

Responses to questions about Washington D.C. defamation case against Clack and the National Academy of Sciences (NAS) and California Labor Commissioner Case against Stanford University

by Prof. Mark Z. Jacobson, March 27, 2024

1. Did the Washington D.C. trial court or appellate court issue a decision on your defamation complaint filed against NAS or Clack?

No, I voluntarily dismissed my defamation case before any decision on it.

2. Was there any discovery permitted in the D.C. case?

No. The trial court judge prohibited discovery in the case.

3. Did any judge in in the D.C case issue a finding of fact?

No judge issued any finding of fact in the D.C. case.

4. Has a judicial body in California issued a finding of fact regarding the statements you alleged were defamatory in the D.C. case?

Yes. I filed a claim with the California Labor Commissioner against Stanford University, requesting the Commissioner to order Stanford to reimburse me under Labor Code 2802 for necessary expenses I incurred in filing the D.C. defamation case. The Labor Commissioner held a hearing with an expert witness, a fact witness, and arguments and issued a 12-page “Finding of Fact” on June 30, 2022.

5. What was the conclusion of the Labor Commissioner?

The Labor Commissioner ruled that the Clack Paper stated false facts that tarnished my reputation:

“The writing and publishing of the Clack paper, to the extreme, **tarnished Plaintiff’s reputation...** As such, plaintiff brought suit against Clack and PNAS, to remedy the damage **caused by Clack stating false-facts in his paper**, as Stanford refused to mitigate the damage on behalf of Plaintiff,...” (emphasis added)

6. What remedy did the Labor Commissioner order?

The Labor Commissioner ordered Stanford to reimburse me for my own legal fees for the three years prior to the proceeding and withheld judgment on whether it would order Stanford to reimburse me for attorney's fees of Clack and NAS that I have had to reimburse them for in the D.C. case.

7. What judgment was issued in the D.C. case?

That I should reimburse certain attorney's fee expenses of NAS and Clack

8. Were you ordered to pay Clack or NAS personally beyond reimbursing fees?

No.

9. Was NAS required to pay any of its own attorney's fees?

Yes, NAS was required to pay \$107,180 of its own attorney's fees. NAS requested \$535,903.65 and was awarded \$428,722.92 in reimbursements.

10. Why did you have to reimburse any attorney's fees?

Because the D.C. Court of Appeals interpreted a law for the first time, stating that one who voluntarily dismisses a defamation case any time after a motion to dismiss is filed, may be required to reimburse legal fees of the other party even if the dismissal occurs before a ruling. The Court of Appeals stated (p.11) that "the text is ambiguous but favors permitting a fee award." Thus, there was no prior ruling guiding this decision.

11. Why did you voluntarily dismiss on February 22, 2018 before a ruling?

My reason for voluntarily dismissing was published publicly the same day of my dismissal as follows:

"It became clear, just like in the Mann case, which has been going on for 6 years, that it is possible there could be no end to this case for years, and both the time and cost would be enormous. Even if the motions for dismissal were defeated, the other side would appeal, and that alone would take 6-12 months if not more. Even if I won the appeal, that would be only the beginning. It would mean time-consuming discovery and depositions, followed by a trial. The result of the trial would likely be appealed, etc., etc."

"Second, a main purpose of the lawsuit has been to correct defamation by correcting the scientific record through removing false facts that damaged my coauthors and

my reputations. While I have not succeeded in having the scientific record in the C17 article corrected, I have brought the false claims to light so that at least some people reading C17 will be aware of the factually inaccurate statements.”

“As such, after weighing the pros and cons, I find that I have no more reason to fight this battle. I believe it is better use of my time continuing to help solving pressing climate and air pollution problems.”

In fact, the *Mann* case took 12 years to reach trial. The reason “[i]t became clear” was that my attorney told me the day of the hearing that, if I won, “the other side would appeal” rather than face trial. Because D.C. courts were clogged, it could be 6+ years before finality, as with *Mann*. Thus, the courts could not “correct defamation,” which was “[a] main purpose of the lawsuit,” in a timely manner, and my own fees over 6+ years would be “enormous.”

12.Does the D.C. Court system now permit data falsification in science papers?

Yes, the D.C. Court of Appeals held that statements made in science papers “require[] so deep an understanding of the relevant science” that it will not consider whether they are false, fraudulent, or defamatory. Specifically, the court stated (p. 24 of its ruling):

“But to even recount the allegedly false statements lays bare that he is seeking to drag a scientific debate into court under the auspices of defamation law. To illustrate, Jacobson alleges that (1) Clack falsely stated that the values in Table 1 of Jacobson’s article were maximum values when they were in fact average values; (2) Clack falsely stated that he was unaware of any explanation for the large peak discharge of hydropower depicted in three figures in the Jacobson article; (3) Clack falsely claimed that the annual hydropower output represented in Jacobson’s article was higher than historical averages; and (4) Clack falsely asserted that Jacobson’s work contained modeling errors. To even form an opinion on whether Jacobson is correct would require so deep an understanding of the relevant science that these debates lie squarely within the realm of scientific debate-who is right on these matters is not something that defamation law polices.”

As such, the Washington D.C. court system now permits scientists to falsify facts and lie in science papers to defame with impunity.

13.Does the D.C. Court system now hold that the only statements that can be defamatory are ad hominem attacks or similar statements?

Yes. The D.C. Court of Appeals (p. 23 of its ruling) stated that the only defamatory comments allowed under D.C. law are ad hominem attacks or other similar statements. Similarly, the trial court held that the only defamatory statements are those that accuse one of “misconduct or impugn his integrity.” Statements that don’t attack one’s “honesty or accuse him of misconduct” cannot be defamatory.

This differs from California law, and most every defamation law in the world. In California, for example, an ordinary false factual claim of professional error defames since it imputes to one “incompetence in his trade.” *Gould v. Maryland Sounds Ind., Inc.*, 31 Cal.App.4th 1137 (1995).

14. Did NAS and Clack publish false facts?

Yes. As concluded by the California Labor Commissioner (Point 5) and as verified by four experts (Exhs 1-8) and by admissions from Dr. Clack himself (Exhs 9-10), Clack and NAS published the following false facts:

- 1) They falsely claimed Table 1 of the Jacobson paper contained maximum values when it factually contained average values.
- 2) They falsely claimed the Jacobson Paper contained a modeling error by falsely claiming a discrepancy between Table 1 and some figures in the Jacobson Paper when it was the Clack Authors who made the error by falsely claiming Table 1 contained maximum values.
- 3) They produced false graphics omitting the inclusion of Canadian hydropower in the Jacobson paper. Clack admitted (Exh 9) in a presentation on September 21, 2017 that he agreed that the Jacobson Authors “rely on Canadian hydroelectricity when necessary,” yet he never corrected his false graph.
- 4) They falsely claimed the Jacobson Paper contained a modeling error with regard to the high hydropower peak discharge rate in some figures when the Clack Authors were well aware that the Jacobson Authors assumed turbines were added to existing dams without changing annual hydropower output. Clack himself admitted in writing on March 2, 2016, 16 months before the Clack paper was published, that he understood this “hydropower assumption” and tested it (Exh 10 – “I am not disagreeing with the possibility that it can be done with CSP and hydro etc....I have done tests on the efficacy of hydroelectric dispatch in 100% CF scenarios.”) but pretended he didn’t know about the assumption in the Clack Paper, stating (section S1.1) “we hope there is another explanation for the large amount of hydropower output depicted in these figures.”

15. Do the experts agree that the statements at issue are false facts, not scientific disagreements?

Yes.

Prof. Howarth

Exh 1: “The issues I address in points #10 and #11 above are questions of fact, and are examples where the Clack Paper failed to follow due diligence. In my professional judgement, these facts can be correctly determined from evidence in the Jacobson et al. paper and in the sources cited there. “

Exh 5: “In my professional opinion, the Clack Paper incorrectly took average values in a table from the Jacobson et al. paper and stated that these were maximum values.”

Exh 5: “Further, the Clack Paper omitted that the hydropower production estimate in the Jacobson et al. paper included imported Canadian hydropower, and then based on this omission erroneously stated that the estimate of the Jacobson et al. paper was excessively high for hydropower.”

Exh 5: “The Clack Paper then stated that Jacobson et al. had made a “modeling error,” when in fact the Clack Paper was simply mis-stating what Jacobson et al. had presented.”

Exh 5: “The Clack Paper was not making informed “interpretation of judgement of data,” but rather was making changes to the factual definition of the data and omitting information, and then interpreting/judging based on these altered and omitted data.”

Prof. Diesendorf

Exh 2: “My assessment is that Question 11.1 is a question of fact that I have verified from studying both the Jacobson PNAS paper itself and its reference 22 (also by Jacobson), which is the source of the data in Table 1 of Jacobson’s PNAS paper. Furthermore, the latter reference states clearly on page 2095 that “The table is derived from a spreadsheet analysis of annually *averaged* end-use load data” (my italics). Therefore, the answer to Question 11.1 is “average”, as stated by Jacobson.”

Exh 2: “My assessment is that Question 11.2 is a question of fact that I have verified from both the Jacobson PNAS paper itself together with its reference 22, which states clearly on page 2102 that ‘In addition, 23 U.S. states receive an estimated 5.103 GW of delivered hydroelectric power *from Canada*’ (my italics). Therefore, the answer to Question 11.2 is ‘yes’, as stated by Jacobson. “

Exh 6: “This is not an interpretation/judgment of data but instead is altering the factual definition of data.”

