

PUC Docket No. E-999/CI-14-643
OAH Docket No. 80-2500-31888
Clean Energy Organizations
Exhibit _____

**BEFORE THE MINNESOTA OFFICE OF ADMINISTRATIVE HEARINGS
600 North Robert Street
St. Paul, MN 55101**

**FOR THE MINNESOTA PUBLIC UTILITIES COMMISSION
121 Seventh Place East, Suite 350
St Paul, MN 55101-2147**

**In the Matter of the Further
Investigation into Environmental and
Socioeconomic Costs Under Minnesota
Statute 216B.2422, Subd. 3**

**PUC Docket No. E-999/CI-14-643
OAH Docket No. 80-2500-31888**

**SURREBUTTAL TESTIMONY OF DR. ANDREW DESSLER,
Professor of atmospheric sciences, Texas A&M University**

On Behalf of

Clean Energy Organizations

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	RESPONSE TO DR. ROY SPENCER.....	2
III.	RESPONSE TO DR. RICHARD LINDZEN	5
IV.	RESPONSE TO DR. WILLIAM HAPPER.....	7
V.	RESPONSE TO DR. RICHARD TOL.....	10
VI.	CONCLUSION.....	12

1 **I. INTRODUCTION.**

2 **Q. Please state your name.**

3 **A.** Dr. Andrew Dessler

4 **Q. Are you the same Dr. Andrew Dessler who provided rebuttal testimony on behalf of**
5 **the Clean Energy Organizations in this proceeding?**

6 **A.** I am.

7 **Q. What is the purpose of your surrebuttal testimony?**

8 **A.** In this surrebuttal testimony, I respond to the direct testimony of many of the witnesses
9 for the other parties, including: Drs. Roy Spencer, Richard Lindzen, William Happer, and
10 Richard Tol, witnesses for Peabody Energy.

11 **Q. What is your overall impression of the Rebuttal Testimony submitted by Drs.**
12 **Spencer, Lindzen, and Happer?**

13 **A.** Overall, Drs. Spencer, Lindzen, and Happer respond to each query with what appears to
14 be an impressive list of publications supporting their view. However, many of these
15 publications would not be considered acceptable citations in a scientific debate (e.g.,
16 Wall Street Journal op-ed). That they provide such sources as “evidence” is a strong
17 indicator of exactly how weak their position actually is.

18 The papers that do appear in the peer-reviewed literature, and therefore should be
19 considered legitimate evidence, in most cases do not say what Spencer, Lindzen, and

1 Happer claim they say. I do not know if this is because they have not read the papers, or
2 whether they know what they're claiming is incorrect—the data support both hypotheses.
3 Below, I will discuss their response and demonstrate that it is completely inadequate.

4 **II. RESPONSE TO DR. ROY SPENCER .**

5 **Q. Do you agree with Dr. Spencer that his “discovery responses provide significant**
6 **evidentiary support” for the statement: “The models, on average, produce surface**
7 **warming rates at least twice those observed since the satellite record began in 1979.**
8 **Models, on average, produce deep-atmosphere (tropospheric) warming rates about**
9 **2-3 times those observed over the same period”?**

10 **A.** No; I find many problems with his response. First, Dr. Spencer says that his claim is
11 primarily based on Fyfe et al., *Overestimated Global Warming over the Past 20 Years*,
12 which was published in 2013. That may seem like a recent analysis, but this is a fast-
13 moving subject and new papers come out on this monthly. As I described in my rebuttal
14 testimony, more recent work has more carefully compared models and observations and
15 concluded that they are basically consistent.

16 Additionally, the Fyfe paper covers the period beginning 1993, not 1979. And Dr.
17 Spencer's claim is about deep tropospheric temperatures, but the Fyfe paper talks about
18 surface temperatures. I therefore conclude that the Fyfe paper does not actually support
19 Dr. Spencer's claim.

1 Dr. Spencer provides a list of additional sources that he asserts support his claim. I have
2 not read the blog posts or Wall Street Journal editorial cited—I don't consider them
3 legitimate sources of scientific information and do not believe they should have any
4 bearing on the outcome of this case.

