

STATE OF NEW MEXICO

BEFORE THE ENVIRONMENTAL IMPROVEMENT BOARD

IN THE MATTER OF THE PETITION)
TO ADOPT NEW REGULATIONS)
WITHIN 20.2 NMAC,) EIB No. 8-19 (R)
STATEWIDE AIR QUALITY REGULATIONS, TO)
REQUIRE GREENHOUSE GAS EMISSIONS REDUCTIONS)
NEW ENERGY ECONOMY, INC. PETITIONER)

Rebuttal Testimony of David S. Gutzler, Ph.D.

Rebuttal to testimony of William D. Balgord, Ph.D.

Dr. Balgord presents as his major exhibit a document published by the Heartland Institute (Exhibit 2). The bulk of material in Exhibit 2 is presented with little or no credible scientific support. The established basis for establishing credible scientific support is through the scientific peer-review process, and in this regard it is important to note that most of the results in the Heartland Institute report have not undergone peer review.

One of the stated motivations for the Heartland Institute report (Exhibit 2, page iv, at the beginning of its Preface) is to present a "second opinion" about climate change, presumably because the contributors to the report do not like the conclusions drawn from peer-reviewed results in the Intergovernmental Panel on Climate Change (IPCC) assessments of climate change research -- the implication being that the IPCC report is a potentially suspect "first opinion". My rebuttal testimony will include a defense of the integrity of the IPCC in my response to testimony submitted by Dr. Robert Kampelmann.

With regard to "second opinions", it should be noted that the United States government, under Republican presidential administrations, has also mandated independent national assessments of climate change: first the National Assessment of Climate Change (NACC, mandated in 1990, final report published in 2000), then the U.S. Climate Change Science Program (CCSP, mandated in 2002, which has issued synthesis reports on different topics

starting in 2006). The CCSP still operates under the title U.S. Global Change Research Program, and issued several major climate change assessment reports last year.

I would briefly summarize the results of these large and comprehensive national assessment projects as providing emphatic confirmation of the IPCC results, with the addition of considerably more regional detail. So the Heartland Institute report is not really a "second opinion" -- it is perhaps a third or fourth opinion, generated because a relatively small number of holdout "skeptics" simply refuse to accept any synthesis of peer-reviewed research that conflicts with their deeply-held personal beliefs. It is legitimate and appropriate for the EIB to accept all opinions submitted by the public, but the EIB should recognize that the level of scientific rigor and peer-review associated with Exhibit 2 is vastly inferior to the consensus view of climate change science derived from peer-reviewed research.

Dr. Balgord presents a list of brief, and often vague, critical comments derived largely from material in Exhibit 2. These are very briefly assessed below. Given the very sketchy scientific support for many of Dr. Balgord's comments, it is often difficult to provide detailed rebuttals.

- 1) This conclusion is contradicted by the vast majority of peer-reviewed studies.
- 2) This assertion is false. Global climate models have been shown to reproduce the major multi-decadal fluctuations in temperature during the 20th Century, if (and only if) they are forced with observed anthropogenic greenhouse gas and aerosol pollution during that time.
- 3) This assertion is overblown. All numerical weather and climate models contain approximations and parameterizations (in which small-scale variables such as clouds are represented statistically in terms of the large-scale variables resolved in the model). However all of the phenomena listed in Dr. Balgord's comment are represented in the models, and the global models developed at major modeling centers, such as those used for projections disseminated through the IPCC, have been very extensively tested and validated.

- 4) This assertion is false. The Mann et al. paper in question is now more than a decade old. Many investigators have since generated analogous time series using different sources of

proxy climate data and different analysis techniques. The more recent results tend to show more century-scale variability prior to the Industrial Revolution than the Mann et al. "hockey stick". However the rapid increase in temperature in the 20th Century still stands out as very unusual compared to temperature reconstructed for the previous millennium in the newer reconstructions cited in the 2007 IPCC assessment.