Prof. Ingraffea

Exh 3: “Clearly, Clack et al. incorrectly assessed the numbers in Table 1 as “maximum” values... This is not a matter of scientific disagreement. Rather, it is a matter of fact: the numbers in Table 1 are either maximum values, or they are average values.”

Exh 3: “Claim #2: Clack alleges that it is only “scientific disagreement” concerning the Jacobson paper use of Canadian hydropower in its calculations. Again, this is a matter of fact, not opinion: either it does or it does not include such imports. The Clack paper clearly errs in fact in asserting that hydroelectric output used in the Jacobson paper calculations is from U.S. facilities only.”

Exh 7: “This is clearly another instance of apparently purposeful obscuring of the factual definition of data.”

Exh 7: “This is an instance where authors of the Clack paper made an incorrect inference about the model based on their own altering and obscuring of factual data.”

Exh 7: “The unsupported inference of “modeling error” should have been obvious to the authors had they thoroughly checked for mathematical computer modeling error.”

Prof. Strachan

Exh 4: “...it is clear that the answer to the question contained in 10.1 is average, as correctly stated by Dr. Jacobson... This is a point of fact. 12. Therefore, I am again perplexed as to why Dr. Clack and his co-authors made yet another basic error... This is another point of fact.”

Exh 8: ”This is an instance of altering the factual definition of data. With erroneous conclusions then arising. It is my perception that changing the definition of data in this way amounts to reckless / poor scholarship.”

Exh 8: “This is a further instance of altering the factual definition of data. It is my perception that the Clack paper made a reckless error in this respect. With erroneous conclusions then arising.”

Exh 8: “The Clack paper makes spurious claims in this respect. There is no evidence of ‘modelling errors’. It is my perception that this is an example of poor scholarship.”

Exh 8: “The Clack paper again makes spurious claims in this respect. There is no evidence of ‘modeling errors’. It is my perception that this is an example of reckless or rash scholarship.”

Exh 8: “When criticizing in a significant way an author’s paper it is accepted custom and practice to seek clarifications on the issue or issues of an uncertainty or issues that are in dispute...Failure to seek clarification from an author, especially where there is a significant rebuttal of a paper would amount to acting in disregard of the truth.”

16. Do the experts agree that it was unethical and reckless disregard for the truth for the Clack Authors to refuse to correct their false facts when they were informed of the correct facts or admitted the facts were false?

Yes.

Prof. Howarth

Exh 5: “Due diligence would also have required that Dr. Clack and coauthors correct their factual misinterpretation of the Jacobson et al. paper, and do so quickly once they became aware of their error.”

Exh 5: “Dr. Clack and coauthors should have either withdrawn their manuscript or completely revise it so as not to perpetuate their error. If they only became aware of the error after publication in *PNAS*, they should have asked the journal to publish a correction, and perhaps an apology.”

Prof. Diesendorf

Exh 6: “Is an author who makes a factual mistake in a review of other people’s work following due diligence or acting in reckless disregard for the truth or in bad faith when he or she...refuses to correct the factual mistake when informed about it, with evidence, after publication? Acting in reckless disregard for the truth and in bad faith.”

Prof. Ingraffea

Exh 7: “Is an author who makes a factual mistake in a review of other people's work following due diligence or acting in reckless disregard for the truth or in bad faith when he or she: Refuses to correct the factual mistake when informed about it, with evidence, before publication? My answer: This is an instance of reckless disregard for the truth.”

Exh 7: “Is it unethical or ethical for authors of a paper to REFUSE to issue a correction to their paper AFTER publication if a material FACTUAL error is discovered in their paper? My answer: It is unethical.”

Prof. Strachan

Exh 8: “Is an author who makes a factual mistake in a review of other people’s work following due diligence or acting in reckless disregard for the truth or in bad faith when he or she...refuses to correct the factual mistake when informed about it, with evidence, after publication? This is clearly unethical behaviour and in contravention of accepted academic norms and values. It is fundamentally dishonest. My perception is that this amounts to gross misconduct,...”

EXHIBIT 1

Declaration of Dr. Robert Howarth

1. My name is Robert W. Howarth, Ph.D. I am over the age of 18 and competent to make the following Declaration.
2. I have been a tenured faculty member at Cornell University, Ithaca, NY, since 1985. Since 1993, I have held an endowed position at Cornell as the *David R. Atkinson Professor of Ecology & Environmental Biology*.
3. I have extensive experience in academic publishing. I am the author or co-author of over 200 papers, and these have been cited by others in the peer-reviewed literature more than 65,000 times. I am the Founding Editor of the academic journal *Biogeochemistry* and served as Editor-in-Chief of that journal from 1983 to 2004. I was also the Editor-in-Chief of the academic journal *Limnology & Oceanography* from 2014 to 2019.
4. I served on the Committee on Ethics of the America Society for Limnology & Oceanography from 1992-1998. I served as President-Elect and then President of the Coastal & Estuarine Research Federation from 2005 to 2009, overseeing the publications and ethical issues of that professional society. And I have been a member of the Committee on Publication Ethics (COPE) since 2014. COPE “is a nonprofit organization whose mission is to define best practice in the ethics of scholarly publishing and to assist editors, publishers, etc. to achieve this.” (https://en.wikipedia.org/wiki/Committee_on_Publication_Ethics)
5. I am aware of the litigation filed by Dr. Mark Jacobson against Dr. Clack and others associated with writing and publishing the paper entitled “Evaluation of a proposal for reliable low-cost grid power with 100% wind, water and solar,” *PNAS*, doi:1073/pnas.1610381114, 2017 (the “Clack Paper”).
6. I am not a party to the litigation and have not participated in the litigation prior to filing this Declaration.
7. I was not associated with the publication of the Clack Paper nor of the 2015 paper by Dr. Jacobson and others, also published in *PNAS*, that was the subject of the Clack Paper.
8. I have previously collaborated with Dr. Jacobson and am a co-author of two papers with him published in 2013 and 2014 (Jacobson M.Z., R.W. Howarth, M.A. Delucchi, S.R. Scobies, J.M. Barth, M.J. Dvorak, M. Klevze, H. Katkhuda, B. Miranda, N.A. Chowdhury, R. Jones, L. Plano, and A.R. Ingraffea, 2013, “Examining the feasibility of converting New York State’s all-purpose energy infrastructure to one using wind, water, and sunlight,” *Energy Policy* 57: 585-601, doi.org/10.1016/j.enpol.2013.02.036i; and Jacobson, M.Z., M.A. Delucchi, A.R.

Ingraffea, R.W. Howarth, G. Bazouin, B. Bridgeland, K. Burkart, M. Change, N. Chowdhury, R. Cook, G. Escher, M. Galka, L. Han, C. Heavey, A. Hernandez, D.F. Jacobson, D.S. Jacobson, B. Miranda, G. Novotny, M. Pellat, P. Quach, A. Romano, D. Steward, L. Vogel, S. Wang, H. Wang, L. Willman, and T. Yeskoo, 2014, "A roadmap for repowering California for all purposes with wind, water, and sunlight," *Energy*, doi.org/10.1016/j.energy.2014.06.099).

9. I have carefully reviewed both the Jacobson et al. 2015 paper and the Clack Paper.
10. The Clack Paper claimed that Table 1 in the Jacobson paper presented maximum values, and they therefore concluded that the Jacobson et al. a discrepancy between the table and figures presented in the paper. The Clack Paper is wrong with regard to this claim. Table 1 presented average values. Consequently, the Clack Paper is also wrong to have concluded there was any discrepancy. There was not. It is not at all apparent how the Clack Paper reached this erroneous conclusion, which lies at the heart of their criticism of the paper by Jacobson and colleagues.
11. The Jacobson et al. 2015 paper includes hydro power from Canada. The Clack Paper failed to recognize this, and therefore mistakenly claimed that the annual average hydro-power values used by Jacobson et al. were too high: the Clack Paper was wrong in their assumption that the hydro values in Jacobson et al. were just for power produced within the United States.
12. The issues I address in points #10 and #11 above are questions of fact, and are examples where the Clack Paper failed to follow due diligence. In my professional judgement, these facts can be correctly determined from evidence in the Jacobson et al. paper and in the sources cited there. Beyond that, if Dr. Clack and his colleagues were confused, normal scientific practice would have been for them to directly contact Dr. Jacobson for clarification, rather than to publish the critique as they did in the Clack Paper.
13. As an expert on scientific publishing, I conclude that the Clack Paper should not have been published in the *Proceedings of the National Academy of Sciences* as a "Research Article." The Clack Paper is clearly not a research article, either as generally defined by the community of research scientists or as specified by the journal's own guidelines. These guidelines state that the journal only publishes research articles if they are based on "original scientific research of exceptional importance..." (<https://www.pnas.org/page/authors/purpose-scope>). There was no original research in the Clack Paper.
14. The Clack Paper was written specifically and exclusively as a comment on the Jacobson et al. paper. There were no new data presented. There were no hypotheses tested. This was not original research. As such, if it were to have been published at all, it should have been

published as a “Letter” or as a “Commentary.” This is true under either general science-publishing traditions or the specific rules and guidelines of the *Proceedings of the National Academy of Sciences* (<https://www.pnas.org/page/authors/purpose-scope>). Note that these journal guidelines specify that Letters be used to “point out potential flaws in studies published in the journal.” That is not the purpose of a Research Article.