5 If we consider the peer-reviewed papers Dr. Spencer provided, they are all invalid for one
6 reason or another. Two of the studies are from 1997 and 2001, too old to make usable
7 claims about modern climate models. None of the other papers cited reach Spencer's
8 conclusion—that models overestimate by 2-3 times trends in deep tropospheric
9 temperatures since 1979. In fact, most of the sources don't even address this question.

10 Overall, it is clear to me that there is no legitimate support for Dr. Spencer's claim here.

11 **Q. Did Dr. Spencer provide citations to support this statement: “Yes, surface**
12 **thermometers are capable of directly measuring temperatures near the surface of**
13 **the Earth, but tend to have long-term spurious warming effects over land from**
14 **urbanization effect”?**

15 **A.** No. Again, I find many problems with his response. Dr. Spencer cites several papers
16 supporting his position, all of which have problems. Dr. Spencer says the main support
17 for his claim comes from a Government Accountability Office report. While this report
18 does exist, and does discuss proper siting standards for surface thermometers, the report
19 does not support his conclusion. In fact, the report says *nothing* about the accuracy of
20 global trends derived from the surface temperature record.

1 Dr. Spencer cites several other papers, all of which have problems with respect to Dr.
2 Spencer's claim:

- 3 • Oke (1973): The paper documents the existence of the urban heat island effect;
4 this is not controversial. In fact, the surface temperature records are explicitly
5 adjusted to take this into account. The mere existence of the urban heat island
6 therefore does not support the claim of significant biases in the global temperature
7 record.
- 8 • de Freitas, et al. (2014) and Yang et al. (2011): These are both regional
9 assessments. Neither paper analyzes biases in the global record. These papers
10 therefore do not support existence of significant biases in the surface temperature
11 record.
- 12 • Wang et al. (2014): This is the most puzzling reference. While the word "bias"
13 does exist in the title, it is bias in the models, not the measurements that are
14 discussed. In addition, the paper talks about ocean measurements, which cannot
15 be affected by the urban heat island effect. Given how far this paper is from what
16 Dr. Spencer claims, it's difficult to believe that Dr. Spencer even read the paper.

17 **Q. Do the papers cited by Dr. Spencer in response to the Clean Energy Organizations**
18 **Information Request 10c "provide significant evidentiary support" for the**
19 **statement that: "An increasing number of peer-reviewed studies are suggesting**
20 **much lower climate sensitivity than the IPCC [Intergovernmental Panel on Climate**
21 **Change] and its models assume, possibly as low as 1 deg. C or less for a doubling of**
22 **atmospheric CO₂."**

23 **A.** No. Both the original claim and the rebuttal are deeply misleading. The peer-reviewed
24 papers cited by Dr. Spencer all contain estimates of climate sensitivity that overlap

1 substantially with the IPCC's estimate. While the ranges do not overlap perfectly, there is
2 no evidence to conclude that the IPCC's range is likely wrong. In addition, as I pointed
3 out in my rebuttal testimony, Dr. Spencer ignores the analyses that suggest higher climate
4 sensitivities, which also overlap with the IPCC's range.

5 **III. RESPONSE TO DR. RICHARD LINDZEN.**

6 **Q. In Dr. Lindzen's rebuttal testimony he states that his discovery "responses supply**
7 **citations supporting certain elements of [his] testimony." Have you reviewed the**
8 **discovery responses to which Dr. Lindzen is referring?**

9 **A.** Yes.

10 **Q. Do you agree that he provided citations to support his opinion that: "a climate**
11 **sensitivity value of 2°C or more is highly unlikely. Evidence indicates that climate**
12 **sensitivity may fall within a range of from about 0.85°C to 1.5°C."?**

13 **A.** No. Dr. Lindzen provides a list of papers that purportedly support his analysis. However,
14 reading the papers reveals that *none* of them support his contention that either (1) the
15 likely range is 0.85-1.5°C or (2) that climate sensitivity values above 2°C are unlikely.

