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Sarah Butler
Chief Clerk
Select Committee on Energy Independence
and Global Warming
U.S. House of Representatives
Washington, DC 20515

Dear Ms. Butler:

Thank you for your letter of June 11 with questions from the Select Committee on Energy Independence and Global Warming. In my response below, I will first repeat the questions and then give my answer.

Question 1. In your testimony, you argue that increased concentrations of carbon dioxide and global warming will be "good for mankind." Is this a personal value judgment or a scientific determination? If it is scientifically based, please describe the methodology that you have employed and provide a list of any peer-reviewed papers that you have authored to support this determination.

Answer 1. That increased CO2 will be good for mankind is an assessment based on many scientific studies. One example is the book "The Greening of Planet Earth," which can be accessed at the website http://www.co2science.org/. This book contains many references to peer-reviewed scientific papers, and its contents are summarized as: "Evidence is presented to show how current CO2 levels, which are 30 percent higher than in the pre-industrial era, have greatly enhanced the growth of trees and other plants. Results from controlled studies show how a doubling of CO2 in the atmosphere, which is expected to occur over the next century, will increase crop yields by 30 to 40 percent, double the water-use efficiency of most of the earth's vegetation and possibly triple the productivity of forests."

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I am by no means alone in arguing for the benefits of increased CO2. Professor Freeman Dyson of the Princeton Institute for Advanced Study (Albert Einstein and John Von Neumann were among the first members of the Institute) says in a book review, http://www.vaclavsmil.com/wp-content/uploads/docs/smil-bookreview-earths-biosphere 20030515-the-new-york-review-of-books–what-a-world!.pdf , "Experiments in greenhouses with an atmosphere enriched in carbon dioxide show that the yields of many crop plants increase roughly with the square root of the carbon dioxide abundance. If this were true for the major crop plants grown in the open air, it would mean that the 30 percent increase in carbon dioxide produced by fossil fuel-burning over the last sixty years would have resulted in a 15 percent increase of the world's food supply. A similar increase might have occurred in the world production of biomass of all kinds."

Professor Dyson goes on to point out, "If the supply of water is limiting, as it often is in times of drought, then increased carbon dioxide can still be helpful. The little pores in the leaves of plants have to be kept open for the plant to acquire carbon dioxide from the air, but the plant loses a hundred molecules of water through the pores for every one molecule of carbon dioxide that it gains. This means that increased carbon dioxide in the air allows the plant to partially close the pores and reduce the loss of water. In dry conditions, increased carbon dioxide becomes a water-saver and gives the plant a better chance to keep on growing."

Concluding his review, Professor Dyson says, "The humanist ethic does not regard an increase of carbon dioxide in the atmosphere as evil, if the increase is associated with worldwide economic prosperity, and if the poorer half of humanity gets its fair share of the benefits."

Of course there is more to the issue of overall benefit than vegetation growth and crop yields. For example, as part of the campaign of fear, IPCC reports have told us of impending malaria epidemics in a warming world. However, Professor Paul Reiter, a medical entomologist at the prestigious Pasteur Institute in Paris, has pointed out in an open letter to a select committee of the British Parliament, "Malaria is not a tropical disease. The principle determinants of malaria transmission are politics, economics, and human activities," not climate change. Noting that not one of the IPCC lead authors has ever written a research paper on mosquito-borne diseases, he calls the IPCC treatment of malaria "ill-informed, biased, and scientifically unacceptable." Reiter says that mosquito-borne diseases are unlikely to spread to non-tropical regions of the world and become a problem there. Malaria, for example, was once prevalent in most of Europe and even Siberia but has been largely eliminated. The main reason is that modern farming methods and changes in human living conditions have reduced the number of disease-spreading mosquitoes and reduced their access to people.

One cannot help but observe that bursts of human development have tended to accompany warm periods in the past; the Holocene; the Roman, and Medieval Warmings all coincided with expansions of human civilization and culture.