15. In my professional opinion, the publication of the Clack Paper falls outside of the bounds of normal scientific debate. PNAS did not follow normal publication procedures, defined either in terms of general norms in our field or the specific guidelines of their own journal. I believe this caused harm to the reputation of Dr. Jacobson.

I declare under penalty of perjury that the foregoing is true and correct, to the best of my knowledge. Executed on July 20, 2020 from my home in Trumansburg, NY.



Robert W. Howarth, Ph.D.

EXHIBIT 2

**SUPERIOR COURT OF THE DISTRICT OF COLUMBIA
CIVIL DIVISION**

Mark Z. Jacobson, Ph.D.,

Plaintiff,

v.

Christopher T.M. Clack, Ph.D.

and

National Academy of Sciences,

Defendants.

2017 CA 006685 B

Judge Elizabeth Wingo

Next Court Date: None Scheduled

DECLARATION OF DR MARK O. DIESENDORF

Declaration of Dr Mark O. Diesendorf

1. My name is Mark O. DIESENDORF, I am over the age of 18 years and am competent to make the following declaration.
2. I am currently Honorary Associate Professor at UNSW Sydney, formerly called the University of New South Wales. Previously, at various times before my nominal retirement in 2016, I was a Principal Research Scientist in Australia's national research organization, CSIRO; Professor of Environmental Science and Founding Director of the Institute for Sustainable Futures at University of Technology Sydney; Associate Professor and Deputy Director of the Institute of Environmental Studies at UNSW Sydney; and Education Program Leader of the Australian Cooperative Research Centre for Low Carbon Living. As an author or coauthor, I have published 78 peer-reviewed journal papers, three scholarly books, 36 scholarly book chapters and 13 peer-reviewed conference papers.
3. From 2011 to 2016 I was a senior researcher in a research program at UNSW Sydney that performed computer simulation modelling of the operation of the Australian National Electricity Market running entirely on renewable energy. I am co-author of several peer-reviewed journal papers on this particular topic. This research is similar to that conducted on the electricity systems of the United States of America by Dr Mark Jacobson. Therefore, I have expertise in the scientific issues discussed in Dr Jacobson's and Dr Clack's journal papers published in PNAS in 2015 and 2017 respectively. I have studied both papers.
4. I understand that Dr Jacobson has initiated litigation against Dr Clack on the grounds that the Clack paper and public statements by Dr Clack misrepresent Dr Jacobson's paper.
5. I have not been involved in this litigation prior to making this declaration am not a co-author of either of the papers relevant to this litigation.
6. Dr Jacobson has requested my expert opinion on whether three issues raised in the case are matters of fact or of scientific disagreement.

7. As a scientist, I understand that a fact is something that has either been proven to be true or is true by definition or logical argument. The following are examples of facts:
 - 7.1 That I am an Australian citizen, because it can be verified by inspection of my birth certificate and passport.
 - 7.2 That, if 2 and 3 are real numbers, $2 + 3 = 3 + 2 = 5$.
 - 7.3 That the Earth is warming, because it has been verified by scientific measurements taken over decades by many independent research groups based in different countries.

8. As a scientist, I understand that a scientific disagreement can occur when we have incomplete information about the system of interest and different scientific hypotheses can be held that are consistent with the available data, logic and existing scientific facts. For example, it is at present a matter of scientific disagreement as to whether there is any kind of life on Mars or whether human-induced climate change is already irreversible by human actions.

9. I wish to emphasize that disagreement between scientists is not always the same as 'scientific disagreement'. For example, a scientist who dislikes me could claim incorrectly that I am not an Australian citizen, although I can supply strong documentary evidence to show that I am an Australian citizen. This disagreement between scientists is not a scientific disagreement, because the scientist making the incorrect claim is not basing it on science but rather on emotion.

10. Another example of a disagreement between scientists that is not a scientific disagreement is the following. Based on their religious beliefs, a scientist could claim that the earth was created literally in seven days, but to do this they would have to ignore all the fossil, geological and biological evidence to the contrary; this disagreement is not a scientific disagreement.

11. Dr Jacobson asserts that the following three questions raised in the litigation are issues of fact and not issues of scientific disagreement:
 - 11.1 Does Table 1 of the Jacobson paper, published in PNAS in 2015, contain maximum or average values?

11.2 Did the Jacobson PNAS paper contain imported Canadian hydro power as part of its results?

11.3 Is there a modelling error in Jacobson's LOADMATCH computer code that he used in his PNAS paper?

12. My assessment is that Question 11.1 is a question of fact that I have verified from studying both the Jacobson PNAS paper itself and its reference 22 (also by Jacobson), which is the source of the data in Table 1 of Jacobson's PNAS paper. Furthermore, the latter reference states clearly on page 2095 that 'The table is derived from a spreadsheet analysis of annually *averaged* end-use load data' (my italics). Therefore, the answer to Question 11.1 is 'average', as stated by Jacobson.
13. My assessment is that Question 11.2 is a question of fact that I have verified from both the Jacobson PNAS paper itself together with its reference 22, which states clearly on page 2102 that 'In addition, 23 U.S. states receive an estimated 5.103 GW of delivered hydroelectric power *from Canada*' (my italics). Therefore, the answer to Question 11.2 is 'yes', as stated by Jacobson.
14. Whether Question 11.3 is a question of fact or of scientific disagreement depends on the definition of 'modeling error'. As a modeler myself, I believe that the vast majority of scientists would interpret 'modeling error' as an error or bug in the computer code, as I do. Such an apparent scientific disagreement can be resolved *factually* from expert examination of the computer code and the model output. To establish the existence of such a modelling error, Clack would have to present evidence identifying it. His paper fails to do this and therefore fails to establish that there is a genuine scientific disagreement.
15. Instead, Clack's paper identifies results he contests in Jacobson's paper and includes them in the section of Clack's paper called 'Modeling Errors'. In my assessment the Clack paper is claiming the contested results are due to computer bugs in the LOADMATCH computer model.
16. In particular, the following statement is in the Clack paper's section on Modeling Errors:

‘In fact, the flexible load used by LOADMATCH is more than double the maximum possible value from table 1 of ref. 11. The maximum possible from table 1 of ref. 11 is given as 1,064.16 GW, whereas figure 3 of ref. 11 shows that flexible load (in green) used up to 1,944 GW (on day 912.6). Indeed, in all of the figures in ref. 11 that show flexible load, the restrictions enumerated in table 1 of ref. 11 are not satisfied.’

In my reading, the quoted sentences claim that Jacobson’s paper has a software bug, because Jacobson’s figures don’t match their Table 1. But this claim is based on Clack’s factually incorrect reading of the values in Jacobson’s Table 1, as pointed out in Paragraph 12 of this Declaration. Clack has assumed incorrectly that Jacobson’s Table 1 contains maximum values when it actually contains average values. Therefore, this Claim by Clack, that Jacobson’s paper contains a modelling error, i.e. an error or bug in the computer code, has not been established.

17. Similarly, the following statement is in the Clack paper’s section on Modeling Errors:

‘For example, the numbers given in the supporting information of ref. 11 imply that maximum output from hydroelectric facilities cannot exceed 145.26 GW (SI Appendix, section S1.1), about 50% more than exists in the United States today (15), but figure 4B of ref. 11 (Fig. 1) shows hydroelectric output exceeding 1,300 GW.’

Once again, I read this as a claim that Jacobson’s paper contains an error or bug in the computer code, because the Clack paper states Jacobson’s figure 4B, which derives from the LOADMATCH computer program, has values that exceed 145.26 GW, thus a discrepancy exists between model output and other data from the paper. Again, whether such a difference is due to a computer bug can be determined factually, thus is a question of fact, not a question of scientific disagreement.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 4 August 2020.