16 As an example, Dr. Lindzen cites Stevens' paper *Rethinking the Lower Bound on Aerosol*
17 *Radiative Forcing* as support for low climate sensitivity. Not only does this paper not
18 support Dr. Lindzen's claim, but the author has put out a statement explicitly saying so:

19 In my new paper I did not speculate as to the implications of my findings for
20 estimates of Earth's Equilibrium Climate Sensitivity, which is perhaps the
21 simplest measure of the response of the Earth System to a change in concentration

1 of atmospheric carbon dioxide. However others have used my findings to suggest
2 that Earth's surface temperatures are rather insensitive to the concentration of
3 atmospheric CO₂. I do not believe that my work supports these suggestions, or
4 inferences.¹

5 This establishes a pattern of Dr. Lindzen misquoting papers. The Fyfe et al. paper, for
6 example, mentions the possibility that climate sensitivity in the models may be too high.
7 But nowhere do they talk about what the actual values might be. The Stott et al. paper
8 similarly does not conclude that climate sensitivity values are as low as Dr. Lindzen
9 claims. The Lewis and Curry paper does allow low sensitivities (almost 1°C), but also
10 allows a climate sensitivity greater than 4°C. This clearly contradicts Dr. Lindzen's
11 claim.

12 I'll defer to Dr. Lindzen in his opinion that his previously published works supports his
13 contention. However, I would point out that no one in the scientific community believes
14 those papers—they have been, by and large, discredited.

15 Thus, I find that Dr. Lindzen provides no convincing evidence that climate sensitivity
16 may be low.

¹ <http://www.mpimet.mpg.de/nc/en/communication/news/single-news/article/statement-bjorn-stevens-to-publication-rethinking-the-lower-bound-on-aerosol-radiative-forcing.html>

1 **Q. Do you agree that Dr. Lindzen supported his claim that “if we wish to account for**
2 **the observed warming over the past 150 years on the basis of greenhouse gases,**
3 **volcanoes and aerosols, then the new bounds on aerosols rule out sensitivities over**
4 **about 2C.”**

5 **A.** No. In his response, Dr. Lindzen simply points to his response to the last query. Given
6 how inadequate that response was, it’s not surprising that I find his response here to be
7 equally devoid of merit.

8 **Q. Do you agree that Dr. Lindzen supported his claim that “Interestingly, a recent**
9 **paper (Mauritsen and Stevens, 2015) notes that the inclusion of the iris effect in**
10 **their model uniquely corrects a variety of serious model deficiencies”?**

11 **A.** No. The query asked Lindzen where in the paper it said the iris effect was a unique
12 solution to model deficiencies. In his response, Lindzen simply repeated the citation to
13 the paper—he did not respond to the actual query. I can tell you with certainty that his
14 claim is incorrect, so I suspect that his lack of response means that he also knows this.

15 **IV. RESPONSE TO DR. WILLIAM HAPPER.**

16 **Q. In Dr. Happer’s rebuttal testimony he states that his discovery responses “show**
17 **there is ample evidentiary support for each of [his] statements.” Have you reviewed**
18 **the discovery responses to which Dr. Happer is referring?**

19 **A.** Yes.

1 **Q. Did Dr. Happer provide support for the statement that: “Observations are**
2 **consistent with little, and perhaps even negative feedback, corresponding to**
3 **doubling sensitivities of $S = 1\text{ K}$ or less”?**

4 **A.** No. Much like the responses of Drs. Spencer and Lindzen, Dr. Happer provides a long
5 list of citations. While superficially impressive, a thorough reading reveals anything but
6 support for Dr. Happer’s claim. First, I dismiss without further comment the blogs, op-
7 eds, Congressional testimony, and other non-peer reviewed sources of information. As
8 mentioned above, the fact that this is advanced as “evidence” provides a strong indication
9 of the weakness of the support for their argument. I also dismiss the paper by
10 Abdussamatov, which appears in a journal that accepts everything submitted in order to
11 collect page charges—it is effectively a vanity press.

12 Many of the remaining papers are the same as those cited by Drs. Spencer and Lindzen.
13 The Fyfe et al. paper, for example, mentions the possibility that climate sensitivity in the
14 models may be too high. But nowhere do they talk about what the actual values might be.
15 The Stott et al. paper similarly does not conclude that climate sensitivity values are likely
16 1°K or less. The Lewis and Curry paper does allow low sensitivities (almost 1°C), but
17 also allows a climate sensitivity greater than 4°C . This clearly contradicts Dr. Happer’s
18 claim.

