_TS.pdf. The equilibrium sensitivity of the climate system is the temperature increase that would result from a doubling of atmospheric concentrations of GHG, after the climate system were to "finalize" all attendant adjustments. See also https://judithcurry.com/2021/10/06/ipcc-ar6-breaking-the-hegemony-of-global-climate-models/#:~:text=With%20regards%20to%20equilibrium%20climate,range%20to%202.5%2D4.0%20C.

[16] This is discussed further below in section V.

[17] This is the Model for the Assessment of Greenhouse Gas Induced Climate Change (MAGICC), at www.magic.org. The summary analysis presented below uses version 5.3. Versions 6.0 and 7.0 are available, but the differences in predictions on temperatures and other climate phenomena are trivial.

average than those in the CMIP-5 iteration.[18]

Again, suppliers of investment products conducting climate "risk" analysis will have powerful incentives to choose among assumptions on future emissions and atmospheric concentrations, climate sensitivity, and other crucial parameters so as to insulate themselves from political attack, adverse regulatory actions, and litigation. They thus will be led toward analytic homogeneity, yielding a very real danger of an artificial "risk" "consensus" regardless of the actual evidence, and perhaps largely inconsistent with it. Any such consensus would be an artifact of the political pressures and litigation and regulatory risks to which they would be subjected; it would have nothing to do with "science" and certainly would not provide investors with material information. Moreover, these perverse incentives imply directly that any rule mandating the disclosure of climate risks to investors would provide no actual information improving investment choices.

If, implausibly, those conducting climate "risk" analysis were to opt to use models and/or sets of assumptions that differ in important dimensions, the ensuing predictions about future climate phenomena ("risks") would vary substantially or hugely, yielding very large uncertainties in terms of "risk" implications. What would the CFTC do under that condition, how would the suppliers respond, and — again — what would such decisions have to do with "science"?

Those political pressures will lead suppliers of investment products and the CFTC and other relevant government agencies not to consider the benefits of increasing atmospheric concentrations of GHG, as reported by the National Oceanic and Atmospheric Administration (NOAA), and in the peer-reviewed literature. Examples are planetary greening, increased agricultural productivity, increased water use efficiency by plants, and reduced mortality from cold.[19] Nor will such analysis include important dimensions of the adverse impacts of government climate policies, which as a core imperative must have the effect of increasing energy costs artificially, notwithstanding common assertions that alternative energy sources are competitive in terms of costs.[20] In short, government policies that force or induce the suppliers of investment products to evaluate the climate "risks" confronting their operations and markets will yield confusion rather than material information. One result of such confusion would be important distortions in capital markets due to a weighting of climate "risks" above those posed by other important phenomena, whether natural or manmade.

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[18] Private communication with Professor John R. Christy, March 14, 2021. See also CMIP-5 at https://pcmdi.llnl.gov/mips/cmip5/; and CMIP-6 at https://pcmdi.llnl.gov/CMIP6/.

[19] On the carbon dioxide "greening" effect see NOAA at https://www.nasa.gov/feature/goddard/2016/carbon-dioxide-fertilization-greening-earth; and Zaichun Zhu, *et. al.*, "Greening of the Earth and Its Drivers," *Nature Climate Change*, Vol. 6 (2016), pp. 791-795, at https://www.nature.com/articles/nclimate3004. On the agricultural productivity effects, see, e.g., Goudriaan and Unsworth at https://acsess.onlinelibrary.wiley.com/doi/abs/10.2134/asaspecpub53.c8. On water use efficiency by plants, see, e.g., http://www.co2science.org/subject/w/summaries/wateruse.php. On the beneficial impacts of moderate warming on mortality, see https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(14)62114-0/fulltext.

[20] See Benjamin Zycher, *The Green New Deal: Economics and Policy Analytics*, American Enterprise Institute, 2019, at http://www.aei.org/wp-content/uploads/2019/04/RPT-The-Green-New-Deal-5.5x8.5-FINAL.pdf?x91208. See also the Energy Information Administration at https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf, Table 1b (including the costs of backup by gas turbines or battery systems); and the Institute for Energy Research at https://www.instituteforenergyresearch.org/wp-content/uploads/2019/06/IER_LCOE2019Final-.pdf.

