

BEFORE THE OHIO POWER SITING BOARD

- - -

In the Matter of the :  
Application of The Ohio :  
State University for a :  
Certificate of :  
Environmental :  
Compatibility and Public : Case No. 19-1641-EL-BGN  
Need to Construct a :  
Combined Heat and Power :  
Facility in Franklin :  
County, Ohio. :

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PROCEEDINGS

before Ms. Sarah Parrot, Administrative Law Judge,  
Ohio Power Siting Board, called at 10:00 a.m. on  
Tuesday, July 14, 2020.

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Volume I

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Tuesday Morning Session,  
July 14, 2020.

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ALJ PARROT: Let's go on the record.

The Ohio Power Siting Board has set for hearing at this time and place Case No. 19-1641-EL-BGN which is captioned in the Matter of the Application of the Ohio State University for a Certificate of Environmental Compatibility and Public Need to Construct a Combined Heat and Power Facility in Franklin County, Ohio.

Good morning, everyone. My name is Sarah Parrot. I am the Administrative Law Judge assigned by the Board to hear this case.

At this time I would like to take the appearances of the parties starting with the Applicant.

MR. ALEXANDER: Good morning, your Honor. Trevor Alexander and Steve Lesser from the law firm of Calfee, Halter & Griswold representing The Ohio State University.

ALJ PARROT: And your address, Mr. Alexander, please.

MR. ALEXANDER: 41 South High Street, Huntington Building, 12th Floor, Columbus, Ohio

1 43215.

2 ALJ PARROT: Thank you.

3 On behalf of Sierra Club.

4 MS. WACHSPRESS: Your Honor, Megan  
5 Wachspress, along with me Richard Sahli and Tony  
6 Mendoza on behalf of Sierra Club. Our address is  
7 2101 Webster Street, 13th Floor, Oakland, California  
8 94612.

9 ALJ PARROT: Thank you.

10 And on behalf of the Board Staff.

11 MR. LINDGREN: Your Honor, on behalf of  
12 the Board Staff, Ohio Attorney General Dave Yost by  
13 Thomas G. Lindgren and Werner L. Margard. Our  
14 address is 30 East Broad Street, 16th Floor,  
15 Columbus, Ohio 43215. And I will let Mr. Ball  
16 introduce himself.

17 Brian, are you on? I'm sorry. Maybe he  
18 stepped out, but Brian Ball of the Ohio Attorney  
19 General's Environmental Enforcement Section is  
20 representing the Ohio Department of Natural Resources  
21 in this proceeding. And I am sorry, I do not have  
22 his address.

23 ALJ PARROT: That's all right. We'll go  
24 ahead and proceed. Thank you, Mr. Lindgren.

25 Due to the COVID-19 emergency that

1 remains in effect on Executive Order 2020-01D issued  
2 by the governor of the State of Ohio and consistent  
3 with the Amended Substitute House Bill 197, this  
4 hearing is being held through Webex which enables the  
5 parties to participate by video conference while also  
6 affording public access to the hearing by telephone  
7 or video on the internet.

8           Before we get started with the first  
9 witness, I would like to address some preliminary  
10 issues. First, if counsel or witnesses experience  
11 technical difficulties during the hearing, please let  
12 me know by phone or e-mail immediately. You can also  
13 contact Mary Fischer, our event host, by phone or  
14 e-mail, and all counsel should have my contact  
15 information as well as Ms. Fisher's.

16           Another -- excuse me. Another option for  
17 reaching me or Ms. Fischer is to use either the chat  
18 or the raise hand feature in Webex if you need  
19 technical assistance. Please be aware chats are  
20 recorded and should not be considered private. Chats  
21 are also not part of the official record for this  
22 case.

23           Let's talk a little bit about how the  
24 hearing will be conducted. In many respects this  
25 virtual hearing will proceed in much the same way as

1 an in-person hearing before the Board. However, here  
2 are some general ground rules and reminders for the  
3 hearing. To avoid unnecessary background noise, I  
4 ask that counsel keep their microphones on mute  
5 unless they are speaking or to be prepared to speak  
6 quickly, for example, to raise objections during the  
7 examination of a witness. Microphones of the  
8 witnesses will be kept on mute until it is time for  
9 their testimony.

10 With respect to your video, counsel  
11 should leave their camera on at all times except  
12 during breaks. You can also turn your video off if  
13 you need to step away from the hearing during periods  
14 where your co-counsel has the reign. Just remember  
15 to turn it back on when you return. Witnesses will  
16 need to turn on their video when it is time for their  
17 testimony.

18 Also please be mindful of our court  
19 reporter. You should speak clearly and at a  
20 reasonable speed so that the court reporter can  
21 accurately transcribe the hearing. We are just going  
22 to have a reminder at this point for everyone to do  
23 their best to avoid speaking over each other by  
24 taking proactive steps like intentionally allowing  
25 for a pause at the end of questions to the witnesses



1 and generally slowing down the pace of the hearing to  
2 allow for connectivity lags and objections from  
3 counsel.

4 Finally, I believe that the parties have  
5 agreed that the witnesses during their testimony will  
6 have access only to the filings in the case docket as  
7 well as other documents that have been identified as  
8 potential exhibits that have been exchanged already  
9 among the parties and provided to me. Witnesses  
10 should not access or seek other information or  
11 documents while testifying nor should they  
12 communicate through any means with anyone privately  
13 during their testimony.

14 Does anyone have any questions about  
15 these ground rules?

16 All right. Very good. Are there any  
17 preliminary matters that the parties wish to address  
18 at this time?

19 All right. Mr. Alexander, I will turn it  
20 over to you.

21 MR. ALEXANDER: Thank you, your Honor.  
22 For its first witness the Ohio State University calls  
23 Mr. Serdar Tufekci.

24 MR. TUFEKCI: Good morning.

25 ALJ PARROT: Good morning. Can you hear

1 everyone?

2 MR. TUFEKCI: Yes.

3 ALJ PARROT: Very good. Would you please  
4 raise your right hand.

5 (Witness sworn.)

6 ALJ PARROT: Very good.

7 - - -

8 SERDAR TUFEKCI

9 being first duly sworn, as prescribed by law, was  
10 examined and testified as follows:

11 DIRECT EXAMINATION

12 By Mr. Alexander:

13 Q. Could you please state your name for the  
14 record.

15 A. Serdar Tufekci.

16 Q. And did you cause prefiled direct  
17 testimony to be filed in this proceeding?

18 A. Yes.

19 Q. Do you have any changes or corrections to  
20 that testimony?

21 A. No.

22 Q. Now, the application in this proceeding  
23 was incorporated by reference in your testimony as  
24 Exhibit 1; is that correct?

25 A. That is correct.

1 Q. Do you have any changes or corrections to  
2 the application you filed in this proceeding?

3 A. I do. I have two clerical errors in the  
4 application that I would like to correct.

5 Q. Okay. Please do so.

6 A. On page 39, Table 9, Section 3, the  
7 current as is and predicted problem numbers are  
8 different. The figure "421,492" should be updated as  
9 "486,534." That's the as is carbon emissions from  
10 Columbus Campus. And the figure "231,967" should be  
11 corrected as "314,570." And that other figure, it  
12 should reflect 35 percent reduction. It's the first  
13 in the document.

14 The second correction is on page 28  
15 towards the bottom of the page. It lists the stack  
16 height to be 125 feet; whereas, the designed stack  
17 height is 115 feet, 1-1-5, and that's referenced  
18 elsewhere in the information as 115 and also the  
19 modeling results is based on 115 feet. Those are the  
20 two corrections I would like to make.

21 Q. Thank you. Besides those two  
22 corrections, do you have any other changes or  
23 corrections to the application?

24 A. No.

25 MR. ALEXANDER: Your Honor, I'm sorry. I

1 should have done this before. Could I ask that  
2 Mr. Tufekci's testimony be marked for identification  
3 as Ohio State Exhibit A.

4 ALJ PARROT: So marked.

5 (EXHIBIT MARKED FOR IDENTIFICATION.)

6 MR. ALEXANDER: Thank you.

7 Q. (By Mr. Alexander) With that if I were to  
8 ask you these same questions that exist in your  
9 testimony, would your answers today be the same as  
10 they appear in your written testimony?

11 A. Yes.

12 MR. ALEXANDER: With that, your Honor,  
13 Ohio State moves for the admission of Mr. Tufekci's  
14 prefiled written direct testimony, subject to  
15 cross-examination.

16 ALJ PARROT: Thank you, Mr. Alexander.  
17 Ms. Wachspress.

18 MS. WACHSPRESS: We have no objections to  
19 the admission of the testimony, but we would like to  
20 conduct cross-examination.

21 ALJ PARROT: Go ahead and proceed at this  
22 time.

23 - - -

24

25

CROSS-EXAMINATION

1  
2 By Ms. Wachspress:

3 Q. Mr. Tufekci, you are the CEO of Ohio  
4 State Energy Partners, correct?

5 A. Yes.

6 Q. And if I refer to Ohio State Energy  
7 Partners as OSEP going forward, we'll understand each  
8 other?

9 A. Yes.

10 Q. Okay. What is OSEP?

11 A. It is a joint venture between ENGIE North  
12 America and Axium Infrastructure. It participated in  
13 the partnership in energy management tendered at Ohio  
14 State and leased in 2017. And this joint venture was  
15 awarded to manage the energy infrastructure of the  
16 utility system of Ohio State Columbus Campus.

17 Q. What is OSEP's relationship to OSU or the  
18 Ohio State University?

19 A. It is the concessionaire recognized in  
20 the public partnership for the long-term lease and  
21 concession agreement for Ohio State University to the  
22 system.

23 Q. And you are providing testimony today on  
24 behalf of OSU, correct, the Ohio State University?

25 A. Correct.

1 Q. And going forward if I use OSU for the  
2 Ohio State University, we'll understand each other,  
3 correct?

4 A. Correct.

5 Q. What is the relationship between OSEP and  
6 ENGIE Buckeye Operations?

7 A. In the concession agreement, an entity is  
8 recognized as the operator that does operations,  
9 maintenance, engineering, and construction services  
10 related to the system. So OSEP has an operations and  
11 maintenance agreement with ENGIE Buckeye Operations.  
12 And ENGIE Buckeye Operations is a subsidiary of ENGIE  
13 North America.

14 Q. And do you have any relationship with  
15 ENGIE Buckeye Operations personally in your  
16 professional capacity?

17 A. I am an ENGIE employee appointed to OSEP  
18 as -- as an officer. So on a day-to-day basis, I do  
19 interact with ENGIE Buckeye Operations' staff. In  
20 fact, the office I am in right now is housed within  
21 the ENGIE Buckeye Operations' offices on Ohio State  
22 campus.

23 Q. And is there any direct contractual  
24 relationship between ENGIE Buckeye Operations and  
25 OSU?

1           A.    No, other than being recognized as the  
2 operator in the concession agreement.

3           Q.    Thank you.  So OSU has been interested in  
4 building a combined heat and power facility on campus  
5 for a number of years, correct?

6           A.    Correct.

7           Q.    And a firm called Burns & McDonnell  
8 developed a feasibility study for a combined heat and  
9 power facility at OSU in 2014, correct?

10          A.    Yes.

11          Q.    How did that feasibility study come to be  
12 conducted?

13          A.    I'm sorry?  How did that feasibility  
14 study?

15          Q.    How did the feasibility study come to be  
16 conducted?

17          A.    Come to be conducted?

18          Q.    The circumstances surrounding its  
19 conduction.

20          A.    I do not know.  This was before our  
21 concession agreement with the University was signed  
22 in 2017.

23          Q.    So OSEP and OSU executed a concession  
24 agreement in April of 2017, correct?

25          A.    Yes.

1 Q. And one of the terms of this agreement is  
 2 that OSEP will conduct a feasibility study for the  
 3 construction of a combined heat and power facility,  
 4 correct?

5 A. Not exactly. One of the clauses in the  
 6 concession agreement gave the University the option  
 7 to request a feasibility study. It wasn't a  
 8 requirement.

9 Q. But the agreement specifically referred  
 10 to a combined heat and power or CHP facility in that  
 11 section, correct?

12 A. Yes.

13 Q. And that feasibility study was completed  
 14 in 2018, correct?

15 A. Correct.

16 Q. And a redacted -- a version with certain  
 17 confidential information redacted is attached as  
 18 Exhibit 4 to your testimony, correct?

19 A. Correct.

20 Q. And OSU retained TRC, an environmental  
 21 consulting firm, to perform certain analyses related  
 22 to the proposed facility, correct?

23 A. I am not familiar with it.

24 Q. So you are not familiar with the fact  
 25 that OSU retained an environmental consulting firm



1 with the name TRC to perform analyses related to the  
2 proposal?

3 A. I'm sorry. I thought you said ERC. TRC,  
4 T as in my last name.

5 Q. Yes.

6 A. OSEP hired TRC, and Buckeye Operations  
7 hired -- retained TRC to assist with environmental  
8 permitting process.

9 Q. Okay. But TRC did not perform any  
10 comparison between the proposed CHP facility and any  
11 other means of generating electricity, correct?

12 A. Correct.

13 Q. And TRC did not perform any comparison in  
14 between the proposed CHP facility and any other means  
15 of generating heat, correct?

16 A. Correct.

17 Q. And TRC did not perform any environmental  
18 analysis of the impacts of natural gas extraction,  
19 correct?

20 A. Correct.

21 Q. Thank you. Okay. If I could direct --  
22 okay. So as part of its application filed in this  
23 case, OSU identifies five purposes and needs for the  
24 construction of this CHP facility and those are  
25 increased campus resiliency and increased campus

1 reliability, establish the University's microgrid,  
 2 reduce its carbon footprint, and reduce energy costs,  
 3 correct?

4 A. Yes.

5 Q. Okay. Have you investigated or caused to  
 6 be investigated the frequency of forced outages at  
 7 combined heat and power plants in similar  
 8 climatological conditions as the proposed facility?

9 A. I'm sorry. Could you repeat the  
 10 question?

11 Q. Have you investigated the frequency of  
 12 forced outages at combined heat and power plants in  
 13 similar climatological conditions as the proposed  
 14 facility?

15 A. I'm not sure if I understand your  
 16 question. Have I investigated frequency of forced  
 17 outages of combined heat and power plants?

18 Q. Yes.

19 A. As an operator of a number of similar  
 20 facilities, ENGIE does have an in-house monitor of  
 21 typical expected forced outages for a facility.  
 22 Specific facility, no.

23 Q. Okay. So based on that in-house  
 24 knowledge, what is the typical frequency of forced  
 25 outages at such a facility?

1           A.    A typical frequency would be considered  
2 depending on the configuration.  Less than 1 percent.

3           Q.    I'm so sorry.  I did not catch that  
4 because of internet issues.  Could you repeat  
5 yourself, please?

6           A.    Typical forced outage rate, depending on  
7 the facility configurations, typical design, the way  
8 the redundancy is built, around 1 percent or less  
9 than 1 percent.

10          Q.    Thank you.  Have you investigated the  
11 rate of disruption of electricity supply from the PJM  
12 grid to the OSU campus over a historical period?

13          A.    I have not.

14                MS. WACHSPRESS:  Okay.  And I would like  
15 to move to admit as Exhibit A, the Concession  
16 Agreement Annual Report for Fiscal Year 2019.

17                MR. ALEXANDER:  Objection.

18                ALJ PARROT:  Grounds, Mr. Alexander?

19                MR. ALEXANDER:  Two.  First, I believe we  
20 are on Exhibit B, just a quick clerical record --  
21 clarifying the record here.

22                Second, this document was produced after  
23 your Honor's required time by which such documents  
24 had to be produced yesterday; and, therefore, we  
25 object to its use here.

1           Additionally, the document was -- was  
2 never actually shown to the witness or used in the  
3 proceeding, and it's 2,500 pages long. So to include  
4 that amount of information when the witness is able  
5 to answer all the questions would be unduly  
6 burdensome to the record.

7           MS. WACHSPRESS: Your Honor, may I  
8 respond?

9           ALJ PARROT: You may.

10          MS. WACHSPRESS: So initially I think  
11 there may be some confusion as to which document I am  
12 referring to. I am referring to the document with  
13 the file name Annual Report\_January 2020\_final which  
14 is a 23-page document.

15          Proceeding on that with counsel's sincere  
16 apologies for missing the deadline I think by  
17 approximately three hours, this is a document that  
18 was produced to us by Applicant. It is a document  
19 produced by OSEP. It is an annual report of some  
20 significance to the parties. It is a document they  
21 certainly would have been familiar with and perhaps  
22 even had a role in authorship prior to the hearing.  
23 So I think there is no sandbagging or surprise  
24 happening here.

25          This is a document Applicant would have

1 been familiar with both prior to litigation and  
2 through the course of preparation for the hearing  
3 today and again with our apologies for the delay. I  
4 do not believe that prejudices either the witness or  
5 counsel in any manner.

6 MR. ALEXANDER: Your Honor, if I could  
7 just very briefly respond, your Honor.

8 ALJ PARROT: Go ahead.

9 MR. ALEXANDER: The miscommunication over  
10 which document we're referring to goes to why I don't  
11 think this document should be admitted. It wasn't  
12 actually used. It wasn't presented to the witness.  
13 The document was never authenticated, and so I don't  
14 think we've established a need to include it in the  
15 record.

16 ALJ PARROT: Well, that goes to issues  
17 that we will decide after we get through  
18 Ms. Wachspress's examination with the witness.

19 As to the marking of this, I think as  
20 long as we are clear that this is Sierra Club Exhibit  
21 A as opposed to Ohio State's Exhibit A, I think we're  
22 fine. That's consistent with our usual practice at  
23 the Board so we will mark it as Sierra Club Exhibit  
24 A.

25 (EXHIBIT MARKED FOR IDENTIFICATION.)

1 ALJ PARROT: And as to the timeliness, I  
 2 appreciate your apologies, Ms. Wachspress. I fail to  
 3 see the prejudice to the Applicant on this. And the  
 4 deadline was also for my benefit, and I am prepared  
 5 to move the case forward at this time despite the  
 6 brief delay in getting the documents to me.

7 So anything from Board Staff on this  
 8 issue, Mr. Lindgren?

9 MR. LINDGREN: No, no. We have no  
 10 position, your Honor.

11 ALJ PARROT: Well, with that then I am  
 12 going to overrule the objections.

13 And go ahead and proceed, Ms. Wachspress.

14 Q. (By Ms. Wachspress) Mr. Tufekci, if I  
 15 could direct your attention in the exhibit to page  
 16 Bates stamped OSU 003269. My apologies. I am in the  
 17 wrong place in my notes. I am going to direct you to  
 18 page OSU 003658.

19 MR. ALEXANDER: Ms. Wachspress, could you  
 20 please identify the exhibit again.

21 MS. WACHSPRESS: Oh, I'm sorry.

22 Q. Mr. Tufekci, you have before you a  
 23 document with a file name annual  
 24 report\_January 2020\_final, and it's labeled the "Ohio  
 25 State University, Ohio State Energy Partners,

1 Concession Agreement Annual Report, Fiscal Year 2019"  
2 with Bates stamp OSU 003655 on the first page.

3 A. Okay.

4 Q. Okay. So now we are going to go to the  
5 page Bates stamps 3658. There should be --

6 A. Okay.

7 Q. -- two charts on this page. One is  
8 labeled "Utility Reliability Fiscal Year 2019," and  
9 the other is labeled "Utility Outages Events Fiscal  
10 Year 2019"; is that correct?

11 A. That is correct.

12 Q. And if you look at the first chart, Chart  
13 1, it shows that electricity during fiscal year 2019  
14 had 100 percent reliability; is that accurate?

15 A. That is correct.

16 Q. And steam shows 100 percent reliability  
17 during fiscal year 2019 as well, correct?

18 A. Yes.

19 Q. Okay. You can put that one aside for  
20 now. I am going to direct you to Sierra Club --

21 MS. WACHSPRESS: I am going to move for  
22 admission of Sierra Club Exhibit B which is a file  
23 with the file name "CEMP Annual Report FY18 Final."

24 MR. ALEXANDER: Your Honor, could we go  
25 off the record for just a moment?

1 ALJ PARROT: Yes.

2 (Discussion off the record.)

3 MS. WACHSPRESS: Okay. I would like to  
4 mark for purposes of identification as Sierra Club  
5 Exhibit B a document with the file name, for those of  
6 us following along electronically, "CEMP Annual  
7 Report FY18 Final.pdf," and it reads on the cover  
8 "Sustainability Innovation Academic Impact,  
9 Comprehensive Energy Market," and is entitled "Annual  
10 Report Fiscal Year 2018," and the first page is Bates  
11 stamped OSU 003678.

12 (EXHIBIT MARKED FOR IDENTIFICATION.)

13 Q. Mr. Tufekci, this document is an annual  
14 report produced by OSEP for OSU for the fiscal year  
15 2018, correct?

16 A. No.

17 Q. I'm sorry?

18 A. No, that is not correct.

19 Q. Okay. Could you tell me what this  
20 document is -- are you familiar with this document?

21 A. I am familiar with it. It's a report  
22 produced by Ohio State University for OSEP, not the  
23 other way around.

24 Q. Got it. So it is a report produced by  
25 Ohio State University, correct? Okay. If I could



1 direct you to Bates stamp on -- you know, I am so  
2 sorry. I have -- I have the wrong document here.

3 MS. WACHSPRESS: Can I move to admit this  
4 document for the time being and then I am going to  
5 refer to a different document for my next set of  
6 questions, your Honor? Or I can return to this  
7 document and move to admit.

8 ALJ PARROT: It has already been marked  
9 as Sierra Exhibit B, so we have it marked, and you  
10 can come back to it when you are ready.

11 MS. WACHSPRESS: Okay. Thank you.

12 Q. (By Ms. Wachspress) Okay. I would like  
13 to refer you, Mr. Tufekci, to the Staff Report of  
14 Investigation filed in this proceeding which I would  
15 mark for identification as Sierra Club Exhibit C.

16 A. Okay.

17 ALJ PARROT: I keep interrupting. I'm  
18 sorry. I think we will go ahead and mark this as a  
19 Staff exhibit.

20 MS. WACHSPRESS: Staff exhibit.

21 ALJ PARROT: Mr. Lindgren, is it all  
22 right if we mark this as Staff Exhibit A?

23 MR. LINDGREN: Yes. That would be my  
24 preference too. Thank you, your Honor.

25 ALJ PARROT: You're welcome.

1 MS. WACHSPRESS: I did not want to be  
2 presumptuous about Staff's exhibit.

3 ALJ PARROT: So marked.

4 (EXHIBIT MARKED FOR IDENTIFICATION.)

5 Q. So I would like to direct your attention  
6 to page 7 in the Staff Report and on I guess the  
7 third full paragraph down --

8 A. Which page?

9 Q. Page 7, the third full paragraph down.  
10 And that paragraph describes a gross power output of  
11 118.1 megawatts for the proposed facility with a  
12 nominal net electrical output of 105.5 megawatts. Is  
13 that an accurate characterization of the proposed  
14 facility?

15 A. The 105.5 megawatts is the correct net  
16 electric output. The 118.1 megawatts is the  
17 nameplate total sum of generated capacities.

18 Q. So the proposed facility has a parasitic  
19 load of approximately 13 megawatts, correct?

20 A. That is not correct.

21 Q. In what way is that statement not  
22 correct?

23 A. Because 118.1 megawatts are not  
24 necessarily the output of the facility. It's the sum  
25 of the nameplate generator -- there are three

1 generators. It's the sum of the nameplate rating on  
2 the generators.

3 Q. And the proposed facility will not be  
4 capable of achieving the nameplate generation on the  
5 generators; is that correct?

6 A. Correct.

7 Q. So would you disagree with the  
8 characterization in the Staff Report as the gross  
9 power output being equal to 118.1 megawatts?

10 A. I don't --

11 MR. ALEXANDER: Could I have the question  
12 reread, please.

13 (Question read.)

14 MR. ALEXANDER: Thank you.

15 A. I am not exactly sure how the Staff  
16 intended to use the term "gross" in this context.  
17 Therefore, I am not in a position to -- to say yes.

18 Q. How would you typically use the term  
19 "gross" in this context?

20 A. In a typical facility the gross output  
21 would be the net ability that a facility can produce  
22 in its generator term limits. For example, a  
23 50 megawatts gas turbine to a 70 megawatt generator,  
24 the gross output of that facility would still be  
25 50 megawatts even though the generator is 70 megawatt

1 capacity. This context, again, I am not sure how the  
2 word is used.

3 Q. Does the proposed facility have a  
4 parasitic load?

5 A. It does.

6 Q. And what is that amount?

7 A. I do not know at the moment, but I would  
8 expect it to be a few megawatts.

9 Q. And by a few you mean?

10 A. Less than -- definitely less than 5.

11 Q. And the parasitic load of running off the  
12 grid is zero, correct?

13 A. What do you mean by "running off the  
14 grid"?

15 Q. What would you -- how would you normally  
16 use the phrase "running off the grid"?

17 A. How would I normally use it?

18 Q. The parasitic load of OSU running off the  
19 grid is zero, correct?

20 A. Again, I am not sure what you mean by  
21 that context because there is no parasitic load of  
22 running off the grid.

23 Q. All right. Thank you. We'll move on.  
24 So I would like to direct your attention to Exhibit 4  
25 of -- of your testimony, the redacted version of the

1 feasibility study.

2 MS. WACHSPRESS: And, your Honor, if you  
3 could clarify for me whether I need to move to have  
4 this marked as a new exhibit or move for admission  
5 here or if I can just proceed on it?

6 MR. ALEXANDER: Already marked and moved  
7 it so.

8 MS. WACHSPRESS: Okay. Thank you.

9 Q. (By Ms. Wachspress) So I would like to  
10 direct your attention to the page in this study  
11 marked as 3-10. And at the bottom it states "Based  
12 on the current configuration the CHP is unable to  
13 meet the NFPA 110 level 1 requirements. Therefore,  
14 we are assuming that all current and future medical  
15 facilities will have emergency diesel generation  
16 equipment." And I have your -- I have your attention  
17 to that line. Is it correct to say that OSU must  
18 continue to maintain its existing backup diesel  
19 generation equipment even after the completion of the  
20 proposed facility?

21 A. Not necessarily.

22 (Off the record.)

23 ALJ PARROT: Mr. Tufekci, if you have  
24 something to add to that, I think we have everyone  
25 back with us. So let's go ahead and proceed and

1 thank you all for your patience.

2 A. The University needs to maintain the  
3 backup diesel generators for critical facilities such  
4 as the medical facilities that are required by code  
5 to do so. That's why my answer was not necessarily  
6 meaning other facilities that are not critical may  
7 not need backup generators going forward.

8 Q. Give me a moment. But it is correct to  
9 say that for those critical facilities OSU must  
10 continue to maintain its existing backup diesel  
11 generator equipment even after the completion of the  
12 proposed facility?

13 A. Yes.

14 Q. And redirecting your attention to page  
15 3-10 of the feasibility study, the chart at the top  
16 with the heading "University on Campus Back-up  
17 Generation." In the first column, it says "Medical  
18 (Emergency Generation)." Those are the critical  
19 facilities you were referring to, correct?

20 A. Correct.

21 Q. And the total capacity associated with  
22 those facilities, if you'll look over at the third  
23 column, is 31 megawatts, correct?

24 A. Correct.

25 Q. And 31 megawatts is approximately a

1 little bit less than a third of the nameplate  
2 capacity of the proposed facility, correct?

3 A. Correct.

4 Q. Okay. So now I would like to talk to you  
5 about black start capability. Black start capability  
6 is the capacity of generation facilities to start off  
7 without any electricity from the grid, correct?

8 A. Yes.

9 Q. Will the proposed facility include black  
10 start capability?

11 A. At the moment in its design and the way  
12 the application is made to the Siting Board, it does  
13 not, but it can be added as an option in the future.

14 Q. So the facility as described in the  
15 application does not include black start capability.

16 A. It does not.

17 Q. And the facility as described in the  
18 permitting applications with the Ohio EPA does not  
19 include black start capability, correct?

20 A. Correct.

21 Q. Is it, therefore -- so if both the  
22 proposed facility and the grid were to go down at the  
23 same time, the proposed facility as described in the  
24 application would not be able to independently  
25 restart until the grid has been restored, correct?

1           A.    Correct.

2           Q.    So I am going to direct your attention to  
3 the feasibility study at page 2-6, the third full  
4 paragraph, beginning "Electrically." So --

5           A.    Okay.

6           Q.    Okay. So the study states that the  
7 proposed facility at the time it is completed will  
8 not be capable of connecting to the West Substation,  
9 correct?

10          A.    Let me take a look. I think the  
11 paragraph says it cannot connect to both substations  
12 at the same time --

13          Q.    Okay.

14          A.    -- which doesn't necessarily mean it  
15 cannot connect to the West Substation.

16          Q.    But it also says "As a future option, the  
17 CHP can also be connected to the West Substation,"  
18 correct?

19          A.    Correct.

20          Q.    So at the time it is completed, the CHP  
21 will not be connected to the West Substation,  
22 correct?

23          A.    Correct.

24          Q.    And so the portion of campus connected to  
25 the West Substation will not benefit from any



1 islanding capabilities of the proposed facility,  
2 correct?

3 A. Not necessarily because many buildings on  
4 campus, depending on their energy need, practicality  
5 are connected to both substations. So all of  
6 those -- only those that are connected to the West  
7 Substation, and I don't know how many, but I would  
8 expect that number to be low, would not benefit from  
9 the CHP generation.

10 Q. And you stated that each generator can  
11 only be connected to -- based on this paragraph, each  
12 generator can only be connected to one substation at  
13 a time, correct?

14 A. Yes.

15 Q. So if in the future one of the generators  
16 were to be disconnected -- excuse me. If in the  
17 future one of the generators were to be connected to  
18 the West Substation, that would mean it would have to  
19 be decoupled from the OSU Substation, correct?

20 A. Correct.

21 Q. And this would reduce the capacity of  
22 electricity available to the portion of campus  
23 connected to the OSU Substation, correct?

24 A. Correct.

25 Q. The proposed facility does not have a

1 backup fuel source, correct?

2 A. Correct.

3 Q. And so if there were to be a disruption  
4 to the gas pipeline, the proposed facility would be  
5 unable to operate, correct?

6 A. Correct.

7 Q. And the proposed facility is -- as we  
8 discussed, will be connected to at least initially  
9 the OSU Substation, correct?

10 A. Correct.

11 Q. And if the substation were to become  
12 nonoperational, the CHP facility could no longer  
13 provide electricity to the campus, correct?

14 A. Could you elaborate what you mean by  
15 substation becomes nonoperational? Because typically  
16 there are switchboards and transformers at a  
17 substation. Is your question suggesting that all of  
18 it is nonoperational?

19 Q. Yes.

20 A. Then in that case, in that case, correct,  
21 the CHP will also be not operational.

22 Q. And if there were to be partial  
23 disruptions to that substation, those would affect  
24 portions of campus's ability to draw energy from the  
25 proposed facility, correct?

1           A.    Correct.

2           Q.    All right.  I would like to direct your  
3 attention to page 6-4 of the feasibility study and  
4 specifically the figure of 6-5.  And this -- this  
5 figure shows that the McCracken facility will  
6 continue to generate more than half of the campus's  
7 steam needs until 2035, correct?

8           A.    May I take a minute to study the graph?

9           Q.    Yes, please.

10          A.    It has been a while since I have seen  
11 this chart.

12                        So this chart is showing the steam  
13 production capability of McCracken and CHP and future  
14 heating sources is the net steam load, predicably net  
15 steam load of the campus.

16          Q.    Okay.  So based on this chart, is it --  
17 relying on this chart, is it the case that McCracken  
18 even with the construction of the proposed facility  
19 will continue to generate more than half of the  
20 campus's steam capacity until 2035?

21          A.    That is not correct.

22          Q.    What about that is not correct?

23          A.    The feasibility study was enacted in  
24 2018, and it considered a number of different  
25 configurations, a number of different locations on

1 campus, and two different gas-driven models. What's  
2 in our application to the Siting Board is a different  
3 gas turbine with different capacity. So based on our  
4 application and our predicted future heating and  
5 power demand of the campus, we expect McCracken on an  
6 annual average to provide only 15, 1-5, percent of  
7 heating demand after the CHP facility is operational.

8 Q. How many boilers at McCracken will be  
9 retired prior to 2035?

10 A. Per our application only one.

11 Q. And how many boilers are at McCracken  
12 currently?

13 A. Six.

14 Q. So according to this feasibility study,  
15 the University believes that additional steam  
16 generation facilities will have to be constructed to  
17 meet projected campus needs after McCracken's planned  
18 retirement in 2035, correct?

19 A. Well, that's not what the study says. In  
20 order to retire McCracken, presuming the future  
21 demand of campus continues as predicted by 2035, some  
22 alternative heating sources must be identified and  
23 installed.

24 Q. So the proposed facility is not capable  
25 of being the sole source of steam on OSU's campus,

1 correct?

2 A. Within the next few years, that is  
3 correct.

4 Q. And when you say within the next few  
5 years, what -- at what date do you anticipate the  
6 proposed facility will be the sole source of OSU's  
7 steam needs?

8 A. I am not able to predict and give you a  
9 precise date when that can happen because that  
10 depends on a number of different factors such as  
11 campus growth, how many new buildings Ohio State will  
12 build at what time, what kind of buildings they will  
13 be, what kind of in-building systems they will have,  
14 and also how our energy conservation measures program  
15 will result and whether there will be a second  
16 conservation measures program after the first one is  
17 completed.

18 So depending on all those factors, that  
19 could be six, seven years into the future. It could  
20 be 10, 12 years into the future. I am not able to  
21 give you a specific date today.

22 Q. So I want to make sure I understand you  
23 correctly. Currently the proposed facility as -- at  
24 the time of completion, the proposed facility will  
25 not be capable of providing all of the campus's steam

1 needs, correct?

2 A. On a year-round basis, that is correct.  
3 About 15 percent of the time -- sorry. About  
4 15 percent of the annual steam capacity will come  
5 from McCracken. In other words, six to eight months  
6 of the year the CHP will be fully able to provide the  
7 necessary heat capacity. In the winter months when  
8 the demand goes up, McCracken will operate. And then  
9 when there is scheduled maintenance on the CHP  
10 facility, on those times as well, McCracken --  
11 McCracken boilers would operate.

12 Q. And it's your testimony that at some  
13 point in the future, the proposed facility will be  
14 able to provide all of the campus's steam needs, but  
15 you are not sure what that date is, correct?

16 A. That is not correct. The facility makes  
17 it possible; it enables McCracken to retire in the  
18 future. But I cannot guarantee that nor can I give  
19 you a date today because many of the factors are  
20 outside my control.

21 Q. Understood. But given the capabilities  
22 of the proposed facility as stated in the  
23 application, will OSU need to replace the McCracken  
24 facility with a different steam-generating facility  
25 to fulfill the campus heating needs?

1 MR. ALEXANDER: Object as asked and  
2 answered. I think we have done this three times now.

3 Q. Could you identify some of the fac --

4 MR. ALEXANDER: There is an objection.

5 MS. WACHSPRESS: Objection. Your Honor,  
6 the witness testified that at some point but not at a  
7 date that he is able to give the -- there will be a  
8 point at which the proposed facility will be able to  
9 provide all of the campus needs, and I am just trying  
10 to get clarification on the apparent inconsistency  
11 between that and the document and his prior  
12 testimony. I am just trying to figure this out.

13 ALJ PARROT: Overruled. Go ahead and  
14 answer, Mr. Tufekci.

15 A. For the record, your Honor, I did not say  
16 the facility will be able to provide -- will be the  
17 single source of providing steam generation. I said  
18 it's possible that it may be. It will -- it will  
19 enable retirement of McCracken.

20 Q. (By Ms. Wachspress) You stated that there  
21 were several factors that were out of your control  
22 that might affect the -- the proposed facility's  
23 ability to do this. What are those factors?

24 A. The largest one is naturally how the  
25 University grows. If Ohio State builds let's say a

1 new medical facility that consumes a lot of steam,  
2 then that steam will have to be produced by some  
3 means.

4 Q. Okay. I want to go back to your -- to  
5 your prior statement that it is possible that the  
6 proposed facility will be able to provide all the  
7 steam needs on campus. The facility -- is that a  
8 fair representation of your -- of your prior  
9 statement?

10 A. Okay.

11 Q. The facility is not going to produce more  
12 steam in the future than it will at the time of  
13 completion, correct?

14 A. I'm sorry. Are you asking me what may  
15 happen in the future?

16 Q. So -- so it's your testimony that the  
17 facility will -- the proposed facility will enable  
18 the retirement of McCracken, correct?

19 A. Correct.

20 Q. Correct. As it stands currently  
21 McCracken provides 15 percent of the annual steam  
22 capacity on campus. That's your testimony. Excuse  
23 me. Scratch that.

24 It is your testimony that once this  
25 proposed facility is completed, McCracken will



1 continue to provide 15 percent of the annual steam  
2 capacity on campus, correct?

3 A. Yes.

4 Q. And it is also your testimony that at  
5 some point it is possible that the proposed facility  
6 will provide all of the steam needed on campus,  
7 correct?

8 A. Correct.

9 Q. Are the campus's steam needs anticipated  
10 to decrease over time?

11 A. I cannot give a precise answer to that  
12 question because there are two factors that change  
13 the steam demand of the campus. One is the energy  
14 conservation program that we are implementing as we  
15 speak. It's part of the concession agreement. It  
16 requires at least 25 percent energy using intensity  
17 on Columbus Campus within 10 years.

18 As part of that program, we are  
19 implementing a number of projects that is indeed  
20 using the steam demands. But on the other hand, the  
21 campus is growing. Ohio State is adding new  
22 buildings to the system and that does increase  
23 heating demands.

24 I want to be precise there. I am not  
25 saying steam demands but heating demands. Depending

1 on the facility, for example, a new facility, it may  
2 only need heating, whereas, there could be a new  
3 facility that may need both heating and process steam  
4 for medical or research reasons. Those are not under  
5 my control obviously. Therefore, I cannot give you  
6 specific number whether this will be declining or  
7 increasing.

8 Q. But is it correct to say that the  
9 proposed facility will only be able to provide the  
10 entirety of the campus's steam needs if those needs  
11 decrease overall?

12 A. Correct.

13 Q. Okay. What is the total cost associated  
14 with the construction of the proposed facility?

15 A. I would like to refer to our application  
16 to give you a precise number. On page 37 I would  
17 like to -- I am going to be a little technical here  
18 because I have to be. The proposed facility also  
19 houses a new central chiller water tank. In other  
20 words, there will be central chillers which is not  
21 part of the combined heat and power production but  
22 because of synergies it will be housing central  
23 chillers. Including the cost of the chillers \$197  
24 million as shown on page 37 of the application.

25 Q. And what are the synergies you identified

1 for the location of the chillers?

2 A. There is two. One is going to build a  
3 building and you have both chillers and heating  
4 equipment in the same facility so you don't need two  
5 separate buildings. That's synergy. You don't need  
6 two separate power lines coming to that building.  
7 And most importantly once the distribution is built  
8 meaning the heating piping coming out of the CHP and  
9 the cooling piping that carries the chilled water.  
10 It can be built and they would be built concurrently  
11 in the same trench. So there are synergies to  
12 conductance, design, and build.

13 Q. Thank you. So OSU as -- excuse me. As  
14 part of the feasibility study, the levelized cost of  
15 electricity for the proposed facility was estimated,  
16 correct?

17 A. Yes.

18 Q. And what was the estimated levelized cost  
19 of electricity for the proposed facility?

20 A. Which page of the feasibility study are  
21 you referring to?

22 Q. Let me pull that up. I am looking at  
23 page 3-18 at the very bottom.

24 A. Approximately \$47 a megawatt-hour.

25 Q. Okay. And OSEP will pay for the

1 construction of the proposed facility but will be  
 2 reimbursed for those costs of the project plus  
 3 provided with a return on equity, correct?

4 A. Correct.

5 Q. And over what period will OSEP be  
 6 reimbursed for the cost of construction?

7 A. 25 years.

8 Q. And just for clarity, it will be  
 9 reimbursed by OSU, correct?

10 A. Correct.

11 Q. And the rate of return on equity for OSEP  
 12 for the construction is 9.35 percent, correct?

13 A. For the first five years of the  
 14 concession agreement, that is correct. Every five  
 15 years this number resets based on two different  
 16 factors. The return on equity is based on the  
 17 approved utility return on equity rate in the State  
 18 of Ohio and neighboring states. And the return on  
 19 debt is determined by Barclays Cost Index. Both of  
 20 these are readily available, publicly available on  
 21 Ohio State's website as part of the published  
 22 concession agreement.

23 Q. Okay. So for 50 percent of the costs of  
 24 construction, OSEP will receive a return on equity at  
 25 a rate of 9.35 percent reset every five years,

1 correct?

2 A. No. The 9.35 percent is the result of  
3 the return on equity and return on debt.

4 Q. Got it. So OSEP will receive a return on  
5 equity on 50 percent and a return on debt on the  
6 other 50 percent.

7 A. Correct.

8 Q. And the combined percentage --

9 A. Actually, Ms. Wachspress, I would like to  
10 correct. The 9.35 percent is the return on equity  
11 figure. Return on debt is much lower. It's 3 point  
12 something. And the combined average, which is the  
13 final number that we see, is, I believe,  
14 6.35 percent.