1 The paper by Mauritsen and Stevens cited by Dr. Happer actually concludes the *exact*
2 *opposite* of what Happer claims.² The paper by McKittrick does not even mention climate
3 sensitivity once, so it's hard for me to understand how Dr. Happer can conclude that the
4 paper supports a sensitivity less than 1°K.

5 And, of course, Dr. Happer references the Stevens' paper *Rethinking the Lower Bound on*
6 *Aerosol Radiative Forcing* as support for low climate sensitivity. Apparently Dr. Happer
7 has not read Stevens' statement contradicting that interpretation of the paper.

8 I will again defer interpretation of the Dr. Lindzen articles, but I will also again point out
9 that they have been thoroughly discredited.

10 Clearly, Dr. Happer has not provided any legitimate evidence to support his claim of low
11 sensitivity.

12 **Q. Did Dr. Happer provide support for his claim that “[e]ven the lower limit, 1.5 K, is**
13 **hard to reconcile with the almost complete lack of warming since the year 1998.”**

14 **A.** No. In response to this question, Dr. Happer points to his response to the previous
15 question. As you can probably infer from my discussion above, the citations he presents
16 simply do not say what he claims they do. Thus, I find his argument completely
17 unconvincing.

18 **Q. Did Dr. Happer provide support for his claim that “ground-based warming [is]**

² See <http://www.realclimate.org/index.php/archives/2015/04/the-return-of-the-iris-effect/> for a general-audience summary of the paper.

1 **known to have serious systematic errors associated with the loss of observing**
2 **stations and urban heat island effects, both of which bias the results to more**
3 **warming than actually exists.”**

4 **A.** No. His argument is virtually identical to the response from Dr. Spencer, even
5 referencing the same irrelevant paper by Wang et al. that does not even mention land
6 temperature measurements, let alone discuss biases in them. It’s hard for me to
7 understand how two of Peabody Energy’s experts could both independently
8 misunderstand the same paper in exactly the same way. As I discuss in my response to
9 the nearly identical response of Dr. Spencer, the overall argument is weak and
10 unconvincing.

11 **V. RESPONSE TO DR. RICHARD TOL.**

12 **Q. Have you reviewed the written testimony of Dr. Richard Tol?**

13 **A.** Yes.

14 **Q. Do you agree with his conclusions about the consensus of climate scientists?**

15 **A.** No. As a climate scientist, I talk to other climate scientists every day, I read the peer-
16 reviewed literature every day, and I go to national and international meetings on climate
17 science just about every month. Based on this experience, I can tell you with great
18 confidence that the main conclusions of climate science (the earth is warming, humans
19 are extremely likely to blame for most of the recent warming, and future warming could
20 be significant) are supported a strong consensus of the expert scientific community.

1 It is important to note that Dr. Tol’s testimony never actually argues that there is NOT a
2 consensus in climate science. Rather, his testimony is focused on attacking 97% number
3 determined by the Cook et al. study. I admit that I have never read the Cook et al. study,
4 so I cannot comment on any methodological flaws it might have. But even if flaws exist
5 in the study, the conclusion—that a strong consensus exists among the relevant experts—
6 is correct. I base this on my own expert view of the scientific community—one far more
7 informed than that of an economist like Dr. Tol.

8 In fact, we can find evidence for this strong consensus everywhere. Every year, for
9 example, I hear from Texans who want to set up a “debate” about climate science. There
10 are dozens of atmospheric/climate scientists in Texas at our major research universities
11 who they can pick from to represent the mainstream view. In my department alone, there
12 are at least four faculty members who have participated in these kinds of events in the
13 past. However, it is apparently impossible to find a Texas scientist who will represent the
14 skeptical viewpoint. Inevitably, the organizers of the “debate” are required to fly skeptics
15 in from out of state. If there were a legitimate debate about the main conclusions of
16 climate science, you should be able to find many Texas atmospheric scientists who would
17 be willing to take the skeptical position. Given the fact that no one’s been able to locate
18 any, I find this convincing evidence of a strong consensus in the expert scientific
19 community.

1 **VI. CONCLUSION.**

2 **Q. Does this conclude your testimony?**

3 **A. Yes.**