II. The Evidence on Climate Phenomena and the Effects of Climate Policies in the EPA Climate Model

The available body of evidence does not support the ubiquitous assertions that a climate "crisis" is upon us or looming large. This means that the asserted climate "risks" threatening the pecuniary interests of investors in instruments covered by CFTC rules are far less obvious than often assumed.

That anthropogenic climate change is "real" — that increasing GHG concentrations are having detectable effects — is incontrovertible, but that does not tell us the magnitude of the observable impacts, which must be measured empirically. Temperatures are rising, but as the Little Ice Age ended no later than 1850, it is not easy to separate natural from anthropogenic effects on temperatures and other climate phenomena.[21] The latest research in the peer-reviewed literature suggests that mankind is responsible for about half of the approximate temperature increase of 1.1 degrees C since 1880.[22]

The "crisis" assertions are unsupported by the evidence reported in the peer-reviewed, official, or scientific literature. There is little trend in the number of "hot" days for 1895–2017; 11 of the 12 years with the highest number of such days occurred before 1960.[23] NOAA has maintained since 2005 the U.S. Climate Reference Network, comprising 114 meticulously maintained temperature stations spaced more or less uniformly across the lower 48 states, 21 stations in Alaska, and two stations in Hawaii.[24] They are placed to avoid heat island effects and other such distortions as much as possible; the reported data show no trend over the available 2005–20 reporting period.[25] A NOAA reconstruction of global temperatures over the past one

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[21] On the surface (land/ocean) temperature record, see UK Met Office, Hadley Centre/University of East Anglia Climatic Research Unit, "Tim Osborn: HadCRUT4 Global Temperature Graphs," https://crudata.uea.ac.uk/~timo/diag/tempdiag.htm. On the Little Ice Age, see Michael E. Mann, "Little Ice Age," in *Encyclopedia of Global Environmental Change, Volume 1: The Earth System: Physical and Chemical Dimensions of Global Environmental Change*, ed. Michael C. MacCracken, John S. Perry and Ted Munn (Chichester, England: John Wiley & Sons, 2002), http://www.meteo.psu.edu/holocene/public_html/shared/articles/littleiceage.pdf.

[22] See https://crudata.uea.ac.uk/cru/data/temperature/HadCRUT5.0Analysis_300.png. See also Ross McKitrick and John Christy, "A Test of the Tropical 200- to 300 hPa Warming Rate in Climate Models"; Nicholas Lewis and Judith Curry, "The Impact of Recent Forcing and Ocean Heat Uptake Data on Estimates of Climate Sensitivity," *Journal of Climate* 31 (August 2018): 6051–71, https://journals.ametsoc.org/doi/pdf/10.1175/JCLI-D-17-0667.1; and John R. Christy and Richard McNider, "Satellite Bulk Tropospheric Temperatures as a Metric for Climate Sensitivity," *Asia-Pacific Journal of Atmospheric Sciences* 53 (2017): 511–18, https://link.springer.com/article/10.1007/s13143-017-0070-z. For a chart summarizing the recent empirical estimates of equilibrium climate sensitivity as reported in the peer-reviewed literature, see Patrick J. Michaels and Paul C. Knappenberger, "The Collection of Evidence for a Low Climate Sensitivity Continues to Grow," Cato Institute, September 25, 2014, https://www.cato.org/blog/collection-evidence-low-climate-sensitivity-continues-grow.

[23] For the reconstruction of the NASA data, see John R. Christy, "Average per Station (1114 USHCN Stations) 1895–2017: Number of Days Daily Maximum Temperature Above 100˚F and 105˚F," drroyspencer.com, http://www.drroyspencer.com/wp-content/uploads/US-extreme-high-temperatures-1895-2017.jpg.