15 Q. Okay. And this rate of return and the  
16 debt factor will be part of the variable fee --  
17 excuse me, the variable fee paid each year by OSU to  
18 OSEP, correct?

19 A. Correct.

20 Q. And this variable fee is in addition to  
21 two other fees paid by OSU to OSEP, correct?

22 A. Correct.

23 Q. And one of those annual fees is a fixed  
24 fee of -- beginning at \$45 million per year for  
25 performing utility services and OSEP's expertise,

1 correct?

2 A. Correct.

3 Q. And in addition to the fixed fee, there  
4 is an annual operating fee paid by OSU to OSEP,  
5 correct?

6 A. Correct.

7 Q. And initially this operating fee will be  
8 approximately \$9 million per year, correct?

9 A. Correct.

10 Q. And this operating fee is intended to  
11 cover operations and maintenance costs for the entire  
12 utility system including the proposed facility,  
13 correct?

14 A. Correct.

15 Q. And so OSU will pay any operational and  
16 maintenance costs associated with the proposed  
17 facility as part of this operating fee, correct?

18 A. Correct.

19 Q. Okay. If I could direct you to your  
20 testimony on page 3, lines 4 through 7. And you  
21 state in your testimony "Notably, OSEP receives no  
22 additional benefit connected to the type of  
23 technology utilized in capital improvement projects  
24 at Ohio State," correct?

25 A. Correct.

1           Q.    But OSEP does receive a return on  
2 investment of -- for 50 percent of the costs of  
3 construction of the proposed facility, correct?

4           A.    Correct.

5           Q.    And OSU covers the costs of debt  
6 associated with the remaining 50 percent of the costs  
7 of construction, correct?

8           A.    Correct.

9           Q.    And it's correct to say that OSEP would  
10 not receive a similar return on investment for a  
11 power purchase agreement, correct?

12          A.    Correct.

13          Q.    Is it fair to say OSEP does receive a  
14 benefit connected with the choice of construction as  
15 opposed to power purchases?

16          A.    That is correct. It is stated in my  
17 testimony in lines 2 through 4. Just the sentence  
18 before the reference you gave.

19          Q.    Okay. I would like to direct your  
20 attention to, we are still on the feasibility study,  
21 Exhibit 4, Appendix N, at the very end.

22          A.    Appendix N, okay.

23          Q.    Appendix N.

24          A.    As in Nancy?

25          Q.    Nancy, yes. And this appendix describes

1 the use of heating hot water or HHW for heating  
2 buildings, correct?

3 A. It does a comparison of using steam  
4 versus heating hot water for heating buildings,  
5 correct.

6 Q. And it states that the clear majority of  
7 new district heating systems are heating hot water,  
8 correct?

9 A. Correct.

10 Q. And just for -- to be clear, OSU is a  
11 district heating building system, correct?

12 A. Correct.

13 Q. And the clear majority of new district  
14 heating systems are heating hot water because it is  
15 preferable to steam as a source of heating for new  
16 construction, correct?

17 A. Correct.

18 Q. And heated hot water is more efficient  
19 than steam, correct?

20 A. Correct.

21 Q. And the appendix also states that the  
22 rate at which facilities are converting from steam to  
23 heated hot water is increasing, correct?

24 A. Where does it refer? Which section?

25 Q. It states an ever increasing -- so about



1 midway down the first page of the appendix, it states  
2 an ever increasing number of facilities have  
3 committed to investing in the conversion of steam to  
4 heated hot water.

5 A. Okay. On page 8-22.

6 Q. 8-22, yes.

7 A. Okay.

8 Q. That's correct. An ever increasing  
9 number of facilities have committed to investing in  
10 conversion of steam to heated hot water.

11 A. That's a general statement made in this  
12 feasibility study and I would generally agree with  
13 that statement.

14 Q. And just to be clear OSU does not use  
15 heated hot water currently, correct?

16 A. Incorrect.

17 Q. Incorrect. Okay. Where does OSU use  
18 heated hot water?

19 A. As part of the CHP facility, the overall  
20 actually approved project by the Board of Trustees of  
21 the Ohio State University includes a new district  
22 heating and cooling network. And that's the one I  
23 was referring to earlier when I was talking about the  
24 chillers in the CHP facility. This new network is  
25 indeed based on heating hot water. So at the moment

1 parts of the campus that's on the west side of  
2 Highway 315 does not have a heating or chilling  
3 network. There is no district heating and cooling.

4 With this new CHP facility, there would  
5 be a new district heating and cooling network  
6 established based on heating hot water as well as the  
7 midwest part of the campus which is between the  
8 Olentangy River and Highway 315 is a CHP facility,  
9 and the new heating hot water-based district heating  
10 system would enable those buildings to convert to  
11 heating hot water from steam.

12 So that's what we propose to do in the  
13 future. At the moment on the main campus, as new  
14 buildings are connected to the steam network, we have  
15 started to convert to heating hot water. And the  
16 example is project 15-18-EXP College Road is part of  
17 the new Department of Theater and School of Music  
18 buildings that are -- one is under construction. One  
19 is under design. We did not simply extend the steam  
20 network. Instead we installed a heat exchanger in  
21 the east chiller plant and actually provide -- will  
22 be providing heating needs of these two buildings via  
23 heating hot water.

24 Q. But the proposed facility does not  
25 generate heated hot water, correct? It generates

1 steam?

2 A. That is not correct.

3 Q. The pro --

4 A. The proposed --

5 Q. Sorry.

6 A. The proposed facility captures the  
 7 exhaust air as it is coming out of the gas turbines  
 8 in heat recovery steam generators and then this is --  
 9 then produces two products. One of them is heating  
 10 hot water. It will provide the heating needs of any  
 11 new building on Midwest Campus and West Campus that  
 12 will be connected to the new network. It also does  
 13 provide steam to feed into their existing steam  
 14 system.

15 Q. Is the hot -- heated hot water produced  
 16 by the facility produced directly, or does it need --  
 17 is the heating hot water produced directly by the  
 18 operation of the facility?

19 A. Yes.

20 Q. So there's no cooling process that it  
 21 needs to undergo to convert from steam to heated hot  
 22 water.

23 A. Correct.

24 Q. And --

25 A. Through the heat exchanger there is no

1 cooling involved.

2 Q. Through a heat exchanger.

3 A. Yes.

4 Q. So there is a heat exchanger process  
5 between the output and the heated hot water that  
6 flows to the rest of the campus.

7 A. Correct.

8 Q. And what happens to the excess energy  
9 from that heat exchanger?

10 A. There is no excess energy.

11 Q. Okay. So the -- what -- what enters the  
12 heat exchanger to produce the hot water?

13 A. Steam.

14 Q. Steam, okay. And when it leaves the heat  
15 exchanger, it's heated hot water, correct?

16 A. No.

17 Q. No.

18 A. So I am going to be a little technical  
19 again. Steam and heated hot water don't mix. On one  
20 side of the box steam comes in at a certain  
21 temperature and leaves at the lower temperature  
22 because it gives some of its energy to the hot water  
23 which enters at a lower temperature and leaves at a  
24 higher temperature. So there are two different  
25 loops.

1           Q.    Got it.  So is it fair to say that steam  
2 is generated by the facility, and the energy from  
3 that steam is used to heat a heated hot water loop  
4 exiting the facility?

5           A.    Correct.

6           Q.    Okay.  Thank you.  All right.  Going  
7 back, so you stated that -- to quote from the study  
8 again, an ever-increasing number of facilities have  
9 committed to investing in the conversion of steam to  
10 heated hot water.  And they do so because the  
11 benefits of converting to heated hot water outweigh  
12 the costs associated with performing that conversion,  
13 correct?

14          A.    Possibly.  It depends on the application,  
15 the costs, the needs, many different factors but  
16 possibly, yes.

17          Q.    Would a facility commit to converting  
18 steam to heated hot water if the costs of that  
19 conversion exceeded the benefits associated with  
20 heated hot water?

21          A.    I don't know.  I mean, I am not in a  
22 position to make such decisions.  It depends on who  
23 is making the decision and what their drivers are and  
24 also depends on what the steam is needed for.  Is it  
25 just for heating, or does it have other non-heating

1 functions?

2 Q. And what are some other non-heating  
3 functions steam might have?

4 A. Sterilization definitely and there are  
5 other users in the medical centers that I honestly  
6 don't know. I know there are medical reasons, and  
7 it's used in research facilities. For example, in a  
8 librarium it is used for cleaning. It's used for  
9 food production. It's also used for HVAC systems for  
10 controlling humidity, especially in humidity  
11 sensitivity facilities such as museums or a library.

12 Q. And can those needs be met through --  
13 through boilers specific to those locations?

14 A. I do not know.

15 Q. You do not know.

16 A. I do not know because I listed a number  
17 of different applications, and my expertise does not  
18 extend to those areas.

19 Q. So, for example, sterilization, can a  
20 localized boiler be used to generate steam for  
21 sterilization purposes?

22 A. Possibly, yes.

23 Q. So if you look down at Appendix N,  
24 Table 2, it lists five universities that are  
25 currently or have undergone this conversion from

1 steam to hot water, correct?

2 A. Correct.

3 Q. And each of these projects describe --

4 (Off the record.)

5 (Thereupon, at 11:37 a.m., a lunch recess

6 was taken.)

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Tuesday Afternoon Session,  
July 14, 2020.

- - -

ALJ PARROT: Let's go back on the record.  
We have had about an hour long recess for everyone to have a lunch break, and due to some technical issues with our transcription, I think, Karen, if you could just let us know where we left off, we'll get picked up again from what you last had on the transcript.

(Record read.)

ALJ PARROT: Ms. Wachspress, have you found your spot in your notes?

MS. WACHSPRESS: I have, thank you.

ALJ PARROT: Mr. Tufekci, if you want to kind of pick up from that point and complete your answer and we'll go from there.

MS. WACHSPRESS: I think the question was actually interrupted.

ALJ PARROT: Okay. Let's start there then. Thank you, Ms. Wachspress.

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SERDAR TUFEKCI

being previously duly sworn, as prescribed by law,  
was examined and testified further as follows:

CROSS-EXAMINATION (Continued)

By Ms. Wachspress:

Q. So each of the described conversions is  
currently in process or completed, correct?

ALJ PARROT: Mary, can we unmute Mr.  
Tufekci, please? Thank you.

All right, Mr. Tufekci.

A. Correct.

Q. So heated hot water technology is  
currently available, correct?

A. Correct.

Q. And for the five projects described  
attribute reductions in greenhouse gas emissions to  
the conversion from steam to heated hot water,  
correct?

A. Sorry. Could you repeat the question?

Q. Four of the five projects described  
attribute a reduction in greenhouse gas emissions to  
the conversion from steam to heated hot water,  
correct?

A. Based on the information provided from  
these universities to the public, correct.

1 Q. And that percentage reduction at Stanford  
2 is 50 percent, correct?

3 A. Again, based on the information provided  
4 by the universities, correct.

5 Q. And based on the information provided by  
6 the universities -- University, that percentage is 22  
7 percent at the University of British Columbia,  
8 correct?

9 A. Correct.

10 Q. And based on the information provided by  
11 the University, it's 30 percent at the University of  
12 California, Davis, correct?

13 A. Correct.

14 Q. And at Brown University, again based on  
15 the information provided by the University, that  
16 percentage is --

17 A. Ms. Wachspress, could you rephrase? At  
18 the time of the report we received, their plan or  
19 hope was to be 30 percent. Some of these numbers are  
20 not proven, but they are rather plans when they  
21 initiated these projects.

22 Q. Okay. And the greenhouse gas emission  
23 reductions claimed by the University with respect to  
24 the proposed facility are similarly projections,  
25 correct?

1           A.    Correct.

2           Q.    Okay.  And so the projected emissions --  
3   reduction in emissions from Brown University is  
4   42 percent, correct?

5           A.    Goal of reducing by 42 percent.  I would  
6   say if their goal is 42 percent, not necessarily  
7   their projection.

8           Q.    Right.  But it's a goal that is premised  
9   on the capacities of the conversion to the heat --  
10  heated hot water system, correct?

11          A.    I believe so, yes.

12          Q.    So Appendix N, on page A-23 of Appendix  
13  N, it states that generally, the only disadvantage of  
14  heated hot water system, or HHW system, is the  
15  inability to perform sterilization and other  
16  processes that directly require the use of steam,  
17  correct?

18          A.    Not including implementation costs, I  
19  would agree with that statement.

20          Q.    So are implementation costs a  
21  disadvantage associated with the operation of heated  
22  hot water?

23          A.    No, overall cost of installing the  
24  system, cost of ownership.

25          Q.    So the cost of installing the system is a

1 disadvantage associated with the conversion, but once  
2 the conversion is complete, the only disadvantage is  
3 the inability to perform sterilization and other  
4 processes that directly require the use of steam,  
5 correct?

6 A. Let me study that sentence for a second,  
7 Ms. Wachspress, because... The sentence starts with  
8 the word "generally" which suggests that for the most  
9 part for purposes of heating, heating hot water is  
10 the preferred technology today but that doesn't  
11 exclude some disadvantages that may be present  
12 depending on location and depending on context.

13 Q. Are you aware of any other disadvantages  
14 of heating hot water as a system for the OSU campus?

15 A. Well, which part of the campus are we  
16 talking about? Because we actually agree with you  
17 that heating hot water is a technology to implement  
18 going forward. And for that reason the heating and  
19 cooling system that we've designed to be built  
20 concurrently with the CHP facility is indeed heating  
21 hot water. So I'm not sure if I understand your  
22 question.

23 Q. Okay. The next sentence states that for  
24 new systems heated hot water is the clear choice,  
25 correct?

1 A. Correct, as we are doing.

2 Q. Right. And so let's talk about some of  
3 those advantages. If you look at Table 3, this is a  
4 chart comparing steam to heated hot water, correct?

5 A. Correct.

6 Q. Okay. Heated hot water is preferable to  
7 steam with respect to generation efficiency, correct?

8 A. Yes.

9 Q. And heated hot water is preferable to  
10 steam with respect to its ability to facilitate heat  
11 recovery, correct?

12 A. Which line are you in?

13 Q. Heat recovery potential. It's about the  
14 fourth line down under energy.

15 A. Correct.

16 Q. And heated hot water but not steam can be  
17 used in conjunction with energy storage technology,  
18 correct?

19 A. Generally speaking, yes.

20 Q. Okay. And you use the -- or the exhibit  
21 uses the term here deep carb -- excuse me. Strike  
22 that.

23 The exhibit uses the phrase here "deep  
24 decarbonization potential." Can you tell me what is  
25 meant by "deep decarbonization potential"?

1           A.    I'm sorry.  I would have to refer to my  
2 staff members in this specific intent of the words  
3 used in that line, in that line.

4           Q.    Okay.  But heated hot water -- if you  
5 turn to the next page, heated hot water but not steam  
6 can be generated by renewable resources, correct?

7           A.    Incorrect because depending on how you  
8 define renewable resources, steam can be generated  
9 with biomass, biofuels.  I think the intent on page  
10 340 is using solar energy or energy exchange is  
11 technically possible to make steam but practically  
12 not from a financial feasibility perspective.  That's  
13 what this table intends.

14          Q.    Okay.  So you -- you mentioned biomass as  
15 a renewable energy source.  Could you tell me what --  
16 I'm sorry, biogas.  Could you -- biomass.  Could you  
17 tell me what biomass is?

18          A.    Generally speaking it is considered  
19 vegetation that can be converted to generate energy.

20          Q.    Are there any facilities of comparable  
21 size to the proposed facility currently operating  
22 exclusively on biomass?

23               MR. ALEXANDER:  Objection.  Your Honor,  
24 at this point we've ventured pretty far afield from  
25 the application issue in this case, and we are now

1 asking about another technology and other facilities,  
 2 so I am going to object on relevance grounds.

3 MS. WACHSPRESS: Your Honor, I can return  
 4 to this topic with additional documents where  
 5 Applicant does reference biomass as a potential  
 6 energy source, but I'm happy to move on for now.

7 ALJ PARROT: Okay.

8 Q. (By Ms. Wachspress) Okay. So Appendix N  
 9 identifies the biggest weakness of heated hot water  
 10 at the Ohio State University as the fact that the  
 11 steam -- steam system is currently utilized, correct?

12 A. Correct.

13 Q. And then if you will -- if you'll look  
 14 with me at the very last paragraph in this appendix,  
 15 it says: "Once the size and location of the CHP is  
 16 determined, or in combination of the determination of  
 17 size and location of the CHP should the University  
 18 direct O -- direct OSEP to do so, the various steam  
 19 to heating water conversion strategies can be  
 20 evaluated and an optimum solution or solutions can be  
 21 provided to Ohio State."

22 Is it a fair inference from this  
 23 statement that at the time this study was authored,  
 24 OSEP and OSU had already decided to construct the CHP  
 25 facility without having conducted a full feasibility

1 study regarding a steam to heated hot water  
2 conversion?

3 MR. ALEXANDER: Can I have that question  
4 read, please.

5 (Record read.)

6 MR. ALEXANDER: Yeah. Your Honor, I am  
7 going to object on the basis that misstates the  
8 nature of the exhibit at issue here. It is labeled  
9 "Feasibility Study CHP." That's what it's labeled on  
10 every page so I think that misstates what this  
11 exhibit shows.

12 MS. WACHSPRESS: Your Honor, obviously we  
13 can make arguments in briefing, but we've already  
14 established a condition of the concession agreement  
15 between OSEP and OSU was the construction of a  
16 feasibility study, and the plain text of the  
17 statement says "once the size and location of the CHP  
18 is determined," I am asking a witness who has  
19 advanced this exhibit as part of his testimony to  
20 explain the meaning of this statement and describe  
21 the order of operations in terms of these  
22 considerations. I think it's a fair question.

23 ALJ PARROT: And the objection is  
24 overruled.

25 Go ahead and answer, Mr. Tufekci.



1           A.     That sentence does not necessarily  
2 suggest that conversion cannot be or should not be  
3 considered without the CHP.  What the sentence says  
4 is once the -- if a CHP is considered, based on that  
5 assumption, how could the conversion be considered  
6 and optimized.

7           Q.     So is it correct to say that the  
8 University conducted a feasibility study with respect  
9 to the CHP facility prior to conducting a feasibility  
10 study regarding the conversion of steam to heated hot  
11 water?

12          A.     I can only answer that question for  
13 July 2017 to today because that's the period we've  
14 operated.  During that period there has not been a  
15 formal conversion study of steam to heated hot water.  
16 But I am not aware whether something like this was  
17 done before.

18          Q.     Okay.  Thank you.  And the new  
19 construction to the west of the proposed facility  
20 will use heated hot water rather than steam for  
21 heating, correct?

22          A.     I'm sorry.  You froze for a second.  
23 Could you repeat the question?

24          Q.     Oh, yes.  The new construction to the  
25 west of the proposed facility at OSU will use heated

1 hot water rather than steam for heating, correct?

2 A. Yes.

3 Q. And heated hot water can be used in  
4 conjunction with geothermal energy storage, correct?

5 A. It could be.

6 Q. Can heated hot water also be used in  
7 conjunction with heating exchanges with chiller  
8 systems?

9 A. They could be.

10 Q. And geothermal heating does not provide  
11 any greenhouse gas emissions, correct?

12 A. Not correct. Geothermal systems also use  
13 pumps and motors to push the fluids. They do use  
14 electricity.

15 Q. And the order of magnitude for those  
16 emissions would be on the order of a thousand tons  
17 per year?

18 A. I don't -- I don't know. I could not  
19 give you a specific number.

20 Q. Okay. Would they be less or more than  
21 the proposed facility?

22 MR. ALEXANDER: Objection, incomplete  
23 hypothetical. Objection, incomplete hypothetical.  
24 Your Honor, the hypothetical does not identify the  
25 size of the proposed geothermal facility which is to

1 be compared to the CHP.

2 MS. WACHSPRESS: I can restate my  
3 question, your Honor.

4 ALJ PARROT: Go ahead.

5 Q. (By Ms. Wachspress) Would a geothermal  
6 heating system with similar heating capacity as the  
7 proposed CHP system have greater or lesser carbon  
8 greenhouse gas emissions than the proposed facility?

9 A. I do not know. That would require acres,  
10 hundreds of acres of land, so I don't know how much  
11 energy it would use to pump the hot water across the  
12 campus, such land doesn't exist on Ohio State campus,  
13 and also the source of energy, so I don't think I can  
14 or anybody can answer that question.

15 Q. What is the basis for your statement that  
16 it would require hundreds of acres of land?

17 A. I am told information based on the  
18 existing geothermal system on Ohio State campus.

19 Q. Are you familiar with how many acres of  
20 land were utilized in the Stanford University  
21 conversion to heated hot water?

22 A. I am not.

23 Q. Are you familiar with the acres of land  
24 utilized in any other university campuses' use of  
25 geothermal energy?

1           A.    I could not give you specific numbers off  
2 memory at the moment.

3           Q.    Are you familiar -- but are you familiar  
4 with other campuses' conversions to geothermal  
5 energy?

6           MR. ALEXANDER:   Just a point of  
7 clarification, does this include Ohio State's -- are  
8 you asking about Ohio State's conversion in  
9 geothermal or non-Ohio State campuses?

10          MS. WACHSPRESS:   Non-Ohio State.

11          Q.    Are you familiar with non-Ohio State  
12 geothermal energy -- scratch.

13                 Are you familiar with geothermal energy  
14 systems at universities other than Ohio State?

15          MR. ALEXANDER:   Now I am going to object  
16 to that question because we are asking about other  
17 technologies at other universities which are not at  
18 issue in this case.

19          MS. WACHSPRESS:   Your Honor, I thought  
20 this was resolved by the motion to compel, that the  
21 availability of other technology with lesser  
22 environmental impacts goes to the heart of this issue  
23 and it is a fair question whether such technology  
24 exists and it is being implemented at other  
25 universities and whether the witness has knowledge of

1 those implementations.

2 ALJ PARROT: Overruled.

3 Q. (By Ms. Wachspress) I'll repeat my  
4 question.

5 A. So --

6 Q. Oh, go ahead.

7 A. I'm not sure what you mean by "familiar,"  
8 the root of the term "familiar." Is it professional  
9 in the industry? I do attend conferences, and I do  
10 read papers. So am I familiar that some geothermal  
11 systems have been implemented around the country?  
12 Yes, I am familiar. Would I able to be in a  
13 technical debate whether this system is better than  
14 the other system? No.

15 Q. But OSEP as a contractor to OSU was  
16 responsible for making the feasibility determination  
17 with respect to various technologies for use for the  
18 University's heating and electricity needs, correct?

19 MR. ALEXANDER: Objection, vague as to  
20 various technologies.

21 MS. WACHSPRESS: Your Honor, I think the  
22 question stands. This goes back to our point of  
23 contention. I can name those technologies, but I  
24 think the -- it's a fair question for the reasons  
25 discussed earlier.

1 ALJ PARROT: Mr. Tufekci, go ahead and  
2 answer the question. And if you need clarification,  
3 please feel free to ask for it from Ms. Wachspres.

4 A. As part of the concession agreement, we  
5 did consider any technology that's commercially  
6 available to be implemented on campus at any given  
7 time, not specific to this project. For the record,  
8 as we speak, we have over 40 projects that are either  
9 completed or in the process of being designed or  
10 implemented. The CHP facility is one of them;  
11 therefore, we do consider all technologies that are  
12 available. Neither OSEP nor Axium or ENGIE are  
13 technology manufacturers. We are not tied to any one  
14 technology.

15 But based on University available land on  
16 the University, or lack thereof, and based on the  
17 scale of heating required on campus and based on the  
18 scale of non-heating-related steam required on  
19 campus, we've considered that geothermal is not an  
20 alternative to a CHP facility.

21 Q. And did you produce any documents stating  
22 that conclusion? Did OSEP produce any documents  
23 stating that conclusion?

24 A. No.

25 Q. You mentioned that OSU does already use

1 geothermal heating at certain places in its Columbus  
2 Campus, correct?

3 A. Correct.

4 Q. And so there are five campus highrise  
5 halls that are supplied with 90 percent of their  
6 annual heating need from a geothermal field network,  
7 correct?

8 A. I would not necessarily agree with the 90  
9 percent number. I don't know the exact number. A  
10 portion of their heating needs are provided by the  
11 existing geothermal system.

12 MS. WACHSPRESS: Okay. I would like to  
13 move for identification for I think we are at Sierra  
14 Club Exhibit C. And this is a document titled  
15 "Climate Action Plan, Path to Carbon Neutrality, Ohio  
16 State Climate Action Plan" dated April 2020. I would  
17 like to refer the witness, if he has the opportunity  
18 to pull it up, to page 11 of that document.

19 ALJ PARROT: It will be marked Sierra  
20 Club Exhibit C.

21 (EXHIBIT MARKED FOR IDENTIFICATION.)

22 A. Which page?

23 Q. Page 11.

24 A. Okay.

25 Q. Okay. And the bullet point that states

1 "Geothermal Heating and Cooling."

2 A. Okay.

3 Q. And it states "In 2013, the university  
4 completed a project that now supplies five south  
5 campus high-rise halls with 100 percent of their  
6 annual cooling and 90 percent of their annual heating  
7 consumption, there is a 411 geothermal well field  
8 network located beneath the South Oval and Hale Green  
9 on the Columbus campus." Does this refresh your  
10 recollection as to the percentage of heat of those  
11 highrise halls that are served by geothermal?

12 A. I am not an author of this document. I  
13 contributed to preparing the Climate Action Plan.

14 Q. So --

15 A. It is indeed in their plan, if that's  
16 what you are asking me.

17 Q. Okay. So is it your understanding that  
18 everything in the Climate Action Plan is accurate to  
19 the best of your knowledge?

20 MR. ALEXANDER: Objection. He just  
21 stated he wasn't the author of the plan.

22 MS. WACHSPRESS: Your Honor, I have a  
23 document here that has been authored by OSU to which  
24 the witness testified he was involved in its  
25 preparation. He is testifying on behalf of OSU. I



1 think it's fair to ask whether he -- the witness  
2 is -- stands by the statements made in the document  
3 or not.

4 ALJ PARROT: Overruled.

5 A. No. This document is prepared by Ohio  
6 State. It's a conceptual and rather academic  
7 document. I have -- my team and I have contributed  
8 to the document, but I am not in a position to  
9 confirm or dispute every sentence in it.

10 Q. Do you have any reason to believe that  
11 this statement is inaccurate?

12 MR. ALEXANDER: Objection. Which  
13 statement are you referring to? That last question  
14 related to the entire document.

15 Q. Do you have any reason to believe that  
16 the statement that 90 percent of the annual heating  
17 consumption of the five south campus highrise halls  
18 are served by geothermal energy? Do you have any  
19 reason to believe that statement is inaccurate?

20 A. I don't.

21 Q. So if I could direct your attention back  
22 to the feasibility study, and we are going to page  
23 6-6, 6-6. And here we have -- we have a chart  
24 showing the retirement costs -- the McCracken  
25 retirement cost summary in millions of dollars.

1           A.    Okay.

2           Q.    And if you'll look at the -- I think it's  
3 the fifth line down where it says "Conversion of  
4 existing primary steam heat exchangers to primary hot  
5 water heat exchangers," and the estimated cost of  
6 that conversion is \$16.9 million, correct?

7           A.    Correct.

8           Q.    And then just above that it says  
9 "Conversion of steam to hot water distribution," and  
10 that estimated cost is \$25 million, correct?

11          A.    Correct.

12          Q.    So is it accurate to say that the  
13 conversion of the current steam distribution system  
14 to hot water heating would be approximately \$42  
15 million, the sum of those two numbers?

16          A.    I don't think so.  Could -- could I have  
17 a minute to review the table?

18          Q.    Yes, please.

19          A.    So this feasibility study was a  
20 feasibility study on a CHP facility.  It was not a  
21 feasibility study on conversion of steam to heating  
22 hot water.  The numbers here, especially conversion  
23 of the network, look very low to me.  Therefore, I  
24 would not agree that the conversion would be 25  
25 million plus 16.9 million.  It would be much more

1 than that, so I can only guess that this considered a  
 2 future retirement of McCracken perhaps 15 years from  
 3 now. I think 2035 is the suggested date in this  
 4 study.

5 Q. This study was -- oh, sorry. This study  
 6 was performed by OSEP, correct?

7 A. It was conducted by Buckeye Operations on  
 8 behalf of OSEP, correct.

9 Q. Okay. And you're saying that the numbers  
 10 OSEP included in this study, you don't believe that  
 11 they are accurate.

12 MR. ALEXANDER: Objection, misquotes  
 13 testimony. The witness testified clearly as to the  
 14 source of the numbers. The numbers don't show what  
 15 counsel thought they showed. That does not indicate  
 16 that the numbers in the feasibility study aren't  
 17 accurate.

18 MS. WACHSPRESS: Your Honor, the witness  
 19 testified that the numbers in the study prepared by  
 20 OSEP as to particular costs seemed low to him. I  
 21 think it's fair to follow up and see whether OSEP  
 22 stands behind the number in the study.

23 ALJ PARROT: Overruled.

24 A. Specifically to that line network  
 25 conversion, it appears to me that certain assumptions

1 were made in terms of how much of the steam network  
2 would still remain as steam by 2035. Therefore, how  
3 much would it cost to do that last bit of conversion.

4 Q. But those --

5 A. How much would it cost -- how much would  
6 it cost today to convert the existing steam on campus  
7 which I would estimate to be in the order of a few  
8 hundred million.

9 Q. So on what basis do you estimate it to be  
10 a few hundred million?

11 A. Considering the scale of the campus,  
12 logistics, you can't stop operations on campus for a  
13 couple years while we do the conversion which  
14 requires a lot of temporary systems to be implemented  
15 while the conversion is being done. It's a  
16 professional estimate without going into detail of a  
17 full formal feasibility study.

18 Q. But OSEP represented as part of this  
19 feasibility study that the cost of that conversion in  
20 association with the retirement of the McCracken  
21 boilers would be closer to 40 million; is that  
22 correct?

23 A. Based on a certain assumption of the  
24 steam network remaining by 2035, that's what it  
25 appears.

1           Q.    Could you point me to where in the  
2 document it articulates that assumption about the  
3 steam system remaining?

4           A.    I am not suggesting that the document  
5 states that.

6           Q.    So those assumptions are not spelled out  
7 in the feasibility study, correct?

8           A.    Correct, because this was not a steam to  
9 heating hot water conversion feasibility study.

10          Q.    Because you did not -- OSEP did not  
11 conduct a full steam to heating conversion study  
12 at -- since 2017 that you're aware of, correct?

13          A.    Correct. We did not conduct a formal  
14 feasibility study of steam to heating hot water  
15 conversion.

16          Q.    So turning back to Appendix N, are you  
17 aware of the cost of the conversions described here  
18 at Stanford University?

19          A.    Sorry.

20          Q.    Appendix N. I'm sorry, Table 2. And the  
21 question is do you know how much it cost Stanford  
22 University to perform this conversion?

23          A.    I remember more than \$400 million based  
24 on the paper I had read.

25          Q.    But you can't identify that paper.

1 A. No.

2 Q. Do you know the cost of the conversion at  
3 the University of British Columbia?

4 A. No.

5 Q. Do you know the cost of conversion at the  
6 University of California, Davis?

7 A. No.

8 Q. Do you know the cost of conversion at  
9 the -- at Brown University?

10 A. I cannot recall the exact cost of  
11 conversion of the universities listed here.

12 Q. Okay. Thank you. So if I could direct  
13 your attention to Appendix K of the feasibility  
14 study.

15 A. A as in alpha?

16 Q. K as in kite or kitten.

17 A. Okay.

18 Q. And this appendix describes a proposal  
19 from OSEP to convert the Midwest Campus from steam to  
20 heated hot water, correct?

21 A. Correct.

22 Q. And the cost of this conversion was  
23 estimated to be \$19,750,000, correct?

24 A. At the time, correct.

25 Q. And roughly what percentage of buildings

1 at the OSU Columbus Campus are located on the Midwest  
2 Campus?

3 A. In the order of 10 to 15 buildings.

4 Q. Did OSU consider the feasibility of  
5 converting existing campus -- the existing campus  
6 heating system to heated hot water as an alternative  
7 to constructing a steam generating facility?

8 A. I'm sorry. Could you repeat the  
9 question?

10 Q. Did OSU consider the feasibility of  
11 converting the existing campus heating system to a  
12 heated hot water system as an alternative to  
13 constructing an additional steam generating facility?

14 A. On a campus-wide approach, no. We did  
15 not do a formal feasibility study on the conversion.  
16 We rather take a cost effective approach where in the  
17 example I gave earlier before the lunch break where  
18 two new buildings are headed to campus, and so they  
19 are extending the steam network. They provided  
20 heating hot water. In this Midwest example, there  
21 are some repair costs required in the next few years,  
22 so it does make -- it's more financially feasible to  
23 make the conversion in Midwest Campus rather than  
24 repair existing steam system.

25 Q. And I believe it was your testimony

1 earlier that neither OSU or OSEP considered the  
2 feasibility of using a geothermal system for  
3 generating heated hot water as an alternative to  
4 constructing an additional steam system, correct?

5 A. That is not correct. What I said was we  
6 did not consider a geothermal system as a campus-wide  
7 alternative as a result of a campus-wide formal  
8 study.

9 Q. And if I recall correctly, your testimony  
10 was also that there is no document that represents  
11 that conclusion or conveys that conclusion, correct?

12 MR. ALEXANDER: Objection. Objection.  
13 We're now just repeating prior testimony, and we are  
14 misstating the prior testimony. What the witness was  
15 actually asked previously was whether such a document  
16 had been produced in discovery, not whether Ohio  
17 State or OSEP had any such documents evidencing the  
18 viability of geothermal. That is a separate  
19 question. And I don't see the point of now we are  
20 asking the witness to repeat testimony which has just  
21 been given.

22 ALJ PARROT: Go ahead and rephrase,  
23 Ms. Wachspress.

24 Q. (By Ms. Wachspress) Was a document ever  
25 authored that conveyed OSEP's conclusion that a



1 geothermal system was not feasible as a campus-wide  
 2 alternative to constructing additional steam  
 3 generation capacity?

4 MR. ALEXANDER: Objection, calls for  
 5 speculation. The witness can't answer as to any  
 6 document ever being prepared by someone besides  
 7 himself or not to his knowledge.

8 ALJ PARROT: To the best of your  
 9 knowledge, Mr. Tufekci, go ahead and answer the  
 10 question.

11 A. To the best of my knowledge, there has  
 12 not been a formal campus-wide study to consider  
 13 geothermal as a campus-wide solution.

14 Q. Did OSEP or OSU consider the feasibility  
 15 of supplying campus heating needs with heat exchanges  
 16 from the current chiller system as an alternative to  
 17 constructing an additional steam-generating facility?

18 A. Yes.

19 Q. Was a document ever authored evaluating  
 20 that feasibility?

21 MR. ALEXANDER: Objection. Same  
 22 objection.

23 Q. To your knowledge.

24 ALJ PARROT: With that go ahead and  
 25 answer.

1           A.    The way heat recovery chillers, I think  
2    that's what you are referring to, when we considered  
3    heat recovery chillers as an alternative, in the  
4    heating source, there is no campus-wide analysis of  
5    network conversion.  However, as part of our energy  
6    conservation measures project, we do carry out  
7    building by building detailed audits.

8                    And in those buildings where there is a  
9    demand for a heat source and chilling year round,  
10   then we do implement recovery chillers.  And as we  
11   speak, we have installed a number of heat recovery  
12   chillers in a number of buildings, in the order of 15  
13   as we speak.

14                   We are also installing heat recovery  
15   chillers in another set of buildings in the order of  
16   15 buildings.  And our next phase building system  
17   optimization project is on schedule to be presented  
18   to the Board of Trustees for approval during their  
19   August 2020 Board of Trustees' meeting which would  
20   add another order of 15 to 20 buildings where heat  
21   recovery chillers can be implemented.

22                   And finally, again in August 2020 Board  
23   of Trustees' meeting, we will be proposing things  
24   like a centralized heat recovery chiller to the south  
25   chiller plant to provide heated hot water to some

1 buildings in the medical center.

2 Q. But you have not conducted a study with  
3 respect to the chiller facility that is to be  
4 installed in the same building as the proposed CHP  
5 facility, correct?

6 A. Correct.

7 Q. OSU or OSEP -- scratch.

8 OSEP did not conduct an hourly analysis  
9 of thermal load on campus, correct?

10 A. Not correct.

11 Q. So OSEP did conduct an hourly analysis of  
12 thermal load on campus.

13 A. Yes.

14 Q. Did OSEP conduct an analysis of  
15 systemwide thermal load that considered heating and  
16 cooling loads separately?

17 A. I am not sure if I understand the  
18 question.

19 Q. What about the question don't you  
20 understand?

21 A. I think I already answered in my previous  
22 answer that on a building-by-building basis, we do  
23 look at hourly consumption data, cooling and heating  
24 demands at the same time because that's the way heat  
25 recovery chillers can be considered and, if feasible,

1 can be designed and implemented.

2 Q. And those studies have been conducted at  
3 the building level, correct?

4 A. That is correct.

5 Q. So there has never been an hourly  
6 analysis of thermal load conducted at the system  
7 level, correct?

8 A. That is correct because at the system  
9 level, it cannot be implemented with the existing  
10 steam network of Main Campus.

11 Q. Could it be implemented with a heated hot  
12 water system?

13 A. Speaking hypothetically, possibly.

14 Q. And what is the -- what remains of the  
15 current lifespan of the steam heating system on which  
16 the OSU Campus currently relies?

17 A. Are you asking how much life there is  
18 left in the current steam system?

19 Q. Yes.

20 A. I cannot give you a simple answer because  
21 it's a complex system with different -- there are six  
22 boilers in McCracken at different ages. Some of them  
23 will come near end of life in the next decade. Some  
24 of them are relatively younger. Same for the steam  
25 piping system. Some will require maintenance in the

1 next decade. Some were installed in the last decade.  
2 So it's degree of life expectancy.

3 Q. So portions of the distribution system  
4 will require replacement within the next decade,  
5 correct?

6 A. They will -- I don't necessarily say  
7 replacement, but they will require some repairs.

8 Q. And what is -- the portions of the  
9 distribution system that were installed in the last  
10 decade, when will they next be repaired?

11 A. Steam system repairs aren't necessarily  
12 made on a scheduled basis. That's made on an  
13 assessment basis depending on conditions. So it  
14 could be a few years. It could be more. And it also  
15 depends on whether they are in tunnels or whether  
16 they are direct buried. It depends on soil  
17 conditions. It depends on whether the condensate  
18 return system which usually runs parallel to the  
19 steam network are in good condition, whether there  
20 are leaks. So there are many factors that determines  
21 what should be repaired when.

22 Q. Okay. How frequently does OSEP  
23 anticipate performing repairs to the steam  
24 distribution system over the next 10 years?

25 MR. ALEXANDER: Objection. Your Honor, I

1 am going to object to this line because we have now  
2 ventured afield from not just the CHP facility in  
3 this case but even the total amount of thermal load  
4 which Ohio State has to meet for either steam or hot  
5 water which are at least arguably relevant. Here, we  
6 are asking now about the repair schedule for a  
7 non-jurisdictional asset, the steam network, and it's  
8 too far afield.

9 MS. WACHSPRESS: Your Honor, the witness  
10 has testified that the cost and disruption associated  
11 with conversion to hot water was part of the  
12 conversation in rejecting that, you know, to the  
13 extent that rejection is documented, and I think it's  
14 fair game to ask questions about the current  
15 operation of the steam system that go to whether  
16 those claims regarding the relative cost and  
17 disruption are justified.

18 MR. ALEXANDER: The issue is not Ohio  
19 State's thermal need which is an issue in this case.  
20 It's Sierra Club's arguments as to what Ohio State  
21 should do with its campus which frankly is not  
22 jurisdictional. It's not a jurisdictional question  
23 before this body.

24 MS. WACHSPRESS: I mean, the question is  
25 whether the proposed facility represents the minimum

1 environmental impact -- adverse impact considering  
2 the available alternatives. We're discussing  
3 available alternatives. The witness's own documents  
4 show the viability of these alternatives in certain  
5 respects, and I am trying to nail down why these  
6 alternatives were rejected despite their own  
7 documentation showing they were preferable and allow  
8 similar needs to be met with reduced adverse  
9 environmental impact.

10 ALJ PARROT: Karen, can I hear the  
11 question again, please.

12 (Record read.)

13 ALJ PARROT: I am going to overrule the  
14 objection as to this question. I am going to see  
15 where you go with it, Ms. Wachspress.

16 MS. WACHSPRESS: Thank you.

17 A. May I refer to a table in the document to  
18 fresh my memory? I would say in the next decade in  
19 the order of under \$20 million range.

20 Q. Okay. Thank you. Okay. Starting a new  
21 line of questions, one of OSU's stated goals in  
22 constructing the CHP facility is reducing its carbon  
23 footprint, correct?

24 A. Correct.

25 Q. And wind generation has a lower carbon

1 generation than gas-fired generation, correct?