5) This assertion is false, as noted above in the rebuttal to point 4. The climate research community has long since advanced beyond the "hockey stick" diagram as noted in point 4 above; skeptics who continue to harp on the deficiencies of the "hockey stick" have simply failed to keep up with current research.

6) This assertion is false. Climate does show discernable variations but, at time scales longer than the modest 11-yr cycle associated with solar variability, they are not significantly cyclic.

7) This assertion is false. There is no known solar cycle that can account for the century-scale cooling that seems to have played a large role in the Little Ice Age. The best, peer-reviewed estimates of solar variability show that solar brightness was reduced during the Little Ice Age, associated with the disappearance of sunspots. But there is no known cyclicity associated with the Maunder Minimum in sunspots during the Little Ice Age. No known solar cycle that can plausibly explain long-term warming in the 20th Century, long after the re-establishment of the 11-year solar cycle in the 18th Century.

8) This statement demonstrates ignorance of how climate feedbacks work. Ice age cycles are thought to be forced by fluctuations in Earth's orbit around the sun that change the distribution of solar radiation. The direct solar forcing at the initiation of a glacial episode is relatively modest, but the direct forcing is amplified by positive feedback effects: growing ice sheets that reflect sunlight, the uptake of CO2 by a cooling ocean, and the probable decrease in humidity as temperatures cool.

It is not clear to me that Dr. Balgord understands the implications of these strong positive feedback mechanisms for the current climate. That is because, far from contradicting the hypothesis that increasing greenhouse gases could produce a significant climate change, our understanding of how ice ages develop provides powerful support for the concept that strong positive feedbacks exist and are likely to amplify the direct effects

of imposed forcing on the climate system. In the present day, that forcing comes overwhelmingly from anthropogenic increases in the greenhouse effect, not from the much slower orbital changes that force ice ages.

9) This vague statement (“various factors ... are incompletely understood”) is both unsupported and meaningless. The increase in atmospheric CO2 is unambiguously human-caused, as outlined in my rebuttal to comment 17 below.

10) This statement is only true if all else in the climate system stays the same. In New Mexico, flora and fauna are largely water-limited, not CO2-limited. Therefore the deleterious effects of diminished snowpack and increased evaporation rates associated with a significantly warmer climate are much more important than the fertilization effect of increasing atmospheric CO2 concentration.

11) I am not an economist so I will not address this comment, other than to make the observation that it is yet another unsupported assertion.

12) I concur with the estimate of 1 degree C warming given here as the direct radiative effect of doubling CO2. But there is no evidence whatsoever that the negative feedbacks vaguely asserted here (due to “clouds and other atmospheric agents”) exist in the climate system. On the other hand, there is abundant evidence, both theoretical and observed, for positive feedbacks that amplify the direct radiative effect of increasing CO2 (as discussed above in comment 8). Dr. Balgord fails to acknowledge any of this evidence.

13) This assertion is false. There are numerous “fingerprint” tests that confirm that much of recent observed warming is due to an increased greenhouse effect. For example, the stratosphere has been observed to cool in recent decades, which is consistent with greenhouse gas-forced surface warming but inconsistent with solar forcing.

14) This assertion is false. Temperatures have been observed to rise across most of the continental areas with long-term records, not just in growing urban areas. Weather records suspected of having an urban warming bias are routinely inspected by comparison with rural sites that are well outside the city but close enough to experience comparable weather patterns. I have studied temperature trends in New Mexico in some detail, and I

find warming trends in rural areas that are entirely comparable to the trends observed at more urban sites.

15) Observations and global climate models all tend to show that the increased humidity in a warmer climate adds to the greenhouse effect, providing a positive feedback on the system and amplifying the warming effect of increasing CO2. Over the past several decades Prof. Lindzen has proposed different conceptual alternative mechanisms that could lead to a negative water vapor feedback. But there is no observational evidence that Lindzen et al.'s proposed negative feedback mechanisms are significant in the actual climate system.