[24] For the Climate Reference Network program description, see National Centers for Environmental Information, "U.S. Climate Reference Network," https://www.ncdc.noaa.gov/crn/.

[25] For a visualization of a prototypical station, see Willis Eschenbach, "NOAA's USCRN Revisited—No Significant Warming in the USA in 12 Years," Watts Up with That?, November 8, 2017, https://wattsupwiththat.com/2017/11/08/the-uscrn-revisited/. For the monthly data and charts reported by the National Oceanic and Atmospheric Administration (NOAA), see National Oceanic and Atmospheric

million years, using data from ice sheet formations, shows that there is nothing unusual about the current warm period.[26]

Global mean sea level has been increasing at about 3.3 mm per year since satellite measurements began in 1992. The tidal-gauge data before then show annual increases of about 1.9 mm per year, but that comparison does not show an acceleration in sea-level rise because the two datasets are not comparable. The tidal gauges do not measure sea levels *per se*; they measure the difference between sea levels and "fixed" points on land that in reality might not be fixed due to seismic activity, tectonic shifts, land settlement, etc. Accordingly, the data are unclear as to whether there is occurring an acceleration in sea level rise; it is reasonable to hypothesize that there has been such an acceleration simply because temperatures are rising due to both natural and anthropogenic influences, as noted above, and such increases should result in more melting ice and the thermal expansion of water. But because rising temperatures are the result of both natural and anthropogenic causes, we do not know the relative contributions of those causes to any such acceleration.[27]

The Northern and Southern Hemisphere sea ice changes tell different stories; the arctic sea ice has been declining, while the Antarctic sea ice has been stable or growing.[28] U.S. tornado

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Administration, "National Temperature Index," https://www.ncdc.noaa.gov/temp-and-precip/national-temperature-index/time-series?datasets%5B%5D=uscrn&parameter=anom-tavg&time_scale=p12&begyear=2005&endyear=2020&month=8.

[26] See R. Bintanja and R. S. W. van de Wal, "North American Ice-Sheet Dynamics and the Onset of 100,000-Year Glacial Cycles," *Nature* 454, no. 7206 (August 14, 2008): 869–72, https://www.researchgate.net/publication/23171740_Bintanja_R_van_de_Wal_R_S_W_North_American_ice-sheet_dynamics_and_the_onset_of_100000-year_glacial_cycles_Nature_454_869-872. NOAA published the underlying data at R. Bintanja and R. S. W. van de Wal, "Global 3Ma Temperature, Sea Level, and Ice Volume Reconstructions," National Oceanic and Atmospheric Administration, August 14, 2008, https://www.ncdc.noaa.gov/paleo-search/study/11933. For a chart showing the temperature record over one million years, see Institute for Energy Research, "Temperature Fluctuations over the Past Million Years," https://www.instituteforenergyresearch.org/wp-content/uploads/2020/03/temperature-flucturations.png.

[27] See Frederikse *et. al.* at https://www.nature.com/articles/s41586-020-2591-3. As a crude approximation, the data suggest that about two-thirds of such sea level increases are due to ice melt, and one-third to thermal expansion of water. See Judith Curry, "Sea Level and Climate Change," Climate Forecast Applications Network, November 25, 2018, https://curryja.files.wordpress.com/2018/11/special-report-sea-level-rise3.pdf. Curry cites research from Xianyao Chen and colleagues, the central finding of which is that "global mean sea level rise increased from 2.2 ± 0.3 mm/year in 1993 to 3.3 ± 0.3 mm/year in 2014." See Xianyao Chen et al., "The Increasing Rate of Global Mean Sea-Level Rise During 1993–2014," *Nature Climate Change* 7 (June 26, 2017): 492–95, https://www.nature.com/articles/nclimate3325. Whether the trend from a 21-year period can yield important inferences is a topic not to be addressed here. For a different empirical conclusion from the tidal gauge record, see J. R. Houston and R. G. Green, "Sea-Level Acceleration Based on U.S. Tide Gauges and Extensions of Previous Global-Gauge Analyses," *Journal of Coastal Research* 27, no. 3 (May 2011): 409–17, https://meridian.allenpress.com/jcr/article-abstract/27/3/409/28456/Sea-Level-Acceleration-Based-on-U-S-Tide-Gauges?redirectedFrom=fulltext. For an example of temporary rapid sea-level rise in the 18th century, see W. R. Gehrels et al., "A Preindustrial Sea-Level Rise Hotspot Along the Atlantic Coast of North America," *Geophysical Research Letters* 47 (2020), https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2019GL085814. For further reported evidence of an acceleration, see Hans-Otto Pörtner et al., *Special Report on the Ocean and Cryosphere in a Changing Climate*, Intergovernmental Panel on Climate Change, 2019, https://www.ipcc.ch/srocc/.