2 A. Generally speaking, yes.

3 Q. And solar generation has a lower carbon  
4 footprint than gas-fired generation, correct?

5 A. Correct.

6 Q. And the use of battery storage does not  
7 increase the carbon footprint associated with solar  
8 or wind generation, correct?

9 A. Technically incorrect.

10 Q. Okay. Explain to me how it's incorrect.

11 A. There is some losses when you charge and  
12 discharge the battery but generally speaking, yes.

13 Q. But losses, not emissions.

14 A. Correct.

15 Q. OSEP did not consider construction of  
16 on-site renewable generation resources as an  
17 alternative to the proposed facility, correct?

18 A. That's correct because it's physically  
19 unfeasible to get to the scale needed on campus.

20 Q. And OSU did not either, correct?

21 MR. ALEXANDER: Objection. Calls for  
22 speculation.

23 Q. To your knowledge, OSU did not either.

24 ALJ PARROT: With that go ahead and  
25 answer.



1           A.    To my knowledge, no.

2           Q.    And OSEP did not consider construction of  
3 off-site renewable generation resources as an  
4 alternative to the proposed facility, correct?

5           A.    Everything outside the boundaries of  
6 Columbus Campus is -- is outside the jurisdiction of  
7 the concession agreement.

8           Q.    So if OSU were to construct renewable  
9 generation off-site, not on the Columbus campus, OSEP  
10 would have no role in that construction?

11          A.    That is correct.

12          Q.    OSU currently has a power purchase  
13 agreement with the Blue Creek Wind Farm for  
14 50 megawatts of electricity; is that correct?

15          A.    Yes.

16          Q.    And did OSEP consider increasing the  
17 power purchase agreement with Blue Creek Wind Farm  
18 instead of constructing the proposed CHP facility?

19          A.    OSEP is not. The concession agreement  
20 does not include power purchase agreements on behalf  
21 of Ohio State.

22          Q.    So --

23          A.    We are not in a position.

24          Q.    So OSEP plays no role in the power  
25 purchase agreement between OSU and Blue Creek Wind

1 Farm?

2 A. Correct.

3 Q. If I could direct your attention to the  
4 feasibility study at 3-17. At the bottom there is a  
5 statement "Wind procurement is not sufficient to  
6 supply more than 25 percent of the power the  
7 University consumes as illustrated in Figure 3-16 and  
8 is not dispatchable." What is the basis for the  
9 statement that "Wind procurement is not sufficient to  
10 supply more than 25 percent of the power the  
11 University consumes"?

12 A. So talking about the Blue Wind Creek  
13 Farm, it's on contract.

14 Q. So the current 50 megawatt contract is  
15 not sufficient to supply the electricity that the  
16 campus needs, correct?

17 A. I would have to defer to my staff for the  
18 specific meaning of the sentence.

19 Q. Okay. But there's no technological  
20 constraint that precludes the University from  
21 obtaining more than 25 percent of its power from wind  
22 procurement generally, not specific to the Blue Creek  
23 Wind Farm.

24 A. With regards to the University's need for  
25 electricity, correct, there is no technical limit.

1           Q.    So the University could obtain  
2 electricity from renewable resources either through  
3 constructing new generation resources, power purchase  
4 agreements with outside generators, or both, correct?

5           A.    I am not in a position to speak on behalf  
6 of Ohio State with regards to constructing  
7 facilities; but with regards to purchase, yes, the  
8 University can procure their electricity needs.

9           Q.    But generally speaking -- I apologize for  
10 the crosstalk. Please finish.

11          A.    The University is free to do what it --  
12 what's best in terms of in regards to the  
13 procurement.

14          Q.    But generally speaking an institution,  
15 not necessarily OSU, can obtain electricity from  
16 renewable resources either by constructing those  
17 resources themselves or purchasing electricity from  
18 renewable generation held and operated by a different  
19 entity, correct?

20          A.    Correct.

21          Q.    And so if we go back to -- scratch that.

22                Is it your understanding that the  
23 University intends at some point in the future to  
24 increase its renewable procurement for the  
25 procurement of electricity from renewable generation

1 sources?

2 A. It's my understanding that the University  
3 always considers procuring renewable energy.

4 Q. I'm going to go back to the feasibility  
5 study, 3-19.

6 A. Okay.

7 Q. Okay. And I would like to direct your  
8 attention to Table 6.

9 A. Okay.

10 Q. This is the solar all-in delivered cost  
11 of energy stated in units of dollar per  
12 megawatt-hour.

13 A. Okay.

14 Q. And this purports to show the cost of  
15 solar-generated electricity procurement for the  
16 University, correct?

17 A. Correct.

18 Q. And the feasibility study cites this cost  
19 of solar renewable procurement as a reason to favor  
20 construction of the proposed facility, correct?

21 A. No, that is not correct.

22 Q. Okay.

23 A. The primary driver for the proposed  
24 facility is to meet the heating demand of campus  
25 because off-site renewable energy cannot provide the

1 steam demand and the heating demand of campus.

2 Q. Okay. Can I -- can I direct your -- your  
3 attention to 3-18 under "Offsite Renewable  
4 Procurement."

5 A. Okay.

6 Q. And it states that "An Offsite Renewable  
7 procurement strategy...is not economically attractive  
8 (Table 6)."

9 A. Which line are we?

10 Q. I'm sorry. There is a blue line that  
11 says "Offsite Renewable Procurement."

12 A. Okay.

13 Q. And the paragraph immediately beneath  
14 that and it states that "An Offsite Renewable  
15 procurement strategy by itself provides less carbon  
16 offset. It is not economically attractive." And  
17 it's directing the reader to Table 6.

18 A. Okay.

19 Q. So is it fair to say that the University  
20 and OSEP considered the cost of renewable generation  
21 of electricity as a part of its decision to build  
22 the -- part of its decision to construct the proposed  
23 facility?

24 A. Sorry. Could you repeat the question?

25 Q. Sure. So the feasibility study states

1 that "An Offsite Renewable procurement strategy...is  
2 not economically attractive" and cites Table 6. Is  
3 it, therefore, fair to say that OSEP and the  
4 University considered the comparative costs of  
5 renewable generation as one of the reasons to  
6 construct the proposed facility in lieu of increased  
7 renewables procurement?

8 A. No, I would not agree with that statement  
9 because the starting point of the proposed facility  
10 is not to replicate or displace electricity brought  
11 onto campus. The primary starter was generate the  
12 necessary heating demand and steam demand of campus  
13 through a more efficient process.

14 Q. But the proposed facility will generate  
15 105.5 megawatts of electricity, correct?

16 A. That's its rated capacity. During normal  
17 operations it will not be 105 megawatts.

18 Q. During normal operations what will it be?

19 A. It depends on conditions. On a day like  
20 this, so I'll reference some numbers, I actually  
21 checked our steam production last week when it was 90  
22 degrees, 90 degrees and above in Columbus every day,  
23 and average steam production varied between  
24 104,000 pounds to 119,000 pounds an hour. And  
25 clearly that's not the heating requirement. That's

1 the non-heating, mostly non-heating requirements.

2 Q. Okay. But what is that as a percentage?

3 A. So continuing my train of thought, so on  
4 a day like this where heating demand is relatively  
5 low and cooling demand is high, cooling is provided  
6 by chillers, probably the facility would generate  
7 around, let's say, 70 to 80 megawatts if it was  
8 operational today. If it's wintertime and it's very  
9 cold, probably most of the steam would be diverted to  
10 the steam network and the heated hot water network  
11 and the facility would probably produce 40 megawatts,  
12 50 megawatts. I am just giving reasonable numbers  
13 depending on season.

14 Q. And is the load fixed for that? Does the  
15 load vary depending on the megawatts produced?

16 A. Which "load" are you referring to?

17 Q. The load in terms of the turbines and the  
18 fuel consumed.

19 A. Well, the load is the demand of the  
20 campus, and the turbines are then dispatched to meet  
21 the demand.

22 Q. Got it. Okay. I think I'll come back to  
23 that. So let's -- so at a minimum the facility is  
24 going to be generating approximately on a normal  
25 operations basis 40 megawatts of electricity,

1 correct?

2 A. That is not correct.

3 Q. Okay. What -- at a normal operations  
4 basis, what is the amount of electricity the  
5 facility -- proposed facility is going to generate?

6 A. Could you define "normal operating  
7 basis"?

8 Q. On a day like today.

9 A. On a day like today, it would produce  
10 approximately a 60 to 70 megawatt range but that  
11 again depends on the -- the demand, campus demand,  
12 and the demand has two components. One is --  
13 actually in the case of the CHP three components.  
14 One will be heating hot water demand, second one will  
15 be steam demand, and third one would be power demand.  
16 And that changes, especially electricity demand  
17 changes depending on day of the week, week of the  
18 month, time of day, occupancy, and et cetera. So  
19 based on these variables, the CHP will follow the  
20 campus demand.

21 Q. But one of those demands is electricity,  
22 correct?

23 A. Yes.

24 Q. And one of the benefits cited in the  
25 feasibility study for the proposed facility is



1 reducing the University's cost of electricity  
2 relative to the grid, correct?

3 A. Correct.

4 Q. And so one of the purposes for which the  
5 facility will be built is generating electricity for  
6 campus use, correct?

7 A. Correct.

8 Q. Okay. But let's go back to Table 6, the  
9 solar all-in delivered cost of energy. Can you tell  
10 me what is meant by the "Solar Commodity PPA"?

11 A. The intent in that sentence is the  
12 wholesale price of 1 megawatt-hour of electricity  
13 from a solar facility.

14 Q. And what is the basis for the estimate  
15 here of \$35 per megawatt hour?

16 A. A number of data points. Some are based  
17 on the facilities ENGIE North America builds, owns,  
18 operates, and some based on market numbers.

19 Q. And then the next line down is the "PPA  
20 Capacity Tag." What is the "PPA Capacity Tag"?

21 A. I am not an electricity distribution  
22 expert, so I'm not going to be able to go into the  
23 detail of each term in there and their definition,  
24 but generally speaking the first line "Commodity PPA"  
25 covers the wholesale price of 1 megawatt-hour at the

1 point of generation. The other lines, the "PPA  
2 Capacity Tag" and "Ancillary, RPS, Shape Costs,"  
3 those are the various charges that are added on to  
4 the cost of the wholesale price to bring that  
5 electricity from point of generation to point of use  
6 including distribution, transmission and distribution  
7 charges.

8 Q. And what is the basis for the estimates  
9 associated with those -- those figures -- associated  
10 with the 5.2 and 10.1 and 13.7?

11 A. Basis is considering the markets,  
12 electricity markets in Ohio, and the location of the  
13 campus, and what these charges are likely to be.

14 Q. Did OSEP solicit any bids to inform its  
15 estimate of these charges?

16 MR. ALEXANDER: Objection just as to when  
17 you say "these charges," are you referring to the  
18 distribution utility charges or the PPA charges?

19 MS. WACHSPRESS: The PPA capacity tag,  
20 the ancillary, RPS, shape costs, others, and the  
21 utility delivery costs.

22 MR. ALEXANDER: Thank you.

23 A. We did not because these are very  
24 reasonable numbers. And some of them are publicly  
25 available tariff numbers such as distribution and

1 delivery costs.

2 Q. I don't see a distribution and delivery  
3 cost there. I see a PPA capacity tag, ancillary and  
4 RPS, shape costs, others, and utility.

5 A. The last line "delivery costs," that's  
6 the distribution costs.

7 Q. Okay. And that -- and you say it's  
8 publicly available. Are you -- are you -- can you  
9 state where it's publicly available or who publishes  
10 that information?

11 A. Ohio State Columbus Campus is part of AEP  
12 Ohio territory. That would be available on AEP Ohio  
13 tariff.

14 Q. And does Ohio State pay a PPA capacity  
15 tag as part of its procurement -- excuse me, its PPA  
16 with Blue Creek Wind Farm?

17 A. I do not know. We -- as I stated  
18 earlier, we are not -- concession agreement does not  
19 extend to off-site procurement of electricity, per  
20 se.

21 Q. All right. If I could direct your  
22 attention up one page again to the feasibility study  
23 at 3-18.

24 A. Okay.

25 Q. If you go almost at the bottom, the

1 second bullet point from the bottom, it states that  
 2 one of the benefits that renewables lack is that they  
 3 are not dispatchable into the market, correct?

4 A. Correct.

5 Q. The proposed CHP facility will not be  
 6 connected to the PJM grid, correct?

7 A. Incorrect. It will be running parallel  
 8 to the PJM grid.

9 Q. But my understanding -- scratch that.

10 It is correct that OSU or OSEP have not  
 11 completed the necessary filings or paperwork to sell  
 12 energy into the PJM market, correct?

13 A. That's correct.

14 Q. And could you tell me what you meant by  
 15 running parallel to the grid?

16 A. That means the generators will be an in  
 17 synchronous operation with the grid.

18 Q. What -- what is the total amount of  
 19 electricity used by campus on a day like today at  
 20 OSU?

21 A. Typically in the summer the demand  
 22 changes anywhere between 56 megawatt range to about  
 23 110 megawatts.

24 Q. And during the winter what -- what is  
 25 that total amount of electricity?

1           A.    Again, I am going to refer to the demand  
2 numbers, not necessarily megawatt-hours.  Winter  
3 it's -- let me check.  I believe it's around  
4 40 megawatts to 70, 80 megawatt range.

5           Q.    And that's the electricity you demand,  
6 correct?

7           A.    Correct.  And these are the -- these are  
8 historical numbers.  Those numbers will go up with  
9 the construction of new buildings on campus.

10          Q.    Okay.  And the -- and the Blue Creek Wind  
11 Farm provides 50 megawatts of electricity to campus  
12 currently, correct?

13          A.    No, that's not correct.

14          Q.    Okay.

15          A.    The rated capacity of the contract is  
16 50 megawatts.  But the -- it's a wind facility, so it  
17 produces when the wind blows, so it could be as low  
18 as 0, and it could be as high as 50.  On average, I  
19 checked the data on the last couple of years average,  
20 annual average was around 12 megawatts.

21          Q.    And when OSU draws electricity from the  
22 grid, that can be varied as needed, correct?

23          A.    Correct.

24          Q.    Okay.  OSU has considered the  
25 construction of solar generation as part of its

1 Climate Action Plan, correct?

2 A. Are we talking on campus? Off campus?

3 Q. On campus -- I will direct you to the  
4 exhibit, so if we go to the Climate Action Plan.

5 A. Okay.

6 Q. Sierra Club -- marked as Sierra Club  
7 Exhibit C and direct you to page 24. It says  
8 "Explore Campus-Based Solar Generation." So OSU  
9 considered the solar generation on campus as part of  
10 its Climate Action Plan, correct?

11 A. Okay.

12 Q. Okay. And according to the Climate  
13 Action Plan, OSU has determined that the construction  
14 of ground mount solar generation systems is  
15 infeasible, correct?

16 A. Correct.

17 Q. And this feasibility is attributed to the  
18 "constantly changing nature of the university's land  
19 assets," correct?

20 A. Could you point me out to which sentence  
21 you are referring to?

22 Q. So it's about midway down through that  
23 paragraph, the sentence beginning "As a result,  
24 ground mount systems are likely more physically  
25 feasible, but will be difficult to implement due to

1 the constantly changing nature of the university's  
 2 land assets."

3 A. Okay.

4 Q. What does that mean, "constantly changing  
 5 nature of the university's land assets"?

6 A. So I am not an author of this document,  
 7 but as a reader of this document, I would think that  
 8 there are -- there could be two types of ground mount  
 9 systems. One is called -- generally speaking one is  
 10 called canopy type, canopy mount. Typically in a  
 11 parking lot, you can implement it so that the land  
 12 can still be used to a certain degree while the  
 13 panels would be producing energy.

14 The other type is you literally take the  
 15 land and mount the panels on the ground. So I expect  
 16 that the sentence means both, that the University is  
 17 in an urban setting. It's literally in the middle of  
 18 the urban part of the City of Columbus and so there  
 19 are not acres and acres of open land to build on  
 20 Columbus Campus as other facility.

21 I think that's the intent of the  
 22 sentence.

23 Q. So if you'll -- I will direct your  
 24 attention up to the top. It says "Currently, Ohio  
 25 State has a few solar rays -- solar arrays across its

1 campuses." So is it correct that Ohio -- that  
2 Columbus is not Ohio State's only campus?

3 A. That is correct. Columbus Campus is in  
4 Main Campus. Over 50 thousand of the 60 plus  
5 thousand students are on Columbus, but the University  
6 does have a few other campuses around the State of  
7 Ohio as well.

8 Q. And are those campuses similarly urban?

9 A. Not to my knowledge.

10 Q. I am going to direct your attention back  
11 to the feasibility study at --

12 A. Okay.

13 Q. -- page 4-1.

14 A. 4-1?

15 Q. 4-1.

16 A. Okay.

17 Q. And under the paragraph labeled "Onsite  
18 Renewables," I would say about halfway down.

19 A. Okay.

20 Q. There is a sentence that states "A solar  
21 farm with the same capacity as the average campus  
22 load would require a footprint of 700 acres of land."  
23 What is the basis for that conclusion?

24 A. That's -- this is a general statement.  
25 Obviously output of a solar facility would change



1 depending on what parallel on the earth the facility  
2 is, whether it's a fixed or whether it has a single  
3 access tracking system, but generally speaking 5 to 7  
4 acres is considered the rule of thumb number to be 1  
5 megawatt rated capacity.

6 So going with that logic 700 acres  
7 probably one could have a solar asset of in the order  
8 of 100 to 120 megawatts. Again, this is rated  
9 capacity meaning on a sunny day around noon, it would  
10 produce that power. In the morning it won't. In the  
11 afternoon it won't. When it's cloudy, it is going to  
12 be less, and when it's nighttime, it will be zero.

13 Q. And does this estimate reflect any kind  
14 of formal study or -- or calculation performed by  
15 OSEP?

16 A. No.

17 Q. Okay. And I believe your testimony  
18 earlier was that the electricity demand on campus at  
19 the highest point, which is in the winter, can go up  
20 to about 80 megawatts; is that correct?

21 A. Correct. Well, if you are looking for a  
22 specific number, I would have to pause and check the  
23 historical curves, or are you asking in general  
24 terms? What's the order of magnitude?

25 Q. General terms order of magnitude.

1           A.    I would say it would vary between 45 to  
2 78 megawatt range.

3           Q.    Okay.  So the average of that, and I know  
4 it's a weighted average across time, but it's  
5 somewhere in the 50, 60 megawatt range.

6           A.    Okay.

7           Q.    Is that correct?

8           A.    It's plausible.

9           Q.    Plausible, okay.  So help me out with the  
10 math here.  5 to 7 acres per megawatt-hour for a  
11 campus capacity average of 50 to 60 does not equal  
12 700 acres unless I am missing something.  It equals  
13 closer to 250 to 300, correct?

14          A.    No, that's not correct.

15          Q.    Okay.  How is that not correct?

16          A.    So let's state the load.  Let's say  
17 6 acres per megawatt.

18          Q.    Okay.

19          A.    So 700 acres would give us, again this is  
20 rule of thumb, 110 megawatt rating capacity.  So  
21 in -- on campus we actually have run a rooftop  
22 project that we've worked on, and it's still in  
23 our -- in development, so I am going to refer to the  
24 numbers from that project.  About 13 to 14 percent of  
25 the rated capacity is -- is -- is the net average

1 output. In other words, if we were to build 100  
2 megawatts rated solar facility on campus, again this  
3 is based on a rooftop project, I'm extrapolating.

4 Q. Uh-huh.

5 A. It's likely to produce an average of  
6 14 megawatts of power. So the math does work quite  
7 well.

8 Q. So -- so there's a 110 megawatt rating  
9 associated with 700 acres of land and that that will  
10 work out when taking into account the rating to be  
11 roughly equivalent to the average campus load.

12 A. Yes.

13 Q. Okay. Are the same types of solar cells  
14 used in rooftop solar installation as in utility  
15 scale solar farms?

16 A. It may vary. Some rooftops may consider  
17 in film, but in the study that we did we actually  
18 used the same panels that would go into a utility  
19 scale solar.

20 Q. So you said in the study that you did.

21 A. Not study, in one rooftop project that we  
22 have been developing it's based on the same panels  
23 that would go into a utility scale system.

24 Q. How many acres of land does OSU own?

25 A. In Columbus Campus or statewide?

1 Q. Across the board.

2 A. I don't know, but outside Columbus  
3 doesn't really make any difference.

4 Q. How many acres is the Columbus Campus?

5 A. I believe total is in the 700 acres.

6 Q. 700 acres? Okay. So the University has  
7 established a goal of carbon neutrality by 2050,  
8 correct?

9 A. Yes.

10 Q. Why did the University set carbon  
11 neutrality as a goal?

12 A. I think you have to direct that question  
13 to the University.

14 Q. Okay. Okay. And is it OSEP's position  
15 that a gas-fired combined heat and power facility is  
16 the best available technology for greenhouse gas  
17 emissions?

18 A. No. OSEP's position is the CHP facility  
19 on the Ohio State Campus is the best available  
20 technology that meets the University's emerging  
21 needs, financial needs, and carbon reduction needs;  
22 so, therefore, I would not make a general statement.  
23 Specifically the Columbus Campus of the University,  
24 yes, that is.

25 MR. ALEXANDER: I apologize. I had maybe

1 a technical issue. I couldn't hear that last  
 2 response. Karen, could you please read it back, if  
 3 you could hear it.

4 COURT REPORTER: I had trouble also, and  
 5 this computer says it wants to restart, so I'm having  
 6 two problems.

7 MS. WACHSPRESS: Your Honor, this is  
 8 actually a good moment for me to take a break.

9 MR. ALEXANDER: Could we -- before we  
 10 break could we either have you retract that question,  
 11 or I just don't want to break while a question is  
 12 pending.

13 MS. WACHSPRESS: Sorry. I will retract  
 14 that question and ask it again when we reconvene.

15 ALJ PARROT: Sounds good. Let's take a  
 16 5-minute recess.

17 (Recess taken.)

18 ALJ PARROT: Let's go back on the record.  
 19 I think we were going to ask the question again; is  
 20 that correct, Ms. Wachspress?

21 MS. WACHSPRESS: Yes.

22 ALJ PARROT: All right.

23 Q. (By Ms. Wachspress) Okay. So the  
 24 question is OSU's position is that a gas-fired  
 25 cogeneration facility is the best available

1 technology for greenhouse gas emissions, correct?

2 A. That is not correct. I would not make a  
3 general statement as such. Specific to Ohio State  
4 University Columbus Campus, a CHP facility is the  
5 best solution to address the University's energy  
6 needs.

7 MS. WACHSPRESS: So I would like to  
8 introduce a document in -- with the file name Permit  
9 Application Attachment to the Supplement\_687120,  
10 Bates stamped the first page OSU 000193 and mark that  
11 as Exhibit D, Sierra Club Exhibit D.

12 ALJ PARROT: So marked.

13 (EXHIBIT MARKED FOR IDENTIFICATION.)

14 A. Are you referring to the application to  
15 the Siting Board?

16 Q. No, no. I'm referring to attachments to  
17 the application for the permit to install for the  
18 Ohio EPA.

19 A. Okay.

20 Q. The document is from 2019. Once you have  
21 that I would like to direct your attention to the  
22 page Bates stamped OSU 000203.

23 A. Are you referring to the application for  
24 the permit to install or the permit to install  
25 itself?

1           Q.    I am referring to the attachments, one of  
2 the attachments appended to the Ohio EPA PTI  
3 Application No. A0064624 completed June 2019 and it  
4 was shared with counsel for the University under file  
5 name Permit Application Attachments and  
6 Supplements\_687120, and I believe that's also the  
7 file name of the document as it was produced to the  
8 Sierra Club.

9           MR. ALEXANDER:  If it's helpful, the  
10 header of the document is Ohio State Smart Campus  
11 Project, and it's about 20 pages or so.

12          A.    I'm sorry.  So this document was  
13 submitted by Sierra Club as an exhibit.  Is this  
14 after or before?

15          Q.    It was submitted yesterday as a potential  
16 exhibit for cross-examination.  It was produced to  
17 Sierra Club by OSU in response to discovery requests.

18          A.    Okay.  And the file name is?  Could you  
19 repeat it one more time?

20          Q.    Permit Application Attachments and  
21 Supplements underscore --

22          A.    Okay.  Okay.  It's 18 documents.

23          Q.    And I would like to direct your attention  
24 to page 11.  It's 11 -- page 11 of the PDF, but the  
25 page is marked OSU 000203.

1           A.    Okay.

2           Q.    Okay.  And if you see the heading "BAT  
3 for Greenhouse Gases"?

4           A.    Okay.

5           Q.    The application states that "ENGIE  
6 proposes that the installation of a natural gas-fired  
7 cogeneration/combined heat and power facility is  
8 itself BAT and would also satisfy the PSD requirement  
9 to demonstrate best BACT if the Director's exemption  
10 letter had not been issued."  And so I'll ask again,  
11 is it OSEP's position that a gas-fired CHP facility  
12 is the best available technology for greenhouse gas  
13 emissions?

14           MR. ALEXANDER:  Objection.  I've got two  
15 concerns here.  One, we have done no authentication  
16 or discussion of this document which is knowledge  
17 therein.  That's the housekeeping one.  Then, two, we  
18 also haven't identified what the available technology  
19 is and how that relates to the question which is  
20 being posed.  So I think there is a foundational  
21 aspect we have to cover here as well as make sure we  
22 are talking about apples to apples.

23           MS. WACHSPRESS:  Your Honor, I am happy  
24 to lay the foundation.

25           ALJ PARROT:  Let's go ahead and start



1 with that.

2 Q. (By Ms. Wachspress) Okay. So you are  
 3 looking at a document that was produced to Sierra  
 4 Club by Ohio State University, and if you look at  
 5 this bottom footer, it's labeled as Ohio EPA PTI  
 6 Application No. A0064024 and dated June 2019. And  
 7 this appears to be an attachment provided as part of  
 8 the application for a permit to install for the  
 9 proposed facility. Do you have any reason to doubt  
 10 that characterization of this document?

11 MR. ALEXANDER: Objection. That's not a  
 12 proper foundation.

13 Q. All right. Do you recognize this  
 14 document?

15 A. Is the question to me?

16 Q. Yes. Do you recognize this document?

17 A. I saw this document yesterday  
 18 afternoon --

19 Q. Were you --

20 A. -- and was -- was not able to review it,  
 21 did not have time to review it.

22 Q. Were you involved in the process of  
 23 seeking the permit to install for the proposed  
 24 facility from the Ohio EPA?

25 A. I was. The consultants and the staff

1 that work to provide the necessary documentation and  
2 studies to get to the permit eventually are directed  
3 to me; so, yes, I was involved.

4 Q. And so you had authority over those  
5 individuals that submitted the permit application,  
6 correct?

7 A. Correct.

8 Q. And are you familiar with the permit  
9 application by -- the permit application for the  
10 proposed facility?

11 A. I am familiar with the permit  
12 application.

13 Q. But you're not familiar with this  
14 document.

15 A. I did not say that. As part of the  
16 permit application which takes a certain amount of  
17 time, a lot of documents and versions of a lot of  
18 documents are circulated. Clearly I am not in a  
19 position to remember and refer every single document  
20 or explain what each sentence means.

21 Q. Okay. Are you familiar with the term  
22 best available technology as used in the context of a  
23 Title V permit?

24 A. In general terms, yes. I am not an  
25 environmental specialist or environmental lawyer, but

1 as a professional in the industry, I have a general  
2 understanding.

3 Q. And is it your understanding that under  
4 state regulations, a proposed generation facility  
5 that is considered a major stationary source must  
6 represent that it is using the best available  
7 technology, technical term, to minimize the emissions  
8 of certain criteria pollutants associated with that  
9 facility?

10 A. Again, I will repeat that I am not an  
11 environmental specialist, so I am not in a position  
12 to elaborate the definition of some of the materials  
13 you referred to, but I do know that we did follow  
14 Ohio law, and as a result, the permit to install was  
15 issued by EPA.

16 Q. And as part of that permit to install,  
17 did you identify the emissions associated with the  
18 proposed facility?

19 A. Yes. The modeling was done by our  
20 consultant TRC, and the results of the modeling  
21 including the native file was shared with Ohio EPA.

22 Q. And one of the emissions associated with  
23 the facility are greenhouse gas, correct?

24 A. Correct.

25 Q. And so as part of the permit, you made

1 representations to the Ohio EPA about the relative  
 2 amount of greenhouse gas emissions associated with  
 3 your facility as compared to other technologies,  
 4 correct?

5 MR. ALEXANDER: Objection, best evidence  
 6 rule. The statements made in the permit is the  
 7 permit itself.

8 MS. WACHSPRESS: If you are willing to  
 9 stipulate to the admission of permit attachments as  
 10 an exhibit.

11 MR. ALEXANDER: Sure. Can you be more  
 12 specific and we can we mark it?

13 MS. WACHSPRESS: The exhibit marked --  
 14 the -- the document marked as Exhibit C.

15 MR. ALEXANDER: No, I am not willing to  
 16 stipulate to that.

17 MS. WACHSPRESS: Okay.

18 Q. (By Ms. Wachspress) Okay. Just to be  
 19 clear before we move on, this is for the witness, you  
 20 were -- you were responsible in your capacity as CEO  
 21 of OSEP for the submission of the -- of the permit to  
 22 install application for the proposed facility,  
 23 correct?

24 A. Correct.

25 Q. But you're not familiar with the document

1 produced by OSU to Sierra Club labeled as the --  
2 labeled as the Ohio State University Smart Campus  
3 Project and beneath as the Ohio EPA PTI Application  
4 No. A0064024?

5 A. That is not correct. What I said was  
6 this specific document was circulated yesterday  
7 afternoon. I am familiar with the permit. I don't  
8 recall specifically reading this document prior to  
9 yesterday afternoon.

10 Q. So you -- you -- it is your testimony  
11 that you had not seen this document prior to  
12 yesterday.

13 A. That is not my testimony. It's possible  
14 that I did see it because multiple documents with  
15 different versions have been presented going through  
16 this process.

17 Q. But it is your testimony that you cannot  
18 attest to the accuracy of any of the statements  
19 within that document.

20 MR. ALEXANDER: Objection, asked and  
21 answered. Objection, asked and answered.

22 ALJ PARROT: Sorry. Overruled.

23 Q. It is your testimony that you cannot  
24 attest to the accuracy of any of the statements in  
25 that document.

1           A.    No, I do attest to the accuracy of this  
2 because they were produced by either people that  
3 reported to me or by our consultants.

4           Q.    Okay. Then I would like to bring you  
5 back to page -- the page Bates stamped 203 of that  
6 document which states under the heading "BAT for  
7 Greenhouse Gases, ENGIE proposes that the  
8 installation of a natural gas-fired  
9 cogeneration/combined heat and power facility is  
10 itself BAT and would also satisfy the PSD requirement  
11 to demonstrate BACT if the Director's exemption  
12 letter has not been -- had not been issued." Are you  
13 attesting to the accuracy of that statement?

14          A.    I do.

15          Q.    Okay. And for clarity when you attest to  
16 the accuracy of that statement, you understand BAT to  
17 be an acronym for the term best available technology?

18          A.    Yes.

19          Q.    And the term BACT to be an acronym for  
20 the best available control technology, correct?

21          A.    Correct.

22          Q.    Earlier you testified that you were not  
23 taking the position that the gas-fired CHP facility  
24 is the best available technology for greenhouse gas  
25 emissions, correct?

1           A.    In which context?

2           Q.    Earlier I asked the question is OSU's  
3 position that a gas-fired CHP facility is the best  
4 available technology for greenhouse gas emissions,  
5 and you responded no and gave a longer answer which I  
6 won't attempt to reproduce and I am asking you to  
7 explain the discrepancies between that statement and  
8 the statement here as part of the application.

9           A.    I don't recall which statement I provided  
10 early on, but we were talking about renewable  
11 energies, and you were asking me to compare that to  
12 wind or solar energy. So my answer was in the  
13 context of wind and solar, and the CHP facility would  
14 produce more greenhouse gases. Whereas, in here it  
15 refers to specifics, definition of BAT with regards  
16 to Ohio EPA's regulations.

17          Q.    And you testified that was regulations  
18 that you are not an expert in.

19          A.    I'm sorry. There was echoing on the  
20 line.

21          Q.    You testified that you're not an expert  
22 on environmental regulations, correct?

23          A.    Correct.

24          Q.    Okay. Back to the feasibility study, so  
25 page 3-16. According to the feasibility study, the

1 combined heat and gas -- I'm sorry. The heat and  
 2 power facility, the proposed facility is intended to  
 3 reduce the carbon footprint in two ways, correct?

4 A. One second, please. You said?

5 Q. 3-16.

6 A. Okay. Which section are we referring to?

7 Q. 3-16, the first paragraph beginning with  
 8 "Installation of the clean and efficient."

9 A. Okay. Okay.

10 Q. Okay. According to the study, the  
 11 proposed facility is intended to reduce the carbon  
 12 footprint in two ways, correct?

13 A. Correct.

14 Q. And those two ways are from efficiency  
 15 through cogeneration and reduced carbon emissions due  
 16 to switching from the more carbon intensive grid to  
 17 natural gas generation, correct?

18 A. Correct.

19 Q. And on that same page you state that --  
 20 I'm sorry. If you go -- all right. On page 3-16 at  
 21 the very bottom of that same paragraph, it says the  
 22 CHP is expected to reduce the University's carbon  
 23 footprint by 21 percent, correct?

24 A. Yes.

25 Q. And on the following, page 3-17, you show



1 a -- on the top right corner that red ball you show a  
 2 carbon reduction of -- carbon dioxide reduction of  
 3 38 percent. Can you explain that discrepancy?

4 A. The first number, not --

5 Q. I'm sorry. I am having a hard time  
 6 hearing you. Could you -- I just missed that entire  
 7 answer. Can you start over?

8 A. Sure.

9 Q. Thank you.

10 A. The last sentence of page 3-16 refers to  
 11 25 years of operation, so the 21 percent is an  
 12 average number over 25 years.

13 Q. And the 38 percent corresponds to what?

14 A. First -- first year of operations.

15 Q. Why would the reduction in carbon  
 16 footprint decline over time?

17 A. Because the feasibility study considers  
 18 that over time the grid -- carbon footprint of the  
 19 grid will decline.

20 Q. And at what point is the -- if the  
 21 average is 21 percent but it starts at 38 percent, in  
 22 the final year of the facility's operation, what will  
 23 the carbon savings be associated with it?

24 A. I refer back to the fact that the  
 25 feasibility study is not a detailed design study,

1 feasibility. And the turbine that -- gas turbines  
 2 and congregation used in the application to the  
 3 Siting Board are not the same that are in the  
 4 feasibility study. Therefore, the carbon number in  
 5 the feasibility study are -- are based on the  
 6 congregation and design considered at the time, not  
 7 in our current -- current design and application.

8 Q. So what percentage of OSU's carbon  
 9 footprint is the current design expected to reduce?  
 10 Scratch that.

11 The current design --

12 A. The expected number --

13 Q. -- of the proposed facility is expected  
 14 to reduce the carbon footprint by what percentage its  
 15 first year?

16 A. 35 percent is expected in the first year.

17 Q. And over -- over the 25 years?

18 A. I don't have a specific number.

19 Q. Okay.

20 A. In Figure 18 of the Climate Change Action  
 21 Plan that you referenced early on, there is an  
 22 indicative figure in there.

23 Q. What proportion of these reductions in  
 24 carbon emissions due to the construction of the CHP  
 25 facility are attributed -- attributable to improved

1 efficiency due to cogeneration?

2 A. Could you explain it a little bit?

3 Q. So you cited two reasons -- or, excuse  
 4 me, the feasibility study cited two reasons that the  
 5 CHP is intended to reduce the carbon footprint. One  
 6 is through efficiency through cogeneration, and the  
 7 other is from switching off the grid. And I am  
 8 asking what proportion of that carbon savings are  
 9 attributable to the efficiencies associated with  
 10 cogeneration?

11 A. I don't have --

12 Q. Oh, dear.

13 A. Sorry. I --

14 Q. I don't know if the problems are at my  
 15 end or at yours. I missed that last answer.

16 MR. ALEXANDER: I had an issue there too.

17 A. Yeah. I couldn't speak either.

18 MR. ALEXANDER: Can you hold on a moment?

19 I don't see the Bench.

20 ALJ PARROT: I'm still here. Can you  
 21 hear me?

22 MR. ALEXANDER: Okay. We're back now.

23 ALJ PARROT: Okay. Good. Mr. Tufekci,  
 24 did you get the question or should we repeat that?

25 Still having issues hearing. Mr. Tufekci, can you

1 hear us?

2 THE WITNESS: I can hear you now.

3 ALJ PARROT: Okay. So sorry to be  
4 repetitive, did you hear the full question?

5 THE WITNESS: I think the question was  
6 what percentage of the carbon savings are  
7 attributable to the efficient cogeneration operation;  
8 is that correct, Ms. Wachspress?

9 Q. Proportion, not percentage, but yes.

10 A. I don't have an exact number. I would  
11 have to look back into our calculations.

12 Q. But the increased efficiency will result  
13 in reduced carbon emissions by replacing current  
14 heating generation with steam from the proposed  
15 facility, correct?

16 A. It's a combination of factors. One of  
17 them is the main driver is this McCracken facility  
18 which currently burns natural gas to produce steam.  
19 The CHP facility will provide a significant portion,  
20 about 85 percent, of the steam through cogeneration.

21 Q. And McCracken Boiler No. 5 will be  
22 retired upon completion of the construction of the  
23 proposed facility, correct?

24 A. Correct.

25 Q. But the remainder of the McCracken

1 boilers are not scheduled for retirement until 2035,  
2 correct?

3 A. Correct.

4 Q. So the only ongoing heat generation that  
5 will be eliminated by the construction of the  
6 proposed facility between now and 2035 is boiler No.  
7 5, correct?

8 A. No. I would not agree with that  
9 statement.

10 Q. What is incorrect about that statement?

11 A. At the end of the day the production  
12 will -- steam or heating water production will be  
13 enough to match the demand. So on many months and  
14 days McCracken boilers will not operate.

15 Q. But --

16 A. This is not -- this is not a case where  
17 there are six boilers in McCracken, one will retire,  
18 the five will continue to operate as they are today  
19 and then the CHP. That's not the case. Whatever  
20 steam and heating up water is coming out of the CHP  
21 will be the primary driver -- provider of steam and  
22 heating on campus. And only if and when McCracken  
23 boilers are required, they will operate.

24 Q. But the boilers will still be operational  
25 through 2035, correct?

1           A.    They will be as needed.

2           Q.    And they will still have a permit to  
3 operate, correct?

4           A.    Correct.

5           Q.    If the boilers are not needed, why is  
6 there -- why are five of the six boilers not  
7 scheduled for retirement until 2035?

8           A.    Because they provide redundancy.  They  
9 are assets that have been paid for by the University  
10 and so there is no urgent need to retire them.  It's  
11 like I have three cars.  I can only drive one of  
12 them, but if they are paid for and there is minimal  
13 cost to keep them, I may choose to keep them.

14          Q.    So the other source of carbon emission  
15 reductions that OSU claims are associated with the  
16 construction of the combined heat and power --  
17 combined heat and power facility are attributable to  
18 the relative carbon emissions at the proposed  
19 facility versus the grid, correct?

20          A.    Correct.

21          Q.    And this is due to the replacement of  
22 grid electricity derived from whole generation with  
23 electricity generated by natural gas, correct?

24          A.    Could you repeat that?  Basically it  
25 looks at the grid as a whole and uses the pound per

1 megawatt-hour number published by Energy Information  
2 Administration for the state of Ohio. That is the  
3 reference they have used.

4 Q. And what year is that?

5 A. The 15 -- the number used I believe is  
6 1510 pounds per -- 1,510 pounds per megawatt-hour was  
7 a 2016 figure. And at the time of the feasibility  
8 study, that was the most up-to-date figure. But for  
9 future projections, we used Ohio EPA retirements of I  
10 think the number is 11 -- 10 or 1130, and we did a  
11 linear interpolation and extrapolation.

12 Q. But you don't have a more recent figure  
13 for the pounds per megawatt-hour published by the  
14 EIA, correct?

15 A. Correct.

16 Q. And you stated that that's the EIA number  
17 for the Ohio grid. Why did you use the Ohio grid  
18 rather than the PJM grid as a whole?

19 A. Because we are in the state of Ohio.

20 Q. Is it the case that the campus only draws  
21 energy generated from Ohio?

22 A. Not necessarily.

23 Q. Okay. So I think we already -- OSU --  
24 OSU's electricity is served by the PJM grid, correct?

25 A. Correct.

1 Q. Okay. And the primary forms of  
2 generation on the PJM grid are nuclear, coal, gas,  
3 solar, and wind, correct?

4 A. Actually I would like to rephrase. Ohio  
5 State Columbus Campus is serviced by AEP grid. And  
6 AEP is part of the regional operator called PJM.

7 Q. And AEP will as a general course sell the  
8 electricity it generates to the RTO and then buy back  
9 some portion of that for its customers, correct?

10 MR. ALEXANDER: Objection, on the grounds  
11 that AEP owns generation.

12 MS. WACHSPRESS: Your Honor, I can  
13 rephrase.

14 ALJ PARROT: Go ahead.

15 Q. It is the case -- or I can -- it is the  
16 case that the energy used on OSU's Columbus Campus is  
17 drawn from generation resources on the PJM grid not  
18 necessarily limited to AEP, correct?