Mark Oliver Diesendorf

EXHIBIT 3

**SUPERIOR COURT OF THE DISTRICT OF COLUMBIA
CIVIL DIVISION**

Mark Z. Jacobson, Ph.D.,)	
)	
Plaintiff,)	
)	
v.)	2017 CA 006685 B
)	Judge Elizabeth Wingo
Christopher T.M. Clack, Ph.D.)	Next Court Date: None Scheduled
)	
and)	
)	
National Academy of Sciences,)	
)	
Defendants.)	
_____)	

DECLARATION OF DR. ANTHONY R. INGRAFFEA

DECLARATION OF DR. ANTHONY R. INGRAFFEA

1. My name is Dr. Anthony R. Ingraffea. I am over the age of 18 and competent to make the following Declaration.
2. I currently am the Dwight C. Baum Professor of Engineering, Emeritus, at Cornell University.
3. I am author or co-author of over 250 peer-reviewed technical publications, including papers in the PNAS.
4. I have authored or co-authored papers related to the ongoing national energy transition, including papers co-authored by Dr. Jacobson.
5. I am aware of the litigation filed by Dr. Jacobson and certain claims related to papers entitled Jacobson MZ, Delucchi MA, Cameron MA, Frew BA (2015a) *Low-cost solution to the grid reliability problem with 100% penetration of intermittent wind, water, and solar for all purposes*, PNAS 112:15060–15065 and Jacobson MZ, Delucchi MA, Cameron MA, Frew BA (2015b) *Low-cost solution to the grid reliability problem with 100% penetration of intermittent wind, water, and solar for all purposes*, PNAS 112:15060–15065 (the “Jacobson papers”), and *Evaluation of a proposal for reliable low-cost grid power with 100% wind water and solar*, PNAS, doi:1073/pnas.1610381114, 2017 (the “Clack paper”). I am not a co-author of any of these papers, and am examining them as an independent scholar for the purposes of this declaration.
6. I was not named as a defendant in the litigation and have not participated in the litigation prior to submitting this Declaration.
7. The Clack paper claims that the Jacobson Papers “...do not show the technical, practical, or economic feasibility of a 100% wind, solar, and hydroelectric energy vision...” and contain “...modeling errors; incorrect, implausible, and/or inadequately supported assumptions; and the application of methods inappropriate to the task.” The purpose of my declaration is to refute three (3) of the most important claims of the Clack paper and their assertion that it is mere “scientific disagreement” that is the space between theirs and the Jacobson papers.
8. Claim #1: The Clack paper bases much of its allegations pertaining to unfeasibility, inaccuracy, and modeling errors on its incorrect assessment of Table 1 in the Jacobson paper (2015a). Clearly, Clack *et al.* incorrectly assessed the numbers in Table 1 as “maximum” values. They state:

“The maximum possible from table 1 of ref. 11 is given as 1,064.16 GW, whereas figure 3 of ref. 11 shows that flexible load (in green) used up to 1,944 GW (on day 912.6). Indeed, in all of the figures in ref. 11 that show flexible load, the restrictions enumerated in table 1 of ref. 11 are not satisfied.” (**emphasis mine**)

The Jacobson paper (2015a) clearly states, through a footnote citation to an earlier Jacobson paper (Jacobson *et al.* Energy and Environmental Sciences, 2015), that the numbers in Table 1 are not “maximum” values, but rather “average” annual values. This is not a matter of scientific disagreement. Rather, it is a matter of fact: the numbers in Table 1 are either maximum values, or they are average values. It is not a matter of scientific disagreement to state that, for example, two parties can look at the set of numbers, 5-6-7-8-9-10, and disagree on the point that their average is 7.5 while their maximum is 10. That would be a disagreement of fact, not opinion, scientific or otherwise. This is a crucial point, because subsequent incorrect allegations based on this error in fact percolate throughout the remainder of the Clack paper, as they themselves state:

“Indeed, in all of the figures in ref. 11 that show flexible load, the restrictions enumerated in table 1 of ref. 11 are not satisfied.”

9. Claim #2: Clack alleges that it is only “scientific disagreement” concerning the Jacobson paper use of Canadian hydropower in its calculations. Again, this is a matter of fact, not opinion: either it does or it does not include such imports. The Clack paper clearly errs in **fact** in asserting that hydroelectric output used in the Jacobson paper calculations is from U.S. facilities only:

“For example, the numbers given in the supporting information of ref. 11 imply that maximum output from hydroelectric facilities cannot exceed 145.26 GW (SI Appendix, section S1.1), about 50% more than exists in the United States today (15).”

However, in a footnote to Table S2 of the Jacobson paper (2015a), there is clear reference to the same earlier Jacobson paper which clearly defined hydropower capacity used in Jacobson’s calculations as the sum of both U. S. supplies and imported Canadian supplies.

10. Claim #3: The Clack paper includes a distinct section entitled “Modeling Errors” implicating Jacobson’s LOADMATCH computer program as a source of such alleged errors. However, the Clack paper also includes a distinct section entitled “Implausible Assumptions”. I have led the development of many predictive computer programs, including highly successful commercial programs, and am very aware of the distinction between an alleged modeling error and an implausible assumption in the execution of a computer program. A modeling error is commonly known as a “bug” in the code: given correct input, it gives incorrect, or no, output. A code is not “buggy” if it is given incorrect input but correctly performs all its intended operations on that input; in this case, the incorrect input was based on incorrect or implausible assumptions. Therefore, I conclude that the Clack paper was asserting in its “Modeling Error” section the existence of a “bug” or “bugs” in LOADMATCH; else, why include a separate section called “Implausible Assumptions”?

11. Together, claims #1, #2, and #3 indicate to me a degree of carelessness in the Clack paper that should have been caught and corrected, pre-publication, by one or more of the 21 co-authors of the paper and/or by one or more of its PNAS reviewers.

I declare under penalty of perjury that the foregoing is true and correct. Executed on July 22, 2020.

A handwritten signature in black ink, appearing to read 'A. Ingraffea', with a long horizontal flourish extending to the right.

Anthony R. Ingraffea

EXHIBIT 4

Declaration of Professor Peter A. Strachan

1. My name is Peter Anderson Strachan. I am over 18 years of age and am competent to make the following declaration.
2. I have been an academic member of staff at the Robert Gordon University, Aberdeen, Scotland, since 1993. I am currently Professor of Energy Policy at the Aberdeen Business School. I was appointed Professor of Energy Policy in 2009 and subsequently appointed in 2010 to the role of Group Lead for Strategy and Policy, responsible for a research and teaching group of approximately 20 full-time and part-time academic staff. Following University re-organisation, I returned to my role as Professor of Energy Policy in 2017. My most recent publications are in prestigious peer reviewed journals such as Energy Policy (2019) and Utilities Policy (2020) on the theme of offshore wind power.
3. As an author and co-author, I have an extensive publication record with my work focusing on the transition to 100% renewable energy in Scotland and the other countries that comprise the United Kingdom. I have edited three books and have also served as a journal Associate Editor. Further, I am an active member of several editorial boards. My work by invitation has been presented to the First Minister of Scotland, Holyrood, Edinburgh, Scotland and to Members of Parliament (MPs) of the United Kingdom Parliament, Westminster, London, England. I also receive regular invitations to present at academic and industry events on renewable energy issues. A full list of articles and presentations is available on request. I have also supervised to successful completion 18 doctoral students, with a number of these on renewable energy deployment, particularly in Africa.
4. My research on renewable energy has been funded by Innovate UK and the United Kingdom Economic and Social Research Council (ESRC). The research I work on in Scotland and Europe is very similar to the work on renewable energy published by Dr Jacobson in the context of the United States. Therefore, I have specific expertise to comment on the papers published by PNAS by Dr Jacobson et al. and Dr Clack et al. in 2015 and 2017, respectively. I am familiar with both papers and have spent some time re-reading and then re-evaluating them in the context of making this declaration.
5. I am aware that Dr Jacobson has initiated litigation against Dr Clack on the basis that the Dr Clack PNAS paper and resulting media coverage misrepresented the findings of Dr Jacobson's article and that this has had a detrimental impact on his professional reputation and wider standing in the public domain.
6. I have not been involved in the litigation and am not a co-author, of either of the papers relevant to this litigation. I have not published with Dr Jacobson or any of the authors of the Dr Clack et al. (2017) paper and have no professional association (joint research funding or PhD supervision) with these authors. Therefore, I am offering the following declaration in an independent capacity.
7. Dr Jacobson has requested my expert opinion and has asked me to comment on three issues raised by this case and these are set out in my declaration in points 10-13 below. However, my declaration has been extended to provide comment on related matters points 8 and 9 below which I think are important, and that the Court may consider of wider relevance.
8. As an expert with considerable experience of publishing, I am astonished that the Dr Clack et al. (2017) paper was published by PNAS as a research article. The PNAS publication guidelines are publicly available, with the Dr Clack et al. (2017) paper apparently contravening these guidelines, as there is no original research in the Dr Clack et al. (2017) paper, which in my perception must call into question the commissioning as well as the referee process for their paper. I am dismayed that the journal commissioning editor never identified this important point prior to sending the paper to referees. Furthermore, the referee process must also be called into question,

given the apparent errors by Dr Clack and his co-authors (which I comment on below) in the published version of their paper. If the court considers relevant and if it has not already done so, it should in my opinion request all email and other relevant correspondence from the PNAS on the commissioning process, the resulting referee process, decisions made on publication, and come to a view on how rigorous this overall process was.