[28] See https://www.thegwpf.org/content/uploads/2021/12/Bates-Sea-Ice-Trends.pdf?mc_cid=dac7df538b&mc_eid=ad653edd6d; and https://www.thegwpf.org/content/uploads/2022/04/Humlum-State-of-Climate-2021-.pdf?mc_cid=dac7df538b&mc_eid=ad653edd6d. See also Patrick J. Michaels, "Spinning Global Sea Ice," Cato

activity shows either no trend or a downward trend since 1954.[29] Tropical storms, hurricanes, and accumulated cyclone energy show little trend since satellite measurements began in the early 1970s.[30] The number of U.S. wildfires shows no trend since 1985, and global acreage burned has declined over past decades.[31] The Palmer Drought Severity index shows no trend since 1895.[32] U.S. flooding over the past century is uncorrelated with increasing GHG concentrations.[33] The available data do not support the ubiquitous assertions about the dire impacts of declining pH levels in the oceans.[34] Global food availability and production have increased more or less monotonically over the past two decades on a per capita basis.[35] The IPCC itself in the *Fifth Assessment Report* was deeply dubious about the various severe effects often asserted to be looming as impacts of anthropogenic warming, and the IPCC analysis in the *Sixth Assessment Report* is almost identical.[36]

If we apply the Environmental Protection Agency climate model, under the highest IPCC climate sensitivity assumption (4.5 degrees C as reported in the AR5), net-zero U.S. GHG emissions effective immediately would yield a reduction in global temperatures of 0.173 degrees C by 2100. That effect would be barely detectable given the standard deviation (about 0.11 degrees C) of the surface temperature record.[37] The entire Paris agreement: about 0.178 degrees C. A 50 percent reduction in Chinese GHG emissions: 0.184 degrees C. Net-zero emissions by the entire Organization for Economic Cooperation and Development: 0.352 degrees C. A global

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Institute, February 12, 2015, https://www.cato.org/blog/spinning-global-sea-ice. It appears to be the case that the Antarctic eastern ice sheet — about two-thirds of the continent — is growing, while the western ice sheet (and the peninsula) may be shrinking. No agreed explanation for this phenomenon is reported in the literature.

[29] For the historical data reported by the NOAA, see National Ocean and Atmospheric Administration, "Historical Records and Trends," https://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornado-climatology/trends.

[30] For data on global tropical cyclone activity, see Ryan N. Maue, "Global Tropical Cyclone Activity, updated March 16, 2021, at http://climatlas.com/tropical/.

[31] For the reported U.S. wildfire data, see National Interagency Fire Center, "Total Wildland Fires and Acres (1926–2019)," https://www.nifc.gov/fireInfo/fireInfo_stats_totalFires.html. On the decline in global area burned over past decades, see Stefan H. Doerr and Cristina Santin, "Global Trends in Wildfire and Its Impacts: Perceptions Versus Realities in a Changing World," *Philosophical Transactions of the Royal Society of London, Series B, Biological Sciences* 371, no. 1696 (2016), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4874420/pdf/rstb20150345.pdf.