19 A. I would agree.

20 Q. And the primary forms of generation on  
21 the PJM grid are nuclear, coal, gas, solar, and wind  
22 forms of generation, correct?

23 A. Correct.

24 Q. And nuclear generation has no greenhouse  
25 gas emissions of generation, correct?



1           A.    I am not a nuclear expert, but generally  
2 speaking I think so.

3           Q.    And the same is true of solar, correct?

4           A.    Correct.

5           Q.    And wind.

6           A.    Correct.

7           Q.    Okay.  What percentage of generation on  
8 the PJM grid in 2020 thus far is from a  
9 nuclear-generation facility?

10          A.    I don't know.  I would have to look it  
11 up.

12          Q.    Oh.  Do you know what percentage of  
13 generation on the PJM grid in 2020 thus far is from  
14 coal-generation facilities?

15          A.    Again, I would have to look it up.

16          Q.    Would you agree that generation -- that  
17 gas-generation facilities on the PJM grid have  
18 approximately the same carbon dioxide emission factor  
19 as the proposed facility does?

20          A.    I do not because this is a combined heat  
21 and power plant.  It produces steam through  
22 cogeneration; whereas, the assets you are referring  
23 to, the gas-fired assets you are referring to in PJM,  
24 are power-generation assets.  So a combined heat and  
25 power plant is -- inherently has a lower carbon

1 footprint than a gas-fired power-generation asset.

2 Q. But you are referring to the reduced  
3 carbon footprint associated with the efficiencies due  
4 to that steam generation, correct?

5 A. Yes.

6 Q. Not any efficiencies associated with the  
7 fuel source as converted into electricity, correct?

8 A. Correct.

9 Q. Okay. So with respect to electricity,  
10 gas-fired plants on the grid have the same carbon  
11 emissions -- carbon dioxide emission factor as does  
12 the proposed facility.

13 A. I will not say they are the same because  
14 each facility is different, different turbines,  
15 different cooling technology, but they would have a  
16 similar profile.

17 Q. Okay. Thank you. Okay. So is it  
18 correct to say that all of the carbon emission  
19 savings associated with using the proposed facility,  
20 again ignoring the efficiencies through heating, all  
21 of those carbon emission savings must come from  
22 replacing the proportion of the PJM grid that is  
23 generated by coal with natural gas?

24 A. Not necessarily because this facility  
25 also -- it's part of an overall project which

1 includes the implementation of a district heating and  
 2 cooling system.

3 Q. Right. But we've discussed the  
 4 efficiencies gained by being part of the district  
 5 heating and cooling system.

6 A. Okay.

7 Q. And the feasibility study identifies that  
 8 as one source of carbon emission savings and the  
 9 other source of carbon emission savings as converting  
 10 from grid-derived electricity to natural gas-derived  
 11 electricity, correct?

12 A. Okay.

13 Q. And I'm asking are all of those -- from  
 14 that set of carbon emission savings, are all of those  
 15 attributable to the switch from coal on the grid to  
 16 natural gas at the proposed facility?

17 A. So just for the electricity portion,  
 18 excluding all the other benefits, yes, I believe.

19 Q. And those savings would have to be offset  
 20 by the increased emissions of the natural gas  
 21 facility on campus as compared to the nuclear, wind,  
 22 and solar generation on the grid, correct?

23 A. Sorry. Could you repeat the question?  
 24 We are getting very conceptual.

25 Q. No, I know. So it is the position of

1 the -- of OSEP that there are going to be carbon  
 2 emission savings associated with the switch from  
 3 coal-generated electricity on the grid to natural  
 4 gas-generated electricity at the CHP, correct?

5 A. Correct.

6 Q. But in switching off the grid, the  
 7 University will also be switching away from nuclear-,  
 8 wind-, and solar-generated resources on the grid that  
 9 will be replaced by gas-generated electricity in the  
 10 CHP.

11 A. That is not correct. The CHP does not  
 12 mean the University cannot and will not procure lower  
 13 carbon energy.

14 Q. That was not my question. My question  
 15 was that the carbon savings from replacing  
 16 grid-derived electricity with CHP-derived electricity  
 17 are attributable -- attributable to the change in the  
 18 generation mix, correct?

19 A. Correct.

20 Q. And the proposed facility has less carbon  
 21 emissions than the coal-generation facilities on the  
 22 grid.

23 A. Correct.

24 Q. But it has more carbon emissions than the  
 25 nuclear- and renewable-generation facilities on the

1 grid.

2 A. Correct.

3 Q. So is it your position that any costs --  
4 so scratch that.

5 It is correct to say that any carbon  
6 emission savings from switching off the grid must be  
7 attributable to the relative proportions of coal  
8 versus renewable and coal resources on the grid?

9 A. I'm sorry.

10 MR. ALEXANDER: Objection. Can I have  
11 that question read, please.

12 (Record read.)

13 MR. ALEXANDER: I am going to object to  
14 form just as to where renewable and coal. That  
15 phrase, I think, is vague.

16 MS. WACHSPRESS: I think I misspoke as  
17 well, so I will -- I will attempt again.

18 Q. (By Ms. Wachspress) Is it correct to say  
19 that carbon emission savings associated with the  
20 switch from grid-supplied electricity to CHP-supplied  
21 electricity must be attributable to the relative  
22 proportion of coal on the one hand and nuclear- and  
23 renewable-generation sources on the other in the  
24 grid?

25 A. I'm sorry. I can't get this concept in

1 my mind because you are asking me to separate the  
2 facility because I'm speaking about a hypothetical  
3 situation that doesn't exist. The facility does  
4 produce steam and electricity at the same time. So I  
5 can't -- I don't know what to say. If this didn't  
6 produce the steam and didn't have these benefits,  
7 then what would be happening on the grid. I'm sorry.  
8 I am not really following your line of question.

9 Q. Your claim incorporated into the  
10 35 percent carbon emission reduction as part of the  
11 application is that carbon emissions will be reduced  
12 by switching the campus from grid-supplied  
13 electricity to the CHP-supplied electricity, correct?

14 A. Correct, but not just electricity. It's  
15 also the gas consumed in McCracken and that's the  
16 bigger part and that's why I think I'm struggling to  
17 comprehend your question.

18 Q. Right. So I asked what proportion the  
19 two representative savings were, and you said that  
20 you were not able to answer.

21 A. I am not able to give you a specific  
22 number.

23 Q. Okay. But it is the position of OSU as  
24 part of its application and as part of the  
25 feasibility study that one of the sources of carbon

1 emission savings will be the switch from the grid to  
2 gas-fired electricity, correct?

3 A. Yes.

4 Q. But you're not in a position today to  
5 articulate how that proportion, separate from the  
6 heating, that proportion of the savings is determined  
7 based on the mix, the generation mix on the grid.

8 A. Well, I'm sorry. If you have a question  
9 and homework for us to study this and then come back  
10 with a calculation of a hypothetical case, I think we  
11 can answer the question. But I encourage you to go  
12 to EPA website. There's a very brief description of  
13 how CHPs work and there's actually a 5 megawatt case  
14 study. Very simple, you don't have to be an  
15 engineer. It walks through how CHPs can reduce  
16 carbon emissions.

17 Q. What is the basis -- sorry.

18 What is the basis of your claim that  
19 carbon emissions will be reduced by 35 percent as a  
20 result of the construction of this facility?

21 A. It's a quite straightforward calculation.  
22 The campus, as we speak, imports a certain amount of  
23 megawatt-hours. We have historical data on an hourly  
24 basis. You multiply that number with the EIA figure,  
25 pound per megawatt-hour I referenced early on, so

1 that gives us this sort of electricity-related  
2 portion of the carbon footprint.

3 We also know how much gas is burned on  
4 campus to meet the steam and heating event. You add  
5 them up so you come up with the as-is calculation.  
6 And in the CHP case we say, okay, now the CHP is  
7 operating based on certain operating profile  
8 producing electricity, steam, and heated hot water.  
9 It's going to burn a certain amount of gas. And we  
10 use the conversion rate for that gas to carbon, and  
11 then we look and say, okay, University still needs to  
12 import a certain amount of power. Some of it is wind  
13 so we show the carbon footprint of that power. In  
14 the case of wind, it's zero. And then we say, okay,  
15 about 15 percent of the time McCracken will still  
16 operate. So we -- it's on one side. We add on the  
17 other side and compare the difference in comparison.  
18 It's about 35 percent.

19 Q. But the number you used for the  
20 electricity component of that, the carbon emissions  
21 associated with grid-generated electricity, you  
22 stated, is from 2016, correct?

23 A. Correct, because at the time of the study  
24 that was the most up-to-date number.

25 Q. Well, the study was completed -- oh.



1           A.    The study was presented to the University  
2    in early 2018.  Most of the work was done late 2017.  
3    And at the time the published values by EIA were  
4    based on 2016 but that doesn't really matter.  We  
5    regularly state that we assume the grid will continue  
6    to clean -- get cleaner and the relative carbon  
7    reductions of the facility will also on a linear  
8    basis continue to decrease, but it still will reduce  
9    the University's carbon reduction every year.

10           Q.    So you have not looked into what the  
11   current carbon dioxide emission factor is for the PJM  
12   grid as of 2020 -- or 2019.

13           A.    I don't know if 2019 numbers are  
14   available, but again, this is a process and the  
15   application to the Siting Board was made last year.

16           Q.    Have you looked into the current  
17   generation mix of electricity generation on the PJM  
18   grid?

19           MR. ALEXANDER:  Objection, asked and  
20   answered.  We went through each different type.

21           Q.    The anticipated life span of the proposed  
22   facility is 25 years, correct?

23           A.    Correct.

24           Q.    So OSU's Climate Action Plan states that  
25   ENGIE is currently developing green hydrogen

1 obtainable through water electrolysis, correct?

2 A. Correct.

3 Q. And ENGIE is one of the two companies  
4 that is a partner as part of OSEP, correct?

5 A. Correct.

6 Q. Okay. Has ENGIE published any results  
7 from its research into green hydrogen?

8 A. Internally I have seen a number of  
9 documents, but I don't know really whether we have  
10 external documentation available to the public.

11 Q. What is the nearest body of water to the  
12 proposed facility that could sustain the necessary  
13 level of water consumption necessary for green  
14 hydrogen generation?

15 A. The green hydrogen is not a basis for the  
16 application. Savings from green hydrogen are not  
17 included in our calculations. So I am not in a  
18 position to speculate how green hydrogen may be made  
19 sometime in the future. I'm not an expert in green  
20 hydrogen technology.

21 Q. So OSEP did not consider the potential  
22 for use of green hydrogen in the future as a benefit  
23 in favor of its decision to construct the proposed  
24 facility.

25 A. No. The way I would phrase our

1 consideration was green hydrogen has potential to be  
2 in the energy mix just like solar was 10, 15 years  
3 ago. And solar was very unfeasible 10 years ago.  
4 Battery storage was unfeasible financially. So ENGIE  
5 believes green hydrogen has that potential to be the  
6 next solar power or a new technology. And if it does  
7 happen, can we take advantage of that in the CHP  
8 facility?

9           That was the thought process. And to  
10 enable that our gas turbine selection -- that was a  
11 factor in our gas turbine selection meaning the gas  
12 turbines we proposed to be installed is able to  
13 combust a mixture of green hydrogen, but we did not  
14 make any assumptions that would happen, and the  
15 benefits will be this and that. In my view green  
16 hydrogen is icing on the cake.

17           Q. So the potential for green hydrogen was  
18 not a factor that led OSEP to select gas-fired  
19 generation as compared to alternatives as part of its  
20 proposal?

21           A. It was not one of the primary factors,  
22 no.

23           Q. It wasn't a primary factor, or it was not  
24 a factor?

25           A. It was -- the way we would refer to that

1 is as upside, potential upside.

2 Q. And has green hydrogen been successfully  
3 implemented anywhere in the United States as of  
4 today?

5 A. I am not a green hydrogen expert. I  
6 cannot categorically tell you whether it's been  
7 implemented or not implemented.

8 Q. Okay. But you are not aware of any --

9 A. I am not aware.

10 Q. Okay.

11 A. No.

12 Q. And biogas is methane and other fuels  
13 collected from waste streams and use of combustion,  
14 correct?

15 A. Biogas is a general term. It could be  
16 developed in different ways, and it could have a  
17 different chemical composition.

18 Q. And one of those ways is through the use  
19 of combustion of waste streams, correct?

20 A. I am not sure. I'm not a biomass --  
21 gas -- biogas production expert.

22 Q. Okay. So the proposed facility will emit  
23 464,278 tons of greenhouse gas equivalence each year,  
24 correct?

25 A. Not correct. Which number are you

1 referring to?

2 Q. I am referring to the application page  
3 11, application for the Board, application before the  
4 Board.

5 A. Okay. No, that is not correct. That  
6 number is potential to emit. These figures are from  
7 the permit to install from Ohio EPA and the permit to  
8 install process is not based on projected operation  
9 profile or projected emissions. It's based on  
10 potential maximum emissions; in other words, it  
11 assumes that CHP facility is running 100 percent load  
12 with burners operating at 100 percent 8,760 hours a  
13 year which obviously is impossible.

14 Q. But the proposed facility could emit up  
15 to 464,278 tons per year of greenhouse gases  
16 consistent with its permit, correct?

17 A. Practically, no, because there has to be  
18 some maintenance requirements. Also the facility's  
19 output changes pending temperature based on the  
20 theoretical maximum.

21 Q. Approximately what percentage of  
22 allowance for the year?

23 A. Typically we consider 95 percent for the  
24 facility, but for the back burners that would be a  
25 very small amount.

1 Q. So are there any technological  
2 limitations on, you know, the facility emitting  
3 95 percent of 464,278 tons of greenhouse gases?

4 A. Yeah, what campus demands. If campus  
5 doesn't demand as much energy, and from time to time  
6 it will not, and clearly we are not going to produce  
7 because the energy has no place to go.

8 Q. Okay. And what tons per year of  
9 emissions did you anticipate the facility will emit  
10 as the basis for your carbon savings calculations?

11 A. So the number -- one second. I am  
12 checking my notes.

13 Q. Your notes, are those an exhibit in  
14 evidence or?

15 A. Correct. They are from the application  
16 where I made the correction earlier at the beginning  
17 of my testimony today. So the combined figure,  
18 meaning the CHP facility and McCracken is 314,570.

19 Q. And when you say McCracken and combined  
20 figure, can you elaborate on what you mean by that?

21 A. I mentioned earlier that on an annual  
22 average basis, about 15, 1-5, percent of the heating  
23 demand will still have to come from McCracken when  
24 CHP is not sufficient, so when you combine the two,  
25 the total footprint is expected to be 314,570 tons a

1 year.

2 Q. Okay. But not all of that is coming from  
3 the proposed facility?

4 A. Correct.

5 Q. So there's no number in the application  
6 that corresponds to the greenhouse gas emissions  
7 solely from the facility as you anticipate under  
8 normal operations?

9 A. I don't think so.

10 Q. Okay. Okay. And the permit to install  
11 for the proposed facility permits it to emit up to  
12 41.9 tons per year of particulate matter with a  
13 diameter of less than 2.5 megawatts, correct?

14 A. Which table are you referring to?

15 Q. I believe it's the same table.

16 A. Oh, the same application table?

17 Q. Yeah.

18 A. Sorry. The number was 40.32 tons?

19 Q. Yes. I'm sorry. I misspoke, 40.32.

20 A. Yes, the combined, yes.

21 Q. Yes, 40.32. And for nitrogen oxides  
22 which is indicated by an NO<sub>x</sub>, it states 39 tons per  
23 year, correct?

24 A. Correct.

25 Q. And that's net of the McCracken boiler

1 retirement for the No. 5 retirement, correct?

2 A. Correct.

3 Q. And nitrogen oxides are a precursor to  
4 ozone formation, correct?

5 A. I am -- I think that is beyond my  
6 expertise, the document.

7 Q. Got it. Okay. The natural gas used as  
8 fuel at the proposed facility will be supplied by  
9 Columbia Gas of Ohio, correct?

10 A. It will be transmitted by Columbia Gas of  
11 Ohio. The supplier could be any entity, I believe,  
12 that is connected to the system that Ohio State  
13 chooses to procure from.

14 Q. And the significant proportion of gas  
15 transmitted by Columbia Gas of Ohio is derived from  
16 shale deposits, correct?

17 A. I do not know that, ma'am. I am not a  
18 gas extraction or transportation expert.

19 Q. Okay. And in connection with the  
20 proposed facility, has OSEP conducted any study of  
21 the environmental impacts associated with the  
22 extraction of natural gas?

23 A. No.

24 Q. To your knowledge has TRC?

25 A. What about TRC?



1           Q.    Have they conducted any study of the  
2 environmental impacts associated with the extraction  
3 of natural gas?

4           A.    We have not.

5           Q.    Okay.  Have you conducted any study of  
6 the greenhouse gas emissions associated with the  
7 extraction of natural gas?

8           A.    No.

9           Q.    Nothing about the water usage associated  
10 with the extraction of natural gas?

11          A.    No.  We are not a natural gas extraction  
12 business.

13          Q.    If I could direct your attention to the  
14 feasibility study again at page 1-7, 1-7.  And at the  
15 very bottom it states "At the national level, the  
16 seven major shale plays have and will continue to  
17 account for nearly all the incremental U.S.  
18 production over the long-term."  So is it an  
19 assumption of OSEP as part of the feasibility study  
20 for this facility that shale-derived natural gas will  
21 be a significant proportion of the natural gas used  
22 by the facility?

23               MR. ALEXANDER:  Objection.  The statement  
24 doesn't reflect gas used by the facility but rather  
25 the market options.  Those are two different things.

1 MS. WACHSPRESS: Your Honor, I can lay a  
2 little bit more foundation for that question.

3 Q. (By Ms. Wachspress) The -- this section  
4 of the -- of the feasibility study cites this fact  
5 about shale gas as a premise of its assumption that  
6 natural gas prices will remain low into the future,  
7 correct?

8 A. Correct.

9 Q. And so one of the assumptions built into  
10 the cost estimations associated with the proposed  
11 facility is that natural gas derived from shale will  
12 continue to be -- make up a significant proportion of  
13 natural gas supplies in the United States, correct?

14 A. I don't see that in that sentence. The  
15 way I read the sentence it said a national level  
16 would account for incremental U.S. production.

17 Q. So what -- what is -- in the United  
18 States will natural gas derived from shale continue  
19 to be a significant proportion of natural gas  
20 produced and consumed in the United States? Speaking  
21 in circles a little bit but.

22 A. I don't know in terms of volume whether  
23 that's the case or not. I think the intent of the  
24 section is incremental or marginal is expected to be  
25 shale gas; therefore, shale gas is expected to

1 determine the future natural gas prices. And as a  
2 result, future natural prices are expected to be what  
3 we project in the feasibility study. It doesn't  
4 necessarily say significant volumes, and I don't know  
5 the answer to that.

6 Q. Okay. But is it fair to say that natural  
7 gas derived from shale is driving OSEP's assumptions  
8 about natural gas prices going forward?

9 A. Correct.

10 Q. Okay. So if I could direct your  
11 attention to the application -- same exhibit, the  
12 application at page 60.

13 A. 6-0?

14 Q. 6-0, yes.

15 A. Okay.

16 Q. And so in its initial environmental  
17 impacts analysis for purposes of this application,  
18 OSU and its contractors "did not use or rely on any  
19 EPA -- Ohio EPA air monitoring data to assess our air  
20 pollution potential" and did not require --

21 A. Are you reading a sentence?

22 Q. Yes.

23 A. Which sentence?

24 Q. I apologize. It's about halfway down the  
25 page just before paragraph F there is a sentence

1 beginning "This exemption" saying "project did not  
2 use or rely," and I am assuming that's a typo, "on  
3 any Ohio EPA monitoring data to assess our air  
4 pollution potential. The State-only -- only  
5 dispersion modeling that was performed was restricted  
6 to the project only and did not require major air  
7 emission sources (present and future) in the vicinity  
8 of the site to be included." Is that correct?

9 A. Let me read the sentence.

10 Q. Please take your time.

11 A. So this sentence is -- follows on how the  
12 permit application progressed in that section. And  
13 it does say did not rely on data. Instead it used  
14 Franklin County -- Franklin County data which is --  
15 somewhere in the application it's spelled out.

16 Q. Right. But there were specific modeling  
17 requirements that OSU would have been subject to were  
18 it not for a discretionary exemption issued by the  
19 Ohio EPA, correct?

20 A. Not necessarily. The exemption really  
21 only applies to particulate matter or NOx, SO-2, VOC  
22 emissions are below PSD levels so only -- exemption  
23 only applies to TM, and in that case the permit  
24 application did follow Ohio EPA rules and  
25 regulations. It did do the modeling of the facility,

1 share the modeling results with Ohio EPA including  
2 the need to file, and following Sierra Club's  
3 intervention in the process, we asked TRC to go  
4 further and do more detailed modeling which they  
5 produced and shared the results with you on the  
6 report dated July 6.

7 So in my view we did well beyond the  
8 limit of the regulation, and all results showed all  
9 emissions are well, well within limits.

10 Q. Turning your attention back to the  
11 application at page 60, it states "This exemption  
12 alleviated the need for background air monitoring  
13 data; thus, the project did not use or rely on Ohio  
14 EPA air monitoring data to assess our air pollution  
15 potential." So is it correct that OSU relied on a  
16 discretionary exemption granted by the Ohio EPA in  
17 declining initially to conduct certain kinds of  
18 modeling of particulate matter that it would  
19 otherwise have been required to do?

20 MR. ALEXANDER: Objection, asked and  
21 answered. The witness just literally answered this  
22 exact question.

23 MS. WACHSPRESS: Your Honor, I can have  
24 the testimony read back, but my understanding is that  
25 he did not agree to the proposition that OSU relied

1 on this exemption. He gave a nonresponsive answer  
2 about OSU's compliance with the law generally.

3 MR. ALEXANDER: If we can have the answer  
4 read back, you will see the answer was, in fact,  
5 given so maybe that might be the way to solve this.

6 ALJ PARROT: We can do that.

7 (Record read.)

8 MR. ALEXANDER: So, your Honor, to the  
9 extent you are waiting on me, the answer strictly  
10 referenced an exemption to the Ohio State that  
11 explained why -- explained to what particulate matter  
12 it applied and explained what happened afterwards.  
13 So I think the witness has clearly covered this  
14 topic.

15 MS. WACHSPRESS: I didn't hear the terms  
16 background air monitoring data or Ohio EPA air  
17 monitoring data as part of that answer, but I stand  
18 on submission.

19 ALJ PARROT: Overruled. Let's try it one  
20 more time, Mr. Tufekci.

21 MS. WACHSPRESS: Would you -- Ms. Gibson,  
22 would you read back the question. I can't reproduce  
23 it exactly at this point.

24 (Record read.)

25 THE WITNESS: So am I asked to answer the

1 question one more time?

2 ALJ PARROT: You are.

3 A. Okay. So maybe I'll start restating I am  
4 not an air modeling expert. For this function we  
5 hired TRC, and they followed regulations. I am  
6 checking my notes about the application. The bottom  
7 of the page 59 it states "Engineering Guide 69 also  
8 does not require the consideration of emissions from  
9 other facilities" and then maybe on the prior  
10 below -- above it states that -- on the paragraph  
11 below I read "As such, a detailed evaluation of the  
12 representative background concentrations was not  
13 required."

14 So the way I read this section is TRC did  
15 on our behalf what's required.

16 Q. Okay. But then at a later point OSU or  
17 OSEP did instruct TRC to do additional -- different  
18 and additional monitoring -- modeling, correct?

19 A. Correct.

20 MS. WACHSPRESS: And the summary report  
21 of that modeling was produced to Sierra Club on  
22 July 6, and I would like to mark, I think we are up  
23 to Exhibit E, that summary. It's a document from TRC  
24 and dated July 6, correspondence to Mr. Bryceson  
25 Nunley.

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(EXHIBIT MARKED FOR IDENTIFICATION.)

A. Okay.

Q. And why -- why did OSU instruct TRC to perform this additional modeling?

A. With Sierra Club's intervention we wanted to demonstrate we -- based on the design of the facility and the modeling and analysis done as part of the permit which we received by the time of the Siting Board's application, we knew that there will not be any concern with regards to particulate matter, but nevertheless we thought it would help the public to demonstrate it through a study.

Q. Why did you apply for the exemption initially?

A. Why not? The law allows for it.

Q. So if I can direct your attention to Exhibit E, what's marked as Exhibit E, the July 6 summary report.

A. Okay.

Q. And this summary report describes modeling conducted by TRC with respect to the effects of particulate matter of 2.5 microns or less, particulate matter of 10 microns or less, and nitrogen dioxide emissions on ambient air quality, correct?



1 A. Okay.

2 Q. Okay. And the monitors used by TRC to  
3 measure the background concentration of these  
4 pollutants were not on the OSU campus, correct?

5 A. Correct. Representative existing  
6 Franklin County monitoring stations in and around  
7 Columbus were used.

8 Q. Okay. And the monitors that they used  
9 were not located adjacent to a highway, correct?

10 A. Incorrect. I believe Korbelt Avenue  
11 monitoring station is adjacent to Highway 71, and I  
12 am not sure about the exact locations of the other  
13 ones.

14 Q. Okay. And how far is Korbelt from the  
15 site of the proposed facility?

16 A. I don't know the exact number but just  
17 looking at the map and seeing what's -- where 71 is,  
18 I am going to guess maybe a mile, mile and a half, in  
19 that range.

20 Q. And does the flow of traffic on Highway  
21 71 roughly equal to the flow of traffic on Highway  
22 315?

23 A. I don't know.

24 Q. And the data used by TRC with respect to  
25 meteorological conditions as part of its modeling was

1 not for monitors placed on the OSU campus, correct?

2 A. Correct.

3 Q. And the location where those  
4 meteorological measurements were derived was not  
5 adjacent to a river, correct?

6 A. I am not sure. Again, these are in and  
7 around the city of Columbus. I did look up Korbel  
8 Avenue, but I don't exactly know where the other ones  
9 are, so I am not sure.

10 Q. Okay. All right. So I would like to go  
11 back to the corrections you made at the outset of the  
12 proceeding --

13 A. Okay.

14 Q. -- to ask about the stack height. You  
15 said there was a clerical error associated with the  
16 stack height.

17 A. Correct.

18 Q. Was the correct stack height used as part  
19 of the modeling by TRC?

20 A. Yes.

21 Q. And you also identified clerical errors  
22 associated with the application at page 39 of the  
23 application, Table 9. I will take a moment to find  
24 that. If you would be so kind as to do the same.

25 A. Okay.

1 Q. And so you stated that 486,534 tons per  
2 year are the as is emissions and that should go in  
3 lieu of the No. 421,492?

4 A. Correct.

5 Q. And what was the source of that error?

6 A. Well, I can't remember. I believe it was  
7 when the table was populated, the wrong numbers were  
8 taken.

9 Q. Does the No. 421,492 correspond to  
10 anything?

11 A. I am not sure.

12 Q. Okay. And so the -- and then over to the  
13 right-hand side under the blue, the 231,967 45  
14 percent should be replaced with 35 percent; is that  
15 correct?

16 A. Correct. There are actually two  
17 different numbers there. The first six digits should  
18 be tons, and then the next row it should -- the  
19 incorrect -- the clerical error number would have  
20 said 431,967 tons and 45 percent reduction based on  
21 those two numbers, and those are the corrections I  
22 communicated.

23 Q. Right. And remind me, what does that No.  
24 2 -- that's the 231,967 tons per year, that number  
25 represents what?

1 A. Expected greenhouse -- CO-2 emissions.

2 Q. From what?

3 A. With the implementation of the CHP.

4 Q. But earlier you -- you gave me the  
5 numbers 314,570 tons per year as the total emissions  
6 associated with both McCracken and the CHP.

7 A. Correct. So the 231 number was  
8 incorrect. I corrected it as 314,570.

9 Q. Okay. Got it. I misunderstood your  
10 answer to the most recent question. But the No. 231  
11 is not accurate.

12 A. 231,000 is not accurate, correct.

13 Q. The correct number is 314,570, correct?

14 A. Yes.

15 Q. Okay. Thank you. And I think I have one  
16 more question about the modeling if we can --

17 A. Okay.

18 Q. -- return to that TRC summary. If you  
19 will look at -- no. It's not here. Give me --

20 MS. WACHSPRESS: Your Honor, if I may,  
21 I'm just about finished with the witness. If I could  
22 take a short recess just to track down this last  
23 question and confer with co-counsel and resume, and  
24 then we should be ready to finish up, but obviously I  
25 defer to you how to go forward.

1 ALJ PARROT: Before you do that I would  
2 like to just sort of see where we are at in the day  
3 here. I think that Staff witnesses that were set to  
4 go at the end of the proceeding are now wondering  
5 given the hour whether they need to stay in the  
6 building or if they can be released.

7 I think I will open that up to all of  
8 you, but I guess looking at the time, to me it makes  
9 sense to see if we can, you know, hopefully wrap up  
10 the present witness, and then we can kind of see if  
11 Mr. Potter, who I think is up, yeah, I think  
12 Mr. Potter is our next witness, we will see if we can  
13 get to him, but I think our three witnesses we may  
14 just want to release for the day. Thoughts on that?

15 MR. ALEXANDER: Yeah. Your Honor, for  
16 Ohio State definitely Staff witnesses. I think I've  
17 got roughly two to three hours for Sierra Club's  
18 witness. And one request, how do I pronounce his  
19 last name? Is it Sahu? Dr. Sahu?

20 MS. WACHSPRESS: Sahu, yes.

21 MR. ALEXANDER: Sahu. So I have got two,  
22 three hours for Dr. Sahu, so I think releasing Staff  
23 makes sense.

24 MR. LINDGREN: I think Staff witnesses  
25 would appreciate that.

1 ALJ PARROT: And what about Dr. Sahu as  
 2 well, I guess? He may very well stay on the call but  
 3 just to give him an expectation, I guess, of...

4 MS. WACHSPRESS: I don't imagine there  
 5 will be anywhere near the same amount of questions  
 6 for Mr. Potter. I think we can do that under an  
 7 hour.

8 ALJ PARROT: Okay. Okay. So I guess  
 9 we'll see how it goes with our first three, and then  
 10 we will go ahead and at 10:00 a.m. tomorrow just so  
 11 we know what to tell our Staff witnesses; is that?  
 12 Again, trying to be mindful of everyone out in  
 13 California; is that?

14 MS. WACHSPRESS: At your convenience,  
 15 your Honor. Whatever works for you.

16 ALJ PARROT: Okay. Let's say 10:00 a.m.  
 17 again tomorrow for the Staff witnesses to be ready to  
 18 go.

19 MR. LINDGREN: Very good. Thank you.

20 ALJ PARROT: And with that let's go ahead  
 21 and take a short 5-minute recess or so to give Ms.  
 22 Wachspress some time to see where she's at and  
 23 hopefully wrap it up.

24 (Recess taken.)

25 ALJ PARROT: All right. Let's go back on

1 the record.

2 Q. (By Ms. Wachspress) Okay. If I could  
3 direct your attention to the application page -- oh,  
4 gosh, it's Table 18, and it is on page 66 of the  
5 application.

6 A. Okay.

7 Q. And as part of its air quality modeling  
8 results, it appears that TRC modeled on the basis of  
9 100 percent load and 75 percent load, correct?

10 A. Correct.

11 Q. Did it do any modeling at loads lower  
12 than 75 percent?

13 A. Yes. In the report published on July 6,  
14 50 percent load is also modeled.

15 Q. Okay. And what is the average load that  
16 the facility will -- is anticipated to operate on  
17 during normal operation on a day like today?

18 A. The facilities -- well, let me maybe make  
19 a clarification. These loads percentages doesn't  
20 necessarily refer to the overall percent of the  
21 facility but on a gas turbine by gas turbine basis.  
22 In other words, if one turbine is at 60 percent and  
23 the other one is at 40 percent, we cannot say from an  
24 environmental permitting perspective that we are at  
25 50 percent. We should say one is 40, one is 60.

1           So with that explanation the planned  
2 operation for each gas turbine is to be between  
3 50 percent and 100 percent load.

4           Q.    Okay.  And could you direct me to where  
5 in the July 6 summary it discusses the 50 percent  
6 load is one of the factors in the modeling analysis.

7           A.    Somewhere it mentions 12 different  
8 operating modes are modeled.  Do you recall reading  
9 that, Ms. Wachspress?

10          Q.    I do not.  I'm trying to use a text  
11 search capacity, and it doesn't seem to be working.  
12 So say 12 -- 12 different stack conditions, and 1 of  
13 those stack conditions was at 50 percent load?

14          A.    Correct.  So basically it's a matrix at  
15 50 percent, 75 percent, 100 percent firing, off, off,  
16 off.  That's one -- that's three scenarios and then  
17 back firing, on, on, on.  That's another set of three  
18 scenarios.  So that's six scenarios.  And then this  
19 was done for the summer and also for winter  
20 conditions.

21          Q.    And is there a particular table you are  
22 referring to when you discuss those scenarios in the  
23 summary report?

24          A.    I am not sure it was included in the  
25 summary report.  But that was the case that I was



1 informed by my team that that -- those were the  
2 conditions monitored.

3 Q. So the impact --

4 A. Look at page 3 --

5 Q. Uh-huh.

6 A. -- of the report bottom paragraph where  
7 the heading "Modeling Results for the CHP," about  
8 somewhere in the middle the sentence starts "These  
9 results correspond to the CHP operating condition  
10 (out of 12 models)."

11 Q. But nowhere in the report does it  
12 actually read out what concentrations were found with  
13 modeling at 50 percent, correct?

14 A. The results show the worst case  
15 scenarios.

16 Q. Of the 12 modeled conditions.

17 A. Correct.

18 Q. And it is your testimony that one of  
19 those 12 modeled conditions was at 50 percent load  
20 but that is not included in the report itself,  
21 correct?

22 A. That is correct.

23 Q. Okay. And on what basis do you make that  
24 assertion?

25 A. That was the information given to me by

1 my staff after I read the report and read that there  
2 were 12 conditions modeled. I asked what were those  
3 12 conditions.

4 MS. WACHSPRESS: I am going to object to  
5 the witness's testimony as hearsay. He's reporting a  
6 fact reported to him by staff that's not reported  
7 anywhere in the exhibit and to which he cannot attest  
8 to personal knowledge and he has already professed  
9 himself not to be an expert on air modeling.

10 MR. ALEXANDER: Yeah. Your Honor, what  
11 he did say is he was testifying with regard to the  
12 staff operating under his direction and control. And  
13 we have spent, I would say, about three hours with  
14 this witness on exactly this topic. He's gone  
15 through these exact kind of assumptions in great  
16 detail, and this question was invited by counsel.

17 ALJ PARROT: And your objection is noted,  
18 Ms. Wachspress, but we are going to allow the  
19 testimony to stand.

20 MS. WACHSPRESS: Thank you, your Honor.  
21 Okay. With that I think I'm done with  
22 this witness and thank you so much for your time.

23 THE WITNESS: Thank you.

24 ALJ PARROT: Mr. Lindgren, any questions  
25 on behalf of Board Staff?

1 MR. LINDGREN: No, thank you, your Honor.

2 ALJ PARROT: Okay. Mr. Alexander, any  
3 redirect?

4 MR. ALEXANDER: Yes, just a bit.

5 - - -

6 REDIRECT-EXAMINATION

7 By Mr. Alexander:

8 Q. Mr. Tufekci, I am going to take you all  
9 the way back to what I believe was the first question  
10 of the hearing today. You were asked about whether  
11 TRC compared the proposed CHP facility with purchases  
12 from the PJM grid and the PJM mix. Do you recall  
13 those questions?

14 A. I do.

15 Q. Did someone besides TRC do those  
16 comparisons?

17 A. Correct. We did.

18 Q. And "we" in that sentence means whom?

19 A. Combined effort with OSEP and ENGIE  
20 Buckeye Operations.

21 Q. Okay. And did those entities also  
22 compare the CHP unit with other potential heat  
23 sources? I will rephrase that question.

24 You were also asked whether TRC had done  
25 any comparison of the CHP facility with other

1 sources. Do you recall that question?

2 A. I do.

3 Q. And did someone else make that  
4 comparison?

5 A. Correct. Again, we did, also ENGIE  
6 Buckeye Operations.

7 Q. Okay. Next, you were asked some  
8 questions about the document marked for  
9 identification as Sierra Club Exhibit A, a 2019  
10 report, and specifically within that report questions  
11 about a table that showed 100 percent reliability.  
12 Do you recall those questions?

13 A. I do.

14 Q. Can you ex -- please explain what  
15 100 percent reliability in that table means.

16 A. It means that reflects performance in  
17 terms of delivery of electricity. I'm referring to  
18 the electricity chart from the OSU substation and  
19 from the west substation to Ohio State buildings.  
20 That number does not indicate anything with regards  
21 to the grid reliability.

22 In other words, if there was a natural  
23 disaster at the moment, a hurricane, a tornado, a  
24 terror attack, for whatever reason, if the AEP grid  
25 supplying the campus was unavailable, that chart

1 would still show us being 100 percent available. It  
2 would not count against it because it's beyond our  
3 control and custody.

4 Q. Okay. Same page, Sierra Club Exhibit A,  
5 page 3, there's a value for steam, 100 percent  
6 reliability for steam. Does that show, again, there  
7 was no steam outages through the year?

8 A. Correct.

9 Q. Would your answer be the same for steam  
10 as it is for electricity?

11 A. No. It would be different because the  
12 steam production is under our control and custody.

13 Q. And you were asked several questions  
14 about -- about off-site renewables, and we went  
15 through a hypothetical with doing solar panels on  
16 campus. Do you recall that discussion?

17 A. Yes.

18 Q. So I want to make sure the record is  
19 clear. For a 100 megawatt nameplate solar facility,  
20 would you anticipate that facility to produce 100  
21 megawatt-hours in any given hour?

22 A. Theoretically that it could produce 100  
23 megawatt-hours if it's a perfect sunny day in the  
24 summer and it's 1:00 p.m.

25 Q. And so over the course of the year, you

1 would -- would you anticipate that facility to  
2 produce that same amount in every hour?

3 A. Absolutely not.

4 Q. Is that what's referred to as capacity  
5 factor?

6 A. In this case, yes.

7 Q. Okay. And what would be the capacity  
8 factor for solar in Columbus, Ohio?

9 A. My answer will be based on a project we  
10 have been developing on campus. It's a rooftop  
11 project for a large relatively flat roof. If I  
12 extrapolate my numbers, it's about 14 percent, in  
13 that range. So another utility scale may be  
14 15 percent but that's the sort of order of magnitude.

15 Q. Okay. There were several questions about  
16 thermal need on campus. Do you recall those  
17 questions?

18 A. Yes.

19 Q. Did -- did OSEP track thermal load on a  
20 building-by-building basis?

21 A. We track thermal load on an hour-by-hour  
22 basis and to a certain degree on a  
23 building-by-building basis as well. I'm saying to a  
24 certain degree because part of the concession  
25 agreement also includes implementing a smart meter

1 program, over a thousand smart meters in a  
2 four-year -- four-year window that includes  
3 electricity, chilled water, steam, hot water. We had  
4 about 60 -- 75 percent complete in this  
5 implementation so those were things that where the  
6 smart meters are installed we do get an hourly data,  
7 in fact, minute level data.

8 Q. And what is Ohio State's current heating  
9 demand peak?

10 A. I'm going to use a metric term so it can  
11 be compared to power. It's about 153 megawatts  
12 thermal.

13 Q. Okay. Thank you. And then you had a  
14 discussion with Ms. Wachspress regarding PJM and  
15 epacrids grids. Do you recall that?

16 A. Yes.

17 Q. Okay. Who -- when you are evaluating  
18 reliability for Ohio State, do you consider overall  
19 PJM reliability or reliability at the delivery point?

20 A. At the delivery point.

21 Q. And I would like to first ask you some  
22 questions about -- about that delivery point. Will  
23 Ohio State still be purchasing power from the AEP  
24 delivery point after the CHP facility is constructed?

25 A. Yes.

1           Q.    If the regional or AEP grid fails and the  
2 CHP is operating at the time, would the CHP continue  
3 operating?

4           A.    Yes, it would.  It would go into an  
5 island mode.  That's a term used to indicate that the  
6 Ohio State 13.2 kV network would separate from the  
7 grid, so it would be an island and fed from the CHP  
8 until the grid is restored and can be resynchronized.

9           Q.    So would that -- in that circumstance,  
10 that wouldn't trigger the black start hypothetical  
11 that Ms. Wachspress asked you about?

12          A.    That is correct.

13          Q.    Do you feel that system resiliency is  
14 improved by having a connection to the PJM grid  
15 combined with behind-the-meter generation?

16          A.    Sorry.  There was static.  Could you  
17 repeat your question?

18          Q.    Sure.  Do you believe system resiliency  
19 is improved by combining access to the public grid  
20 with behind-the-meter generation?

21          A.    Absolutely.  Because it does create an  
22 additional source of generation mind the meter  
23 independent from the supply of the public grid.