9. It is my perception that Dr Jacobson has suffered significant loss of professional reputation and public standing following the publication of this paper and the media coverage that has followed. I have for example witnessed Dr Jacobson's work being unfairly mocked in social media outlets such as Twitter, with the Dr Clack et al. (2017) paper then cited as evidence that Dr Jacobson's work is in some way flawed (which in my expert opinion it is not). It is also my view that Dr Ken Caldeira (@KenCaldeira) continues to inflame this situation with recent social media posts such as that on 10th July 2020. Dr Caldeira has more than 24,000 Twitter followers. In the energy space this is a large following. The tweet in question was retweeted 95 times and liked 234 times. This tweet received numerous comments some of which I consider potentially defamatory towards Dr Jacobson, though that would be for a Court to decide.
10. More specifically Dr Jacobson has asked me to comment on three issues:
 - 10.1) Does Table 1 in the Dr Jacobson et al. paper (2015) contain maximum or average values?
 - 10.2) Did the Dr Jacobson et al. (2015) paper contain imported Canadian Hydro power as part of its results?
 - 10.3) Is there a modelling error in Dr Jacobson's Loadmatch computer code that he used in his (2015) paper?
11. From reading the Dr Jacobson et al. (2015) paper and diligently following up on sources contained within the paper – as a professionally qualified researcher would always do – it is clear that the answer to the question contained in 10.1 above is *average*, as correctly stated by Dr Jacobson. I am confused as to why Dr Clack and his co-authors made such a basic error. Furthermore, and as part of the referee process for the Dr Clack et al. (2017) paper, I am astonished that the Dr Clack et al. (2017) error was not identified by suitably qualified referees. There should be no scientific disagreement as to the question of *average*. This is a point of fact.
12. In answering the question in 10.2, the Dr Jacobson et al. (2015) paper contained *Canadian Hydro Power*, as correctly stated by Dr Jacobson. Therefore, I am again perplexed as to why Dr Clack and his co-authors made yet another basic error. Furthermore, and as part of the referee process for the Dr Clack et al. (2017) paper, I would have expected a robust editor and referee process to have identified their obvious errors. There should be no scientific disagreement as to the question of *Canadian Hydro Power*. This is another point of fact.
13. In answering the question in 10.3, I would need to defer to a modelling expert as this is beyond my specific area of expertise, but it would appear to me as a professionally qualified researcher with a PhD in mixed research methods, that Dr Clack et al. (2017) based their assumptions on an incorrect reading of the Jacobson et al. (2015) paper as noted above. There is no substantive evidence available that Dr Jacobson et al.'s (2015) paper contains any modelling errors, which I interpret to mean "computer bugs" and not poor assumptions given that there are separate sections for "Modelling Errors" and "Implausible Assumptions" in the Dr Clack et al. (2017) paper. The Dr Clack et al. (2017) analysis appears to be entirely speculative rather than based on scientific evidence and facts.
14. It is my view that Dr Clack et al. (2017) reached erroneous conclusions, which may have been confounded by both the commissioning of this piece, a lack of editor and

referee scrutiny during the review process, and further exacerbated by the fact that the inclusion of the Dr Clack et al. (2017) paper appears to contravene the Journal's own publication guidelines. As a matter of fact, the Dr Clack et al. (2017) paper is not a "Research Article" as generally defined by the scientific community and more specifically the journals own guidelines. In my view the Dr Clack et al. (2017) paper is no more than an extremely well written (in style, only) but very poorly researched opinion piece that lacks a robust reading of the Jacobson et al. (2015) paper, but yet it has been presented by PNAS as a "Research Article".

15. To conclude, I have also witnessed that Dr Jacobson has suffered significant loss of professional reputation and public standing following the publication of the Dr Clack et al. (2017) paper, and the media coverage that subsequently followed. At least one of co-authors of the Dr Clack et al. (2017) paper, as outlined above, continues to inflame this situation given continued social media posts which result in potentially defamatory comments being made against Dr Jacobson.

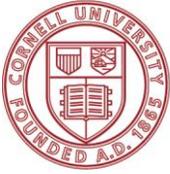
I declare under penalty of perjury that the following is true and correct. Executed on 10th August 2020.

A handwritten signature in black ink that reads "Peter A. Strachan". The signature is written in a cursive, slightly slanted style.

Signed: Professor Peter A. Strachan of 2 Henderson Park, Peterhead, Aberdeenshire, Scotland

Dated: 10th August 2020

EXHIBIT 5



Declaration of Robert W. Howarth

I write at the request of Prof. Mark Jacobson of Stanford to provide my expert opinion regarding the paper by Clack and others entitled “Evaluation of a proposal for reliable low-cost grid power with 100% wind, water and solar” that was published in 2017 in *PNAS*, doi:1073/pnas.1610381114. (the “Clack Paper”). Also at Prof. Jacobson’s request, I submitted a declaration one year ago on July 20, 2021 on the Clack Paper for the court.

I have been a tenured faculty member at Cornell University, Ithaca, NY, since 1985. Since 1993, I have held an endowed position at Cornell as the *David R. Atkinson Professor of Ecology & Environmental Biology*. I have extensive experience in academic publishing. I am the author or co-author of over 200 papers, and these have been cited by others in the peer-reviewed literature more than 70,000 times. I am the Founding Editor of the academic journal *Biogeochemistry* and served as Editor-in-Chief of that journal from 1983 to 2004. I was also the Editor-in-Chief of the academic journal *Limnology & Oceanography* from 2014 to 2019. And I have recently been appointed Co-Editor-in-Chief of *Ocean-Land-Atmosphere Research*. I served on the Committee on Ethics of the America Society for Limnology & Oceanography from 1992-1998. I served as President-Elect and then President of the Coastal & Estuarine Research Federation from 2005 to 2009, overseeing the publications and ethical issues of that professional society. And I have been a member of the Committee on Publication Ethics (COPE) since 2014. COPE “is a nonprofit organization whose mission is to define best practice in the ethics of scholarly publishing and to assist editors, publishers, etc. to achieve this.” (https://en.wikipedia.org/wiki/Committee_on_Publication_Ethics).

I have previously collaborated with Prof. Jacobson and am a co-author of three published peer-reviewed papers with him (Jacobson et al. 2013, *Energy Policy*; Jacobson et al. 2014, *Energy*; Howarth and Jacobson 2021, *Energy Science & Engineering*).

I am aware of the litigation filed by Prof. Jacobson against Dr. Clack and others associated with the Clack Paper, but I am not a party to the litigation and I had no participation with it other than filing the declaration for the court a year ago. Nor was I associated with the publication of the Clack Paper or the 2015 paper by Prof. Jacobson and others, also published in *PNAS*, that was the subject of the Clack Paper. I have, however, carefully reviewed both of these two papers.

Prof. Jacobson has asked that I address a series of questions regarding the Clack Paper.

1. “Is omitting data or changing the definition of data to the wrong definition an ‘interpretation or judgment of data’ or is it ‘not an interpretation/judgment of data but instead altering the factual definition of data’?”

In my professional opinion, the Clack Paper incorrectly took average values in a table from the Jacobson et al. paper and stated that these were maximum values. Further, the Clack Paper omitted that

the hydropower production estimate in the Jacobson et al. paper included imported Canadian hydropower, and then based on this omission erroneously stated that the estimate of the Jacobson et al. paper was excessively high for hydropower. The Clack Paper then stated that Jacobson et al. had made a “modeling error,” when in fact the Clack Paper was simply mis-stating what Jacobson et al. had presented. The Clack Paper was not making informed “interpretation of judgement of data,” but rather was making changes to the factual definition of the data and omitting information, and then interpreting/judging based on these altered and omitted data.

2. “Is an author who makes a factual mistake in a review of other people's work following due diligence or acting in reckless disregard for the truth or in bad faith?”

Again in my professional experience, and based on decades of involvement with the ethics of scientific publication, I believe that the Clack Paper was reckless. Due diligence would have demanded that Dr. Clack and his coauthors contact Prof. Jacobson for clarification before they submitted their manuscript to *PNAS*. Due diligence would also have required that Dr. Clack and coauthors correct their factual misinterpretation of the Jacobson et al. paper, and do so quickly once they became aware of their error. If they were aware before the paper was published, Dr. Clack and coauthors should have either withdrawn their manuscript or completely revise it so as not to perpetuate their error. If they only became aware of the error after publication in *PNAS*, they should have asked the journal to publish a correction, and perhaps an apology. Further, Prof. Jacobson informs me that one of the authors of the Clack Paper had earlier mentored a student who was a coauthor of the Jacobson et al. paper criticized by the Clack Paper, and that Dr. Clack and his coauthors did not inform this student of their criticism until after acceptance for publication of the Clack Paper. If true, this is highly unprofessional behavior, in my opinion.

3. “Is it standard practice in the sciences for authors of a paper to issue a correction to the paper AFTER publication if a material FACTUAL error is discovered in their paper?”

Yes, professional ethics require authors to publish a correction within a reasonable time after they discover an error with their work.

4. “Is it unethical or ethical for authors of a paper to REFUSE to issue a correction to their paper AFTER publication if a material FACTUAL error is discovered in their paper?”

Again, professional ethics require authors to publish a correction. Refusal to do so is unethical.

I declare under penalty of perjury that the foregoing is true and correct. Executed on 14 September 2021.



Robert W. Howarth, Ph.D.
*David R. Atkinson Professor of Ecology
and Environmental Biology*
Cornell University

EXHIBIT 6



Environment & Governance Group
Faculty of Arts, Design & Architecture
UNSW Sydney
Sydney NSW 2052, Australia
Phone (mobile): +61 402 940892
email: m.diesendorf@unsw.edu.au

Web: <https://research.unsw.edu.au/people/associate-professor-mark-diesendorf>

Declaration of Dr Mark Diesendorf

Re: Expert opinion on specific questions related to Clack et al. (2017) paper, www.pnas.org/cgi/doi/10.1073/pnas.1610381114

I am an Honorary Associate Professor at UNSW Sydney, formerly called the University of New South Wales. My PhD is in applied mathematics/theoretical physics. Previously, at various times before my nominal retirement in 2016, I was a Principal Research Scientist in Australia's national research organization, CSIRO; Professor of Environmental Science and Founding Director of the Institute for Sustainable Futures at University of Technology Sydney; Associate Professor and Deputy Director of the Institute of Environmental Studies at UNSW Sydney; and Education Program Leader of the Australian Cooperative Research Centre for Low Carbon Living. As an author or coauthor, I have published 79 peer-reviewed journal papers, three scholarly books, 38 scholarly book chapters and 13 peer-reviewed conference papers.