[32] See US Environmental Protection Agency, "Climate Change Indicators: Drought," https://www.epa.gov/climate-indicators/climate-change-indicators-drought; and US Department of Commerce, National Climatic Data Center, "Divisional Data Select," https://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp.

[33] See R. M. Hirsch and K. R. Ryberg, "Has the Magnitude of Floods Across the USA Changed with Global CO_2 Levels?," *Hydrological Sciences Journal* 57, no. 1 (2012): 1–9, https://www.tandfonline.com/doi/full/10.1080/02626667.2011.621895?scroll=top&needAccess=true&.

[34] See CO_2 Science, "Ocean Acidification Database," http://www.co2science.org/data/acidification/results.php. See also Alan Longhurst, *Doubt and Certainty in Climate Science*, pp. 214–25, https://curryja.files.wordpress.com/2015/09/longhurst-print.pdf.

[35] See Food and Agriculture Organization of the United Nations, *World Food and Agriculture Statistical Pocketbook 2018*, 2018, Charts 28 and 46, http://www.fao.org/3/CA1796EN/ca1796en.pdf. See also Kevin D. Dayaratna, Ross McKitrick, and Patrick J. Michaels, "Climate Sensitivity, Agricultural Productivity and the Social Cost of Carbon in FUND," *Environmental Economics and Policy Studies* 22 (2020): 433–48.

[36] Julie M. Arblaster et al., "Long-Term Climate Change: Projections, Commitments and Irreversibility—Final Draft Underlying Scientific-Technical Assessment," in *Working Group I Contribution to the IPCC Fifth Assessment Report (AR5), Climate Change 2013: The Physical Science Basis*, September 23–26, 2013, p. 12–78, http://www.climatechange2013.org/images/uploads/WGIAR5_WGI-12Doc2b_FinalDraft_Chapter12.pdf. See also the AR6 at p. 12-115 at https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf.

[37] See https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/1999JD900835.

50 percent reduction in GHG emissions implemented immediately and maintained strictly would reduce global temperatures in 2100 by 0.687 degrees C.[38] Note that GHG emissions in 2020 fell by about 6.4 percent as a result of the COVID-19 economic downturn.[39] Can anyone believe that even larger GHG reductions — and the attendant economic costs — are plausible politically? Is there a believable benefit/cost model that would justify such policies?

III. Observations on the Materiality of Climate "Risks"

It is clear that those in support of the proposition that suppliers of investment products subject to CFTC rules evaluate the "risks" of anthropogenic climate change posed their investors view such analyses as "material" in terms of disclosures to investors. Several problems are attendant upon that premise, in substantial part for the reasons discussed above. Any such projections of climate phenomena and resulting "risks" to investors — far into the future — are very far from trivial methodologically. Which climate model(s) should businesses use? Which assumptions about future emissions, about the sensitivity of the climate system, about policies to be adopted internationally, about the climate effects of those policies, *ad infinitum*, should suppliers of investment products incorporate into those models? What confidence should be attached to the predictions made by the models? Are those suppliers in a position to do such analysis in a credible fashion? If not, whom should they retain to do that analysis for them, and how should they evaluate the differences among the available alternative providers of such analyses?

Note that the concept of "risk" by its very nature implies a range of possible outcomes delineated by a statistical distribution of likelihoods around some mean and with some standard deviation. "Uncertainty" clearly is a more accurate term than "risk" in this context, in that the mean and/or standard deviation of the relevant statistical distributions are very unlikely to be known. The reality is that a "climate risk" disclosure requirement would be deeply speculative, and the level of detail and the scientific sophistication that would be needed to satisfy such a requirement is staggering. Such "disclosures" and supporting analysis and documentation would take up thousands of pages, with references to thousands more, and the premise that this "disclosure" requirement would facilitate improved decision making by investors in the relevant investment instruments covered by CFTC rules is difficult to take seriously.