24          Q.    And let's talk about that reliability  
25 with regard to the diesel backups that you were asked



1 about by counsel. Do you recall those questions?

2 A. I do.

3 Q. Are diesel backups as reliable as a  
4 combined heat and power facility?

5 A. No, they are not, and I can elaborate  
6 why. And I am going to refer to some of my personal  
7 experience when earlier in my career I worked in  
8 operations. Backup diesel generators, obviously they  
9 are necessary, and they are required by code from  
10 certain types of facilities. But by their  
11 definition, they only operate approximately one time  
12 a month, average one hour a month and for testing  
13 purposes. So in a way you install it, you test it  
14 once a month, and then you hope that in this one rare  
15 moment event when you actually need it it will start  
16 and operate as you need.

17 Now, when you compare this to a CHP  
18 facility that's operating continuously, naturally the  
19 reliability factors are not the same.

20 Q. How did the carbon emissions of the  
21 diesel backups compare to the carbon emissions of the  
22 CHP at issue in this case?

23 A. When operating the diesel backups, much  
24 larger carbon footprint per megawatt-hour.

25 Q. And let's talk about the reliability of

1 renewable resources. Are solar assets intermittent?

2 A. Yes.

3 Q. And are wind assets intermittent?

4 A. Yes.

5 MS. WACHSPRESS: Your Honor, I am going  
6 to object to this line of questioning. Reliability  
7 of renewable assets was not a topic of which I asked  
8 any questions of the witness.

9 MR. ALEXANDER: I believe you did. I  
10 believe you actually pointed to a section of the  
11 feasibility study which addressed this exact point.

12 MS. WACHSPRESS: Which section of the  
13 feasibility study was that?

14 MR. ALEXANDER: I don't have the  
15 citation.

16 ALJ PARROT: Let's go off the record a  
17 moment.

18 (Discussion off the record.)

19 ALJ PARROT: Let's go back on the record.  
20 What was the last -- I am not sure if  
21 that was in the middle of a question or an answer  
22 where the computer decided to reboot itself.

23 (Record read.)

24 ALJ PARROT: That's right. We were  
25 waiting for that, and I believe we have found that

1 reference. So let's go ahead and pick it up from  
2 there, Mr. Alexander.

3 MR. ALEXANDER: Absolutely, your Honor.  
4 The citation is at page 3.18. And I guess to -- I am  
5 not sure what happened before or after the shutoff.  
6 I'll just reiterate my point as to the objection. I  
7 believe we spent quite a bit of time today on  
8 reliability-related issues associated with the CHP  
9 and Ohio State's system generally. And in response  
10 to that I think it's fair game to raise the  
11 reliability of Sierra Club's preferred option.

12 ALJ PARROT: And your response?

13 MS. WACHSPRESS: Your Honor, we discussed  
14 the reasons that -- dispatchability and cost is  
15 reasons that OSEP gave for rejecting renewable  
16 alternatives as an option, and counsel should not be  
17 permitted to buttress their position with respect to  
18 renewables on a redirect that falls outside the scope  
19 of any questions that I asked relating to those  
20 specific qualities of renewables.

21 MR. ALEXANDER: Just because I think it  
22 might not have been on the record, the section I am  
23 responding to is on page 3.18 of the first bullet  
24 point which I think was discussed during the break,  
25 but I wanted to make sure it was on the record as

1 well.

2 ALJ PARROT: Thank you both. I think I  
3 am going to allow the question.

4 So, Mr. Tufekci, go ahead and respond.

5 A. Mr. Alexander, could you repeat the  
6 question?

7 Q. Yes. Mr. Tufekci, isn't it true that  
8 renewable resources like solar and wind are  
9 intermittent?

10 A. True.

11 Q. So I believe you mentioned this in an  
12 earlier answer today, solar panels don't produce at  
13 night, correct?

14 A. Correct.

15 Q. And so is it also possible for renewable  
16 resources to be down for lengthy periods of time?

17 A. Could you define "lengthy periods of  
18 time"?

19 Q. Sure. Time period of more than one day,  
20 a period of perhaps weeks or months.

21 A. In the case of solar unlikely because the  
22 sun will come out today even though if it's a  
23 cloud-covered day, there will be some production. In  
24 terms of wind, that really depends. Sometimes the  
25 wind doesn't blow for days, so it could be possible.

1           Q.    So let's focus on the Blue Creek Wind  
2 Farm counsel asked you about earlier. Has that  
3 production ever been down for a period of longer than  
4 a few days?

5           A.    I don't have the numbers at the moment,  
6 but I remember looking at the data, and average was  
7 12 megawatts and there were times where it was 0 if  
8 there is no wind.

9                    Also another factor is that is sometimes  
10 imposed by the grid operator for different reasons  
11 where the asset is forced to shut down either part or  
12 all of the facility.

13           MR. ALEXANDER: Your Honor, I would like  
14 to have marked for identification as Ohio State  
15 Exhibit B a document labeled CHP\_Critical\_Facilities.

16           ALJ PARROT: And this is the Oak Ridge  
17 laboratory report; is that correct, Mr. Alexander?

18           MR. ALEXANDER: ICF International report,  
19 your Honor.

20           ALJ PARROT: Yes, I'm sorry, says  
21 prepared for Oak Ridge National Lab, yes.

22           MR. ALEXANDER: Yes.

23           ALJ PARROT: So marked.

24                    (EXHIBIT MARKED FOR IDENTIFICATION.)

25           Q.    (By Mr. Alexander) Mr. Tufekci, have you

1 seen this document before?

2 A. I have.

3 Q. And what is it?

4 A. It's a report prepared by the consulting  
5 firm ICT International, study sponsored by the  
6 Department of Energy, and it was presented to Oak  
7 Ridge National Labs.

8 Q. And is this one of the documents you  
9 relied on when recommending the reliability benefits  
10 of the CHP?

11 A. Yes.

12 Q. What does this study show?

13 A. In summary the study looks at events in  
14 and around Hurricane Sandy and where large portions  
15 of New York, New Jersey, and the northeast of the  
16 United States were out of power for days. And it  
17 references the facilities that did have a CHP  
18 installed at the time and how the CHP responded and  
19 how they continued to provide the energy needs for  
20 the location they were in during this natural  
21 disaster.

22 Q. Did they make any conclusions whether CHP  
23 combined heat and power facilities are beneficial for  
24 reliability?

25 A. Absolutely.

1 Q. And what were those conclusions?

2 A. But they add an additional point of  
3 generation beyond -- beyond and significantly  
4 increase the reliability and resiliency of the load  
5 that they are serving.

6 Q. All right. Now, do you recall some  
7 questions counsel asked regarding the  
8 interconnections of the CHP with facilities west of  
9 315?

10 A. Yes.

11 Q. So am I correct that Ohio State is  
12 building new hospital facilities to the west of 315?

13 A. Correct, new ambulatory services facility  
14 and proton treatment facility are the medical  
15 facilities and an additional interdisciplinary  
16 research center and regeneration center are also at  
17 the moment being designed to be built west side of  
18 315.

19 Q. Will those facilities be connected to  
20 just one of the two substations?

21 A. No. They would connect to both of the  
22 substations.

23 Q. And so would those facilities benefit  
24 from islanding capacities regardless of which  
25 substation the CHP is connected to?

1           A.    They would.  They would by default  
 2 connect to the OSU substation and be on the island  
 3 that the CHP would be on only for reasons,  
 4 operational reasons that may change, but primarily  
 5 they would be on the OSU substation and connected to  
 6 the island that CHP would serve.

7           Q.    Mr. Tufekci, do you recall questions you  
 8 got about whether Ohio State considered using  
 9 chillers?

10          A.    Heat recovery from the chillers --

11          Q.    Correct.

12          A.    -- is that what you mean?  Okay.  Yes, I  
 13 do.

14          Q.    And I believe you mentioned that Ohio  
 15 State had already done some of that in some  
 16 buildings; is that correct?

17          A.    That is correct.

18                MR. ALEXANDER:  Your Honor, could I have  
 19 marked as Ohio State Exhibit C a document labeled HRC  
 20 List ECM Program.

21                ALJ PARROT:  And just a brief description  
 22 of it as well would be helpful, Mr. Alexander.

23                MR. ALEXANDER:  It is a one-page list of  
 24 buildings by number and name.

25                ALJ PARROT:  All right.  Thank you.  It's



1     been marked as OSU Exhibit C.

2                     (EXHIBIT MARKED FOR IDENTIFICATION.)

3             Q.     (By Mr. Alexander) Mr. Tufekci, have you  
4     ever seen this document before?

5             A.     I have.

6             Q.     What is this document?

7             A.     It's a list of buildings where we have  
8     either implemented or in the process of implementing  
9     or in the process of asking the University's approval  
10    to implement heat recovery chillers on campus  
11    buildings.

12            Q.     Is this list true and accurate to the  
13    best of your knowledge?

14            A.     It is.

15            Q.     And at the bottom of the page it says  
16    "Pending BOT approval." Can you please explain what  
17    that means?

18            A.     Those are the projects I was referring to  
19    as these are being presented to the Energy Advisory  
20    Committee with the University body that reviews our  
21    capital improvement project on an annual basis. That  
22    review was done earlier in the early part of 2020.  
23    And then now that's -- the project is now on track to  
24    be presented to the Board of Trustees, the term BOT  
25    is Board of Trustees, in the autumn meeting for

1 approval to construct.

2 Q. Why didn't Ohio State simply install the  
3 heat recovery chillers immediately in every building  
4 on campus?

5 A. Because this cannot be done on every  
6 building. Each building is audited in detail. Each  
7 audit report is 200 pages, and it identifies any and  
8 all technologies we may implement to save energy.  
9 And then based on these technologies we do an  
10 interactive review with University staff and elect  
11 those that deliver the best value to the University,  
12 and then we are going to do a construction phase.

13 So not every building can take that  
14 because I think -- I stated this in my testimony  
15 earlier, for this technology to be cost effective  
16 there's a need for continued heat and cooling element  
17 year round. It's natural some buildings only need  
18 cooling in the summer or heating in the winter and  
19 not year round. And the sum of the energy capacity  
20 of that list, again I am going to use metric units to  
21 keep apples to apples comparison, it's around  
22 17 megawatts thermal. So at the end of our program  
23 we expect to be -- to get to 17 megawatt thermal  
24 savings of the historical heating demands. Campus at  
25 the moment heating demand is 153 megawatts thermal,

1 so, in other words, yes, we will save some energy by  
2 implementing these heat recovery chillers, but at the  
3 same time -- at the same time the University will be  
4 constructing new buildings which will increase the  
5 demand.

6 So overall it's going to be kind of a  
7 wash in terms of reducing the overall heating demand  
8 on campus.

9 Q. Is there a cost associated with  
10 installing a heat recovery chiller?

11 A. Yes.

12 Q. And does that cost vary between  
13 buildings?

14 A. Both the cost and the value there is  
15 between buildings because type and size, type and the  
16 time of replacement, for example, if there is a  
17 building that could benefit from a recovery chiller  
18 and it just so happens to have an in-building chiller  
19 that's very old and end of life, that's the ideal  
20 scenario because we have to replace that chiller  
21 anyway. In that case putting a heat recovery chiller  
22 and using heat delivers more value to the University.  
23 But again, that varies building by building.

24 Q. And can you give me a range of the costs  
25 for just one building? I understand it's going to

1 vary by building but give me some idea of how much  
 2 one of these can cost?

3 A. A few million dollars.

4 Q. Per building?

5 A. That really depends on the building. It  
 6 could be \$300,000 range and typically these  
 7 installations go hand in hand with other ECM  
 8 operations, but overall I would say on average I am  
 9 going to guess here half a million to a million per  
 10 building perhaps.

11 MR. ALEXANDER: I don't have anything  
 12 further. Thank you, your Honor.

13 ALJ PARROT: Any recross, Ms. Wachspress?

14 MS. WACHSPRESS: Yes, if I may, just  
 15 about the new documents that have been introduced.

16 - - -

17 RECROSS-EXAMINATION

18 By Ms. Wachspress:

19 Q. So pulling up again the study prepared  
 20 for Oak Ridge, this study did not consider any other  
 21 types of facilities besides combined heat and  
 22 power -- gas-fired combined heat and power for  
 23 purposes of its reliability analysis, correct?

24 A. I am not sure.

25 Q. But the scope of the study as written is

1 limited to gas-fired facilities, correct?

2 A. The study indicates that in the area most  
3 of the region was out of power for days and then  
4 focuses on the facilities that did have a CHP and how  
5 they were able to provide energy.

6 Q. Right. But the study did not consider  
7 any other facilities that might have existed that  
8 provided similar reliability or backup in the case of  
9 Super Storm Sandy, correct?

10 A. Presumably, correct, but if they don't  
11 have another installation and there is a grid outage,  
12 I don't know where they would get the energy.

13 Q. Okay. And it was completed in 2013,  
14 correct?

15 A. Correct.

16 Q. Okay. And it was limited to a study of  
17 incidents related to Super Storm Sandy, correct?

18 A. Correct.

19 Q. It did not consider any other instances  
20 of grid outages or outages at the point of -- point  
21 of use.

22 A. Correct.

23 Q. And all of the facilities discussed in  
24 this -- in this document are 57 megawatts or less,  
25 correct?

1           A.    I would like to quickly check.  Yes, I  
2 believe so.

3           Q.    So there's no facility here that's  
4 comparable to the proposed facility in terms of  
5 nameplate capacity.

6           A.    I disagree with the term "comparable."  I  
7 would say many of these are comparable.  Whether a  
8 gas turbine is 20 megawatts or 30 megawatts or  
9 50 megawatts doesn't really change the basics of how  
10 it operates and what kind of reliability it provides.

11          Q.    But these facilities were each able to  
12 provide the reliability you described at 57 megawatts  
13 of nameplate capacity or less, correct?

14          A.    Correct.

15          Q.    And then turning back to the other  
16 document that was introduced, the HRC list ECM  
17 program.

18          A.    Okay.

19          Q.    Just a point of clarification, this  
20 describes projects to use heat exchange with chillers  
21 at the building level, correct, not the system level?

22          A.    Except -- one second.  Let me find the  
23 document.  Most of them are building level, but the  
24 last one, I am going to read the correct term in a  
25 second, South Campus Central Chiller Plant, will be

1 at system level.

2 Q. Okay. And all of these conversions could  
3 be completed whether or not the proposed facility is  
4 built, correct?

5 A. Correct.

6 Q. Okay. And the -- if we go back to  
7 Appendix N, in describing the steam to hot water  
8 conversion at the five other universities and  
9 fourth-generation low temperature hot water, those  
10 systems use heat exchange at the system level,  
11 correct?

12 A. I don't know.

13 MS. WACHSPRESS: Okay. Okay. I think  
14 that's -- that's it for me, subject to the exhibits.

15 ALJ PARROT: Any recross, Mr. Lindgren?

16 MR. LINDGREN: No, thank you, your Honor.

17 ALJ PARROT: Okay. Thank you very much  
18 Mr. Tufekci.

19 THE WITNESS: Thank you.

20 ALJ PARROT: Go ahead and take up the  
21 exhibits.

22 MR. ALEXANDER: Your Honor, Ohio State  
23 would move Exhibits A, B, and C.

24 ALJ PARROT: Are there any objections to  
25 the admission of OSU Exhibits A, B, or C?

1 MS. WACHSPRESS: No, your Honor.

2 MR. LINDGREN: No, your Honor.

3 ALJ PARROT: All right. With that OSU  
4 Exhibits A, B, and C are admitted.

5 (EXHIBITS ADMITTED INTO EVIDENCE.)

6 ALJ PARROT: Ms. Wachspress.

7 MS. WACHSPRESS: Sierra Club would like  
8 to move Exhibits A through E.

9 ALJ PARROT: Are there any objections?

10 MR. ALEXANDER: Yes, your Honor, with  
11 regard to B and D. The reason -- the objection on B  
12 is the document was never authenticated or even  
13 really used. It was marked, and we moved quickly on.  
14 And then D, despite some extensive questioning, the  
15 document was never authenticated. It's unclear from  
16 the current record what it is, how it was used. And  
17 we, I think, ultimately got to where counsel wanted  
18 when she put up the document and asked a stand-alone  
19 question whether the witness agreed to a statement.  
20 If that's in the record already, I don't think the  
21 entire document, which again has not been  
22 authenticated or proper foundation laid, should be  
23 admitted under those circumstances. So no objection  
24 as to A, C, or E.

25 MS. WACHSPRESS: With --



1 ALJ PARROT: Response?

2 MS. WACHSPRESS: I'm sorry.

3 ALJ PARROT: Go ahead.

4 MS. WACHSPRESS: With respect to  
5 authentication all of the documents were produced by  
6 OSU, and I believe with respect to Exhibit D, the  
7 witness did eventually come to stand by and attest to  
8 the accuracy of the statements in the permit.

9 With respect to Exhibit B, I believe  
10 counsel is correct. We didn't actually get to that  
11 as a matter of questions, so I can withdraw my motion  
12 to admit that.

13 ALJ PARROT: Okay. With that I am going  
14 to admit Exhibit A, C, D, and E.

15 (EXHIBITS ADMITTED INTO EVIDENCE.)

16 ALJ PARROT: All right. I think the  
17 Staff Report was also marked. We'll go ahead maybe,  
18 unless, you know, the parties are willing to agree at  
19 this point to its admission, we can defer that until  
20 we have a Staff witness on the stand to sponsor that.

21 MR. ALEXANDER: I have no objection if  
22 you would like to do it now, your Honor.

23 ALJ PARROT: Sierra Club?

24 MS. WACHSPRESS: I have no objection  
25 either.

1 ALJ PARROT: All right. We will go ahead  
2 and admit Staff Exhibit A at this time.

3 (EXHIBIT ADMITTED INTO EVIDENCE.)

4 MR. LINDGREN: Thank you.

5 ALJ PARROT: Okay. Are we ready to move  
6 forward with your next witness, Applicant?

7 MR. ALEXANDER: Thank you, your Honor.  
8 My next witness Ohio State calls Scott Potter.

9 ALJ PARROT: Mr. Potter, are you able to  
10 hear me?

11 MR. POTTER: I am.

12 ALJ PARROT: All right. And there's your  
13 video feed. Is everyone able to see and hear  
14 Mr. Potter?

15 All right. Very good. If you could  
16 please raise your right hand.

17 (Witness sworn.)

18 ALJ PARROT: All right. Very good.

19 Mr. Alexander.

20 MR. ALEXANDER: Thank you.

21 - - -

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SCOTT POTTER

being first duly sworn, as prescribed by law, was examined and testified as follows:

DIRECT EXAMINATION

By Mr. Alexander:

Q. Mr. Potter, could you please state your name for the record.

A. Scott Potter, P-O-T-T-E-R.

Q. And did you cause to be filed prefiled direct testimony in this proceeding?

A. I did.

Q. And do you have any changes or corrections to that testimony?

A. I do. I have one correction, page 4, line 14. The paragraph begins "Ohio State owns all parts." It should actually read "The state of Ohio owns, and Ohio State controls all parts," and then continue forward.

Q. So would the full sentence now read "The state of Ohio owns, and Ohio State controls all parts of the proposed project area"?

A. Correct.

Q. Subject to that correction, if I were to ask you the same questions as appear in your prefiled written testimony, would your answers today be the

1 same?

2 A. They would.

3 MR. ALEXANDER: Your Honor, I don't think  
4 we marked this. May I have Mr. Potter's prefiled  
5 direct testimony marked as Ohio State Exhibit D.

6 ALJ PARROT: So marked.

7 (EXHIBIT MARKED FOR IDENTIFICATION.)

8 MR. ALEXANDER: Your Honor, Ohio State  
9 moves for the admission of Ohio -- of Ohio State  
10 Exhibit D, subject to cross-examination.

11 ALJ PARROT: Thank you, Mr. Alexander.  
12 Any cross for this witness, Ms. Wachspress?

13 MS. WACHSPRESS: No objection, subject to  
14 cross.

15 ALJ PARROT: Sorry. I was asking if --  
16 go ahead with your questions.

17 MS. WACHSPRESS: I'm sorry.

18 ALJ PARROT: That's okay.

19 - - -

20 CROSS-EXAMINATION

21 By Ms. Wachspress:

22 Q. Okay. Hi, Mr. Potter.

23 A. Good afternoon.

24 Q. Good afternoon. Your current role with  
25 the University is Senior Director for Comprehensive

1 Energy Management, correct?

2 A. That's correct.

3 Q. And this position was created as a result  
4 of the concession agreement between OSEP and OSU,  
5 correct?

6 A. The position was created after the  
7 concession agreement, that's correct.

8 Q. And you are providing testimony on behalf  
9 of OSU today, correct?

10 A. That's correct.

11 Q. So a firm called Burns & McDonnell  
12 developed a feasibility study for a combined heat and  
13 power facility at OSU in 2014, correct?

14 A. Not exactly. So they originally  
15 conducted a feasibility study at the behest of the  
16 University. I believe it was 2009 or '10. The  
17 University then subsequently asked them to update  
18 that. When we were in the process of considering the  
19 concession, we asked them to update it so we could  
20 include that study as part of the request for  
21 proposals.

22 Q. So the University has been considering  
23 the construction of a CHP facility since at least  
24 2009, correct?

25 A. Yes.

1 Q. And you mentioned requests for proposals.  
 2 Were -- were you referring to requests for proposals  
 3 for the concession agreement or for the facility?

4 A. For the concession agreement.

5 Q. OSU did not consider construction of  
 6 on-site renewable generation resources as an  
 7 alternative to the proposed CHP facility, correct?

8 A. The CHP facility was determined -- the  
 9 reason the University went for the CHP facility is  
 10 because it met both our thermal, our power, and our  
 11 economic needs as well as providing environmental  
 12 benefit. On-site renewable electricity didn't  
 13 achieve those same set of goals for us.

14 Q. But OSU did not perform a formal  
 15 investigation into whether on-site renewables could  
 16 provide those needs, correct?

17 A. A second investigation was not necessary.  
 18 It's known, it's generally known after years of  
 19 experience or market awareness that on-site renewable  
 20 electricity can't provide thermal benefits and the  
 21 reliability benefits and the economic benefits that  
 22 the University was seeking.

23 Q. Did OSU consider construction of  
 24 alternative thermal generation facilities other than  
 25 the CHP as an alternative to the proposed CHP

1 facility?

2 A. We -- OSU considered this -- has  
3 considered many alternatives. As was discussed by  
4 the previous witness, we've had -- we have geothermal  
5 on campus, but no other alternative presented itself  
6 as a reasonable solution for the situation that  
7 exists on the Columbus Campus considering both the  
8 thermal needs, the power benefits, the reliability  
9 benefits, and the economic availability of capital.

10 Q. Did OSU consult with any individuals  
11 involved with the conversion from steam heated hot  
12 water at the five universities identified in Appendix  
13 N?

14 A. I am not sure I understand what you mean  
15 by "consult."

16 Q. Did you contact them?

17 A. Through, you know, peer channels, through  
18 conferences we -- we have chatted. We have not -- we  
19 did not reach out specifically to ask about any of  
20 those particular projects.

21 Q. Did OSU consider construction of off-site  
22 renewable generation resources as an alternative to  
23 the proposed CHP facility?

24 A. OSU doesn't consider off-site renewable  
25 generation for electricity would be an alternative to

1 CHP. We constantly consider renewable energy and  
2 will continue to do so as evidenced by our 50  
3 megawatt wind purchase which was at the time the  
4 largest public university direct renewable wind  
5 purchase in the country.

6 Q. Did OSU consider increasing its power  
7 purchase agreement in lieu of constructing the  
8 proposed power facility?

9 A. Same answer, it wouldn't have served our  
10 purpose.

11 Q. So OSU determined prior to the signing of  
12 the concession agreement that it required a CHP  
13 facility specifically to meet its thermal load,  
14 correct?

15 A. Incorrect.

16 Q. What about that statement is incorrect?

17 A. OSU in its RFP, RFI, and RFQ documents  
18 prior to the concession agreement said that we had  
19 been thinking about and considered CHP, so we asked  
20 all bidders to understand that we had been  
21 considering that as we were only interested in  
22 bidders that could look at things as comprehensively  
23 as we had. That's why we included the Burns &  
24 McDonnell feasibility study in the RFP process. And  
25 we included language in the concession agreement that



1 said if the University asks, the winning bidder, the  
2 concessionaire, will perform a feasibility study.

3 Q. When did the University decide that a CHP  
4 facility was the appropriate means of meeting its  
5 thermal needs?

6 A. The Board of Trustees approved the  
7 construction of the CHP project in the August -- in  
8 the 2019 Board meeting. I can't remember if it was  
9 the May meeting off the top of my head or the August  
10 meeting. It was a multiyear process. The project  
11 first went to the Board after the feasibility study  
12 for a detailed or preliminary design. We still had  
13 not decided to build the CHP plant then.

14 Additional analysis went on. Site  
15 selection analysis went on. And went back to the  
16 Board for a secondary or a middle approval or  
17 additional money to begin that process, and only  
18 after that was all done did the Board finally at its  
19 third agenda or the third time appeared on the agenda  
20 is when the Board approved it for construction.

21 Q. And --

22 A. Subject to the Power Siting Board.

23 Q. And as a point of clarification of the  
24 feasibility study you are alluding to is the one  
25 completed by OSEP in 2018?

1           A.    That's correct.

2           Q.    Okay.  But no feasibility study was  
3 conducted for any other technology besides combined  
4 heat and power with relation to OSU's thermal load,  
5 correct?

6           A.    I disagree.

7           Q.    What --

8           A.    There are -- there are -- it may be  
9 semantics.  There are detailed studies produced for  
10 all of our energy capital projects, as I believe the  
11 previous witness testified to.  For instance, if our  
12 south chiller plant and in our building energy  
13 optimization projects, each one of those projects  
14 includes a detailed we use the term audit, but I  
15 think anybody would consider that to be  
16 interchangeable with feasibility study.

17          Q.    But for the need -- sorry.  What need  
18 would you identify -- what thermal heating need would  
19 you identify the proposed facility as serving?

20          A.    A primary source of heat for a campus  
21 that has very high demand 365 days a year.  We are  
22 over 100,000 pounds an hour in the summer.  You know,  
23 it's 500,000 pounds in the winter.  We are building  
24 two new hospitals so that's the primary need is we  
25 have a -- a miles and miles of legacy system that

1 traverses campus, and this CHP system will tie in  
2 that existing infrastructure.

3 Q. And has OSU conducted any feasibility  
4 study into replacing that legacy system?

5 A. Again back to the previous answer I  
6 provided, feasibility studies are conducted on each  
7 project, and we have not done a study on what it  
8 would take, you know, to -- we've done all the HRC  
9 studies for each project and each ECM project  
10 building by building as well as systems as they come  
11 up, but we've not done a study if what you're  
12 referring to is total conversion because I don't have  
13 an understanding of how that would -- would meet our  
14 thermal needs.

15 Q. So you've never done a study whether a  
16 conversion to heated hot water could help OSU in  
17 meeting its thermal needs?

18 A. Again, same answer. We've -- many  
19 studies. Every building, every capital utility  
20 project has a detailed study. Many of those include  
21 conversion to heated hot water.

22 Q. But all of those studies are on a  
23 building-by-building basis, correct?

24 A. No, that's not correct. Some are on a  
25 central plant basis.

1 Q. OSU has carbon neutrality as a goal,  
2 correct?

3 A. That's correct, by 2050.

4 Q. Okay. And the -- the fuel for the  
5 proposed CHP facility will be delivered by Columbia  
6 Gas of Ohio, correct?

7 A. Yes. Columbia Gas is our local  
8 distribution company.

9 Q. And a significant proportion of that gas  
10 will be derived from shale deposits, correct?

11 A. I can't tell you that that's correct.

12 Q. Do you not know, or do you believe it to  
13 be incorrect?

14 A. I can't tell you that it's not correct.  
15 I know that Ohio is a -- is a net exporter of gas, so  
16 I would assume much of our gas would come from the  
17 Gulf region up the pipeline, but I don't know.

18 Q. You just said Ohio is a net exporter of  
19 gas but that the gas would come from the Gulf region.  
20 Could you reconcile those two statements?

21 A. We send more gas out than we use here.

22 Q. Does it stand to reason then that the gas  
23 used in the facility will come from Ohio rather than  
24 the Gulf region then?

25 A. I don't -- I don't know that. I don't

1 think that assumption can be made.

2 Q. So OSU has not conducted any studies  
3 to -- to learn more about the source of the fuel  
4 being used in the proposed facility, correct?

5 A. Not to my knowledge.

6 Q. And OSU has not assessed the  
7 environmental impacts of the extraction of that fuel  
8 from -- extraction of that fuel for purposes of use  
9 in the proposed facility, correct?

10 A. I can't say if that's correct. This is  
11 beyond my area of expertise really.

12 Q. But as part of this project, the  
13 environmental impacts associated with the extraction  
14 of natural gas were not considered, correct?

15 A. Again, I don't -- I know what the  
16 environmental impacts were reported to us in the  
17 analysis that came from the OSEP and from their  
18 consultant TRC, but I can't tell you what all the  
19 inputs into that were.

20 Q. Were any environmental analyses other  
21 than those reports from TRC produced?

22 A. Ask more.

23 Q. Are there any -- are there any studies of  
24 the environmental impacts of this proposed project  
25 with which you are not familiar?

1           A.     Not --

2                   MR. ALEXANDER:  Objection.  Objection to  
3 that.  How do you want him to answer if he was not  
4 familiar with?

5                   MS. WACHSPRESS:  Well, okay.  The  
6 question retracted.

7                   Okay.  Okay.  I think -- I think that's  
8 it from me for Mr. Potter.

9                   MR. ALEXANDER:  Your Honor, could I have  
10 one moment, please?

11                   ALJ PARROT:  Hang on just a moment.

12                   Mr. Lindgren, did you have any questions  
13 for Mr. Potter?

14                   MR. LINDGREN:  No questions, your Honor.

15                   ALJ PARROT:  All right.  Yes, let's take  
16 a brief moment here for Mr. Alexander to determine  
17 whether he has any redirect.

18                   MR. ALEXANDER:  Thank you.

19                   (Discussion off the record.)

20                   MR. ALEXANDER:  Thank you, your Honor.  
21 Whenever you are ready, I have just got one thing.

22                   ALJ PARROT:  All right.  It looks like  
23 everyone else is ready so go ahead, Mr. Alexander.

24   - - -

25

## REDIRECT EXAMINATION

1  
2 By Mr. Alexander:

3 Q. Okay. Mr. Potter, you in some of your  
4 answers referenced the costs and budgetary concerns  
5 that the University looked at in deciding to go with  
6 the CHP as opposed to another facility. Could you  
7 please explain how Ohio State thinks about its energy  
8 budget and the size of that budget?

9 A. Absolutely. It sort of explains in my  
10 title so. My office is in charge of comprehensive  
11 energy management so all costs of energy, operating  
12 costs, capital costs, the earnings on capital costs,  
13 and the commodity go into that budget; and, you know,  
14 it's a significant portion of the University's  
15 operating costs in total, and we have a budget. You  
16 know, sort of historic our range has been 110 to 135  
17 million, you know, at that range -- annually at that  
18 range or sort of getting toward the cap of what we  
19 can afford.

20 So one of the places we are always  
21 looking, you know, to address the economics is on  
22 those sort of categories of energy. Can we bring  
23 down the commodity costs? Can we bring down the  
24 usage through efficiency? Anything we can do to keep  
25 within that budget so is what we define as

1 comprehensive.

2 MR. ALEXANDER: Nothing further, your  
3 Honor. Thank you.

4 ALJ PARROT: Any recross, Ms. Wachspress?

5 MS. WACHSPRESS: No, your Honor.

6 ALJ PARROT: Mr. Lindgren?

7 MR. LINDGREN: No, your Honor.

8 ALJ PARROT: All right. Very good.

9 Thank you very much, Mr. Potter.

10 THE WITNESS: Thank you, your Honor.

11 ALJ PARROT: All right. I believe we  
12 have one exhibit here, Mr. Alexander. I assume you  
13 are moving for the admission of OSU Exhibit D;  
14 perhaps you already did.

15 MR. ALEXANDER: That would be great, your  
16 Honor. Ohio State asks for admission of Exhibit D.

17 ALJ PARROT: Okay. Any objections?

18 MS. WACHSPRESS: No objections.

19 MR. LINDGREN: No objection.

20 ALJ PARROT: All right. OSU Exhibit D as  
21 in dog is admitted into the record.

22 All right. Let's go off the record just  
23 for a moment.

24 (Discussion off the record.)

25 ALJ PARROT: With that let's go back on



1 the record.

2 All right. Anything else from the  
3 Applicant at this point, Mr. Alexander?

4 MR. ALEXANDER: No, thank you, your  
5 Honor.

6 ALJ PARROT: Okay. Very good.  
7 Then Sierra Club may call its witness.

8 MS. WACHSPRESS: Sierra Club calls  
9 Dr. Ranajit or Ron Sahu to the stand.

10 DR. SAHU: Can you hear me?

11 ALJ PARROT: Doctor, I can hear you. I  
12 am not seeing your video feed yet. Let's see.

13 DR. SAHU: Yeah. I am going to turn it  
14 on. I just saw it, your Honor.

15 ALJ PARROT: Okay. Very good.

16 THE WITNESS: How about that? Is that a  
17 little better?

18 ALJ PARROT: There you are. Very good.  
19 Can everyone see the witness, hear the witness? All  
20 right. Very good.

21 (Witness sworn.)

22 ALJ PARROT: Very good.

23 Ms. Wachspress, I will turn it over to  
24 you.

25 THE WITNESS: Your Honor, I just have a

1 quick question. Although it was reliable for the  
 2 last five hours, the last 20 minutes my internet has  
 3 gone out twice, and I have jumped on the phone. I am  
 4 keeping my fingers crossed that doesn't happen again.  
 5 If it does, I have the phone number and the access  
 6 code just in case. I'm sorry to interrupt.

7 ALJ PARROT: Okay. That's good to know.  
 8 We will try to keep an eye on that. I think we've  
 9 had enough of our fair share of technical issues  
 10 today so let's keep our fingers crossed we are  
 11 through it.

12 THE WITNESS: I hate to add to it. I  
 13 hope it doesn't happen.

14 ALJ PARROT: It does happen. All right.  
 15 Thank you.

16 Go ahead, Ms. Wachspress.

17 - - -

18 RANAJIT SAHU, Ph.D.  
 19 being first duly sworn, as prescribed by law, was  
 20 examined and testified as follows:

21 DIRECT EXAMINATION

22 By Ms. Wachspress:

23 Q. Good afternoon, Dr. Sahu.

24 A. Good afternoon.

25 Q. Did you submit prefiled testimony in this

1 case?

2 A. I did.

3 Q. Do you have it before you?

4 A. I do. I have everything electronically,  
5 so I'm able to look at it on the computer, yes.

6 Q. And would you give the same answers that  
7 you provided in your prefiled testimony if asked  
8 today?

9 A. I would.

10 MS. WACHSPRESS: Okay. Your Honor, I  
11 move for the admission of the testimony of Dr. Sahu  
12 and associated exhibits, subject to  
13 cross-examination, and tender him for cross-exam.

14 ALJ PARROT: Okay. Let's go ahead and  
15 mark it. I think we are on Sierra Club Exhibit F.  
16 So we will go ahead and mark Dr. Sahu's exhibit as  
17 Sierra Exhibit F.

18 (EXHIBIT MARKED FOR IDENTIFICATION.)

19 ALJ PARROT: And with that,  
20 Mr. Alexander, go ahead and proceed.

21 COURT REPORTER: You're muted.

22 MR. ALEXANDER: Thank you. The whole day  
23 I've made it until now.

24 - - -

25

CROSS-EXAMINATION

1  
2 By Mr. Alexander:

3 Q. Dr. Sahu, my name is Trevor Alexander. I  
4 am one of the lawyers representing Ohio State in this  
5 proceeding. I would like to start by turning your  
6 attention to your testimony page 3, line 17.

7 A. Let me just get there. Give me a second.  
8 Did you say page 3?

9 Q. Page 3, line 17.

10 A. Okay.

11 Q. So do you believe that Ohio State uses  
12 steam for all of its heating needs, correct?

13 A. Yes. When I wrote that, that was my  
14 understanding, correct.

15 Q. And so you've been present in the hearing  
16 today, correct?

17 A. Yes.

18 Q. And so do you now understand that that  
19 testimony is inaccurate?

20 A. What I heard was that there was some  
21 buildings that are supplied substantially or to some  
22 extent by geothermal heating. So that is what I  
23 learned that would modify perhaps that statement.

24 Q. And did you also hear testimony that Ohio  
25 State is using heated hot water for some buildings

1 today?

2 A. Yes. I -- if you are referring to the  
3 just recently discussed HRC list, or would you  
4 clarify if you are referring to that or something  
5 else?

6 Q. Do you believe Ohio State is currently  
7 using heated hot water in any buildings today?

8 A. My understanding is that some buildings  
9 are using, again I am not sure to what extent, heated  
10 hot water if they are part of the HRC list. And  
11 that's -- that's my understanding. It's, again,  
12 based on the HRC list that one of the witnesses  
13 testified.

14 Q. Do you have any understanding as to the  
15 volume of processed steam necessary on the Columbus  
16 Campus?

17 A. Numbers such as 100,000 to 100 -- you  
18 know, to somewhat greater than that pounds per hour,  
19 of that range, and I know it varies by season.  
20 That's my understanding.

21 Q. Are you just repeating what you heard  
22 earlier today, or are you going to some other  
23 understanding?

24 A. I've read about that, but I don't have  
25 that number in front of me as I was preparing my

1 testimony, but I also heard numbers in that order of  
2 magnitude.

3 Q. And you heard -- do you know what the  
4 winter steam load is?

5 A. My -- I don't know the exact number. It  
6 might have been as much as 130 or 150 thousand pounds  
7 per hour.

8 Q. In the winter?

9 A. Well, seasonally there was a range  
10 between 100,000 to 150,000. I presume some of the  
11 higher heating needs will be during the winter.  
12 That's my assumption.

13 Q. Okay. Do you have any understanding as  
14 to the types of research on Ohio State's Campus that  
15 may require steam?

16 A. I don't know if you could help me by  
17 being more specific about what do you mean by "type  
18 of research"?

19 Q. Does Ohio State have research processes  
20 done by its professors and scientists which requires  
21 steam?

22 A. I presume they do, but I don't have a  
23 full understanding of that, as to their steam  
24 demands.

25 Q. And do you have any understanding of the

1 steam demands of a 1,300 bed medical center?

2 A. I do have some idea about specific steam  
3 needs in hospitals including large hospitals, yes.

4 Q. Okay. And what is that volume?

5 A. I can't give you volume. I said the  
6 needs such as sterilization; those would be the types  
7 of activities.

8 Q. Okay. And do you know whether or not  
9 Ohio State's food production facilities rely  
10 100 percent on central steam for cooking and  
11 cleaning?

12 A. I have not seen specific documents as to  
13 food production facilities and their needs, but it  
14 doesn't surprise me they are currently hooked up to  
15 the steam system.

16 Q. Okay. Would you agree Ohio State's  
17 current heating peak demand is 153 megawatts thermal?

18 A. That's my understanding, is what was  
19 mentioned by one of the witnesses.

20 Q. Okay. Could you please turn to page 5,  
21 line 7 of your testimony.

22 A. Sure.

23 Q. You state the affordability goals of the  
24 CHP can be met via alternative means. Do you see  
25 that?

1           A.    Yes.

2           Q.    Do you know the current Ohio State  
3 capital budget for energy?

4           A.    I do not other than what I heard from the  
5 previous testimony, that part which I caught when my  
6 connection was valid.

7           Q.    Okay. Do you know the current OSU budget  
8 for additional energy infrastructure?

9           A.    Same answer.

10          Q.    Do you know the current OSU budget for  
11 carbon reduction activities?

12          A.    No. And I don't know what would be  
13 encompassed in carbon reduction activities as you are  
14 using that in that question.

15          Q.    Now turn to page 7, line 20.

16          A.    Sure. Give me a second. Okay.

17          Q.    You say the lowest cost,  
18 least-environmental impact option might not be CHP in  
19 that reference. Do you see that?

20          A.    Yes, I do.

21          Q.    As used here, how do you define lowest  
22 costs?

23          A.    Levelized costs over a period of time  
24 looking at whatever initial capital but also the  
25 operating costs and levelizing that over a reasonable



1 period of time.

2 Q. What periods of time did you deem  
3 reasonable in this case?

4 A. Well, it might be 30 years, 40 years, 50  
5 years. It depends on the life of the equipment that  
6 is chosen based on the alternative, so it would  
7 depend on the selection. I had something in the  
8 order of at least 25 years, but it could be longer.

9 Q. Okay. And in the sentence you say that  
10 the CHP might not be the lowest cost option. Do you  
11 see that, the word "might"?

12 A. I do.

13 Q. So are you testifying today that the CHP  
14 is definitively not the lowest cost option for Ohio  
15 State?

16 A. What I am saying is given my  
17 understanding that there's been no cost studies done  
18 for alternatives that would meet all the needs that  
19 the CHP is intended to fulfill and given that other  
20 district heating including college campuses have gone  
21 to this system, that this -- I use the word might  
22 simply because there have been no studies done at  
23 Ohio State.