From 2011 to 2016 I was a senior researcher in a research program at UNSW Sydney that performed computer simulation modelling of the operation of the Australian National Electricity Market running entirely on renewable energy. I am co-author of several peer-reviewed journal papers on this particular topic. This research is similar to that conducted on the electricity systems of the United States of America by Dr Mark Jacobson. Therefore, I have expertise in the scientific issues discussed in Dr Jacobson's and Dr Clack's journal papers published in PNAS in 2015 and 2017 respectively. I have studied both papers.

On 4 August 2020, I wrote a Declaration concerning issues surrounding the Clack et al. paper in the context of the legal case between Dr Jacobson and Dr Clack. Since then, Dr Jacobson has asked me to provide my expert opinion on additional specific questions related to Dr Clack's paper and the actions of its authors. Below are the questions and my responses (in ***bold italic***), based on my expertise as a scientist and author in the same area of study as Dr Clack and Dr Jacobson.

1. Is omitting data or changing the definition of data to the wrong definition an "interpretation or judgment of data" or is it "not an interpretation/judgment of data but instead altering the factual definition of data" in the following four cases:

a) Changing the definition of values in a table from average to maximum values?

This is not an interpretation/judgment of data but instead is altering the factual definition of data.

b) Omitting the inclusion of Canadian hydropower from total hydropower production?

This is not an interpretation/judgment of data but instead is altering the factual definition of data.



c) Claiming authors made a “modeling error” after wrongly assuming that data values in a paper are maximum rather than average values?

This is not an interpretation/judgment of data but instead is altering the factual definition of data.

d) Claiming authors made a “modeling error” with respect to hydropower output after omitting the fact that computer model output both in the paper and externally available to all authors shows no mathematical computer modeling error?

This is not an interpretation/judgment of data but instead is altering the factual definition of data.

2. Is an author who makes a factual mistake in a review of other people's work following due diligence or acting in reckless disregard for the truth or in bad faith when he or she

a) Fails to request clarification from the authors before publication if he or she is uncertain about an issue in the paper?

Acting in disregard for the truth and in bad faith

b) Hides the publication from a student he or she mentored and is now criticizing, until after acceptance of the paper?

Acting in bad faith

c) Refuses to correct the factual mistake when informed about it, with evidence, before publication?

Acting in reckless disregard for the truth and in bad faith

d) Refuses to correct the factual mistake when informed about it, with evidence, after publication?

Acting in reckless disregard for the truth and in bad faith

3. Is it standard practice in the sciences for authors of a paper to issue a correction to the paper AFTER publication if a material FACTUAL error is discovered in their paper?

Yes

4. Is it unethical or ethical for authors of a paper to REFUSE to issue a correction to their paper AFTER publication if a material FACTUAL error is discovered in their paper and they are requested to make a correction?

It is unethical.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 18 September 2021.

Yours sincerely,

Mark Diesendorf PhD
Honorary Associate Professor

EXHIBIT 7

Exhibit 7

Declaration of Dr. Anthony R. Ingraffea

My name is Dr. Anthony R. Ingraffea. I am the Dwight C. Baum Professor of Engineering, Emeritus, at Cornell University and a Distinguished Member of the American Society of Civil Engineers. I am author or co-author of over 250 peer-reviewed technical publications, including papers in the PNAS. I have been a Co-Editor-In-Chief of a peer-reviewed journal, *Engineering Fracture Mechanics*, for over 15 years. I have authored or co-authored papers related to the ongoing national energy transition, including papers co-authored by Prof. Mark Jacobson.

I am aware of the litigation filed by Dr. Jacobson and certain claims related to some of his papers published in the PNAS. I have thoroughly studied a related paper, *Evaluation of a proposal for reliable low-cost grid power with 100% wind water and solar*, PNAS, doi:1073/pnas.1610381114, 2017 (hereafter, the “Clack paper”). I am not a co-author of any of those papers, and I am commenting on them herein as an independent scholar.

On July 22, 2020, I wrote a Declaration about the Clack paper. Prof. Jacobson has now requested that I provide an expert opinion on additional questions related to that paper. Below are his questions and my answers to them:

1. Is omitting data, or changing the definition of data to the wrong definition an "interpretation or judgment of data", or is it "not an interpretation/judgment of data but instead altering the factual definition of data" in the following four cases:

a) Changing the definition of values in a table from average to maximum values?

My answer: This is clearly an instance of altering the factual definition of data.

b) Omitting the inclusion of Canadian hydropower from total hydropower production?

My answer: This is clearly another instance of apparently purposeful obscuring of the factual definition of data.

c) Claiming authors made a "modeling error" after wrongly assuming that data values in a paper are maximum rather than average values?

My answer: This is an instance where authors of the Clack paper made an incorrect inference about the model based on their own altering and obscuring of factual data.

d) Claiming authors made a "modeling error" with respect to hydropower output after omitting the fact that computer model output both in the paper and externally available to all authors shows no mathematical computer modeling error?

My answer: The unsupported inference of “modeling error” should have been obvious to the authors had they thoroughly checked for mathematical computer modeling error.

2. Is an author who makes a factual mistake in a review of other people's work following due diligence or acting in reckless disregard for the truth or in bad faith when he or she:

a) Fails to request clarification from the authors of the reviewed paper before publication if he or she is uncertain about an issue in the paper?

My answer: In this instance authors are not following due diligence expected from reviewers of scientific papers.

b) Hides the publication from a student he or she mentored and is now criticizing, until after acceptance of the paper?

My answer: This is an instance of reckless disregard for the ethics of peer-reviewed publication.

c) Refuses to correct the factual mistake when informed about it, with evidence, before publication?

My answer: This is an instance of reckless disregard for the truth.

d) Refuses to correct the factual mistake when informed about it, with evidence, after publication?

My answer: This is an instance of reckless disregard for the truth.

3. Is it standard practice in the sciences for authors of a paper to issue a correction to the paper AFTER publication if a material FACTUAL error is discovered in their paper?

My answer: Yes, definitely.

4. Is it unethical or ethical for authors of a paper to REFUSE to issue a correction to their paper AFTER publication if a material FACTUAL error is discovered in their paper?

My answer: It is unethical.

Thank you for your attention to this matter.

I declare under penalty of perjury that the foregoing is true and correct. Executed on July 20, 2021.



Anthony R. Ingraffea, Ph.D., P.E. Dist. Member ASCE

EXHIBIT 8

Declaration of Professor Peter A. Strachan

1. My name is Peter Anderson Strachan. I am over 18 years of age and am competent to make the following declaration.
2. I have been an academic member of staff at the Robert Gordon University, Aberdeen, Scotland, since 1993. I am currently Professor of Energy Policy at the Aberdeen Business School. I was appointed Professor of Energy Policy in 2009 and subsequently appointed in 2010 to the role of Group Lead for Strategy and Policy, responsible for a research and teaching group of approximately 20 full-time and part-time academic staff. Following University re-organisation, I returned to my role as Professor of Energy Policy in 2017. My most recent publications are in prestigious peer reviewed journals.
3. As an author and co-author, I have an extensive publication record with my work focusing on the transition to 100% renewable energy in Scotland and the other countries that comprise the United Kingdom. I have edited three books and have also served as a journal Associate Editor. Further, I am an active member of five journal editorial boards. My work by invitation has been presented to the First Minister of Scotland, Holyrood, Edinburgh, Scotland. And to Members of Parliament (MPs) of the United Kingdom Parliament, Westminster, London, England. I also receive regular invitations to present at academic and industry events on renewable energy issues. A full list of articles and presentations is available on request. I have also supervised to successful completion 20 doctoral students, with a number of these on renewable energy deployment, particularly in Africa.
4. My research on renewable energy has been funded by Innovate UK and the United Kingdom Economic and Social Research Council (ESRC). The research I work on in Scotland and Europe is very similar to the work on renewable energy published by Dr Jacobson in the context of the United States. Therefore, I have specific expertise to comment on the papers published by PNAS by Dr Jacobson et al. and Dr Clack et al. in 2015 and 2017, respectively. I am familiar with both papers and have spent some time re-reading and then re-evaluating them in the context of making this statement.
5. I am aware that Dr Jacobson had initiated litigation against Dr Clack on the basis that the Dr Clack PNAS paper and resulting media coverage misrepresented the findings of Dr Jacobson's article. And further that this has had a detrimental impact on his professional reputation and wider standing in the public domain.
6. I am not a co-author, of either of the papers. I have not published with Dr Jacobson or any of the authors of the Dr Clack et al. (2017) paper and have no professional association (joint research funding or PhD supervision) with these authors. Therefore, I am offering the following statement in an independent capacity.
7. On the 10th August 2020, I wrote a Court Declaration (available on request) requested by Dr Jacobson about the Clack paper. Dr Jacobson has now requested that I provide an expert opinion on additional questions related to that paper. Below are his questions and my answers to them:
 1. Is omitting data or changing the definition of data to the wrong definition an "interpretation or judgment of data" or is it a "factual error" in the following four cases:
 - a) Changing the definition of values in a table from average to maximum values?
My Answer: This is an instance of altering the factual definition of data. With erroneous conclusions then arising. It is my perception that changing the definition of data in this way amounts to reckless / poor scholarship.
 - b) Omitting the inclusion of Canadian hydropower from total hydropower production?
My Answer: This is a further instance of altering the factual definition of data. It is my perception that the Clack paper made a reckless error in this respect. With erroneous conclusions then arising.

c) Claiming authors made a "modeling error" after wrongly assuming that data values in a paper are maximum rather than average values?