If climate "risks" are deemed material in terms of disclosure requirements, why not others that are uncertain or speculative? Climate "risks" are hardly the only ones potentially relevant to investors in commodities and derivative instruments, and all are difficult to evaluate and to incorporate into investment decisions. What about massive volcanic eruptions? Asteroid impacts? Powerful earthquakes? Tsunamis? The potential problem of mass contagion is one with which we are far more familiar now than was the case only somewhat more than two years ago. The use of bioweaponry by terrorists, nuclear war, gamma ray storms, and on and on. Is climate "risk" the most important? If that is the hypothesis, what is the basis for it? Why are those others, and many more, not worthy of incorporation into disclosure requirements for suppliers of investment products? What distortions would result from attention only to climate change and not others?

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[38] Author computations using MAGICC 5.3. The MAGICC model can be found at http://www.magicc.org/.
[39] See https://www.nature.com/articles/d41586-021-00090-3.

Because the perceived "climate "risks" confronting investors in commodity and derivative instruments are dependent upon crucial choices among alternative assumptions, the evaluation of such "risks" would be largely arbitrary given that the "correct" assumptions are very far from obvious. This means that a requirement, whether formal or informal, that climate "risks" be disclosed by the relevant suppliers would weaken the materiality standard for disclosures by those institutions. "Materiality" in the CFTC context always has meant the disclosure of information directly relevant to investment decisions; when "risk" analysis becomes an arbitrary function of choices among assumptions complex, opaque, and far from obvious, the traditional materiality standard inexorably will be diluted and rendered far less useful for the relevant investment markets, an outcome diametrically at odds with the ostensible objectives of those advocating the evaluation of climate "risks."

Note also that the implicit premise that market forces will not induce the full disclosure of even material risks as a matter of competitive market outcomes in the absence of regulatory mandates is not correct. It ignores the powerful long-term incentives of the suppliers of investment products — always interested in maximizing the value of the instruments that they offer — to preserve their credibility by offering full and truthful information to the capital market.[40] It is perhaps unsurprising that regulators might view market incentives as insufficient to engender an efficient outcome in terms of resource allocation, and that a regulatory strengthening of such incentives automatically would yield an allocational improvement. That stance is very far from obviously correct.

IV. Benefit/Cost Analytic Parameters of Climate "Risk" Analysis

Note that the available analysis suggests that the prospective financial risks of anthropogenic climate change, at least in the aggregate, are much smaller than many assert. Consider the predictions from the integrated assessment models, the central one of which is the Dynamic Integrated Climate and Economy Model, for which William D. Nordhaus won the Nobel Prize in Economics in 2018.[41] Under DICE, global gross domestic product (GDP) in 2100 varies by about 3 percent across policy scenarios, including no climate policies at all, a figure that is both very small and almost certainly not statistically significant given the vagaries of economic forecasting and the number of years remaining before the end of this century. (I exclude here Nordhaus' "Stern discounting" policy scenario, as it assumes a discount rate effectively equal to zero, a fundamental analytic error.[42]) Per capita consumption varies only by

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[40] See, e.g., Benjamin Klein and Keith B. Leffler, "The Role of Market Forces in Assuring Contractual Performance," *Journal of Political Economy*, vol. 89, No. 4 (August 1981), pp. 615-641, at https://www.jstor.org/stable/1833028?seq=1.

[41] See William Nordhaus and Paul Sztorc, "DICE 2013R: Introduction and User's Manual," Yale University, Department of Economics, October 2013, Figure 4 and Table 1, http://www.econ.yale.edu/~nordhaus/homepage/homepage/documents/DICE_Manual_100413r1.pdf. See also Benjamin Zycher, "The Climate Left Attacks Nobel Laureate Willian D. Nordhaus," monograph, American Enterprise Institute, July 2020, at https://www.aei.org/wp-content/uploads/2020/07/The-Climate-Left-Attacks-Nobel-Laureate-William-D.-Nordhaus.pdf.