16) I agree with this statement, except to point out that there is nothing at all "notorious" about this result. My own research on climate change in western North America suggests that the climate change signal associated with the trend toward warmer temperatures is much stronger (relative to natural interannual variability) than projected trends in precipitation. But temperature trends have pronounced effects on the hydrologic cycle, especially regarding decreases in snowpack and increases in evaporation off the surface.

Both of these temperature-related impacts have the effect of drying in New Mexico, a semiarid region whose major rivers are snowfed.

17) This assertion is false. Combustion-generated CO2 has a different carbon isotopic ratio than CO2 generated from volcanoes, vegetation decay, or the oceans. Isotopic studies unambiguously show that the current observed increase in CO2 is due to combustion. In addition, the overall rate of change of atmospheric CO2, the interannual variability of CO2 increase, and the interhemispheric gradient of atmospheric CO2, are all clearly correlated with anthropogenic CO2 emissions.

18) The assertion that the IPCC makes any attempt to estimate future anthropogenic CO2 emissions is false. The IPCC has coordinated the development of many emissions "scenarios", with the express goal of testing a wide range of possible emissions futures for policy guidance (and explicitly refraining from prescribing which scenario is preferable or most likely). Having said that, it should be noted that the most commonly cited "mid-range" scenario generated by the IPCC in the early 1990s provides a dramatic underestimate of emissions that have occurred since then, direct contradicting Dr. Balgord's assertion.

19) This statement is true, but it is totally irrelevant to this hearing. The EIB is not concerned with the general survival of life on Earth millions of years ago. The EIB needs to consider whether the changes in climate projected to occur over the next century or less (an extraordinarily abrupt and rapid change by geological standards) due to anthropogenic CO2 emissions are likely to be deleterious to human health and prosperity in New Mexico, including the management of ecosystems within the state. The likelihood that CO2 levels were highly elevated millions of years ago actually provides considerable support for the concept that atmospheric CO2 concentrations could rise far above current levels in the future as anthropogenic emissions continue unabated.

20, 21) Actual climate change is not equivalent to a controlled study of elevated CO2 on plants in a closed environment. Specifically, potential water supply decreases in a warmer climate that are highlighted in studies of climate change in New Mexico and in my own direct testimony will be much more significant for plant growth than CO2 fertilization effects.

22) This hearing pertains to the state of New Mexico. Dr. Balgord's testimony is in large part a generic denial of climate change science, and this comment happens to emphasize coral reefs and polar bears. However neither coral reefs nor polar bears are present in the state of New Mexico. In another setting it would be appropriate to dispute the plausibility of the assertions presented in this comment, but that would be irrelevant to this hearing.

23) This hearing pertains to the state of New Mexico. Dr. Balgord's testimony, which in large part is a generic denial of climate change science, fails to address the issues of potential water supply decreases in a warmer climate that are highlighted in studies of climate change in New Mexico and in my own direct testimony.

Rebuttal to testimony of Robert Kappelmann

Mr. Kappelmann has submitted testimony and exhibits attempting to refute peer-reviewed climate change science, particularly as synthesized and disseminated through the Intergovernmental Panel on Climate Change (IPCC). A substantial fraction of Mr. Kappelmann's testimony and exhibits are based on his view that the IPCC is a corrupt and biased organization. I will address the general criticism of the IPCC first, and then more specifically address several of Mr. Kappelmann's science-related exhibits.

Quality and objectivity of climate change science and the IPCC

The scientific validity of the IPCC's assessments has been affirmed by numerous independent scientific societies. In the United States, formal public statements confirming the reality of current climate change and the attribution of current change to increasing greenhouse gases of anthropogenic origin have been issued by many independent professional groups that have no affiliation with the IPCC. Several such statements are appended to this testimony as NEE Rebuttal Exhibits R1 through R5, as follows:

American Association for the Advancement of Science (AAAS) (February 2007) (R1)

American Meteorological Society (February 2007) (R2)

American Physical Society (November 2007, with Commentary added April 2010)

(R3)

American Geophysical Union (December 2007) (R4)

Geological Society of America (April 2010) (R5)

In addition, the AAAS sponsored a letter to the United States Senate in October 2009 signed by leaders of 18 separate scientific organizations affirming the reality and severity of ongoing and projected climate change. (R6) In December 2009 the AAAS published a comment explicitly reaffirming its previously published opinion on climate change science, specifically stating that "the illegal release of private emails stolen from the University of

East Anglia should not cause policy-makers and the public to become confused about the scientific basis of global climate change.”