My Answer: The Clack paper makes spurious claims in this respect. There is no evidence of "modeling errors". It is my perception that this is an example of poor scholarship.

d) Claiming authors made a "modeling error" with respect to hydropower output after omitting the fact that computer model output both in the paper and externally available to all authors shows no mathematical computer modeling error?

My Answer: The Clack paper again makes spurious claims in this respect. There is no evidence of "modeling errors". It is my perception that this is an example of reckless or rash scholarship.

2. Is an author who makes a factual mistake in a review of other people's work following due diligence or acting in reckless disregard for the truth or in bad faith when he or she

a) Fails to request clarification from the authors before publication if he or she is uncertain about an issue in the paper?

My Answer: When criticising in a significant way an author's paper it is accepted custom and practice to seek clarification on the issue or issues of uncertainty or issues that are in dispute. Such criticisms may involve factual issues contained within a paper, or issues of a substantial nature related to the philosophical approach or methodology employed by an author. Failure to seek clarification from an author, especially where there is a significant rebuttal of a paper would amount to acting in disregard of the truth.

b) Hides the publication from a student he or she mentored and is now criticizing, until after acceptance of the paper?

My Answer: A situation like this is almost inconceivable. The mentor is clearly acting in bad faith and is being dishonest. And worse actively (intentionally or unintentionally) working to discredit their mentee. Professional ethics and accepted practice would dictate that the mentor be fully open and transparent in all interactions with a mentee. Clearly the mentor if he/she had concerns regarding a student's published or other work should have highlighted this as part of the mentee process. And clearly explained this to the mentee so that the mentee could avoid making such a mistake in the future. This standard would apply to both current and former mentoring relationships. In my view a mentor hiding publication activity from their mentees (current or former) where criticisms are being made of the mentee is clearly an act of poor judgement, with this potentially even amounting to gross misconduct, but that would be for an investigation committee / Court to ultimately determine.

c) Refuses to correct the factual mistake when informed about it, with evidence, before publication?

My Answer: This is clearly unethical behaviour and in contravention of accepted academic norms and values. It is fundamentally dishonest. My perception is that this amounts to gross misconduct, though again that would be for an investigation committee / Court to determine.

d) Refuses to correct the factual mistake when informed about it, with evidence, after publication?

My Answer: It would be dishonest for authors not to correct a mistake, when evidence is presented that an error has been made. Once again it is my perception that this amounts to an act of gross misconduct, though again that would be for an investigation committee / Court to determine.

3. Is it standard practice in the sciences for authors of a paper to issue a correction to the paper AFTER publication if a material FACTUAL error is discovered in their paper?

My Answer: Professional ethics and accepted practice dictates that authors should issue a proportionate correction, with an explanation, and within a reasonable timeframe after the discovery of a significant error that has been made in a published output. I would go further and state that when such an error is detected that the author (or, for that matter a whistleblower) should then refer the work to the Head of Faculty and consequently for there to be an investigation undertaken to determine the context, circumstances and to determine if any penalties should arise. Following an investigation process there is precedent in the academic community that when an author has acted recklessly or in bad faith that, that author should then request that their paper be withdrawn from the public domain, with an appropriate explanation given of the circumstances. In my view the Clack paper would fall under this category, and it should be retracted.

4. Is it unethical or ethical for authors of a paper to REFUSE to issue a correction to their paper AFTER publication if a material FACTUAL error is discovered in their paper?

My Answer: It is my perception that it is unethical for authors to refuse to issue a correction when clear errors are apparent in their paper, as is the case with the Clack paper. In my view, as outlined above professional ethics dictate that the Clack paper should be retracted. This would correct the record for all concerned and further avoid potentially reputational damage to an academic and his employer.

I declare under penalty of perjury that the following is true and correct. Executed on 17th September 2021.

Peter A Strachan

Signed: Professor Peter A. Strachan of 2 Henderson Park, Peterhead, Aberdeenshire, Scotland

EXHIBIT 9



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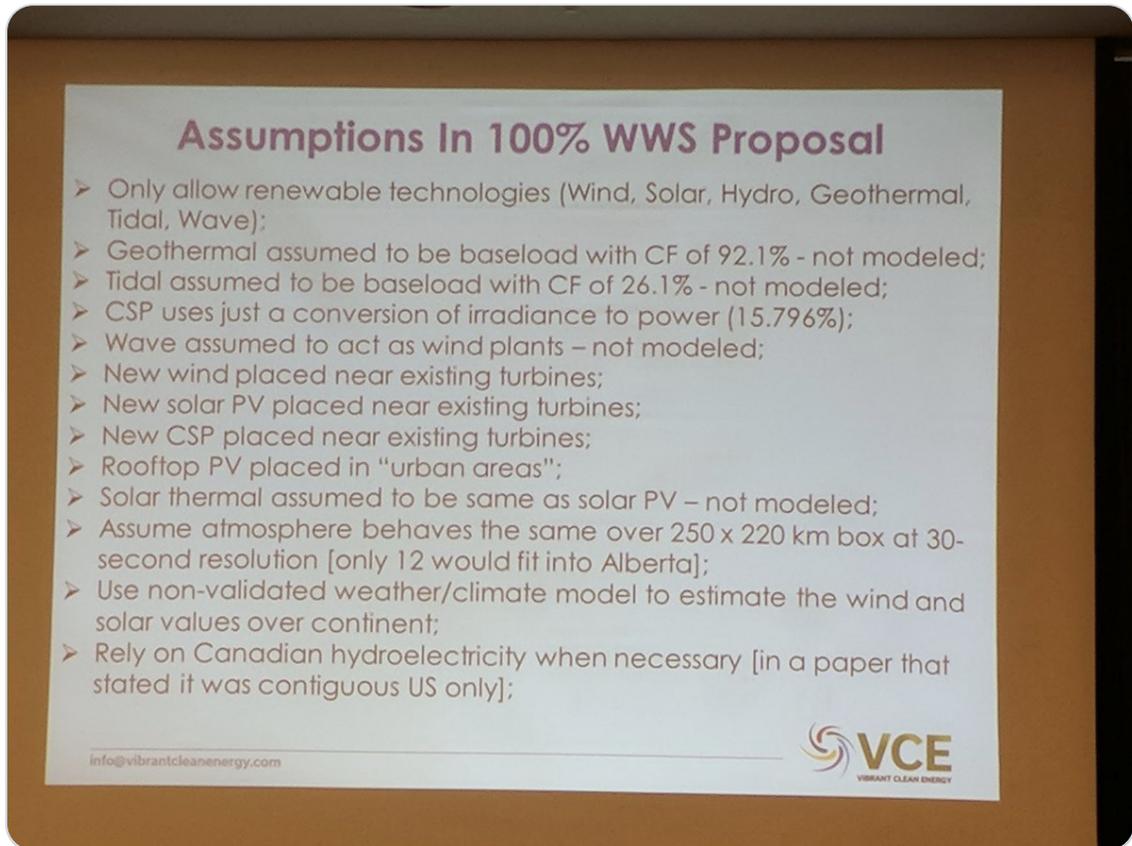
EXHIBIT 9



Alexandria Fisher
@EnviroDevlopmt



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EXHIBIT 10

Subject: Re: Time to talk today?

From: Christopher Clack – NOAA Affiliate <christopher.clack@noaa.gov>

Date: 3/2/16, 10:25 AM

To: jacobson@stanford.edu

Hi Mark,

Great points, but please see my comments below.

On Wed, Mar 2, 2016 at 10:11 AM, Mark Z. Jacobson <jacobson@stanford.edu> wrote:

Hi Chris,

Here's an example calculation for Hoover Dam.

Installed capacity: 2.08 GW --> Maximum possibly output over year = 18.22 billion kWh

Actual output currently: 4.2 billion kWh --> CF = 23.05%.

Output has never been over 11 billion kWh, so maximum possible is not the case here. It has been dropping a lot over the last decade. The CF here is purely a component of available water in the hydrological cycle.

Head = 180 m

I believe this is the maximum head – so it would have to be constantly at that value to be used in the calculations below. It is usually much lower than that. Indeed, if you extract large amounts of water it will likely drop.

Power output (W) = Efficiency (0.8) x water density (1000 kg/m³) x flow rate (m³/s) x gravity (9.81 m/s²) x head (180 m)

--> Max flow rate for 2.08 GW of turbines = 1472 m³/s.

Totally agree with this theoretical calculation, but you have to assume constant head value.

Thus, during the year, a total of 1472 m³/s x CF x 3600s/hr x 8760 hrs/yr of water volume is used.

When I calculate this I get $1472 \cdot 0.2305 \cdot 3600 \cdot 8760 = 10,700,038,656 \text{ m}^3 = 10.7 \text{ km}^3$, this is 30.4% of the entire full capacity of lake Mead.