[42] See, e.g., David Kreutzer, "Discounting Climate Costs," Heritage Foundation, June 16, 2016, at https://www.heritage.org/environment/report/discounting-climate-costs. See Nicholas Stern, *The Economics of Climate Change: The Stern Review* (Cambridge, UK: Cambridge University Press, January 2007),

about 1.3 percent across policy scenarios, also a very small number and almost certain not to be statistically significant.

The IPCC — even in its most alarmist analyses — arrives at a conclusion very close to that reported in the DICE analysis. In a recent report, it finds that the damage from anthropogenic climate change unmitigated by policy initiatives will reduce global GDP by 2.6 percent by 2100.[43] By that year, IPCC projects that individual incomes on average will be at least 400 percent greater than is the case today.[44]

V. Additional Observations and Conclusions

No plausible list of the CFTC's areas of expertise includes climate science and policy, the central implication of which is straightforward: The CFTC does not actually understand what such a "disclosure" rule should demand, and the responses elicited by this Request for Information will not change that reality. The CFTC will not know precisely what it wants the relevant suppliers to "disclose." It will not know how suppliers subject to CFTC rules are to evaluate such hugely complex topics as future climate phenomena disaggregated by sector and geographic region. It will not know which climate model(s) the suppliers should use, what assumptions the suppliers should adopt on future atmospheric concentrations of GHG, on the amount of warming that any given assumption would yield, on the relative importance of natural and manmade ("anthropogenic") influences on climate phenomena, on the magnitude of mitigation to be yielded by human adaptations. The inevitable reliance on the mainstream climate models, the EPA climate model in particular, bespeaks a profound misunderstanding of the fundamental analytic problems attendant upon any future rule driven by this Request for Information. Accordingly, any future rule would have the obvious effect of threatening suppliers with actual risks of regulatory actions and litigation.

The litigation problem would be created by virtually any "risk" analysis. Should, say, a severe storm follow a supplier's conclusion that climate risks are unimportant in its specific context, the plaintiff attorneys will not be far behind, even though attribution of a given weather event to GHG emissions generally, and *a fortiori* to emissions attributable to a given sector, is deeply problematic.[45] Should a supplier calculate the GHG emissions relevant to its investment instruments as high relative to other suppliers or sectors, it will expose itself to purported causes of action as a "cause" of the asserted costs of the anthropogenic climate change "crisis."

A mandate from the CFTC that suppliers of investment products subject to CFTC rules evaluate climate "risks" — even those in total attendant upon GHG emissions in the aggregate — is likely to distort the allocation of capital away from economic sectors disfavored by certain

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https://www.cambridge.org/us/academic/subjects/earth-and-environmental-science/climatology-and-climate-change/economics-climate-change-stern-review?format=PB.

[43] See Marco Bindi, *et. al.*, "Impacts of 1.5°C of Global Warming on Natural and Human Systems," at https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Chapter3_Low_Res.pdf, Chapter 3 of Valerie Masson-Delmotte, *et. al.*, eds., IPCC Special Report, *Global Warming of 1.5°C*, at https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf.

[44] This implies average annual growth in per capita GDP of less than 1.5 percent for the rest of this century.

[45] See Ross McKitrick at https://link.springer.com/article/10.1007/s00382-021-05913-7. See also https://judithcurry.com/2021/08/18/the-ipccs-attribution-methodology-is-fundamentally-flawed/.

political interest groups pursuing ideological agendas. Accordingly, a future CFTC climate "risk" rule would prove in practice a mechanism with which to use private-sector resources for political purposes generally, and to constrain the availability of capital to industries disfavored politically. It would be, therefore, fundamentally an effort to return to Operation Choke Point, the blatantly illegal attempt by the Obama administration to deny credit to certain industries.[46] That effort and any future CFTC climate "risk" rule are obvious circumventions of the formal policymaking process: It is Congress from which authorization for such expansions of government power should originate. This would preserve our constitutional institutions generally, and the political accountability of government officials in particular.

[46] See https://www.americanbanker.com/opinion/theres-no-downplaying-the-impact-of-operation-choke-point.