The assessments of climate change science and the IPCC listed above are much more serious, objective, and credible than Mr. Kappellmann’s personal opinions, and so are much more germane to this hearing. It is important for the EIB to understand that claims of uncertainty and ongoing scientific debate about the most basic results of climate change science are contradicted by a mountain of diverse scientific evidence, vetted by hundreds of climate scientists, and endorsed by the foremost independent scientific societies in this country and abroad.

Exhibit RLK 5

Raw political contempt for the IPCC is a central theme of Mr. Kappellmann’s testimony. For example, the entirety of Exhibit RLK 5, which his testimony describes as “a summary of problems with IPCC Climate Change reports”, is simply a sarcastic list of “Gates” that plays on the public controversy generated by the release of stolen emails (“Climategate”) from a server at the University of East Anglia (UEA) in 2009. It is certainly true that the three-volume set of principal IPCC assessments published in 2007 -- each volume nearly 1000 pages long -- contains several significant editorial errors that have been widely publicized (and promptly corrected). As an active researcher who frequently uses the IPCC reports as reference materials, especially for their exhaustive list of peer-reviewed references, my personal opinion is that the number of identified errors is remarkably small.

At least five different independent reviews carried out this year have exonerated the scientists involved in “Climategate” from the charges of fraud or bias repeatedly mentioned by Mr. Kappellmann, and by Dr. Balgord in his testimony. The most recent of the reviews, carried out by an independent panel of British scientists commissioned by UEA, stated that “We find that their rigor and honesty as scientists are not in doubt” (referring to the UEA scientists involved). To be sure, this controversy has highlighted the need for improved transparency in data processing. But claims that “Climategate” exposed some grand conspiracy are overblown by skeptics to the point of utter absurdity. If climate change science is nothing but a hoax generated by an IPCC-led conspiracy, then apparently the conspiracy includes the U.S. government (which commissioned its own national assessments under both Presidents Bush, as discussed in my rebuttal to Dr. Balgord), the

British government (which commissioned its own review of "Climategate" that exonerated the scientists), and the independent, nongovernmental scientific societies that have released their own statements (Exhibits introduced above) supporting the basic conclusions of the climate change research community. It should be noted that the December 2009 AAAS letter and the April 2010 GSA statement were both issued after the publicity surrounding "Climategate", illustrating the non-impact of that episode on the scientific community.

Exhibit RLK 6

This exhibit illustrates two estimates of reconstructed global temperatures, extending backward in time before the instrumental record. Both of these estimates were generated more than a decade ago, and neither of them should be considered representative of current research. A tremendous amount of research has been carried out over the past decade to refine paleoclimatic estimates of Holocene temperatures. Arguing over results from the 1990s on this topic is irrelevant to this hearing.

Exhibit RLK 6a

This document presents a critique of climate change science by Dr. Alan Carlin. A point-by-point review of this document would be tedious and, in my opinion, is unnecessary. As a general and very important comment, it should be noted once again that -- like the principal exhibit submitted by Dr. Balgord -- the document submitted as Exhibit RLK 6a has not been peer-reviewed, which is the standard scientific method for quality control. Not surprisingly, most of the references cited and discussed in Exhibit RLK 6a are not peer-reviewed either. In summary, then, Exhibit RLK 6a is a compendium of Dr. Carlin's personal opinions selectively compiled from the personal opinions of others, with no attempt made (insofar as I could tell) to comprehensively review the best and most recent science.