24 MR. ALEXANDER: Your Honor, I apologize.  
25 I had a couple of motions to strike. Nothing to

1 cover on the stuff we've just gone through. Would  
2 now be a convenient time to hear those?

3 ALJ PARROT: Go ahead, Mr. Alexander.

4 MR. ALEXANDER: Okay. The first is with  
5 regard to Exhibit E as in Edward. This exhibit is a  
6 complete air state facility permit for a facility in  
7 the state of New York. The grounds for the objection  
8 are it's hearsay. For which it is asserted is that  
9 the levels Ohio State has determined to be the best  
10 available control technology is not because other  
11 agencies have found that different technologies can  
12 support lower emissions. In support of that claim  
13 the witness offers 80 pages about a facility not at  
14 issue in this case, under a different state, under a  
15 different standard.

16 That -- that exhibit applied the LAER  
17 standard, which we'll talk about later with this  
18 witness, instead of the best available technology  
19 standard at issue here. So the only fact established  
20 through this exhibit, which again is hearsay, the  
21 witness is not offering it based on his personal  
22 knowledge, is that a completely unrelated facility  
23 was issued a permit by the state of New York using a  
24 different standard. So based on that, we would move  
25 to strike Exhibit E.

1 ALJ PARROT: Response, Ms. Wachspress?

2 MS. WACHSPRESS: Your Honor, this is a  
3 government document issued by a government agency and  
4 subject to the exception for government documents  
5 under Rule 803 of the Ohio Rules of Evidence. It's  
6 introduced to support the experts -- expert opinion  
7 that the lower emissions affiliated with nitrogen  
8 dioxide is technically feasible, and he as an expert  
9 can also rely on the existence of a permit by a  
10 government agency which is a reliable exception to  
11 the hearsay rule to assert that such a limited is  
12 technically feasible in his expert -- in his  
13 expertise.

14 MR. ALEXANDER: I'm sorry. Your Honor,  
15 just as to the new argument raised on the exception,  
16 the hearsay rules apply when the document is offered  
17 for the truth of the matter asserted. And so if the  
18 document were being offered to prove the truth that  
19 this permit had been, in fact, issued, if that was a  
20 fact at issue in this case, then I would agree that  
21 exception might apply.

22 Here the document is not being offered to  
23 prove that the permit had been issued, the purpose of  
24 the hearsay exception cited by counsel. But instead  
25 it's being offered to prove that a technology in the

1 document with which the witness has established no  
2 personal knowledge of any kind is, in fact,  
3 achievable and should be adopted here. That is  
4 outside of the hearsay exception. It does not apply.

5 MS. WACHSPRESS: Your Honor, may I  
6 respond briefly?

7 ALJ PARROT: Yes.

8 MS. WACHSPRESS: It's being introduced  
9 for the fact a permit was issued by a government  
10 agency with this limit which the expert in his  
11 expertise had assessed to be a reasonable limit that  
12 was not considered by OSU -- that was not considered  
13 as part of the permitting process by OSU.

14 ALJ PARROT: I am going to allow the  
15 exhibit to stand, Mr. Alexander. Did you have  
16 another motion as well?

17 MR. ALEXANDER: I do, your Honor. This  
18 applies to the testimony at page 2, line 17 to 19;  
19 page 2, lines 25 and 26; page -- and this is the  
20 largest section which is referred to in the two prior  
21 references, page 21, line 6 to page 24, line 9.

22 ALJ PARROT: Okay. Slow down. Did you  
23 jump ahead to 21?

24 MS. WACHSPRESS: Yeah. Can we go back?  
25 Can we start -- would you start with the first, go

1 back to the beginning, please, if you don't mind?

2 MR. ALEXANDER: Certainly. Page 2, lines  
3 17 to 19; page 2, lines 25 to 26; and then this is  
4 the largest section, page 21, line 6 to page 24, line  
5 9. Finally, I guess this is the largest section,  
6 page 29, line 11, through page 36, line 17.

7 ALJ PARROT: Last one again.

8 MR. ALEXANDER: Page 29, line 11, to page  
9 36, line 17.

10 ALJ PARROT: Grounds?

11 MR. ALEXANDER: Relevance, your Honor.

12 The scope of this case is an application for a  
13 generation unit. In this section Sierra Club  
14 advances alternative technologies.

15 ALJ PARROT: Wait, wait. Which section?  
16 You have covered a whole bunch.

17 MR. ALEXANDER: All of it.

18 ALJ PARROT: All of it? Okay.

19 MR. ALEXANDER: All of it. And I think  
20 if we -- if the motion is rejected and we end up  
21 going through this, I think you'll see how it's all  
22 related. Sierra Club in this testimony seeks to  
23 introduce evidence outside of that established by the  
24 Power Siting Board, the Ohio Administrative Code, and  
25 the Ohio Revised Code here. It brings up alternative

1 technologies, technologies which have nothing to do  
2 with the generation which is going to be used in this  
3 case. It goes to things like whether hot water heat  
4 is appropriate for Ohio State or meet Ohio State's  
5 goals better than that technology chosen by Ohio  
6 State.

7 Well, that can certainly be Sierra Club's  
8 position. It is outside the jurisdiction of the  
9 Power Siting Board which is limited to only those  
10 generation assets which are within its jurisdiction.  
11 And by Ohio deregulating generation since Senate Bill  
12 3, there is no integrated resource planning required  
13 to build generation in Ohio any longer. And there is  
14 no obligation for Ohio State to satisfy every  
15 possible hypothetical which could be asserted by an  
16 intervenor.

17 And, therefore, I believe this  
18 information about things which are not related to the  
19 plan, which relate to alternative technologies,  
20 should be stricken.

21 And, finally, I would like to propose a  
22 hypothetical. Suppose one wanted to build a solar  
23 plant in the State of Ohio. Under Sierra Club's  
24 analysis, that applicant would be required to present  
25 any possible technology out there which might be

1 cheaper than that solar plant which might fill the  
2 applicant's goals for carbon reduction or otherwise  
3 better than the technology chosen by that applicant.

4 And I don't think that's Ohio law. I  
5 don't think Ohio law requires applicants to do a full  
6 integrated resource plan for building generation in  
7 Ohio. That changed after Senate Bill 3 and Ohio  
8 State is not a public utility.

9 And based on that, I think this  
10 information is irrelevant, and it should be stricken.

11 ALJ PARROT: Ms. Wachspress?

12 MS. WACHSPRESS: Well, just start by  
13 saying Applicant raised these same issues in  
14 opposition to our motion to compel and was overruled  
15 on that point precisely because the Board has already  
16 addressed this argument and reached the conclusion  
17 that alternative generation technologies are relevant  
18 under 4906.10(A)(3) which is a statutory requirement  
19 that requires an applicant to demonstrate that the  
20 proposed facility represents the minimum adverse  
21 environmental impact as compared to other available  
22 technologies.

23 All of this testimony goes to other  
24 available technologies, that it is Sierra Club's  
25 position OSU did not adequately consider and,

1 therefore, cannot meet the statutory standards set  
2 forth at 4906.10(A)(3).

3 I'll also mention that in the  
4 hypothetical when Mr. Alexander talked about solar  
5 plants being -- having to demonstrate that they are  
6 cheaper, I think that precisely proves the point  
7 there's nothing in the statute about demonstrating  
8 that the facility is the cheapest available. It has  
9 to demonstrate that it represents the minimum  
10 environmental impacts. That's the language of the  
11 statute.

12 And with respect to Mr. Alexander's point  
13 about which -- about the IRP planning versus not,  
14 one, again, I don't think this is an IRP planning  
15 process. This is all tied back to the statutory  
16 language again as we set forth in our motion to  
17 compel and again as the court has already issued --  
18 I'm sorry, your Honor has already issued an opinion  
19 on.

20 But I'll also say that the structure of  
21 funding for this facility closely resembles that of a  
22 regulated utility. We have already had testimony  
23 today that there is a return on equity that's tied  
24 precisely to return on equity for regulated utilities  
25 elsewhere, that this is functioning like a regulated



1 utility with respect to the students at OSU.

2 And so to the extent that Mr. Alexander  
3 wants to bring in that as a comparison, I think  
4 that's a relevant point, but the bigger point is that  
5 this comparison is, in fact, ostensibly drawn from  
6 an appendix produced by -- by -- by the Applicant  
7 regarding heated hot water. They introduced as part  
8 of their feasibility study evidence relating to the  
9 comparative advantage of that. They introduced as  
10 part of their feasibility study comparisons to the  
11 cost of solar. They have put all of this at issue in  
12 addition to the statutory language, and it's there to  
13 express an opinion on whether they adequately  
14 considered these alternatives and, thus, met the  
15 statutory standard.

16 ALJ PARROT: Anything else,  
17 Mr. Alexander?

18 MR. ALEXANDER: Just briefly, your Honor,  
19 a couple of points. First, the distinction here is  
20 that we are not talking about a discovery dispute.  
21 We are talking about what's being admitted into  
22 evidence at the hearing. Those are different  
23 standards; different rules apply.

24 Second, we are not talking about the  
25 environmental impact of the proposed facility. We

1 are now in this section talking about non-generation  
2 assets, non-jurisdictional generation assets like  
3 Ohio State's steam network. That is different from a  
4 different type of generation asset which is what was  
5 at issue in the Ohio case that's relied on by the  
6 Sierra Club today. In that case we were discussing  
7 the distinction between gas and coal. Right? Those  
8 are two different kinds of generation assets.

9 Here we are talking about the use for  
10 which Ohio State is going to use the thermal energy  
11 produced by the CHP. That is a non-jurisdictional  
12 question and I think it's fundamentally different for  
13 Ohio.

14 MS. WACHSPRESS: Your Honor, may I  
15 respond?

16 ALJ PARROT: Go ahead.

17 MS. WACHSPRESS: OSU is proposing to  
18 build a facility on the grounds that it will supply  
19 thermal needs. The evidence goes to whether those  
20 thermal needs can be met through other means  
21 including means that are tied up with the steam to  
22 hot water conversion because they are facilitated by  
23 that conversion, but it goes to the feasibility of  
24 other means of meeting the thermal needs that OSU has  
25 identified as the basis for its request to build this

1 facility.

2           And simply -- it is the -- it is the role  
3 of the Board to evaluate whether the Applicant has  
4 adequately demonstrated that facility meets its needs  
5 and represents the minimally environmentally  
6 detrimental way of meeting those needs. And again,  
7 all of this evidence goes to precisely that, and I  
8 will note that the -- that the motion -- that the  
9 decision that your Honor cited as part of the opinion  
10 on discovery was a motion in limine, not a -- not a  
11 motion on discovery, that the issue has come up and  
12 been resolved in that 2008 in precisely this context  
13 with respect to the admission of testimony and  
14 evidence at hearing.

15           MR. ALEXANDER: Yeah, that's correct. I  
16 was referring to the decision earlier in this case,  
17 the AMP-Ohio's motion.

18           ALJ PARROT: All right. Thank you both.  
19 I appreciate the arguments. I think I am going to  
20 deny your motion to strike, Mr. Alexander, allow the  
21 Board to determine what weight, if any, to give to  
22 these sections of Dr. Sahu's testimony.

23           MR. ALEXANDER: Okay. Thank you, your  
24 Honor. I apologize for starting the cross before I  
25 did that. That was my mistake.

1 Q. (By Mr. Alexander) Okay. Dr. Sahu, back  
2 to page 7, line 20, and our discussion regarding the  
3 meaning of the word might. Do you recall where we  
4 left off?

5 A. Yes, I do.

6 Q. Okay. So I'm going to repeat the  
7 question I think we ended on to get us back into the  
8 discussion. Are you able to conclusively say today  
9 that the CHP is not the lowest-cost option for Ohio  
10 State?

11 A. Again, I do want some clarification in  
12 your question just so I understand it, Mr. Alexander.  
13 When you say "cost," does your cost include the cost  
14 of environmental impacts or what does -- what goes  
15 into the cost bucket in your question as posed?

16 Q. In my question as posed, I am not  
17 including any environmental costs. I am referring to  
18 the costs to Ohio State for the capital to construct  
19 the facility and the O&M to operate it.

20 A. So you are excluding in your costs the  
21 environmental impacts due to the emissions,  
22 environmental impacts due to the greenhouse gas  
23 emissions like a carbon cost? Like you are excluding  
24 all of that?

25 Q. Correct. And we can actually do two

1 separate questions, if you would like, but let's  
2 answer mine first and then we will answer yours. So  
3 are you able to conclusively say the CHP is not the  
4 lowest-cost option for Ohio State?

5 A. It is my opinion that it is not the  
6 lowest-cost option when you look at it on an LCOE  
7 basis in a reasonable time frame, yes, that is  
8 correct.

9 Q. What is the lowest-cost option?

10 A. The lowest cost option would appear to be  
11 a combination of technologies to meet its heating and  
12 power generation needs as I've discussed in my  
13 report.

14 Q. But your report does not include any  
15 projected costs for those items, correct?

16 A. Correct. I just mentioned those options,  
17 that that's my opinion that the costs associated with  
18 those options would be the lowest-cost options, again  
19 on an LCOE basis, that is correct.

20 Q. But you are asserting that opinion  
21 without actually doing any cost projections?

22 A. I have not been able to do cost  
23 projections because that would require me getting a  
24 lot of detailed engineering data that was not  
25 publicly available and is not publicly available as

1 far as I know.

2 It is also based on the fact that others  
3 faced with exactly similar situations and cost  
4 analysis have concluded just the opposite to what  
5 Ohio State has concluded.

6 Q. Are you able to provide a levelized cost  
7 of energy for your proposed option?

8 A. You mean again tailored for Ohio State?

9 Q. Yes.

10 A. No. Did I just not say in the previous  
11 answer preparing a cost estimate which includes the  
12 levelized cost estimate would require getting basic  
13 load and other data, engineering data, that is not  
14 publicly available on the record even if one were  
15 able to do such a thing and intended to, the time and  
16 resources needed, that basic data is not available in  
17 the record sitting here as we do today.

18 Q. And you never requested that data from  
19 Ohio State, correct?

20 A. I looked at the record and what's  
21 available because that's the basis for proceeding  
22 with the CHP design was based on that record.

23 MR. ALEXANDER: Objection. Move to  
24 strike, nonresponsive.

25 MS. WACHSPRESS: Your Honor, the

1 Applicant has advanced the argument in other contexts  
2 that the Board should make its decision on the basis  
3 of the application alone, and the expert is offering  
4 his opinion on the basis of the application and other  
5 materials provided to Sierra Club in the course of  
6 discovery. I think the answer should stand.

7 MR. ALEXANDER: The question was whether  
8 they had just requested the information, your Honor.

9 ALJ PARROT: I am going to deny the  
10 motion to strike, Mr. Alexander.

11 Q. (By Mr. Alexander) Let's talk a little  
12 more about lowest cost. So when you talk about the  
13 life cycle costs of an asset, would you agree that  
14 includes an upfront capital cost and then ongoing  
15 costs of operation?

16 A. Yes. Those are certainly two but there  
17 could be other costs, that's correct.

18 Q. Absolutely. So if the initial capital  
19 investment is more than someone can afford, even if  
20 it is an asset that would otherwise be the lowest  
21 cost, isn't it true they may not always be able to  
22 afford it?

23 A. I'm not an expert in affordability. I am  
24 not an expert in how one goes about raising capital.  
25 There are plenty of ways to do that. I am aware of,

1 you know, raising debt, raising equity. We can see  
2 things people do to raise capital to do projects. So  
3 subject to that, I don't fully understand the  
4 constraint on affordability.

5 Q. So the question in your testimony at page  
6 7, line 8, that you are responding to here is "Why is  
7 it important to analyze both heating and cooling  
8 loads." Do you see that question?

9 A. I do see it, yes.

10 Q. What does that have to do with the  
11 standard to be applied by the Power Siting Board in  
12 this case?

13 A. It's a very --

14 MS. WACHSPRESS: Objection, your Honor.  
15 It calls for a legal conclusion.

16 MR. ALEXANDER: You know what, your  
17 Honor? I'll rephrase the question.

18 Q. Do you believe that the amount of Ohio --  
19 strike that.

20 Do you have an opinion as to whether  
21 costs is involved in the consideration for the Ohio  
22 Power Siting Board?

23 A. You will have to again define costs. I  
24 don't fully understand. I understand that it can  
25 certainly play a role in some fashion, but again, it



1 would have to depend on how that cost -- cost is a  
2 broad term. It means different things to different  
3 people.

4 Q. Okay. Costs that would be part of the  
5 construction or operation of a facility. Do you  
6 believe that those considerations should be taken  
7 into account by the Ohio Power Siting Board?

8 MS. WACHSPRESS: Your Honor, objection.  
9 The witness is not an expert on the laws of the Ohio  
10 Power Siting Board. He is an expert on thermal and  
11 energy generation. The counsel is trying to get a  
12 legal opinion in a different way.

13 MR. ALEXANDER: Your Honor, the witness's  
14 testimony is based most exclusively on cost  
15 considerations. There is a section on air impacts we  
16 are going to get to later but the witness discussed  
17 his costs in great detail and Ohio State has been  
18 consistent in this proceeding seeking to limit it to  
19 just these non-cost and jurisdictional considerations  
20 and has been rejected.

21 So I feel like we should be given the  
22 leeway to find out why the witness thinks that costs  
23 is something the Power Siting Board should take into  
24 account here, and I would like to explore were there  
25 any limitations on the witness's opinion that

1 environmental issues should supercede other issues.

2 ALJ PARROT: Overruled.

3 A. Could you ask the question again? I'm  
4 sorry, Mr. Alexander. I got lost in the back and  
5 forth.

6 MR. ALEXANDER: Certainly. Karen, can  
7 you please read the question back.

8 (Record read.)

9 A. Thank you. The answer again is those  
10 costs, and perhaps additional costs, is my  
11 understanding that they can be taken into account  
12 subject to at least meeting one of the requirements  
13 which is the minimum environmental impact  
14 alternative.

15 Q. Let's talk about that environmental  
16 impact. In your testimony you identified geothermal  
17 energy as something -- as an alternative Ohio State  
18 did not consider, correct?

19 A. Yeah. I did not see ground based, i.e.,  
20 geothermal resources to meet its heating and  
21 certainly -- heating and cooling loads -- loads for  
22 that portion, yes.

23 Q. And your testimony also states that heat  
24 exchange with off-site renewable energy is an  
25 alternative Ohio State did not consider, correct?

1           A.    Say again.  You are cutting out.  Heat  
2 exchange with what?

3           Q.    Off-site renewable energy is an  
4 alternative Ohio State did not consider, correct?

5           A.    Where do I say that?  Again, are you  
6 talking about electricity generation or for heating?

7           Q.    I am referring to your testimony at page  
8 3, line 3.

9           A.    Page 3, line 3?  I'm sorry.  Let me just  
10 go there because I want to read exactly what you are  
11 referring to so I don't misanswer the question.

12          Q.    Sure.  We are referring to heating, I  
13 believe, but I will let you look at the citation.

14          A.    Yes.  So you juxtaposed two concepts.  
15 That's why I was confused.  For heating, as I said in  
16 my previous answer, yes, I did not see geothermal or  
17 heat exchange technologies for meeting heating needs.  
18 These would be things in the context of ground-based  
19 heat exchange.

20                    Then separately I say in line 4 that  
21 off-site renewable electricity generation.  That's  
22 for the electrical power needs.  I thought your  
23 question kind of combined the two so that confused  
24 me.

25          Q.    Okay.  So your testimony does not include

1 any analysis showing how feasible those technologies  
2 would be for Ohio State's purposes, correct?

3 A. Right, because I did not have the  
4 information just as we went through 5 minutes ago to  
5 do that but I did provide examples for others faced  
6 with exactly similar needs like the Ohio State  
7 University Campus in Columbus. I've come to relying  
8 on ground-based, for example, technologies for  
9 meeting the heating needs and others who have relied  
10 on renewables, off-site renewables, for meeting their  
11 power needs, so I have given those examples as  
12 situations where they were faced in my view with  
13 similar decisions that were before OSU.

14 MR. ALEXANDER: Your Honor, I move to  
15 strike the response as nonresponsive. The question  
16 was simply whether he quantified the costs.

17 ALJ PARROT: The motion to strike is  
18 denied, Mr. Alexander.

19 MS. WACHSPRESS: Your Honor, could you  
20 read back the question again, please, Ms. Gibson?

21 (Record read.)

22 MS. WACHSPRESS: Your Honor --

23 MR. ALEXANDER: I am going to withdraw my  
24 motion. I apologize. I was at the wrong point in my  
25 outline.

1 ALJ PARROT: Very good.

2 Q. (By Mr. Alexander) So your testimony does  
3 not quantify the costs associated with pursuing those  
4 technologies, correct?

5 A. Right, for the reasons stated before.

6 Q. And your testimony includes no analysis  
7 of the environmental impact of either geothermal or  
8 heat exchange technologies, correct?

9 A. That's correct.

10 Q. I would like to talk about life cycle  
11 costs for a moment. You discuss that with regard to  
12 gas, correct?

13 A. Yes. Well, I just discuss that as a  
14 concept. I mean.

15 Q. Correct. So I would like to discuss that  
16 concept with regard to renewable generation  
17 options --

18 A. Sure.

19 Q. -- you recommend. Isn't it true that  
20 also life cycle costs are associated with solar  
21 generation?

22 A. Yes, there are.

23 Q. And so, for example, there are costs  
24 associated with the production of solar glass,  
25 correct?

1           A.    Yes.

2           Q.    For example, cadmium-telluride panels.  
3    Are you familiar with cadmium-telluride solar panels?

4           A.    I know that there are many different base  
5    materials for the panels and that could be one of  
6    them. I have not studied them all in detail to tell  
7    you the true, Mr. Alexander.

8           Q.    Okay. Do you know whether cadmium is  
9    poisonous?

10          A.    Anything is poisonous in enough dose.

11          Q.    Okay. Do you know whether  
12    cadmium-telluride is able to be disposed of in  
13    landfills?

14          A.    I don't know if it's a hazardous material  
15    or nonhazardous material. That would dictate how  
16    it's disposed of if it has to go to a landfill.

17          Q.    And do you know whether the Electronic  
18    Power Research Institute has recommended solar panels  
19    not be disposed of in landfills?

20          A.    Did you mean the Electric Power Research  
21    Institute or Electronic Power Research Institute?

22          Q.    Electric, EPRI.

23          A.    You would have to point me to the study.  
24    I don't know all of EPRI's various technical  
25    documents. Again, most of them are behind the pay

1 wall, so they are not publicly available.

2 Q. And have you done any analysis of the  
3 impact of solar -- silicone on the environment?

4 A. Silicone meaning silicone for the purpose  
5 of making the solar panels?

6 Q. Yes.

7 A. Not in this case, no.

8 Q. And have you done any analysis of the  
9 impact of -- life cycle impact of batteries,  
10 particularly lithium ion batteries?

11 A. I have not done an analysis on this case,  
12 but I'm aware of LCOE studies by others including the  
13 Department of Energy for various battery storage  
14 technologies including lithium ion batteries.

15 Q. And lead, are you familiar that lead can  
16 also be hazardous in high enough quantities?

17 A. Yes, I am aware of that.

18 Q. And did you take any of those life cycle  
19 costs into account when evaluating the possibility of  
20 solar to meet Ohio State's needs?

21 A. Again, as just to reiterate, I have not  
22 done or been able to do a life cycle cost analysis  
23 for this particular matter, but I am aware of  
24 numerous studies that do LCOE, again defining the  
25 boundaries wider and wider as you have given me

1 examples of what a proper LCOE would include and that  
2 includes various types of battery technology  
3 including the conventional lead acid batteries and  
4 now the nickel metal hydride battery, and lithium ion  
5 batteries. Yes, I am aware of those studies, and I  
6 can speak in general terms, but I cannot speak in  
7 terms of something I have not done in the current  
8 context.

9 Q. So would you agree with me that to do an  
10 apples-to-apples comparison, we would need to take  
11 the life cycle cost of the CHP plant versus the  
12 alternatives?

13 A. I would agree with that but here is the  
14 very important distinction which is an LCA, which is  
15 sort of a life cycle analyses, that's the acronym  
16 they go by, one of the first steps they have to  
17 decide when they are comparing two options to  
18 properly define those boundaries, primary boundaries,  
19 secondary boundaries, cursory boundaries.

20 And then as long as you do that on an  
21 apples-to-apples basis, I would completely agree.  
22 But often what happens is bias is introduced because  
23 people can stretch or modulate those boundaries or a  
24 preferred option, if you will, and that's what  
25 distorts that analysis.



1           But in your question you said apples to  
2 apples. Staying with apples to apples, as I've  
3 interpreted that, I would agree.

4           Q.    Okay. Now I would like to focus on  
5 geothermal.

6           A.    Sure.

7           Q.    You state that OSU did not consider  
8 geothermal means of meeting its heating needs, but as  
9 we've heard here today, Ohio State currently uses  
10 geothermal, so do you believe that that sentence may  
11 need to be revised?

12          A.    I think the sentence stands because when  
13 I was writing this, it was as replacement for the  
14 entire district-wide heating. That's what the CHP is  
15 going to provide. I've recognized in instances that,  
16 you know, Ohio State Campus has, for example, diesel  
17 emergency generators, or it has other localized needs  
18 and loads and ways to fulfill them.

19                    So my focus when I was saying geothermal  
20 is in the context of looking at district-wide. And  
21 frankly what I heard today in testimony was that,  
22 yes, from a central district-wide perspective  
23 geothermal was not considered, so it kind of  
24 reinforces what I said there. I don't think I need  
25 to modify that.

1 Q. Do you know the size of Ohio State's  
2 geothermal system?

3 A. I don't know the size of the geothermal  
4 system that supplies the residence halls, no, I  
5 don't.

6 Q. Do you know the number of Ohio State's  
7 residence halls which is served by the current  
8 geothermal system?

9 A. Again, I would be going by memory. I  
10 heard there were somewhere between three to six or  
11 something like that. It's an accountably finite  
12 number of them in single digits I heard. I don't  
13 recall the exact.

14 Q. And you are just repeating what you heard  
15 another witness say today? You don't have any  
16 personal knowledge of that?

17 A. I do not. That particular one I heard in  
18 testimony today as I said in the very beginning.

19 Q. And you don't know whether there's any  
20 suitable land for additional geothermal wells on the  
21 Ohio State campus, correct?

22 A. I did hear testimony on that,  
23 Mr. Alexander, and I was confused by that. So when  
24 you say "suitable land," my understanding of the  
25 geothermal system is they are wells that you sink

1 into the ground at different depths to essentially do  
2 your heat exchange with the mother nature's uniform  
3 temperature resource once you go below a few feet  
4 into the ground. So it's a matter of sinking wells  
5 as opposed to serve contiguous land that would be  
6 acquired. And then, you know, you would have  
7 trenches and piping and all that stuff, of course.  
8 So if you could clarify what you mean by "land," I  
9 may be able to answer your question a little better.

10 Q. Land where a geothermal system could be  
11 installed. You don't know whether there is any  
12 suitable land on the Ohio State Columbus Campus where  
13 a geothermal system could be installed, correct?

14 A. I have not seen an analysis of where it  
15 would be installed but what I did hear reinforces the  
16 idea that geothermal resources exist below the campus  
17 as they must, and as validated by the fact that at  
18 least in limited ways they are being used for certain  
19 residence halls.

20 MR. ALEXANDER: Again, I am going to move  
21 to strike everything after the word "but." We are  
22 now repeating what other witnesses said, and I would  
23 like to focus this conversation on what this witness  
24 knows with his personal knowledge.

25 MS. WACHSPRESS: Your Honor, the witness

1 is offered as an expert on geothermal systems and is  
 2 buttressing his opinion about the plausibility of the  
 3 geothermal systems on the OSU campus, and it's fair  
 4 game to rely on comparable systems at other campuses.

5 MR. ALEXANDER: I didn't ask about other  
 6 campuses. I asked about whether there was suitable  
 7 land on Ohio State's campus. That was the question.

8 MS. WACHSPRESS: Your Honor, the witness  
 9 is testifying to his knowledge. I don't see any  
 10 reason to strike his answer which is responsive to  
 11 the question about what his knowledge is of suitable  
 12 land on the OSU campus.

13 ALJ PARROT: I am going to deny the  
 14 motion to strike.

15 Q. (By Mr. Alexander) Dr. Sahu, do you know  
 16 whether there is any suitable land on the Ohio State  
 17 Campus where geothermal system equivalent thermal  
 18 output to the CHP facility could be located?

19 A. I have not done a personal study of that  
 20 nor have I seen a study done by others on, so I do  
 21 not know the answer to that question.

22 Q. And do you have any personal knowledge  
 23 regarding the geological conditions underneath the  
 24 Ohio State Columbus Campus?

25 A. This one I am going to have to ask you to

1 clarify because you've been sort of asking me  
 2 questions with terms of art. You would have to  
 3 clarify what you mean by "geothermal or geological  
 4 conditions," and if you are still talking about  
 5 geothermal issues, your question is confusing to me.  
 6 Geologic means a whole very broad set of conditions.

7 Q. Well, define it as subsurface.

8 A. Well, that is still very broad,  
 9 Mr. Alexander.

10 Q. So you are unable to answer my question?

11 A. Because I don't understand your question.  
 12 I think I am allowed to ask for clarification of your  
 13 question if -- if I don't understand a question.

14 Q. I asked if you have any knowledge  
 15 regarding the subsurface conditions on the Ohio State  
 16 University Columbus Campus.

17 A. I do have some knowledge, yes.

18 Q. Okay. What do you know?

19 A. I know that subsurface conditions in  
 20 portions of the campus allow for the installation of  
 21 geothermal systems as evidenced by the fact that they  
 22 are being -- they are used for certain buildings on  
 23 campus.

24 Q. How many acres are currently used to  
 25 provide geothermal service to the Columbus Campus?

1           A.    I don't know.  Again, that's a surface  
2 question, not a subsurface question just to clarify,  
3 right?

4           Q.    Correct.

5           A.    I do not know the answer to that.

6           Q.    Have you calculated how much geothermal  
7 would need to be installed to create a viable  
8 alternative to the CHP in this case?

9           A.    Not for Ohio State's needs, I have not.

10          Q.    Have you calculated the -- strike that.  
11                Let's move to page 21, line 29.

12          A.    Can give me a second to get there.  Page  
13 21, you said?

14          Q.    Yes.

15          A.    And which line?  I am there on the page.  
16 Which line?

17          Q.    Line 29.  It starts the conversation.

18          A.    Oh, at the very bottom of the page.  I  
19 understand.

20          Q.    Yeah.  It starts a section here that I  
21 would like to talk about with regard to renewable  
22 resources.

23          A.    Okay.  I understand.  I am there at line  
24 29, yes.

25          Q.    Okay.  So would you agree with me that

1 off-site renewable resources would not provide the  
2 thermal benefits requested by this -- or provided by  
3 the CHP project?

4 A. Right. When I wrote this, I did not  
5 imply and I did not think that you would rely on  
6 off-site electrical generating resources for meeting  
7 the campus's thermal needs, that's correct.

8 Q. And similarly off-site renewable  
9 resources will not provide any reliability  
10 improvements for Ohio State's Columbus Campus.

11 A. Well, that's a little different. When  
12 you say reliability benefits, is that for power? Is  
13 that for heat?

14 Q. Power, yes.

15 A. Okay. I'm switching to power. Well,  
16 what is the baseline? The baseline is the proposed  
17 system and compared to that whether you went with an  
18 alternative renewable resource; is that the two  
19 comparisons?

20 Q. I don't think it matters. Is there any  
21 circumstance in which an off-site generation resource  
22 could improve the reliability on Ohio State's campus?

23 A. Improve the reliability compared to what?  
24 Compared to the proposed project or compared to write  
25 the base conditions now before the project?

1           Q.    Let's take a step back.  For any off-site  
2 generation resource, that generation would be  
3 delivered into the grid and then ultimately wield to  
4 the end customer, correct?

5           A.    That's one of the ways of doing it, yes.

6           Q.    Okay.  And so if the distribution utility  
7 has an outage and unable to deliver that power to  
8 Ohio State, there would be no benefit to Ohio State  
9 to having that power during the period of that  
10 outage, correct?

11          A.    Thank you for clarifying that.  Yes,  
12 under that premise I agree with you, yes.

13          Q.    Okay.  So I guess just ask the question  
14 so we have it clear in the record, an off-site  
15 generation resource would not provide any reliability  
16 benefits on campus in the event of an outage in the  
17 distribution network, correct?

18          A.    I will say in response since you  
19 clarified in my answer an off-site renewable resource  
20 that is delivering power through the grid through the  
21 campus would not provide extra reliability.

22          Q.    Okay.  Now, let's go to where we may have  
23 some more interesting conversation.  At page 22, line  
24 20.

25          A.    I'm sorry.  Which page?  22?



1 Q. 22.

2 A. Uh-huh.

3 Q. Line 20. You include discussion  
4 regarding Ohio State's projection of the costs for  
5 off-site renewable. Do you see that?

6 A. I do see that, yes.

7 Q. Okay. So in this paragraph you reference  
8 Ohio State's delivered costs of \$64 a megawatt-hour,  
9 correct?

10 A. Yes, looking at Ohio State's own  
11 analysis, correct.

12 Q. Okay. And you compare it to a Lazard  
13 estimate for solar power purchase agreements between  
14 \$32 and \$43 a megawatt-hour?

15 A. As one reference, correct, yes.

16 Q. And then your next reference is to an  
17 NREL estimate of \$40 a megawatt-hour?

18 A. That's right. That's on their website  
19 right now, yes.

20 Q. Okay. And you also compared it to a  
21 NIPSCO PPA in Indiana which received 26 bids  
22 averaging \$35.67; is that correct?

23 A. That's right.

24 Q. Now, the Ohio State estimate of \$64 per  
25 megawatt-hour is a retail as delivered cost, correct?

1           A.    That's my understanding is what was  
2 intended, yes.

3           Q.    Okay.  And so that \$64 per megawatt-hour  
4 includes the commodity along with the costs of  
5 delivering the commodity to Ohio State's Columbus  
6 Campus?

7           A.    Well, the table has four line items and  
8 that's what comprises the \$64 per megawatt-hour in  
9 Table 6 as I reference in the study.  And some of  
10 those line items are not spelled out or defined.  
11 I -- your own witness, I think, this morning had some  
12 lack of understanding of some of those, and I too  
13 didn't see definitions, but my understanding is that  
14 \$64 is supposed to be the all-in delivered costs.  
15 That's my understanding.

16          Q.    Are you an expert in PJM charges?

17          A.    I have done some work on other projects  
18 of particular type of PJM charges, but as a broad  
19 general statement, I wouldn't say I am an expert in  
20 all PJM charges.

21          Q.    Absolutely.  Let's stay at a high level.  
22 Would you agree PJM charges market participants a fee  
23 for moving power through the transmission  
24 distribution system?

25          A.    They do, yes.

1 Q. And local distribution utilities also  
2 charge a fee for distributing the power.

3 A. Yes. Nobody wields power for free I will  
4 agree with you.

5 Q. Correct. And similarly regulates  
6 transmission rates for energy and their costs there  
7 as well, correct?

8 A. Yes. Yes.

9 Q. Okay. And so the \$64 given by Ohio State  
10 includes all of those costs, correct?

11 A. That's my understanding. And I use the  
12 words all-in delivered costs within quotes, as you  
13 say, so that's my understanding, correct.

14 Q. Sure. But what I want to drill down on  
15 is the reasonableness of Ohio State's \$35 EPA  
16 estimate because \$35 is below the average Lazard  
17 estimate that you provided, correct?

18 A. Okay.

19 Q. And \$35 is below the NREL estimate you  
20 created, correct?

21 A. Yeah. I said approximately \$40 and their  
22 estimate is actually going down and so I was reading  
23 off of a curve there, yes.

24 Q. Sure. Absolutely. And both the Lazard  
25 and NREL estimates are national averages, correct?

1           A.    Yes.  And some of them are levelized as I  
2   said, yes, that's correct.

3           Q.    And do you know how the number of sunny  
4   days in Ohio compares to the national average?

5           A.    I have not looked at the number of sunny  
6   days in Ohio.  I do know they are comparable to the  
7   number of sunny days in other midwestern states and  
8   European countries, so I at some point ask you about  
9   the relevance of sunny days, but for now I do not  
10   know the exact number, and I suspect it varies even  
11   place to place in Ohio that you would not have the  
12   same number of sunny days however we define sunny  
13   days.

14          Q.    Sure.  And the reason I am asking is the  
15   national averages would include better climates for  
16   solar places like Nevada, Arizona, and California,  
17   correct?

18          A.    Yeah.  National averages include all  
19   climatic -- climatic conditions.  But just to  
20   clarify, the NIPSCO one, of course, is not a national  
21   average, that example that I gave you there.

22          Q.    Well -- right.  I did not include that in  
23   the question for a reason.

24          A.    I hear you.  Yes.

25          Q.    Okay.  So you don't know how the number

1 of sunny days in Columbus, Ohio, compares to the  
2 national average, correct?

3 A. I did not do that comparison.

4 Q. Okay. And, now, let's focus on NIPSCO.  
5 So the NIPSCO PPA was for the state of Indiana,  
6 correct?

7 A. That's right.

8 Q. And none of the bidders in the NIPSCO  
9 auction were located in Ohio, correct?

10 A. I don't remember all the ownership of all  
11 the bidders to tell you the true, so I can't answer  
12 the question.

13 Q. I'll rephrase the question to make sure  
14 it's clear. None of the proposed solar facilities to  
15 be delivered into Indiana were located in Ohio,  
16 correct?

17 A. Again, I could not answer definitively  
18 because I would have to refresh my memory and look at  
19 where all the generation was going to occur for that  
20 project.

21 Q. Please turn to your testimony Exhibit G  
22 and then page 15 within that exhibit.

23 A. Yep. I just opened that. Let me just go  
24 to page 15. Is that -- I'm sorry. Mr. Alexander,  
25 page 15 did you say? 15?

1 Q. I did.

2 A. PDF?

3 Q. It's labeled at the bottom page 15. I am  
4 not sure what the PDF number is. It's a map showing  
5 the distribution of proposals received. Are you  
6 there?

7 MS. WACHSPRESS: I think we lost him.  
8 Your Honor, may I call the witness and see if -- I  
9 don't know how to proceed here, but I don't want to  
10 contact the witness without ensuring it's okay with  
11 your Honor.

12 ALJ PARROT: Yeah. I was just going to  
13 give him a minute here to see if -- the message I'm  
14 getting is that he's got low bandwidth right now, and  
15 I'm guessing you all kind of see that as well, so I  
16 was going to wait just a minute and see. I know he  
17 had mentioned he may try to call in.

18 There he is.

19 THE WITNESS: Hi. I was trying to call.

20 ALJ PARROT: Can you hear us, Dr. Sahu?

21 THE WITNESS: I am so sorry. Do know I  
22 tried to call in but I was on mute so you couldn't  
23 hear me on the phone. I can hear you now.

24 Q. (By Mr. Alexander) Okay. So I am going  
25 to repeat my question just to get us acclimated.

1 MR. ALEXANDER: Karen, are you good?

2 COURT REPORTER: I am, yes.

3 MR. ALEXANDER: I didn't want to go back  
4 until you were ready.

5 Q. (By Mr. Alexander) Okay. Dr. Sahu, isn't  
6 it true that none of the proposals received by NIPSCO  
7 were located in the State of Ohio?

8 A. That's what the map would indicate, yes.

9 Q. Okay. And so based on the three examples  
10 you provided, OSU is actually using a wholesale  
11 commodity cost of solar which is less than each of  
12 the three examples you provided, correct?

13 A. Well, I would have to go back and look at  
14 what was included in some of those because, as I  
15 said, the NREL one is a life -- is an overall  
16 levelized cost, so I can't say that definitively.

17 Q. Would you agree that solar unless paired  
18 with a battery is an intermittent resource?

19 A. Solar has to be -- with some storage, I  
20 would call it generally storage, and battery may be  
21 one form of storage. It would be an intermittent  
22 resource -- resource if it didn't have any storage of  
23 some sort.

24 Q. And you have not included in your  
25 testimony any costs associated with a storage

1 resource, correct?

2 A. I have not in my analysis. I have not  
3 included costs to establish that.

4 Q. So I would like to explore page 23 of  
5 your testimony, the paragraph starting at line 7.

6 A. Page 23, line 7. Okay. Yes. I am  
7 there.

8 Q. You say "The study provides no support  
9 for statements regarding the lack of reliability or  
10 resiliency due to the 'intermittent nature of  
11 renewable generation.'"

12 A. I see that.

13 Q. Okay. But you agree that solar without  
14 being paired with a storage resource is intermittent,  
15 correct?

16 A. Right. It is intermittent just all by  
17 itself, that's correct, and again, I should clarify  
18 here, and this may be a good place to clarify  
19 something you had mentioned before. It is  
20 intermittent, but how long it lasts depends on the ED  
21 technologies and whether they can use sound light or  
22 even after-hours generation. There are -- there is  
23 solar generation contrary to popular myth in the dark  
24 because they rely on infrared part of the spectrum.  
25 It doesn't depend on the visible sunlight that



1 obviously does generate solar so there is generation  
2 across all times. Amount varies, of course. So in  
3 the very strict sense it's how much you generate as  
4 opposed to on/off.