Many similar studies conclude that increasing CO2 will benefit mankind. But unfortunately in IPCC, National Academy of Sciences, and media reporting, these beneficial effects of increased atmospheric CO2 are not discussed, nor is research on them recommended. Instead we continue to pour ever more funding dollars into climate models, which are known to have serious flaws. Therefore in the public mind, effects of CO2 are considered to be threatening, if not alarming. This is a good example of the unbalanced, indeed biased, approach to the issue by the institutions entrusted to understand and inform us dispassionately on the global-warming issue.

Question 2a. In your testimony, you argue that dangerous levels of warming require a large feedback from water vapor. What temperature change would you consider dangerous? What atmospheric water vapor content would produce such a temperature change?

Answer 2a. The geological history of the earth shows that when CO2 levels were several thousand parts per million (ppm) – many times the 390 ppm we have now, and much more than we can produce from burning fossil fuels – life flourished on the land and in the oceans. Neither the higher CO2 levels or higher water levels of the atmosphere were a problem, and both contributed to more abundant life.

Question 2b. Would that level of water content pose a threat to human health if directly inhaled?

Answer 2b. Humans experience no ill effects from breathing the water vapor in air of 100% relative humidity (the maximum water-vapor content) at any temperatures encountered on earth, from the tropics to the poles. Health problems often come from too little water in the air, which is why forced-air heating systems of homes normally include a humidifier.

Question 3. In the past, you have compared climate scientists to a "religious cult" and to Nazis as reported in Daily Princetonian. Do you believe that this sort of public characterization of climate scientists - comparing them to Nazis - benefits the science and the position of science in the public policy process?

Answer 3. Naturally, comparing climate scientists or climate advocates to Nazis would be extreme and undefendable, and I never did so. Puzzled by this false accusation, I went back and looked at the Daily Princetonian article that I presume you have in mind. I could not find the word Nazi mentioned once. At the beginning of the article, in the context of characterizing the wild claims, fear, and exaggerations being promulgated under the guise of climate science, I was quoted as saying "This is George Orwell. This is the Germans are the master race. The Jews are the scum of the earth. It's that kind of propaganda." I was referring to the demonization of CO2, which is very similar to the demonization and scapegoating of the Jews in Germany. German Jews were a huge benefit to their country, just as CO2 is a benefit to the planet.

As for extreme public statements, of course they don't help, and you may wish to ponder extreme statements from some climate scientists and their supporters which do little to advance a dispassionate dialogue on the issue: In the Congressional Record Dr. James Hansen stated that climate skeptics are guilty of "high crimes against humanity and nature."

Attacking any who question impending climate catastrophe at a "Live Earth" concert, Robert Kennedy, Jr. said: "Get rid of all these rotten politicians that we have in Washington, who are nothing more than corporate toadies for companies like Exxon and Southern Company; these villainous companies that consistently put their private financial interest ahead of American interest and ahead of the interest of all of humanity. This is treason. And we need to start treating them as traitors."

Commenting on those who question global-warming hysteria, Canadian environmentalist David Suzuki stated: "What I would challenge you to do is to put a lot of effort into trying to see whether there's a legal way of throwing our so-called leaders into jail because what they're doing is a criminal act. It's an intergenerational crime in the face of all the knowledge and science from over 20 years."

Speaking of those who question climate apocalypse, Vermont's Senator Sanders said "It reminds me in some ways of the debate taking place in this country and around the world in the late 1930s. During that period of Nazism and fascism's growth - a real danger to the United States and democratic countries around the world - there were people in this country and in the British parliament who said; 'don't worry! Hitler's not real! It'll disappear!' "

In spite of these and even more extreme attacks on any who dare question the dogmas of global warming, in testimony to the Senate on February 25, 2009, I stated: "Let me say again that we should provide adequate support to the many brilliant scientists, some at my own institution of Princeton University, who are trying to better understand the earth's climate, now, in the past, and what it may be in the future."