As an example, one of Dr. Carlin's three principal criticisms is that "satellite microwave sounding units show no appreciable temperature increases during the critical period 1978-1997, just when the surface data show a pronounced rise" [Executive Summary, page v]. But it is false to assert that discrepancies between estimates of global temperature change derived from satellites vs. surface thermometers disprove any basic conclusions regarding recent global warming. Apparent discrepancies between surface temperature and satellite

microwave data have been widely discussed since the late 1980s. Given the importance of this matter, the U.S. National Research Council commissioned a report on precisely this topic, published in 2000 (“Reconciling Observations of Global Temperature Change”, National Academy Press). Data through 1998 were available at the time the report was written (the satellite data record begins in 1979). The panel that produced the NRC’s report included representatives from the group that produces the satellite data as well as independent atmospheric scientists, and the report was thoroughly peer-reviewed following standard NRC practice.

The principal conclusion of the NRC report, given in boldface type in its Executive Summary, is as follows: “In the opinion of the panel, the warming trend in global-mean temperature during the past 20 years is undoubtedly real and is substantially greater than the average rate of warming during the 20th Century. The disparity between surface and upper-air trends in no way invalidates the conclusion that surface temperature has been rising.”

Six years later the first of the CCSP reports (“Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling Differences”, CCSP Synthesis and Assessment Report 1.1, 2006) also reviewed this topic, incorporating new research since the publication of the NRC report. The conclusion of CCSP SAP 1.1 was that “There is no longer a discrepancy in the rate of global average temperature increase for the surface compared with higher levels in the atmosphere”.

The 2000 NRC report and the 2006 CCSP report present independent, objective, and thorough reviews of satellite-surface temperature discrepancies, but the author of Exhibit RLK 6a simply ignores them. Could this be because he is eager to promote uncertainties and discrepancies that no longer exist?

Exhibit RLK 7

This exhibit illustrates projected warming trends derived from different methods. I have not seen a thorough description of how these results were generated so I cannot assess these in detail. However, it seems that the “empirical ‘estimates’” represent attempts to extrapolate short-term trends in temperature to the entire 21st Century. Any such extrapolation has no statistical validity whatsoever.

The fallacy of using short-term climate variability (on sub-decadal time scales) to assess longer-term climate change trends is pervasive in this testimony and attached exhibits. Climate change projections are not aimed at explaining or predicting individual weather events or short-term interannual variability. Any attempt to do so is inappropriate and invalid.

SUMMARY OF REBUTTAL TESTIMONY

There is a critically important place for reasoned skepticism in scientific research. However in my opinion the testimony and exhibits submitted by Dr. Balgord and Mr. Kappelmann exemplify the low level of so-called "debate" now being carried out with regard to climate change science. The same objections are made, over and over again, by the same small group of "skeptics". Any evidence or assessment that contradicts the "skeptical" perspective is simply ignored or dismissed as "biased", regardless of scientific rigor. Repeated appeals are made to policy-related bodies such as the EIB to "keep an open mind" and to "consider both sides of the issue" in an attempt to generate levels of uncertainty and confusion regarding climate change that extend far beyond the actual levels of uncertainty associated with the current state of the science.

To be sure, legitimate uncertainties still exist and will always be a component of climate change assessment and prediction. Uncertainty is inherent in any field of cutting-edge science, and the scientific advice sought by policy-makers with regard to climate change definitely draws on the newest research available. As my direct testimony clearly describes, considerable uncertainty exists with regard to the quantitative magnitude and rate of change of climate to expect during the 21st Century. Uncertainties are greater at the scale of the state of New Mexico, with which the EIB is concerned, than at global scales. Century-scale temperature trends -- upward -- are projected with more certainty than corresponding precipitation trends. The EIB will need to deliberate with these uncertainties in mind. However the wholesale denial of climate change science presented in adverse testimony to this hearing has no credible basis beyond political posturing.


David S. Gutzler, Ph.D.