5 Q. Okay. The next sentence you say "other  
6 district energy systems have successfully integrated  
7 renewable generation without undermining reliability  
8 or resiliency." Do you see that?

9 A. I do.

10 Q. By "district energy systems," what do you  
11 mean?

12 A. District energy is kind of a broader term  
13 where you include heating and cooling, all types of  
14 thermal loads primarily, and then in some cases you  
15 can include power, but the reality is district  
16 heating and cooling was initially determined for  
17 thermal loads. We have heating and then cooling  
18 loads, and it is for a particular area. It might be,  
19 you know, a certain part of a city. It might be a  
20 university. It might be an institution. There's  
21 like a prison. It may be, you know, a subdivision,  
22 so it's sort of a geographic district and within that  
23 meet the energy needs.

24 Q. And so if we think of a district energy  
25 system as a microgrid, would that be correct? Would

1 a microgrid be a district energy system?

2 A. You can have within a district a  
3 microgrid to manage your different levels of thermal  
4 and electrical loads, sure. I mean, I am saying you  
5 can have grids that are even down to, you know,  
6 subdistrict level. You know, microgrids are sort of  
7 not a defined term, but you could have a microgrid on  
8 a district level. That's certainly possible. That's  
9 what new microgrids are trying to do.

10 Q. So if a microgrid was powered solely with  
11 an intermittent resource, then that grid would have  
12 reliability problems, correct?

13 A. Oh, if you mean -- just to understand,  
14 you mean you only had intermittent resources, again,  
15 we are not considering storage, then would that have  
16 problems. And just to clarify you are saying storage  
17 nowhere; is that the idea?

18 Q. It is, yes.

19 A. Okay. That's an important clarification.  
20 Then I would agree with you. The reason I said is  
21 because now storage is available at the point of use  
22 and that changes the dynamics quite a bit, especially  
23 in a microgrid.

24 Q. And so when you say district information  
25 systems, did you include something as large as a

1 utility scale or even RTO scale system?

2 A. No. I was referring to institutions, and  
3 district in the way I defined it not regional, not  
4 utility scale.

5 Q. Okay. And so when you say the systems  
6 have integrated renewable generation, are you saying  
7 they've integrated it with purchases from the grid or  
8 something else?

9 A. Purchases from the grid, purchases from  
10 renewable resources on the grid coupled with storage,  
11 particularly thermal storage, on their -- in their --  
12 within their district.

13 Q. But you are not assuming it's a  
14 self-contained district, correct? You are assuming  
15 outside energy to be brought into the district?

16 A. Yeah. I thought the entire premise, I'm  
17 sorry if I lost that somewhere, was renewable or  
18 intermittent, as you put it, electricity generation  
19 that would be coming from outside.

20 Q. Okay. And would you agree that  
21 behind-the-meter solar by itself cannot improve  
22 reliability or resiliency?

23 A. Behind-the-meter solar coupled with  
24 storage can do that. But you need some storage, yes,  
25 and it could be behind-the-meter storage.

1 Q. And so behind-the-meter storage without  
 2 storage would not improve reliability or resiliency,  
 3 correct?

4 A. It probably would not improve  
 5 reliability, that's correct. I have to think about  
 6 resiliency. There is a definition of resiliency.

7 Q. Turning to page 17, line 1 of your  
 8 testimony.

9 A. Let me just get there. If you would give  
 10 me a second. 17, line 1? Yes. I'm there.

11 Q. Do you understand that all of Ohio  
 12 State's assumptions in the application assume that  
 13 natural gas is used to fuel the CHP?

14 A. That's my understanding.

15 Q. And would you agree that the  
 16 environmental benefits of green hydrogen are not  
 17 speculative? They have, in fact, been established?

18 A. Say that question again. One word cut  
 19 out there.

20 Q. Sure. Would you agree that the  
 21 environmental benefits of green hydrogen is not  
 22 speculative? Those have been established.

23 A. And again, just to be clear, green  
 24 hydrogen meaning from the hydrolysis of water to  
 25 create the hydrogen just to be sure? Because I

1 was -- I just want to understand what green hydrogen  
2 is.

3 Q. Yes. As used in your testimony at page  
4 17, line 1.

5 A. And I am just quoting from the Climate  
6 Action Plan there as you can see. And I know there  
7 was some discussion on that in earlier testimony  
8 today. And if you say it is green hydrogen coming  
9 from hydrolysis of water, subject to impacts on the  
10 water side, I understand that it would be from a  
11 carbon standpoint beneficial. That's my  
12 understanding.

13 Q. Do you have any knowledge as to whether  
14 Ohio State procures renewable energy credits today?

15 A. I don't know if it does. I saw mention  
16 of renewable energy credits as an option in looking  
17 at its carbon balance I think in the study, but I  
18 don't know to what extent it procures RECs.

19 Q. I would like to focus on your criticism  
20 of Ohio State's gas forecasts.

21 A. Okay.

22 Q. You have not quantified -- strike that.

23 You have not provided your own forecast  
24 of future natural gas prices, correct?

25 A. I did not because I could not give you a

1 reliable forecast of natural gas prices next year,  
 2 much less for the next 25 years.

3 Q. Do you know what the EIA is?

4 A. Yes, I know who the EIA is.

5 Q. And the testimony does not -- strike  
 6 that.

7 Does the EIA prepare -- strike that.

8 Would you agree that electricity prices  
 9 are strongly correlated to the price of natural gas?

10 A. That's a very broad statement. I don't  
 11 think so. Is it, you know, geographically and so on  
 12 and so forth and what type of electricity prices,  
 13 day-ahead price, you know, there is so much in the  
 14 question I couldn't agree with that on a general  
 15 matter -- or not a general way.

16 Q. Okay. Let's be more specific. Let's  
 17 focus on the PJM LMP, okay, which was --

18 A. Yes.

19 Q. And we are going to focus on the AEP Ohio  
 20 zone --

21 A. Okay.

22 Q. -- which is where Ohio State sits. Are  
 23 you following all these assumptions so far?

24 A. What I heard is PJM grid, locational  
 25 maximum pricing for the LMP, and then you mentioned

1 AEP's system as part of that PJM. Those are the  
2 three I got so far.

3 Q. Okay. And so do you believe that the  
4 electricity price in that zone is correlated to the  
5 price of natural gas?

6 A. I haven't seen recent numbers with the  
7 correlation, so I couldn't tell.

8 Q. Do you know whether electricity is  
9 correlated to the price of natural gas in the PJM  
10 system?

11 A. Same answer but the only other advance is  
12 that since gas currently is about 50 percent of the  
13 PJM generation, I would expect some correlation with  
14 natural gas.

15 Q. And do you know what the marginal price  
16 setting fuel is in the PJM system?

17 A. I don't know that, and I don't know that  
18 that's the same fuel at all times.

19 Q. I will rephrase the question. Do you  
20 know what the marginal price setting fuel is in the  
21 PJM system during most hours of the year?

22 A. I don't know. You know, it could be  
23 renewables in some hours. It could be gas in some  
24 hours. Gas prices have been running very cheap as  
25 you know for the last year, year and a half. They

1 have been sub \$3 per BTU for the longest time. So  
2 renewables I can't say that I've studied that in its  
3 entirety, but given their mix it could vary.

4 Q. And the current Henry Hub price is  
5 roughly a dollar 75; is that right?

6 A. The Henry Hub price is \$1.75 to \$1.80.  
7 After Chesapeake declared bankruptcy, I don't know  
8 what happened to Henry Hub. And now the Saudis have  
9 recently tried to boost the price of oil so there is  
10 so many variables going on. Our LNG plants are not  
11 exporting as much as they thought they would to  
12 China. So there's a number of things that  
13 determines, and as you know, Mr. Alexander, Henry Hub  
14 is but 1 of, you know, 20 some hubs and arguably not  
15 the determinative of something relevant for Ohio  
16 State University's purchases given its location,  
17 although it gets all the attention.

18 Q. I would like to talk about ambient air  
19 quality which -- which is described in your  
20 testimony. Would you agree that the National Ambient  
21 Air Quality Standards are limits on the atmospheric  
22 concentration of six different pollutants?

23 A. Yeah. I didn't count all of them but  
24 there are a number of what we call criteria  
25 pollutants. Each of them has one or more Natural



1 Ambient Air Quality Standards, so collectively there  
2 are many more than six because they have different  
3 averaging times and so on.

4 Q. And the EPA regulations on this result  
5 from the Clean Air Act; is that right?

6 A. Right, the Clean Air Act. And I should  
7 clarify. You characterize them as limits. I  
8 wouldn't -- I don't view them that way. They are  
9 targets or goals is the way I view the National  
10 Ambient Air Quality Standards. They are set pursuant  
11 to regulations from the Clean Air Act, that's  
12 correct.

13 Q. And so the six criteria air pollutants  
14 are ozone, atmospheric particulate matter, lead,  
15 carbon monoxide, sulfur oxides, and nitrogen oxides?

16 A. Right. And there are two different  
17 particulate matter standards for different sizes.

18 Q. And we will get to that in just a moment.  
19 Would you agree that the EPA sets two types of  
20 standards, primary and secondary?

21 A. That's right.

22 Q. And the primary standards are designed to  
23 protect the health of sensitive populations such as  
24 asthmatic children and the elderly?

25 A. Well, it doesn't say that in the statute.

1 It says they are set to protect human health with an  
2 adequate margin of safety.

3 Q. And the secondary standards are concerned  
4 with protecting the environment?

5 A. Different welfare standards so anything  
6 that is not in the primary standards.

7 Q. And so a district meeting a given  
8 standard is referred to as in an attainment area; is  
9 that correct?

10 A. Right. If an area meets or is projected  
11 to meet, it's called being in attainment is the way I  
12 think about it.

13 Q. If you do not meet the standard, you are  
14 considered a non-attainment area?

15 A. Yeah, non-attainment or marginal area,  
16 that's correct.

17 Q. And would you agree that the standards  
18 are required to reflect accurately the latest  
19 scientific knowledge?

20 A. Right. That's why they are periodically  
21 updated every five years.

22 Q. And they are updated every five years by  
23 the Clean Air Scientific Advisory Committee?

24 A. Well, the Clean Air Scientific Advisory  
25 Committee only recommends. Ultimately they are --

1 the decision is by EPA. As evidenced just yesterday,  
2 the administrator reaffirmed the ozone standard.  
3 Just literally yesterday Mr. Wheeler, who is the  
4 administrator of the EPA, reaffirmed the ozone  
5 standard. So the CASAC recommends, and the EPA  
6 ultimately is the agency, of course, that adopts it.

7 Q. And so the CASAC makes recommendations  
8 and then there's a public comment period, correct?

9 A. Yes. That's subject to public review.

10 Q. And then those rules are finalized by the  
11 EPA?

12 A. Those rules are finalized, they are  
13 litigated, and ultimately the courts decide but  
14 that's the way it's been at least for the last  
15 several years.

16 Q. And Sierra Club actually litigates those  
17 rules regularly, correct?

18 A. I don't know. You will have to check.  
19 Sierra Club is but one of many folks, and I think to  
20 be fair folks from all sides have litigated. I mean,  
21 people who want the levels to be lower and some  
22 people want them to be higher. So there is -- I  
23 wouldn't agree with that. If you look through  
24 history, there are large numbers of groups on both  
25 sides who want different outcomes who litigate them

1 depending on whether they think it's set in the right  
2 place or not.

3 Q. Let's focus on the particulate matter.  
4 So the first rule is PM10 which is particles of 2.5  
5 microns to 10 microns; is that correct?

6 A. No. The PM10 is all particles PM10  
7 microns and below.

8 Q. Thank you. Okay. And then PM2.5 is 2.5  
9 microns and less, correct?

10 A. Right. And these are all aerodynamic  
11 diameters which is a whole separate thing but, yes,  
12 that's correct.

13 Q. And the primary standard for PM2.5 is  
14 12 microns?

15 A. Yes. I believe that's the annual  
16 standard, that's correct. Now, there's also a  
17 24-hour standard.

18 Q. Turning to your testimony page 4, line  
19 21.

20 A. Page 4?

21 Q. Page 4, line 21.

22 A. I am just trying to get to that page.  
23 Okay. I am there.

24 Q. You say -- I believe it's actually line  
25 19. I had the wrong reference there. You say "PM2.5

1 is a dangerous pollutant, for both respiratory and  
 2 cardiac systems at any level of incremental  
 3 exposure." Do you see that?

4 A. I do.

5 Q. And then again at turning to page 9, line  
 6 28.

7 A. Yes. I see that. I am on line 28.

8 Q. You say "There is no safe threshold for  
 9 PM2.5." Do you see that?

10 A. Yes.

11 Q. And then turn to page 14, line 4.

12 A. Line 4, yes. I'm there.

13 Q. You state that "The report assumes that  
 14 levels at or below the NAAQS are safe. I disagree."  
 15 Do you see that?

16 A. I do see that.

17 Q. So would I be correct in interpreting  
 18 these -- these statements that you believe that  
 19 levels at or below the PM2.5 standard could be  
 20 unsafe?

21 A. That they have adverse health effects,  
 22 that's what I meant. That's correct. Even at very,  
 23 very low thresholds or very, very low levels, that  
 24 current science does not show that there is a safe  
 25 threshold below which they will be of no concern from

1 a health standpoint.

2 Q. So you believe that even something which  
3 was half of the National Ambient Air Quality Standard  
4 could still be not a safe threshold?

5 A. That's right. That even at a level that  
6 is half of the National Ambient Air Quality Standard,  
7 there is still an incremental adverse health outcome  
8 when one is exposed to that level, half the level,  
9 that's correct.

10 Q. And so does that mean you believe all new  
11 sources should have zero emissions of PM2.5?

12 A. No, that's not what I said. I am just  
13 recognizing for -- the toxicological evidence and  
14 science for what it is and how that is translated  
15 into policy for new sources is a different question.  
16 So all the questions that you asked you pointed me to  
17 those are science questions. That's what -- PM2.5 is  
18 fine particles that go deep into our lungs. We don't  
19 have mechanisms to sort of trap them, if you will, in  
20 our respiratory system. That's the -- that's the  
21 evidence. The second question I do not believe that  
22 to be the case.

23 Q. Turning to your footnote 16, you include  
24 a series of citations to articles about PM2.5. Do  
25 you see that?

1           A.    Yeah.  That was just a very small subset  
2 of that universe of literature.  That is what I would  
3 say.  That's correct.  I see that.  I put some of  
4 them there.

5           Q.    And then at footnote 17 you include a  
6 series of filings going back to 2005 regarding PM2.5,  
7 correct?

8           A.    Right.  That's context.  2.5 has not been  
9 regulated as a NAAQS probably in a little over 20  
10 years now, '97 or thereabouts, so relatively sort of  
11 the newest member of the six or seven pollutants you  
12 are talking about.

13          Q.    And so the EPA reports you cite in  
14 footnote 17 are from 2005 to 2012, correct?

15          A.    Correct.

16          Q.    In 2013, the EPA adopted the current  
17 PM2.5 standard, correct?

18          A.    That's right.

19          Q.    And that was the Obama Administration?

20          A.    That's correct, yes.

21          Q.    Okay.  And then in April of 2020, the EPA  
22 issued a notice of proposed rulemaking on PM2.5,  
23 correct?

24          A.    Right, right.

25          Q.    And that notice of proposed rulemaking

1 anticipates retaining the current standard?

2 A. I don't remember that but -- I don't  
3 remember the language, but I think that is correct.  
4 I just haven't verified that.

5 Q. Okay.

6 A. I'm sorry to say usually when EPA puts  
7 out those, they do have alternative levels, and they  
8 may recommend one. They may say here are the  
9 options.

10 Q. So would you agree that the EPA took the  
11 scientific evidence cited in your testimony into  
12 account when it issued the Ambient Air Quality  
13 Standard in 2013?

14 MS. WACHSPRESS: Objection, your Honor.  
15 Lack of knowledge for what the energy efficiency  
16 programs did or did not take into account.

17 MR. ALEXANDER: I'll rephrase the  
18 question.

19 Q. (By Mr. Alexander) Would you agree all of  
20 the information cited in your footnote 17 including  
21 the letter from the Director of the EPA Gina McCarthy  
22 was available to the EPA when it made its decision in  
23 2013 regarding the PM2.5 standard?

24 ALJ PARROT: Looks like the witness is  
25 having some technical issues again. Let's see.



1 Dr. Sahu, can you hear us?

2 THE WITNESS: I can hear. Can you hear  
3 me now?

4 ALJ PARROT: I can.

5 THE WITNESS: Sorry about that. I don't  
6 know about this little momentary glitches. I think  
7 we need to improve the reliability and resilience of  
8 a different system but that's all I can say. I could  
9 hear -- I could see you. That's so funny. But I  
10 could hear you. Can you hear me now? In which case  
11 we can continue.

12 ALJ PARROT: Yes.

13 MR. ALEXANDER: Karen, can you please  
14 read the question back when you have a moment?

15 (Record read.)

16 A. You want me to respond, Mr. Alexander?

17 Q. Yes, please.

18 A. Okay. The answer is yes. It was going  
19 beyond and saying the Science Advisory Committee  
20 considers that and a lot of other information in the  
21 making a recommendation.

22 Q. Okay. Let's apply that background we  
23 just did to the facts of this case. So frankly --  
24 frankly Franklin County is currently in attainment  
25 for all National Ambient Air Quality Standards,

1 correct?

2 A. That's my understanding.

3 Q. And you attach the TRC study to your  
4 testimony as Exhibit D, correct?

5 A. Yeah. I can go -- just to be clear  
6 that's the July 6 one we got most recently?

7 Q. It is, yes.

8 A. Yes, yes.

9 Q. And TRC found that the CHP project would  
10 have a negligible impact on adjusting air quality,  
11 correct?

12 A. That's their conclusion, yes.

13 Q. And let's focus on PM2.5.

14 A. Okay.

15 Q. TRC found a total project impact of less  
16 than .44 percent above the 24-hour background  
17 concentration?

18 A. Yes. Again, that's what's reported. My  
19 understanding is they analyze many different  
20 scenarios, and then they have chosen a scenario to  
21 present and that's their value. Just to be sure  
22 that's the Korbelt Avenue line I think in the table on  
23 page 6 that you are reading, Mr. Alexander, just to  
24 be on the same place.

25 Q. Okay.

1           A.    That's what they say, yes.

2           Q.    Yes.  And then the annual background  
3 concentration is less than .13 percent above the  
4 annual background?

5           A.    I didn't verify the math but that's  
6 what's reported there, yes.

7           Q.    And let's talk about NO2.

8           A.    Okay.

9           Q.    That is less than .66 above the one-hour  
10 background concentration?

11          A.    That's what is shown in the table, yes.

12          Q.    And there was no PSD required for this  
13 pollutant, correct?

14          A.    Yeah.  It was one ton less than the  
15 trigger.  It's 39 tons, and the trigger is 40 tons.  
16 That's my understanding.

17          Q.    And NO2 is less than .05 percent above  
18 the annual background concentration?

19          A.    Again, that's what TRC has said here in  
20 their July 6 memo.

21          Q.    And let's talk about ozone.

22          A.    Okay.

23          Q.    Ozone was less than .13 percent above the  
24 monitored background concentration on an 8-hour  
25 basis?

1           A.    Yes.  And with ozone, they did not  
2 actually model ozone.  I want to state that for the  
3 record.  Their analysis they are reporting shows  
4 that.

5           Q.    And no PSD was required for ozone as  
6 well, correct?

7           A.    Well, ozone really doesn't have a PSD.  
8 You either do it based on NOx or POCs which are the  
9 two precursor pollutants, so my understanding is  
10 neither one of them required PSD based on the  
11 emission calculations done by OSEP.

12          Q.    And TRC also strictly identified  
13 sensitive receptor locations including the Ohio State  
14 Medical Center, correct?

15          A.    That's my understanding, yes.

16          Q.    And it found the highest predicted  
17 impacts at those sensitive locations are only  
18 minimally above the background concentration?

19          A.    That's their -- that's one of their  
20 conclusions, yes.

21          Q.    And they found that the highest predicted  
22 impact at a sensitive receptacle location represents  
23 less than 1 percent of the primary NAAQS established  
24 to protect?

25          A.    Yeah.  I don't know the number if you are

1 reading off somewhere but that's -- if you can tell  
2 me where the 1 percent is then, maybe I will agree  
3 with you absolutely. Otherwise, they said small  
4 value, yes. The only reason I say that on page 4  
5 there are tables. Some of the values are, you know,  
6 5.8 percent and so on. I just want to be sure what  
7 you are talking about.

8 Q. I am going to move on. I don't have the  
9 site in my notes, so I am going to move on. If we  
10 went outside where are --

11 MR. MENDOZA: Your Honor, can I interject  
12 for a second? I think my co-counsel, Ms. Wachspress,  
13 seems to have lost the connection. I don't see her  
14 on here anymore.

15 MS. WACHSPRESS: I can hear you, and I am  
16 trying to speak right now. Can you hear me?

17 ALJ PARROT: I can hear her and see her  
18 both so.

19 MR. MENDOZA: So I'm sorry. I was  
20 worried that our witness was unprotected by any  
21 attorney, and so I was going to offer to speak. I am  
22 going to go back to being quiet now.

23 MR. ALEXANDER: Thanks, Tony.

24 Q. (By Mr. Alexander) Okay. So if we went  
25 outside, would there be in the ambient air in

1 Columbus, Ohio, today PM2.5 particles in the air we  
2 breathe?

3 A. There would be 2.5 particles in the air  
4 you breathe in Columbus, yes, today or any place any  
5 day, that's correct.

6 Q. You note at page 12, line 13, that Ohio  
7 state received an exemption to do the PSD analysis.  
8 Do you see that?

9 A. Yes.

10 Q. That exemption is permitted under Ohio  
11 law, correct?

12 A. Yeah. Ohio law, Ohio rules, I forget,  
13 but, yes, under Ohio authorities.

14 Q. An exemption was certainly approved by  
15 the Ohio EPA?

16 A. Yes. I've seen a letter to that effect,  
17 yes.

18 Q. And you are not provided any opinion here  
19 today that the Ohio EPA erred or somehow violated the  
20 law by issuing the exception?

21 A. I am not.

22 Q. Moving down, page 12, line 21, you say  
23 none of the air quality impacts in this analysis,  
24 "none of the air quality impacts of the project such  
25 as those noted in the previous response, except for

1 PM modeling, have been analyzed or quantified." Do  
 2 you see that?

3 A. I'm sorry. You were a little muffled so  
 4 tell me which lines and I will certainly get there.

5 Q. Sure. It's lines 20 to 22, that  
 6 sentence. Let me just read that very quickly, if you  
 7 don't mind.

8 A. Yes. I read that now.

9 Q. Do you have a copy of the application in  
 10 front of you?

11 A. I can find it. Are you talking about the  
 12 application to the Siting Board or application to --

13 Q. Yes, to the Siting Board.

14 A. I had it here so let me. Yes, I have it.

15 Q. Could you please turn to page 54 and  
 16 focus your attention on Table 16.

17 A. 54. This is numbered page 64, right?

18 Q. 54.

19 A. 54, 5-4?

20 Q. And focusing on Table 16 on that page.

21 A. Oh, I'm sorry. I was in the Staff  
 22 Report. I have to go back to the application. Just  
 23 give me a second. I'm not there yet.

24 MR. MARGARD: Your Honor, Mr. Lindgren  
 25 has been kicked off. He is trying to reconnect. If

1 we can allow him to do that, that would be good.

2 ALJ PARROT: He can do that. Let's hold  
3 right here.

4 MR. MARGARD: Has to do with our office's  
5 VPN. I am not on the VPN connection. So he is  
6 trying to reestablish.

7 THE WITNESS: Yeah. I had that open, and  
8 it disappeared on me. I am trying to get it back.  
9 That's not the one. I have too many things open  
10 here.

11 MR. MARGARD: Take your time. We are  
12 still waiting for my colleague to rejoin so.

13 THE WITNESS: Okay. Okay. Thank you.  
14 I'll find it here. I have found it now. This is the  
15 November 6, 2019, application, Mr. Alexander,  
16 correct?

17 Q. Correct. Doctor, could you just wait  
18 just a minute while we are waiting for counsel?

19 A. Oh, yeah.

20 ALJ PARROT: Hang on a moment.

21 MR. MARGARD: I see his face. Tom,  
22 you're muted. Why don't you unmute and let us know  
23 you are back.

24 MR. LINDGREN: Yes. Thank you. I am  
25 back.



1 MR. MARGARD: Thank you, your Honor.

2 ALJ PARROT: Very good. Go ahead,

3 Dr. Sahu.

4 Q. (By Mr. Alexander) All right. So,  
5 Dr. Sahu, I had -- before the break I had directed  
6 you to Table 16 of the application.

7 A. I'm there.

8 Q. Are you there?

9 A. I am there. I found it.

10 Q. Okay. What is SO<sub>2</sub>?

11 A. That is sulfur dioxide.

12 Q. Does sulfur dioxide have an air impact,  
13 an air quality impact?

14 A. Yes, it does.

15 Q. What is NO<sub>x</sub>?

16 A. NO<sub>x</sub> is commonly shorthand for two  
17 different oxides of nitrogen, NO and NO<sub>2</sub>, so they are  
18 collectively all NO<sub>x</sub>.

19 Q. And does NO<sub>x</sub> have an air quality impact?

20 A. Yes. NO<sub>x</sub> has an adverse air quality  
21 impact in many different ways, just like sulfur  
22 dioxide.

23 Q. What is CO?

24 A. Carbon monoxide.

25 Q. Does carbon monoxide have an air quality

1 impact?

2 A. Yes. It's asphyxiation at high levels so  
3 it does.

4 Q. And what is VOC?

5 A. Volatile organic compounds.

6 Q. And do all organic compounds have an air  
7 quality impact?

8 A. Yes.

9 Q. And what is finally CO2?

10 A. That's carbon dioxide.

11 Q. And carbon dioxide does not have an air  
12 quality impact, correct?

13 A. It has climate impacts but defined as  
14 regional or other, it has -- it does not -- it has  
15 climate impact which, in turn, have air quality  
16 impacts.

17 Q. Okay. So you believe CO2 does have air  
18 quality impacts.

19 A. Not directly but through the process of  
20 impacting the climate.

21 Q. Sure. And I am not trying to debate  
22 climate change. I am just trying to understand your  
23 testimony. So isn't it true that the air quality  
24 impacts of the project were, in fact, analyzed and  
25 quantified as shown through this table?

1           A.    The air quality impacts of these  
2 pollutants were.  There are, of course, other  
3 pollutants that do not have National Ambient Air  
4 Quality Standards.  Many more, in fact.  I would  
5 agree that -- not the air quality impacts.  This  
6 table shows the emissions inventory, that's what we  
7 would call it.  The emissions inventory was done for  
8 these pollutants that are shown here, the seven.  The  
9 impacts, you take that and translate it to these  
10 increased concentrations that one does to modeling.

11           Q.    And the TRC report issued on July 6  
12 provides NO2 and ozone modeling results as well,  
13 correct?

14           A.    Yes, it does.

15           Q.    Do you know what a MAGLC or maximum  
16 acceptable ground level concentration is?

17           A.    Well, when you run a model, you are just  
18 trying to predict the concentration that different  
19 receptors usually in a grid and/or in different  
20 sensitive receptors and then you can look at the  
21 variation of that and find out where you are  
22 predicting maximum impact is.

23                    So that's what it is.  That's the maximum  
24 predicted ground level impact.  You do these  
25 typically at ground level, reading level, if you

1 will. So that's what that represents.

2 Q. And so could there be air quality impacts  
3 at ground level?

4 A. Yes. There could be.

5 Q. And didn't Ohio State do a MAGLC in this  
6 case for ammonia?

7 A. They may have. I don't recall the  
8 particular circumstances, but they could have, yes.

9 Q. Could you please turn to Exhibit N of  
10 your testimony.

11 A. Is that N for Nancy?

12 Q. It is, yes.

13 A. Okay. Let me just get there. Okay.  
14 Yes.

15 Q. And is Exhibit N a copy of the permit to  
16 install for the facility at issue in this case issued  
17 by the Ohio EPA on October 25, 2019?

18 A. Yes. The cover is October 25, yes.  
19 That's the one.

20 Q. Okay. Could you please turn to page 20  
21 of that permit.

22 A. Again, this is the actual page 20?

23 Q. Yeah, page 20 of 29 at the bottom.

24 A. Yeah. I am strolling through here.  
25 Okay. I'm there.

1 Q. Does this refresh your recollection as to  
2 whether a MAGLC was done for ammonia?

3 A. It does. Thank you for pointing that  
4 out.

5 Q. So, yes, one was done?

6 A. Yes.

7 Q. Okay. And how did the calculated MAGLC  
8 for ammonia compare with the standard?

9 A. Well, this -- according to the analysis,  
10 it shows the concentration of 12.4 and then the  
11 concentration limit is 405. So those are the two  
12 numbers, 12.4 as compared to the 405 micrograms per  
13 cubic meter.

14 Q. Next, I would like to address your  
15 discussion regarding the AERMOD Dispersion Modeling  
16 Program. Let's start at page 13 of your testimony,  
17 line 14.

18 A. Yeah. Let me just go back to my report.  
19 Page 13, did you say, Mr. Alexander?

20 Q. Yes, the table that's --

21 A. Yeah. Okay. Yes. Yes, I see that  
22 there.

23 Q. So this table you pulled from the  
24 application filed by Ohio State in this case?

25 A. Yes, I believe so. It's the same number,

1 Table 18 and that.

2 Q. And the application cites to the Ohio EPA  
3 Engineering Guide No. 69 to determine the acceptable  
4 ambient air quality impacts for minor sources,  
5 correct?

6 A. That's what it does, yes.

7 Q. And is that Ohio EPA guidance where you  
8 obtained the acceptable value figures provided in  
9 your testimony of 4.5 micrograms per cubic meter?

10 A. I did not question that I reproduced that  
11 table. The table already had that value in it.

12 Q. Okay. And the table, Table 18,  
13 represents "the worst case results predicted from  
14 five individual years of hourly meteorological data  
15 used in the analysis."

16 A. That's what it does. That's what it  
17 claims to do, that's correct.

18 Q. And the values included in Table 18 are  
19 outdoor readings, correct?

20 A. Yeah. These are ambient impacts, that's  
21 correct.

22 Q. And so for an indoor facility like a  
23 hospital, the values would be different due to the  
24 filtering and other things done inside the hospitals.

25 A. Right. We are talking about ambient

1 impacts. That means these are exposures that  
 2 happened in the ambient air, that's correct.

3 Q. So looking at the annual standards first,  
 4 staying in Table 18 here.

5 A. Okay.

6 Q. The highest value using that worst case  
 7 assumption was .18; is that correct?

8 A. According to the modeling that was  
 9 submitted, yes, that's what's reported on that last  
 10 column.

11 Q. All right. And the acceptable value is  
 12 less than 2, correct?

13 A. Yes.

14 Q. And for 24-hour compliance the highest  
 15 value under again the worst case scenario modeling  
 16 using the past five years was 3.9; is that correct?

17 A. That's right.

18 Q. And the acceptable value is 4.5?

19 A. That's what it says. Again, when I am  
 20 agreeing with you, I am just saying that's the  
 21 acceptable value that has been used subject to the  
 22 caveat that we've talked about for PM2.5 earlier that  
 23 it does not have a safe threshold.

24 Q. And at page 13, line 14, you say Ohio  
 25 State's modeling is incomplete and misleading,

1 correct?

2 A. That's right.

3 Q. Is it your belief that Ohio State should  
4 have conducted modeling at load factors below  
5 75 percent?

6 A. Yes.

7 Q. Is there anything which required Ohio  
8 State to do such modeling?

9 A. Well, they are making a claim these are  
10 worst case and that's plainly not demonstrated by  
11 going to even lower load factors.

12 Q. My question was is there anything which  
13 requires Ohio State to do this model?

14 A. My understanding is they did the modeling  
15 in order to show worst case impacts and what they are  
16 showing is not worst case impacts. So they did the  
17 modeling. They are claiming that it is worst case  
18 impacts, and I am just disagreeing with you.

19 Q. My question was is there anything which  
20 required Ohio State to do modeling below 75 percent?

21 A. I couldn't answer one way or the other.  
22 I have given you the best answer I can regarding the  
23 misrepresentation that these are maximum impacts, but  
24 I can't answer beyond that.

25 Q. And you don't know whether Ohio State did



1 modeling below 75 percent, correct?

2 A. I can only go by what's in the record. I  
3 didn't see that stated anywhere.

4 Q. In your testimony at page 9, line 7 --

5 A. Yes.

6 Q. -- you --

7 A. Page 9, I'm sorry. Let me just go there.  
8 Page 9, line 7, okay.

9 Q. You included a discussion of the tons per  
10 year to be admitted by the facility. Do you see  
11 that?

12 A. You mean that paragraph beginning on line  
13 7 on that page?

14 Q. I do, yes.

15 A. Okay. Sure. I'm there.

16 Q. So all the values included in this  
17 paragraph are based on the plant's potential to emit,  
18 correct?

19 A. Yes, that's what they are supposed to do,  
20 correct.

21 Q. And so all of those values assume the  
22 facility is running at 100 percent load, with  
23 100 percent duct firing, 8,760 hours per year,  
24 correct?

25 A. I don't know that those have all been

1 made but that would be the customary way of doing it  
2 potentially, that's correct.

3 Q. Potential to emit values are actually  
4 required as part of the Ohio EPA permit application  
5 process, correct?

6 A. I believe that to be the case, yes.

7 Q. And the TRC report includes different  
8 values?

9 A. TRC report, yes, includes different  
10 value.

11 Q. And I would now like to focus on the  
12 AERMOD model used by Ohio State. Would you agree  
13 that AERMOD is an acceptable modeling program?

14 A. Yeah. Currently it is an acceptable  
15 program, acceptable model computer program, if you  
16 will.

17 Q. And you disagreed with Ohio State's use  
18 of that model because there's no meteorological data  
19 specific to the Ohio State University Campus  
20 collective, correct?

21 A. Well, I should clarify the semantics here  
22 because they are important. There is the model  
23 itself but in order to -- for the model to run, you  
24 need to give it input data and meteorological data is  
25 one of the inputs to that model, so I agree that that

1 may be a suitable model, now you have to feed it, so  
2 to speak, with input data and the met data, as we  
3 say, is one of them.

4 Q. I did not on review of your CV notice any  
5 training in meteorology. Do you have any specific  
6 training in that area?

7 A. Yeah, about 20 years of modeling but I  
8 did not get a degree in meteorology. I do have a  
9 degree in mechanical and environmental engineering as  
10 part of the Ph.D. work where I worked exclusively  
11 with Caltech's meteorological and atmospheric  
12 chemistry departments. So that would be the answer  
13 plus about 20 years of practice on actual modeling.

14 Q. And you have not done any modeling in  
15 this case of the meteorological conditions on the  
16 Ohio State Campus, correct?

17 A. Again, I keep getting confused by your  
18 question. I mean, meteorological data is an input.  
19 I have not done the modeling.

20 Q. I apologize. I just want to clarify the  
21 question, that's all.

22 A. I did not do any modeling; and,  
23 therefore, I did not include any meteorological data  
24 in any such modeling.

25 Q. I am going to reask the question just so

1 the record is clear. I accidently spoke over you  
 2 there. Isn't it true that you have not collected any  
 3 meteorological data in this proceeding?

4 A. That is correct.

5 Q. Isn't it true that Ohio State is required  
 6 by Ohio law to use the AERMOD model or similar model  
 7 approved by the EPA?

8 MS. WACHSPRESS: Objection, calls for a  
 9 legal conclusion.

10 A. Yeah. I don't know the answer to that.  
 11 All I can say is AERMOD is a widely acceptable model.

12 ALJ PARROT: Dr. Sahu, I am going to  
 13 advise you to wait until your counsel's objection has  
 14 been ruled on.

15 THE WITNESS: I'm sorry, your Honor.  
 16 Thank you.

17 ALJ PARROT: Let's just go ahead,  
 18 Dr. Sahu, you are not an attorney; is that correct?

19 THE WITNESS: That's correct.

20 ALJ PARROT: So in giving the answer you  
 21 just did, you were not offering a legal view on that  
 22 issue to the Board, were you?

23 THE WITNESS: I am not, and you can count  
 24 all of my testimony as a technical person and not a  
 25 legal person.

1 ALJ PARROT: All right. With that the  
2 objection is overruled.

3 Go ahead, Mr. Alexander.

4 Q. (By Mr. Alexander) Page 14, line 32.

5 A. Line 32, let me just get there. Okay.  
6 I'm there.

7 Q. Here you reference the modeling results  
8 presented by OSU are also unreliable because they  
9 include concentrations collected at monitors 2 miles  
10 from the proposed site. Do you see that?

11 A. I do.

12 Q. Now, the Ohio EPA has collected those  
13 background concentrations over years of monitoring,  
14 correct?

15 A. Not that many years actually, just a  
16 couple years what I -- my review showed it is not a  
17 very long number of years that they have been  
18 collecting PM2.5 data. And that varies between their  
19 monitor to monitor so it's not -- yeah, but my  
20 recollection is 2017, 2018 perhaps, so not a lot of  
21 years.

22 Q. Are you aware that TRC used the previous  
23 five years of data in its model?

24 A. I think we are confusing two things,  
25 Mr. Alexander. They used five years of

1 meteorological data, and here we are talking about  
2 background data.

3 Q. The Korbelt Road monitor, is that the  
4 closest monitor to the proposed CHP site?

5 A. Yeah. That appeared to be from when I  
6 looked at the three or four monitors that are in the  
7 greater Columbus area.

8 Q. And have you done any study of the  
9 differences between the Korbelt Road site and the site  
10 where the CHP is proposed to go?

11 A. Well, I don't know what you mean by  
12 study. I know the locations of the two of them so  
13 that's -- that's the relevant factor here. One of  
14 the relevant factors is location of the monitor and  
15 the location of the proposed CHP site.

16 Q. And in this case there is approximately a  
17 2-mile distance between the monitor and the proposed  
18 site, correct?

19 A. Yes. Approximately, that's correct.

20 Q. And the Korbelt Road site is next to U.S.  
21 Interstate 71, correct?

22 A. And that's where I would disagree. I  
23 looked at that very closely. There is at least half  
24 a mile where the Korbelt Road site is next to the park  
25 and it's about, give or take, at least half a mile

1 west of the 71.

2 Q. So are you aware of the differences in  
3 traffic volumes between Interstate 71 and Interstate  
4 315?

5 A. I don't, but again, the site is very  
6 close to 315. The Korbek Road location is quite a  
7 bit distant from 71, so I did not need to look at  
8 traffic volumes of 71 versus 315.

9 Q. If the Korbek Road site had a higher  
10 traffic volume of tractor-trailers, could that impact  
11 the results of that monitoring station?

12 A. It could but experience shows and data,  
13 not experience, and I have done 25 years of this,  
14 that the impacts of highways and traffic extend  
15 typically to about 500 to some -- 5, 6 hundred meters  
16 so that would be that much distance from either side  
17 of major roads. Like I said, I was very curious  
18 about where Korbek Road was in relation to the  
19 highway, and it is substantially farther away from 71  
20 as opposed to where the site is in relation to 315.

21 Q. Go to page 16, line 12.

22 A. Page 16, did you say? I'm sorry.

23 Q. Yes, line 12.

24 A. Okay. I am there.

25 Q. Here you claim that Ohio State had

1 proposed technology and the levels that Ohio State  
2 determined to be BACT for NOx are not, since other  
3 agencies have determined that lower levels are.

4 A. You got muffled there at the end. I  
5 understand. I got most of it.

6 Q. Sure. I am just generally getting you to  
7 this paragraph.

8 A. Yeah. I am there already.

9 Q. This paragraph you base your conclusion  
10 on a 2013 permit issued by the state of New York,  
11 correct?

12 A. As an example, yes. I've cited to the  
13 NYSDEC permit, right.

14 Q. Okay. So let's talk about what these  
15 terms mean. What does BACT mean?

16 A. BACT in the federal rules means best  
17 available controlled technology.

18 Q. And what is that?

19 A. Well, there's a definition in the  
20 regulations but BACT is a level of emissions. It's  
21 not controlled. I guess the level of emissions that  
22 is the maximum degree of pollutant reduction subject  
23 to meeting technological feasibility and cost  
24 effectiveness criteria.

25 Q. And what is the difference between BACT



1 and BAT?

2 A. Well, typically BAT is similar to BACT,  
3 but it may be a little less stringent, although in  
4 this case my understanding is Ohio State's position  
5 is meeting BAT also stands in for meeting BACT.

6 Q. And so is BAT, or best available  
7 technology, what would apply when an area is in  
8 attainment?

9 A. Right. Right, that -- that is correct.

10 Q. So BACT would be one level more stringent  
11 than BAT, correct?

12 A. Well, BACT as well would apply for areas  
13 in attainment in the federal resource review ESD  
14 programs, so BACT is really for attainment areas as  
15 well.