For a CF = ~0.5 (our proposal), this gives $2.32 \times 10^{10} \text{ m}^3$ of water used over the year, or 0.066% of the reservoir water volume, which is $35,200 \text{ km}^3 = 3.52 \times 10^{13} \text{ m}^3$. This water is usually refilled during the year as well.

Let's assume that you can get up to 50% CF each and every year, that means that $1472 \cdot 0.5 \cdot 3600 \cdot 8760 = 23,210,496,000 \text{ m}^3 = 23.2 \text{ km}^3$ as you say. The only issue is that the volume of lake Mead, at FULL capacity, is 35.2 km^3 . So the water used in a year would be 66% of the entire volume of lake Mead. I do not think it is appropriate to state that this is refilled each year, as it most definitely might not be.

We would conserve that volume used over the year and not increase the head, but would increase the maximum turbine power output from 2.08 GW to, say 25 GW. This would require

increasing the maximum flow rate to

$$\text{Flow rate (m}^3\text{/s)} = 2.5 \times 10^{10} \text{ W} / (0.8 \times 1000 \times 9.81 \times 180) = 17,700 \text{ m}^3\text{/s}$$

This flow rate would empty all of lake Mead in 552.4 hours (23 days). This means that it would need to be restocked regularly.

However, this flow rate would be used only infrequently, and the reservoir would never be close to being emptied.

I understand this, but you are multiplying the installed capacity of hydro ~15 x (to more than all the generators installed today). It seems highly unlikely that you can fit all that equipment into the same area as the existing hydroelectric dams and only have to pay for a small fraction of the costs. I have been to many and there is very little space.

This is not done currently because there has not been a need to maximize discharge rates due to the use of gas peaking. However, if we want to eliminate gas peaking and help with hydro, this is one way to do it. Another way is doing the same thing with CSP. Increase the capacity of turbines relative to the size of collection to maximize discharge rates. This is discussed in detail in the paper.

They currently do maximize discharge to load follow throughout the day to shave off gas peaking, as that is expensive compared with hydroelectric. Unfortunately, there are other issues with water management that mean it cannot take all the peak demand (transmission constraints too). The discussion I saw in the paper on CSP in the SI mainly talks about the 2.61 over powering of the turbines (and I assume arrays) to put energy into storage. The CSP itself is also expensive. You cannot just replace PV with CSP, as you need more energy, so you have to add a lot more capacity.

I am not disagreeing with the possibility that it can be done with CSP and hydro etc, I just think that the costs are skewed quite badly by getting all this free dispatchable power, I have done tests on the efficacy of hydroelectric dispatch in 100% CF scenarios. I kept the hydrological cycle intact, and it shows that you need to add capacity at high cost to keep the energy flowing -- I will say that I did this one without storage, but the costs came out at 16¢/kWh just to meet the electric demand for 2030. [still cheaper than the cost of CO2 and climate change!]

Best regards,
Mark

On 3/1/16 5:06 PM, Mark Z. Jacobson wrote:

Thanks, Chris.

Good points. However, I don't think we will need larger reservoirs for the following reason:

In order to increase the discharge rate when adding more turbines, one could either increase the head or increase the flow rate. To avoid raising the dam height (increase head), we would simply increase the flow rate by widening the penstock (or adding separate ones). Since (a) we need the enhanced flow only for short periods, (b) there will be long periods of non-use to accumulate lost water, and (c) we are constrained to use close to the exact same annual energy output as is currently obtained from hydro, it seems like we should not need a larger reservoir.

In sum, it seems we would only need additional electrical equipment plus modification of the penstock. Granted that this will likely cost more than just the electrical equipment (\$0.2–0.3 trillion) due to widening and additional powerhouse construction, even doubling this cost to (\$0.4–0.6 trillion) results in only a 0.3+/- cent/kWh increase in our total cost of energy.

We don't need additional river heads since we would have accumulated sufficient water (to fill up the dams) during the periods of non-use of the turbines. As mentioned, we are using no more total energy than is actually used in the US over the year, and the US capacity factor is only 0.5, so there is much more room to store hydro than we actually use.

The model also accounts for the fact that, if the dams accumulate too much water (larger than the reservoir holds), the power is used immediately.

CSP with 14 hour storage is now down to under 9 cents/kWh according to the company that just installed the Crescent Dunes facility (Solar Reserve), which cost them 4 years ago (13.1 cents/kWh). They are putting up a new one in Chile that they claim is under 9 cents/kWh with 14 hour storage.

Since, if we add CSP, we are replacing PV and are really just paying for the additional storage plus the difference in CSP versus PV energy cost, the additional cost of more CSP with storage at these lower prices also does not seem to be so large although I haven't calculated it yet.

Best regards,
Mark

On 3/1/16 3:54 PM, Christopher Clack – NOAA Affiliate wrote:

Thanks for the response Mark.

I am not sure that it would be such a trivial cost. From the report you sent, only 44 GW of upgraded / proposed hydroelectric would be that cheap in the US. You would still need another 1100GW + of capacity, and the river head flows won't allow that sort of electric production.

The dam heads would have to be significantly raised, causing more flooding of the areas and cost.

The numbers I worked out add 2.7 – 5.6 trillion dollars to the capital costs. Adding CSP would be even more as the capital costs are higher, especially if you include storage. There is a significant percentage of the load being met with hydroelectric within the plots I can see.

Also footprint goes up significantly. It adds ~ 2¢ / kWh (a nearly 20% increase), which I don't think is ignorable. I was using the same data from the IRENA report you sent. I assumed a maximum of 1300 GW from the plot, it may be higher at another time, which would increase the costs even further.

Anyway, I am working on getting the China and Australia load data to you this week.

Best,

Chris

On Mon, Feb 29, 2016 at 6:41 PM, Mark Z. Jacobson <jacobson@stanford.edu> wrote:
Hi Chris,

Thanks for calling today.

I looked into the issue of the high discharge rate of conventional hydro, and it turns out the numbers in the figure are correct as simulated; however, I did neglect to clarify that we increased the number of generators/turbines for each hydro plant (without increasing the dam capacity) and neglected to include the additional cost for turbines/generators; however, the additional costs are relatively minor in comparison with other costs as shown here.

The result is based on the assumption that we would increase the discharge rate conventional hydro while holding the 2050 annual energy output constant (as stated in Footnote 4 of Table S.2 of the paper).

More specifically, the 2050 annual energy output rate converted to power for the CONUS from our 50-state plans is ~ 46.67 GW (multiply by 8760 to obtain annually-averaged energy we used as a constraint). Since the current installed capacity is 87.48 GW, the capacity factor of hydro is ~53.3%.

For the study, we assumed that the discharge rate of hydro would be increased as needed by adding turbines+generators+transformers in the hydro stations thereby increasing the discharge rate.

The additional cost of such electromechanical equipment for 1 TW discharge is approximately \$0.2–0.3 trillion (See cost per 1000 MW in Figure 4.7 of

http://www.irena.org/documentdownloads/publications/re_technologies_cost_analysis-hydropower.pdf

This additional cost compares with the capital cost of the rest of our system of \$14.6 trillion, so is ~1.4–2% of the total cost, thus is relatively minor.

For the future study, I will add a discharge rate limit and add the costs of equipment.

Please also note, that, even if we could not add 1 TW of discharge to current hydro plants, the solution could still be obtained with more CSP albeit at higher cost than the present solution.

Since CSP costs have dropped since our study, we think that would be more competitive with increasing hydro discharge rates.

Please let me know what you think.

Best regards,
Mark

On 2/29/16 10:22 AM, Christopher Clack – NOAA Affiliate wrote:

Hi Mark,

Do you have any time today to have a quick chat on the phone?

Chris

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Christopher Clack PhD BSc (Hons) FRAS FEAS
Research Scientist II
Cooperative Institute for Research in Environmental Sciences (CIRES)
University of Colorado
NOAA/OAR/ESRL
Room DSRC 2B415
325 Broadway, Boulder, CO 80305-3337
E-mail: Christopher.Clack@noaa.gov
Web: <http://www.esrl.noaa.gov/gsd/renewable/news-simulator.html>
Phone: (303)-497-4296

Cell: (720)-668-6873

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Mark Z. Jacobson
Professor of Civil and Environmental Engineering
Director, Atmosphere/Energy Program
Stanford University
Yang & Yamazaki Environ. and Energy Bldg
473 Via Ortega, Room 397
Stanford, CA 94305-4020
Phone: [650-723-6836](tel:650-723-6836)
Fax: [650-723-7058](tel:650-723-7058)
jacobson@stanford.edu
Twitter: @mzjacobson
www.stanford.edu/group/efmh/jacobson/

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Christopher Clack PhD BSc (Hons) FRAS FEAS
Research Scientist II
Cooperative Institute for Research in Environmental Sciences (CIRES)
University of Colorado
NOAA/OAR/ESRL
Room DSRC 2B415
325 Broadway, Boulder, CO 80305-3337
E-mail: Christopher.Clack@noaa.gov
Web: <http://www.esrl.noaa.gov/gsd/renewable/news-simulator.html>
Phone: (303)-497-4296
Cell: (720)-668-6873

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Mark Z. Jacobson
Professor of Civil and Environmental Engineering