Question 4a. On Slide 8 of your presentation, you compare observed and predicted temperature trends. Which IPCC scenarios have you plotted?

Answer 4a. The central projection for each of the four reports. For example, we have from the Summary for Policy Makers, AR4 of 2007 (page 12): "For the next two decades a warming of about 0.2 C per decade is projected for a range of SRES emission scenarios." The value of 0.2 C is plotted in the figure from 2007, and similarly for the previous reports. Obviously, at longer timeframes, projected warming would become more dependent on future emissions scenarios, but the projections are not sensitive to those scenarios at the relatively short timeframes shown in the figure.

Question 4b. Do the model outputs begin in the year in which the IPCC reports were issued as indicated in your plot?

Answer 4b. Yes. There was no attempt to show correspondence or lack of correspondence for times before the respective IPCC reports. As is the norm in scientific hypothesis testing, the objective was to compare predicted vs. subsequently measured temperature.

Question 4c. What are the uncertainty bounds for the model projections that you have plotted?

Answer 4c. The "uncertainty bounds" in the models are quite large, and this is often reflected in IPCC summaries (see following paragraph). Not only are the spreads in results large, there is no evidence of the spreads decreasing during the existence of IPCC, which now exceeds twenty years. For most other scientific investigations, uncertainties diminish with time as observations and modelling improve. As an example of the spread, we find in the Summary for Policy Makers, TAR of 2001 (page 8), "For the periods 1990 to 2025 and 1990 to 2050, the projected increases are 0.4 to 1.1 C and 0.8 to 2.6 C, respectively." The value plotted in the graph corresponds to 0.7 C for 1990-2025, in the center of the range. No attempt has been made to perform a statistical analysis on the projections shown in the figure. Rather the objective of the graph is simply to compare visually what we have been told to expect with what has actually happened during the 20-year period covered by IPCC reports.

The large spread in model predictions has been used by some climate scientists to defend the models against the disagreement between the models as a whole and the actual temperature record. The disagreement increases with each passing year. Clearly the larger the spread, the better one is able to say that "the models still agree with the temperature record." This is a serious flaw in the IPCC approach, for it places a premium on maintaining a large spread by having more models that stray significantly from the central projections.

Instead of circling the wagons around all models, we should view different models as containing different physics, with some models agreeing better with the temperature record than others. For example, in the AR4 of 2007, models show a range of equilibrium climate sensitivity (the amount of warming for doubling of atmospheric CO2) ranging from close to 1 C to more than 4.5 C. This difference reflects different ways of treating the key feedbacks in the climate system. The lower end of the range of models is more consistent with the actual temperature record and with empirical studies that give low climate sensitivities, which are far from threatening catastrophe. Instead the IPCC disregards these low values of climate sensitivity; we have on page 12 of the Summary for Policy Makers, AR4: "It [the equilibrium climate sensitivity] is likely to be in the range 2 to 4.5 C with a best estimate of about 3 C, and is *very unlikely* to be less than 1.5 C [emphasis original]." We would all be better served if the IPCC were to study the physical basis for model disagreements, including comparisons with empirical research finding low climate sensitivities, rather than continuing to defend all models as the basis for its position supporting large climate sensitivity.

Question 5. What is the cause and effect relationship between increased levels of CO2 in the atmosphere and the earth's temperature changes?

Answer 5. CO2 levels have increased from about 280 ppm at the beginning of the industrial revolution to about 390 ppm today. From comparing this increase to the quantity of coal, oil and natural gas burned and changes in the ratio of the isotopes ^{12}C and ^{13}C in the atmosphere, it appears that most of this increase has come from fossil fuels. The CO2 of the atmosphere is readily exchanged with the biosphere, with the soil and with the upper layers of the oceans, which contain about 100 times as much CO2 per unit volume, mainly as the bicarbonate ion, as the air at sea level. Since the solubility of CO2 decreases with temperature, and since the surface layers of the ocean have warmed slightly since the industrial revolution, a small fraction of the increase of CO2 in the atmosphere has come from the oceans.

Question 6. To what extent does CO2 lead to global warming?

Answer 6. The current average surface temperature of the earth is about 34 C warmer than it would be if there were no greenhouse effect. Most of the current greenhouse warming is due to water vapor and clouds, with a relatively minor contribution from CO2. Doubling the concentration of CO2 from preindustrial levels, with no other changes to the atmosphere, would cause an additional warming of about 1 C. The IPCC maintains that water vapor and clouds will change in ways that greatly amplify the warming due to CO2 alone. Two recent studies, one led by Dr. Roy Spencer and one by Dr. Richard Lindzen have compared satellite observations of outgoing short-wave and long-wave radiation with changes in the sea-surface and air temperature. These observational studies indicate that the net effect of water vapor and clouds is to diminish the warming from a CO2 doubling to less than 1 C. Several other independent studies based on observations, not models, also point to a warming from doubling CO2 that will be no more than 1 C. This is far smaller than the IPCC "most likely" value of 3 C.

Question 7. Is EPA right to classify CO2 as a pollutant?

Answer 7. EPA is completely wrong to classify CO2 as a pollutant. Calling CO2 a pollutant is truly Orwellian newspeak. With each breath, humans exhale air with 40,000 ppm CO2, far above the current level of 390 ppm in the atmosphere or any level we can attain by burning all fossil fuels we can find. As I discussed in my answer to question 1, increased levels of CO2 in the atmosphere will very likely be a net benefit for mankind.

Question 8. What empirical data do we have to prove the human impact on climate warming?

Answer 8. We have no persuasive empirical data that the warming of about 0.8 C over the last 150 years – since the end of the little ice age – is mostly due to humans. There have been many similar warmings in the past, for example, the medieval warm period when Vikings farmed Greenland around the year 1000. As I mentioned in connection with Question 6, observational data indicates doubling of CO2 should produce a warming of no more than 1 C. Because of the "saturation" of the CO2 absorption band, most models predict that temperature increases will be proportional to the logarithm of the CO2 increases. This would imply that the increase from 280 to 390 ppm of CO2 has produced half or less of the observed warming. The remaining warming has been due to natural causes that are still poorly understood, but presumably similar to the causes of the medieval warming and earlier warmings. These natural causes, which may be the result of solar variability or spontaneous, unforced changes in the oceans, have been neglected by the IPCC in its relentless focus on ascribing nearly all climate change to human activities. Nevertheless, natural causes are operating today and will continue to operate in the future.

Question 9. Does the climate science record support the implementation of economically expensive proposals like cap and trade as a solution to global warming?

Answer 9. Cap and trade will have no beneficial effect on climate.

Question 10a. Have you ever been discriminated against or felt pressure because of your scientific opinion on global warming?

Answer 10a. Support for the dogma of climate apocalypse due to increased levels of CO2 is a fervidly-held belief in most academic communities and in some other parts of society. I have experienced hostility from time to time, but so far my own institution, Princeton University, has upheld the tradition of academic freedom. However, I know of individuals who are aware of the real state of the science, as I have described it, but who are reluctant to step forward because of concerns about their careers or continued research funding.

Question 10b. Do you believe that grant money favors scientists who exaggerate the effects of global warming?

Answer 10b. One need only survey the research groups working on climate science and related fields and count the few researchers who are brave enough to challenge the alarmist dogma with scientific findings. I estimate that at least ten times more money goes to researchers who exaggerate the effects of global warming than those who question the alarm. There is a concern that funding for climate science will dry up if anthropogenic global warming is widely understood to be a nonthreat.

I believe that the huge amount of funding directed toward this issue is not good for climate science. It may attract researchers who are more motivated by the prospect of readily available funding, prizes, election to honorific learned societies, favorable media attention, and other rewards than a commitment to the science itself and the pursuit of scientific truth.

Best wishes,

William Happer

William Happer
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