16 Q. But it's more stringent than BAT,  
17 correct?

18 A. It could be. I mean, the thing is BAT  
19 definitions, the many states, Pennsylvania uses BAT  
20 differently than Ohio, and many states have BAT  
21 definitions. They are all slightly different. And  
22 you would have to be a talmudic scholar to get into  
23 all the differences, but yes. But they both stand in  
24 for attainment areas, attainment areas.

25 Q. And now let's add in LAER, or lowest

1 achievable emissions rate. Can you explain what that  
2 is?

3 A. Lowest achievable emission rate is again  
4 another level of emissions control that applies  
5 typically in -- it applies in non-attainment areas.

6 Q. And so if a facility were to be built in  
7 a non-attainment area, it would have to meet that  
8 most stringent standard in order not to have an  
9 additional adverse effect on the non-attainment area;  
10 is that the concept?

11 A. That's the concept.

12 Q. Okay. So using the example you gave for  
13 this plant, that permit was issued in a  
14 non-attainment area, correct?

15 A. Yes. That particular permit was issued  
16 in that example for a non-attainment area.

17 Q. Has -- to your knowledge has any state  
18 determined that this technology is the best available  
19 technology, or BAT, rather than the lowest achievable  
20 emissions rate technology, or LAER?

21 A. Yes. There are plenty of examples and,  
22 like I said, that was only one example and I should  
23 just clarify one thing, and I think it's fair to  
24 clarify, when you do a BACT analysis, you look at all  
25 technologically feasible options and even

1 technologies that have been determined to be LAER are  
2 included in a BACT analysis, unless they are ruled  
3 out to be not cost effective, just part of the  
4 formalism. The BACT analysis requires consideration  
5 of all technologically feasible options ranked from  
6 top to bottom.

7 If you follow the so called top down  
8 method and you start with technologies that have been  
9 met as LAER, now in some cases when you then go to  
10 the next steps in the analysis what was LAER, the  
11 more stringent technology might fall out of  
12 consideration because it may be deemed to be not cost  
13 effective, and you might be left with a BACT that is  
14 different than LAER.

15 But as a practical matter, LAER  
16 technologies and levels are included in BAT analyses  
17 unless they can be sort of rejected later on in the  
18 analysis. So this idea they are sort of like two  
19 ships that don't cross each other or pass each other  
20 is a little bit different than how the analysis is  
21 done.

22 Q. Yeah. And this question I am focusing  
23 specifically on the technology referenced in this  
24 paragraph at page 16 of your testimony.

25 A. Yes, yes.

1           Q.    To your knowledge, has any state  
2 determined that that technology is the best available  
3 technology rather than the lowest achievable  
4 emission?

5           A.    Yes, that is.  And again, just to be  
6 clear these are -- technologies, you keep saying the  
7 word technology and that is correct because the word  
8 technology appears in BACT but it's actually emission  
9 levels.  If you look at my exclusions, I'm not  
10 questioning whether dry low NOx monitors and SCR are  
11 the proper technology.  Indeed they are, that  
12 combination, but they have been found -- the same  
13 combination has been found to achieve lower emission  
14 limits than the 3 PPM that have been achieving 2 PPM  
15 and not just in the particular permit I cited.

16                   Incidentally, I worked on that permit in  
17 terms of comments.  I'm familiar with that permit,  
18 the 2013 NYSDEC permit.  That's why I had it handy to  
19 probe as a reference but, yes, other jurisdictions  
20 have determined BAT -- BACT at the 2 parts per  
21 million levels for capacity.

22           Q.    What states specifically?

23           A.    Massachusetts has some.  New Jersey has  
24 some.  California some districts have them.  So there  
25 are a number of states.  It's not just one.  And they

1 could even be Texas, if memory serves. They were  
2 having some combined cycle power plants be permitted  
3 there.

4 Q. Do you know if the Ohio EPA is required  
5 to issue air emissions permits which comply with the  
6 NAAQS or PM2.5.

7 A. My understanding is, yes, at a minimum  
8 they have to show that they have to meet NAAQS.

9 Q. By the Ohio EPA?

10 A. Yeah.

11 MR. ALEXANDER: Your Honor, may we go off  
12 the record for just a moment?

13 ALJ PARROT: Yes. Go ahead. Off the  
14 record.

15 (Discussion off the record.)

16 ALJ PARROT: All right. Let's go back on  
17 the record.

18 Q. (By Mr. Alexander) Dr. Sahu, did the  
19 permit at issue in this proceeding include emissions  
20 limits for PM10 and PM2.5?

21 A. Did the permit -- I'm sorry. Did the  
22 permit include emission limits is what you are  
23 asking? I believe they did, but I don't recall all  
24 the permit limits that are in the permit to install  
25 that you showed me a little while ago.

1 Q. Does the permit issued by the Ohio EPA  
2 include any limitation on the capacity factor at  
3 which the CHP must operate?

4 A. I didn't see that, so I'm not sure it  
5 did.

6 Q. Did the permit include provisions which  
7 are known as federally enforceable standard terms and  
8 conditions?

9 A. I believe I saw a section like that, yes.

10 Q. And so the US EPA would review the  
11 application for the permit as well?

12 A. That I am not sure.

13 MS. WACHSPRESS: Objection, your Honor.  
14 Objection. Speaks to what someone considered about  
15 which the witness has no personal knowledge.

16 MR. ALEXANDER: Your Honor, the witness  
17 already answered he doesn't know, so we can move on.

18 ALJ PARROT: Yeah, overruled. The answer  
19 stands.

20 Q. (By Mr. Alexander) The Sierra Club did  
21 not appeal the EPA permit for the CHP facility at  
22 issue in this case, correct?

23 A. I don't know that. I am not aware of  
24 those proceedings.

25 Q. Let's talk about reliability. In your

1 testimony you discuss the reliability of the grid; is  
 2 that correct?

3 A. Yes.

4 Q. Isn't it true there is a difference  
 5 between grid reliability and reliability at any  
 6 specific point on the grid?

7 A. Right, but the ladder is incorporated  
 8 into the larger grid reliability. When they talk  
 9 about grid reliability means that you have to meet a  
 10 certain reliability criteria at various distribution  
 11 points in the grid.

12 Q. So, for example, the PJM system may have  
 13 a surplus of generation but if there are issues with  
 14 the transmission or distribution system, that could  
 15 still cause reliability concerns for customers,  
 16 correct?

17 A. Local -- localized one, yes.

18 Q. Now, let's apply that to this case. You  
 19 understand that Ohio State is going to remain  
 20 connected to the regional grid, correct?

21 A. That's my understanding, yes.

22 Q. And Ohio State is going to be purchasing  
 23 a portion of its power needs from the regional grid  
 24 even after the CHP is approved, correct?

25 A. What I heard was that since in any

1 electrical system you have to meet the load, that  
2 depends on the load at any given point in time and  
3 how much of that load will be met by the CHP system.  
4 And if you are in need of electrical power beyond  
5 that load, then they could bring in power from the  
6 grid. That's my understanding.

7 Q. And --

8 A. What I meant to say there is not a  
9 committed certain amount you have to pay on the grid  
10 at all times. That's not my understanding.

11 Q. Correct. And any hour in which the  
12 demand of the University is in excess of the  
13 production of the CHP plant, Ohio State will be  
14 meeting that shortfall from the grid, correct?

15 A. That's my understanding.

16 Q. And if the regional grid fails either due  
17 to a grid failure or due to a local distribution  
18 failure, Ohio State would still be able to use the  
19 CHP to power its critical facilities, correct?

20 A. Well, two caveats, my understanding. One  
21 is only if it was already in operation because as we  
22 established I think in earlier testimony, it doesn't  
23 have black start capability.

24 And then second being there are critical  
25 loads, in fact, about a third of the entire power,



1 about 30 some megawatts is critical load that CHP  
2 cannot meet because it doesn't have the fire code 10  
3 second reliability so those will still happen from  
4 the diesel generate -- diesel power generators is my  
5 understanding.

6 Q. It's your understanding that the diesel  
7 power will provide service to those facilities and  
8 not the CHP?

9 A. No, I am not saying that. I am saying if  
10 the CHP is operating, then they will continue to  
11 operate but if -- in other words, there's a  
12 possibility that the grid fails and the CHP fails, in  
13 which case there is diesel power backup is my  
14 understanding.

15 Q. Would you agree that Ohio State's system  
16 would be more resilient by inclusion of the CHP?

17 A. Now, just to be clear, not to nitpick,  
18 just to understand, when you use the word resilient,  
19 that means something particular to me. Resilience  
20 means if your turbine system doesn't come back to its  
21 base state. That's what resiliency is. Did you mean  
22 to ask me about resiliency with that understanding?

23 Q. I am going to rephrase the question.  
24 Would you agree that Ohio State's system would be  
25 more reliable if the CHP were installed?

1           A.    Not as a universal statement, I cannot.

2           Q.    Do you think that a system which is  
3 connected to the public grid is more reliable than a  
4 system connected to both the public grid and which  
5 has behind-the-meter CHP generation?

6           A.    It depends. I mean, it depends on how  
7 well the system is constructed. It depends on how  
8 long it goes down for maintenance, whether it's  
9 preventive maintenance or reactive maintenance. It  
10 depends on the sort of the wire, so to peak, the  
11 distribution system within the campus leading from,  
12 you know, the switchgears and everything else that  
13 goes with that system to distribute the power on  
14 campus.

15                    So there are many ways to look at  
16 reliability and it's not just, you know, one of  
17 these. So as a general rule, the grid reliability is  
18 being improved. Grid reliability across in all RTOs,  
19 including PJM, is substantially improved learning  
20 from things like Super Storm Sandy or the big outage  
21 many years ago or Hurricane Harvey Texas.

22                    And grid resilience, grid reliability and  
23 resilience is improving, so you are comparing two  
24 systems, one of which is increasing in resiliency and  
25 reliability. And just because you have a CHP system

1 doesn't mean it doesn't have its own requirements  
2 from maintenance and so on. As a general matter,  
3 axiomatically I cannot agree with that statement.

4 Q. Okay. So if we assume two hypothetical  
5 scenarios, in the first the system is completely  
6 reliant on the grid, and in the second the system has  
7 access to both the grid and a CHP facility.

8 A. Right.

9 Q. Do you understand the hypothetical?

10 A. I do.

11 Q. Do you believe that the system which has  
12 access to both the grid with its same benefits in  
13 both scenarios and the CHP would be more reliable  
14 than the first system?

15 A. The same answer. For some hours it may  
16 be; for other hours it may not be. It depends on  
17 that factor. And I should point out that the grid  
18 does provide and meet loads for many critical  
19 facilities without their own CHP systems. I mean,  
20 there are any number of very, very critical care  
21 facilities from government facilities to hospitals to  
22 all kinds of things that rely on the public grid and  
23 different public grids, and they meet, you know,  
24 North American Reliability Requirements for that. So  
25 that is -- that's just the reality of every day.

1           Q.    And so do you believe that general PJM  
2 grid improvements have any impact on damage to a  
3 local distribution line caused by a storm?

4           A.    What I know is PJM is continuously  
5 looking at its power delivery through its various  
6 levels of high voltage, medium voltage, low voltage  
7 lines and to increase that very reliability down to  
8 the particular customer load.  So that's a large part  
9 of what PJM does when it is doing its various  
10 analysis of where it needs more generators, where  
11 they should be located, where it needs more  
12 transmission lines or distribution lines.  Those are  
13 all in furtherance of that objective.

14                So what I know is PJM is continuously  
15 trying to improve reliability looking at those very  
16 type of disruptors, whether it's storms or, you know,  
17 sabotage or really sort of things that would cause  
18 disruption on their overall system.

19           Q.    So you believe PJM is modeling local  
20 distribution lines?

21           A.    I'm not saying they are modeling every  
22 local distribution line, but they are trying to get  
23 down to obviously their system delivered to  
24 distribution companies.

25           Q.    And you would agree generation diversity

1 has nothing to do with Ohio State's system and  
 2 reliability, correct?

3 A. Say that again. Generation reliability?

4 Q. Diversity.

5 A. Diversity has nothing to do with? What  
 6 was your question?

7 Q. Ohio State's reliability.

8 A. It does. I mean, if you are dependent on  
 9 a single fuel, natural gas, disruption for that  
 10 single fuel that will affect the reliability.

11 Q. But Ohio State is not depending on a  
 12 single fuel, correct? Ohio State has access to both  
 13 the grid and the CHP facility, correct?

14 A. Oh, I misunderstood. I thought you meant  
 15 diversity for the CHP facility. I take that back.  
 16 Yes. It will have the grid capability and CHP, so it  
 17 is effectively piggybacking on this already reliable  
 18 grid that is delivering electrical power to the  
 19 system.

20 Q. Do you know how much Ohio State  
 21 experiences unplanned power outages?

22 A. I don't. I have not looked at the actual  
 23 statistics. I saw some mention of 100 percent  
 24 reliable in some documents, but I have not studied  
 25 that myself.

1 Q. And your testimony includes an extensive  
2 discussion of several universities and programs that  
3 they pursued. Do you know the size of the electric  
4 load at any of those universities?

5 A. I don't know the size of all of them, but  
6 I know the rough number of sort of students and  
7 faculty, if you will, for the size of these  
8 universities in some of these instances and that's  
9 usually a good indicator of the loads.

10 Q. Okay. Your counsel can ask you about the  
11 other questions. Just help us get through this. I  
12 am trying to go as fast as we can. Just limit  
13 yourself to what I ask. That would be great. Do you  
14 know the size of the thermal load at any of those  
15 universities?

16 A. I don't remember all of them, no.

17 Q. Do you know the size of the thermal load  
18 at any of those universities?

19 A. Yes. If you go to, for example, my --  
20 can I reference my testimony?

21 Q. You can.

22 A. Yes. I have some examples of thermal  
23 loads actually in a couple of universities and that  
24 would be a good place to look. If it's there, let's  
25 see. I thought one of them was there. Yeah. If you

1 go, for example, to page 29, that is an excerpt from  
2 a Stanford paper with their heating and cooling loads  
3 and the overlap loads. And again, it's in different  
4 units. It's millions of BTUs and these are hourly  
5 loads. But that gives you an idea of the both  
6 heating and cooling and overlap. There is a similar  
7 one for Ball State University, a few pages, but that  
8 one does not have a scale in the version of the  
9 document I reproduced for you here. The Stanford one  
10 does have a scale.

11 Q. Let's focus on Stanford. What is the  
12 size of thermal load at Stanford?

13 A. The loads again are very -- like I said,  
14 it's not constant obviously. So we look at that, and  
15 you look at the heating loads which are in red and  
16 yellow, so then once they are below, they are in  
17 negative terms. They go anywhere from, you know, a  
18 little more -- about 3 thousand million BTUs on  
19 particular hours. And then the heating load  
20 similarly on the other side, the blue lines, they  
21 touch the 4 thousand million BTUs. I should say  
22 cooling, the blue ones are cooling. The cooling  
23 loads reach about 4 thousand million BTUs so that  
24 gives you a sense of the hourly heating and cooling  
25 load.

1           Q.    Do you know whether this includes the  
2 total campus load or just the load of the heating and  
3 cooling load?

4           A.    These are thermal loads.  The thermal  
5 load is divided into the heating part of the thermal  
6 load and the cooling part of the thermal load across  
7 their campus.

8           Q.    There could also be load used for other  
9 purposes, for example, research or cleaning, food  
10 preparation, things of that nature, correct?

11          A.    All of that is included as part of the  
12 campus.  Campus is like a small town, so it has all  
13 of that stuff.

14          Q.    All right.  What is the maximum load for  
15 Stanford and --

16          A.    We -- I'm sorry.  It's about 4 thousand  
17 million BTUs per hour on the cooling side and about  
18 3,000 at least when the analysis was done around  
19 2016.

20          Q.    Do you know how the Stanford load  
21 compares to the Ohio State load?

22          A.    I don't because I've -- that was one of  
23 my first criticisms is we don't have an hourly load  
24 analysis for the entire campus.  Neither the heating  
25 nor the cooling is separated.  Just don't have that.



1 Q. Was your answer complete?

2 A. Yes. I'm sorry. I don't have a load for  
3 heating and cooling loads for the Ohio State Campus.

4 Q. What was the cost of the Stanford  
5 conversion referenced in your testimony?

6 A. I don't remember the number, and I don't  
7 know if it was discussed in a primary reference that  
8 I've provided as an attachment, but I don't remember  
9 the number offhand.

10 Q. Was it in excess of \$400 million?

11 A. I can't say. I don't -- I don't --  
12 again, I have not looked at what fossil fuel and what  
13 scope it included, whether it included off-site  
14 generation, for example. The past is not something I  
15 looked at for their system.

16 Q. Do you know the size of the thermal load  
17 for any other university listed in your testimony?

18 A. I don't provide it in testimony. I don't  
19 know if the Ball State University analysis included  
20 their actual cooling and heating loads. I know that  
21 they separated them out and did the analysis. I  
22 don't remember that. I don't sitting here recall the  
23 ones for the other ones I have discussed in my report  
24 or the couple ones that are mentioned in the -- in  
25 the study, the feasibility study, which I did not

1 include in my analysis.

2 Q. Do you know the total capital  
3 expenditures required for the conversions referenced  
4 for any of these universities?

5 A. Again, not sitting here right now. I  
6 have looked at the numbers. I think some of them had  
7 quoted the number 70 million, 80 million for a  
8 particular campus. I can't remember which one that  
9 was.

10 Q. Let's focus on maybe some university  
11 questions to try and help this. Does Ball State have  
12 a hospital on campus?

13 A. I don't remember whether it has a  
14 hospital on campus. It has about 22,000 students is  
15 what I recall.

16 Q. Ohio State has six hospitals on campus,  
17 correct?

18 A. I didn't count all the hospitals. It has  
19 a big medical center, new ones being added, that's  
20 correct.

21 Q. And Ohio State's hospitals have a  
22 critical steam load, correct?

23 A. Again, I don't know which hospitals have  
24 what steam loads, but I've seen common hospital  
25 sterilization loads in some of their hospitals.

1 Q. And Ohio State has over 300 buildings?

2 A. Again, I don't know the exact building  
3 count, what was included in the size of the  
4 buildings, and what counts for a building which is  
5 something that is not a building.

6 Q. Sure. And Ball State has roughly 150  
7 buildings on campus; is that right?

8 A. Again, I didn't do a count on the number  
9 of buildings.

10 Q. Now, would you agree Ohio State is  
11 located in an urban environment?

12 A. Yes. That's my understanding. It's  
13 urban -- it's in an urban environment, that's  
14 correct.

15 Q. And Ball State is in a suburban  
16 environment, correct?

17 A. Well, in Muncie. It depends on whether  
18 you ask people what they think of Muncie compared to  
19 Indy. You get different answers.

20 Q. So should I consider that an "I don't  
21 know"?

22 A. It's a characterization issue. I mean,  
23 it's pretty urbanized in terms of being a town with  
24 lots of -- you know, as an air quality person and a  
25 modeler, I might look at that answer differently.

1 You know, as a census, how the census classifies it,  
2 it could be a different answer, but it's a context  
3 specific determination.

4 Q. Let's turn our attention to Stanford. Do  
5 you know how many hospitals Stanford has on campus?

6 A. Well, I don't know -- they have a  
7 Stanford University Medical System that is pretty  
8 large. I don't know within that how many specific  
9 hospitals they have.

10 Q. And do you know whether any of those  
11 hospitals have a critical steam load?

12 A. Oh, I am sure they do. You can't have  
13 hospitals without sterilization.

14 Q. And so you would assume there is a  
15 critical steam load for any facility which has  
16 hospitals?

17 A. Yes, especially teaching hospitals and  
18 they absolutely do.

19 Q. And do you know how many buildings are  
20 located on Stanford's campus?

21 A. Again, my guess given the other ones  
22 several hundred, but again, I don't know the exact  
23 number.

24 Q. And do you know how many students are  
25 currently attending Stanford?

1           A.    No.  I don't have that enrollment number  
2 offhand.

3           Q.    And do you know how many students attend  
4 the Columbus Campus at Ohio State?

5           A.    66,000 or in that range, I guess.  That's  
6 in the mid 60 thousands is my understanding.

7           Q.    Carleton College, am I pronouncing that  
8 correctly?

9           A.    Carleton.

10          Q.    Carleton, thank you.  Does Carleton  
11 College have a hospital on campus?

12          A.    That I don't know.  They are a smaller  
13 school.  I don't know if they have a hospital.

14          Q.    And do you know how many buildings are  
15 located on Carleton's Campus?

16          A.    I don't.

17          Q.    And is Carleton located in an urban  
18 environment?

19          A.    Carleton is -- Carleton is in Minnesota.  
20 I don't know the exact circumstances.  I know several  
21 people that have gone to Carleton.  I apologize.  I  
22 don't know their exact location and whether they are  
23 suburban, urban, rural, or the specific situation.

24          Q.    And we said Carleton has less than 3,000  
25 students?

1           A.    Might well be. I know it's a smaller  
2 school.

3           Q.    Finally Brown, does Brown have a hospital  
4 on campus?

5           A.    Yes, in Providence. I have been to  
6 Brown, so I can say that for sure.

7           Q.    And Brown has approximately 10,000  
8 students?

9           A.    Yeah. I don't know the exact number, but  
10 yeah. It's obviously larger than Carleton. I don't  
11 know the exact number.

12          Q.    Do you know the number of buildings on  
13 Brown's campus?

14          A.    No. I would guess several hundred, and  
15 they are in Providence in the middle of the urban  
16 area there. Several hundred would be my guess.

17          Q.    Moving back to your point about hourly  
18 level data.

19          A.    Yes.

20          Q.    At page 7, line 1, you say other  
21 universities have conducted "required granular  
22 analysis." Do you see that?

23          A.    Yes.

24          Q.    Who or what requires universities to  
25 conduct that analysis?

1           A.    I'm sorry.  Your question what requires  
2 them to conduct the analysis?

3           Q.    Yes.

4           A.    Well, that analysis informs the choice of  
5 the type of system that would then meet both of those  
6 loads.  So the requirement is finding the optimum  
7 configuration of their energy system to meet those  
8 two different loads.  That's why -- requires them to  
9 do that analysis.  Without that you will miss the  
10 opportunity synergy that you might otherwise see if  
11 you analyze your loads that way.

12          Q.    So there is no legal standard which  
13 requires universities to conduct that analysis,  
14 correct?

15          A.    I am not a lawyer, so we established  
16 that.  I wouldn't know if there is a legal standard  
17 or not.  I am not aware of one.

18          Q.    Okay.  It's only required to conduct that  
19 granular analysis by you?

20          A.    By me; is that?

21                MS. WACHSPRESS:  Objection,  
22 mischaracterizes his testimony.

23                MR. ALEXANDER:  Your Honor, I am trying  
24 to understand what requires this analysis, if it's  
25 simply the witness feels it should be conducted or if

1 there is some other source.

2 ALJ PARROT: And I believe he has  
3 answered the question.

4 Q. (By Mr. Alexander) Okay. When you  
5 drafted your testimony, you did not know whether Ohio  
6 State had hourly load information, correct?

7 A. Nothing was reported. I don't -- I do  
8 know they said they were instrumenting the campus to  
9 be able to collect that type of data but none was  
10 reported. None of that went into the analysis and  
11 feasibility study.

12 Q. When you say none of that went into the  
13 analysis and the feasibility study, do you mean none  
14 of that appears in the feasibility study?

15 A. Appears or is referenced or relied upon  
16 in the feasibility study.

17 Q. And you don't know whether Ohio State  
18 took its hourly load data into account when making  
19 its determination in this proceeding or not, correct?

20 A. Well, I can only go by the document I  
21 have reviewed, and I have given you my answer.

22 Q. Page 28, line 18.

23 A. Give me a second. I will just get there.  
24 Line 18, did you say, Mr. Alexander?

25 Q. Yes.



1 A. Okay. I'm there at that location.

2 Q. I guess let's go up just a bit to the  
3 question that leads to that answer. The question  
4 asked "Did OSU consider any of the above-described  
5 technologies"; do you see that question?

6 A. Yes.

7 Q. And by "above-described technologies,"  
8 are you referring to heated hot water?

9 A. Heated hot water, renewable power for  
10 electricity, that whole combination of things, yes.

11 Q. And after hearing the testimony today, do  
12 you now understand that Ohio State has, in fact,  
13 considered heated hot water?

14 A. Yes, but again, the whole context is  
15 district-wide heating or, you know, in place of the  
16 CHP system, not an individual system for a building  
17 with a HRC or, you know, all the things that were  
18 discussed for specific loads here. I meant obviously  
19 my whole testimony is about the district-wide system  
20 that the CHP is going to satisfy.

21 Q. And you understand the CHP is going to  
22 support a district-wide heated water system for Ohio  
23 State, correct?

24 A. The way in which heated hot water is  
25 being used there is precisely what I have

1 distinguished in my report. You can -- yes, the  
2 steam that is generated will heat up the hot water.  
3 That is not a heated hot water system that relies on  
4 the efficiency of geothermal and ground-based  
5 sources. These already make the steam and use part  
6 of the steam to generate hot water that defeats the  
7 efficiency, the exergy arguments that I've made in my  
8 report. It's how you make the hot water is  
9 important, not make steam first and then make the hot  
10 water from the steam, that's what I heard is part of  
11 the system design, and that I have a difference of  
12 opinion with that. That doesn't make sense to me.

13 Q. So your objection is not that Ohio State  
14 is not using heated hot water district-wide systems  
15 but rather the generation source which Ohio State is  
16 going to use to heat up that water?

17 A. Yes. That is correct because even with  
18 the heated hot water system, I heard previous  
19 testimony that that's only going to go to two  
20 buildings, the arts building and the theater  
21 building.

22 So the larger point is meeting all of its  
23 heating needs first by getting all of the extracted  
24 energy from the cooling system and then relying on  
25 ground-based systems to meet the remainder of

1 efficiencies and then source there for the hot water  
 2 would be either from the cooling system exhaust, the  
 3 chiller exhausts on a district-wide basis, and then  
 4 supplemented by the ground-based sources, not steam  
 5 for any of it.

6 Q. The feasibility study discusses the  
 7 advantages of hot water heating, correct?

8 A. Yes.

9 Q. Have you conducted any analysis of the  
 10 costs of using geothermal heat to create a  
 11 district-wide heated hot water system?

12 A. I have not. Again, I presume for the OSU  
 13 campus.

14 Q. Yes.

15 A. I have not.

16 Q. And have you analyzed whether the  
 17 existing steam piping network on Ohio State's campus  
 18 would be suitable for heated hot water?

19 A. I have not. None of the details of the  
 20 existing steam piping system are provided in the  
 21 records, so no.

22 Q. And do you have any knowledge regarding  
 23 the University's ability to shut off heating to any  
 24 of the buildings currently connected to the steam  
 25 system?

1           A.    No, I have no knowledge on that in terms  
2 of the specifics. I don't think that's in the  
3 record.

4           Q.    And one of the suggestions you proposed  
5 on a slightly different topic is the use of chillers,  
6 correct?

7           A.    Well, the exhaust from the chillers for  
8 meeting part of the heating load, that's correct.

9           Q.    Did you take into account that this is  
10 already part of the ACM program currently being  
11 implemented by OSU?

12          A.    I was aware of that, and again, I saw  
13 testimony to that and the chart showing the buildings  
14 that are in or in process of being connected to heat  
15 recovery chillers. I also heard testimony that  
16 that's about a little more than 10 percent of the  
17 load and that might be subsumed by expansion of the  
18 campus as a whole, but I did -- I was aware of that,  
19 yes.

20          Q.    I would like to ask some questions about  
21 your CV --

22          A.    Okay.

23          Q.    -- Exhibit A. Annex A to your CV, you  
24 provide a list of matters in which you provided  
25 expert reports, correct?

1           A.    Expert reports, testimony, that kind of  
2   stuff, stuff required by federal rules, you know,  
3   those sources.

4           Q.    Does that include matters for your entire  
5   career or just for a certain time period?

6           A.    That one goes back quite far so I think  
7   since I started doing expert work and expert reports  
8   and testimony.  It's all there.

9           Q.    Okay.  Are you familiar with an entity  
10  named Earthjustice?

11          A.    Yes.

12          Q.    Is Earthjustice a law firm?

13                MS. WACHSPRESS:  Objection, your Honor.  
14  What is the relevance of this line of questioning?  
15  Earthjustice is not a party to this proceeding.  We  
16  have no evidence Earthjustice was involved in the  
17  development of the application here.

18                MR. ALEXANDER:  Your Honor, he testified  
19  he's familiar with the entity.  I haven't asked any  
20  questions about the entity thus far, and the witness  
21  relied on that entity in his CV which I am now going  
22  to question him about.

23                ALJ PARROT:  Objection is overruled with  
24  respect to the question that's pending.  We'll see  
25  where we go from there.

1           A.    I'm sorry.  Could you repeat the  
2 question?  I'm sorry.

3           Q.    Are you familiar with an entity known as  
4 Earthjustice?

5           A.    Yes.

6           Q.    Is Earthjustice a law firm that  
7 represents the Sierra Club?

8           A.    I don't know who all their clients are,  
9 but I know they are a law firm.

10          Q.    In review of your CV, it appears you have  
11 done work for Earthjustice directly on five different  
12 occasions; is that right?

13          A.    I didn't count them, but I have not gone  
14 back and counted how many.  So subject to that  
15 caveat, I have done work for Earthjustice on a number  
16 of matters.

17          Q.    Okay.  Were any of the cases where you  
18 did work for Earthjustice where you were retained to  
19 provide testimony on behalf of Sierra Club?

20          A.    I can't -- I really don't know the answer  
21 to that.  I can't remember.

22          Q.    Okay.  Let's quickly go through this  
23 because there is just five.  Turn to Appendix A.  
24 Start with matter 20.

25          A.    You will have to give me a minute to get

1 to Appendix A. I don't have it pulled up.

2 ALJ PARROT: While Excuse me. While he  
3 is finding the reference, let's go off the record for  
4 a moment.

5 (Discussion off the record.)

6 ALJ PARROT: Go back on the record.

7 A. I have the document. I'm sorry. Which I  
8 number?

9 Q. 20.

10 A. Okay.

11 Q. And was that engagement on behalf of  
12 Sierra Club?

13 A. It might have been. I just don't  
14 remember the details. From Sierra Club and several  
15 other groups, it might have been. I can't just  
16 remember for sure.

17 Q. Okay. Next is No. 100.

18 A. 100, okay. I'm there.

19 Q. Was that on behalf of Sierra Club?

20 A. I can't remember, but I list the entities  
21 that Earthjustice seems to have represented in that  
22 matter, and I don't see Sierra Club's name on that  
23 list. Now, subject to that, I don't -- so I can't  
24 say yes or no. I just don't remember.

25 Q. Okay. 119?

1           A.    119.  Again, I don't -- I don't remember.  
 2    If your question is whether Sierra Club was a client  
 3    there in addition to Earthjustice, I don't remember.

4           Q.    124.

5           A.    That's an ongoing matter.  I don't  
 6    believe -- I can't say.  I don't know who the groups  
 7    are that are being represented by Earthjustice in  
 8    that matter.

9           Q.    And actually 195.

10          A.    195, that's the same matter.  So one is  
 11    in deposition, one was the expert report, the same  
 12    answer.

13          Q.    Thank you.  And you've also testified  
 14    directly for Sierra Club, correct?

15          A.    I have, yes.

16          Q.    And in your appendix you identify 57  
 17    different engagements where you have provided expert  
 18    reports on behalf of Sierra Club; is that right?

19          A.    I couldn't tell you if the number is  
 20    right or wrong.  You have counted them; I have not;  
 21    but they are all listed there.

22          Q.    So are you being paid for your work in  
 23    this proceeding on an hourly basis?

24          A.    Yes.

25          Q.    And is there any success fee associated



1 with your compensation --

2 MS. WACHSPRESS: Your Honor, objection.

3 Q. -- in this case?

4 MS. WACHSPRESS: Goes to relevance. I  
5 don't understand why the agreement between the expert  
6 and Sierra Club is relevant to the Applicant's  
7 request to build a combined heating and power  
8 facility.

9 ALJ PARROT: Response?

10 MR. ALEXANDER: Your Honor, these are  
11 standard questions for an expert witness,  
12 particularly when he's done this volume of work for  
13 Sierra Club. I was frankly curious if he was  
14 employed full-time at Sierra Club in light of the  
15 sheer number of matters, and I wanted to see if he  
16 was a Sierra Club employee or operating  
17 independently.

18 ALJ PARROT: Well, let's ask those  
19 questions.

20 MR. ALEXANDER: Well, he answered the  
21 first which was was he being compensated in an hourly  
22 manner.

23 Q. (By Mr. Alexander) And my second is are  
24 you being paid any success fee in association with  
25 your testimony in this case?

1           A.    I am not.

2           MR. ALEXANDER:  Your Honor, may I have a  
3 few minutes to review my notes?

4           ALJ PARROT:  Yes.  And let's go ahead,  
5 everyone, take a 5-minute break, please.

6           (Recess taken.)

7           ALJ PARROT:  Let's go back on the record.  
8 Go ahead, Mr. Alexander.

9           MR. ALEXANDER:  Just one point of  
10 clarification.  I think the witness may want to  
11 double-check an answer.

12          Q.    (By Mr. Alexander) If you could go to  
13 Exhibit J to your testimony, the Stanford summary  
14 that you included.

15          A.    Oh, let me go there.  And where?  I have  
16 the document now, Mr. Alexander.

17          Q.    Great.  Focus your attention on Figure 1  
18 which is the first page.

19          A.    You said Paragraph 1?

20          Q.    Figure 1.

21          A.    Oh, Figure 1.  I see, yes.

22          Q.    So earlier today I had asked you some  
23 questions regarding the total load at Stanford, and I  
24 wanted you to have access to this figure to maybe  
25 provide additional clarity to the Figure 2 that was

1 an annual number. And is Figure 1 a daily number  
2 instead?

3 A. Hang on just one second, if you don't  
4 mind. Yeah. Figure -- Figure 1 for various seasons  
5 shows the hourly million BTUs for typical days, I  
6 suppose, in those seasons, that's right.

7 Q. And so Figure 1 shows the daily load, and  
8 Figure 2 shows annual heat recovery potential; is  
9 that right?

10 A. Yeah. Annual meaning more some by month,  
11 I suppose, yes. So thank you for that clarification.  
12 So the numbers I quoted were from Figure 2 that's in  
13 my report.

14 Q. And if we could go to it's page 3 of the  
15 exhibit; it's labeled page 2 is at the bottom.

16 A. Okay.

17 Q. Is the size of the system -- strike that.  
18 Do you believe the figures included in  
19 this table are true and accurate?

20 A. I'm sorry. The figure meaning in that  
21 system snapshot table at the bottom; is that what you  
22 are referring to?

23 Q. Yes.

24 A. And which -- which figure of that? Which  
25 of those figures in that table?

1 Q. All of them. Do you have any personal  
2 knowledge regarding any of those figures?

3 A. I have not verified them personally, but  
4 they are reported by obviously somebody from  
5 Stanford. And this is the kind of material I rely on  
6 when I am doing my work and expert work so I have no  
7 reason to doubt the accuracy of the numbers.

8 Q. But you just relied on the figures  
9 included in this report in your testimony.

10 A. I did, yes.

11 MR. ALEXANDER: Okay. Nothing further,  
12 your Honor. Thank you, Doctor.

13 THE WITNESS: Thank you, Mr. Alexander.

14 ALJ PARROT: Mr. Lindgren?

15 MR. LINDGREN: Yes, thank you, your  
16 Honor. I do have a few questions.

17 - - -

18 CROSS-EXAMINATION

19 By Mr. Lindgren:

20 Q. Good evening, Dr. Sahu.

21 A. Good evening.

22 Q. You understand that the Ohio EPA has  
23 issued a permit to install for this -- this proposed  
24 project; is that right?

25 A. That's my understanding, yes.

1 Q. Yes. And you are aware they have -- this  
2 permit does include limits on various types of  
3 emissions?

4 A. For certain pollutants, yes, it does.

5 Q. Yes. And would those include nitrous  
6 oxide and also sulfur dioxide?

7 A. Now, if you could help me clarify, when  
8 you say "limits," are you talking about, for example,  
9 the BAT limits that we were talking earlier with  
10 Mr. Alexander be from the -- from the turbines, or  
11 did you mean -- help me understand what you mean by  
12 limits and perhaps we can go to the document so it's  
13 not confusing.

14 Q. Well, if you want to look at the  
15 document, it's on page -- Exhibit 1 of the  
16 application.

17 A. Are we talking about the permit? Right?

18 Q. The application.

19 A. I'm sorry, I spoke over you. I am in  
20 Exhibit N for Nancy; is that -- that's the permit to  
21 install.

22 Q. I believe it's actually Exhibit -- yes,  
23 that is the permit to install. I believe that's on  
24 page 15 where it discusses various limits. Do you  
25 see that?

1 A. Let me go to page 15 and just --

2 Q. Okay.

3 A. This is 15 of 29, right?

4 Q. Yes. That's right.

5 A. Yes. I see -- I see the table that began  
6 on the prior page, 14, that carries over into 15, if  
7 that's what you mean.

8 Q. Yes, I do. Yes, thank you.

9 A. Yes, I see those, those limits, that's  
10 correct.

11 Q. Yeah. Thank you. And if a party  
12 including the Sierra Club disagreed with these  
13 limits, they could have appealed the EPA's issuance  
14 of that permit, couldn't they?

15 A. I couldn't advise what parties can and  
16 cannot do. I suppose that is one of the options,  
17 yes.

18 Q. Thank you. Also could you turn to page  
19 14 of your testimony.

20 A. Okay. Let me just get to that document.  
21 If you give me a second.

22 Q. Sure.

23 A. 14, 1-4.

24 Q. Yes, 1-4.

25 A. Almost there. Yes, I am on page 14.

1 Q. Looking on line 29 you make the statement  
2 "That claim is without support because the modeling  
3 does not consider emissions during so-called upset or  
4 malfunction events, for example, when pollutant  
5 emissions can be significant. The modeling results  
6 cannot therefore be relied upon." Did I read that  
7 correctly?

8 A. Yes.

9 Q. And thank you. And did you review the  
10 application as part of your preparation for this  
11 testimony?

12 A. I did. I did review the application. I  
13 presume by that the application to the Siting Board.

14 Q. Yes, that is correct. And --

15 A. Yes.

16 Q. And would you agree with me that it does  
17 account for the possible failure of air pollutant  
18 pumps?

19 A. I don't think -- so I think it includes  
20 startup, shutdown emissions, and things of that sort  
21 but those are emissions. And the point I was making  
22 in my testimony is how did they model. So there's a  
23 distinction between estimating what your startup,  
24 shutdown emissions would be and what is actually  
25 modeled, that's No. 1. No. 2 --

1 Q. Excuse me.

2 A. Yes.

3 Q. Thank you. But do you have the  
4 application there handy? Can you access it? I  
5 believe you just did.

6 A. I can bring it. It's not immediately  
7 here. I do remember that discussion. Let me try to  
8 find it.

9 Q. Yeah. If you have the application,  
10 please turn to page 70.

11 A. 70, okay. That was where I was going to  
12 ask. I do have it here so let me go there. Yes.  
13 Page 70, I am there, yes.

14 Q. Yes. And do you see Section C at the  
15 bottom that has the caption "Possible Failure of Air  
16 Pollution Controls"?

17 A. Yes, I do see that.

18 Q. So will you agree with me this  
19 application then does take into account that -- the  
20 possible failure of those controls?

21 A. I disagree with you. It discusses that  
22 air pollution controls can fail in that one  
23 paragraph. But -- but to account for it, you have to  
24 estimate the emissions when such failures happen and  
25 then model them, so I would respectfully disagree



1 with you.

2 Q. Anyway that -- you would agree that that  
3 is discussed in the application, correct?

4 MS. WACHSPRESS: Your Honor, objection.  
5 Mischaracterizes the witness's testimony.

6 Q. Is it discussed in the application?

7 MS. WACHSPRESS: Objection, ambiguous.  
8 What does it refer to?

9 Q. Is the possible failure of air pollution  
10 controls stated in -- discussed in the application?

11 A. It is discussed at -- on page 70 on into  
12 page 71 in qualitative terms.

13 Q. Thank you. One moment, please. Would  
14 you agree that OSU was exempt from doing the  
15 prevention of significant deterioration or PSD  
16 analysis?

17 A. I believe that's the case, yes.

18 Q. Yeah. Thank you. Would you also agree  
19 that there's no requirement for the Ohio EPA or the  
20 Board to do an analysis of the possible pollution  
21 resulting from the fuel source? Is there no legal  
22 requirement for that?

23 A. I missed the last part, possibly arising  
24 from? And what were the words after that?

25 Q. From the extraction of the fuel source.

1           A.    Would I agree with that?  No, I would  
2 disagree with that.

3           Q.    Okay.  Could you point me to the legal  
4 requirement for doing that analysis?

5           A.    No.

6           MS. WACHSPRESS:  Objection, calls for a  
7 legal --

8           Q.    Thank you.

9           A.    I'm sorry, misspoke.  My understanding is  
10 one of the requirements is to look at, one, the  
11 criteria for the Siting Board to look at is the  
12 minimum environmental impact and that is the legal  
13 requirement, one of the legal requirements, and so I  
14 disagree based on that particular one and there may  
15 be others.

16          Q.    Okay.  But can you point me to any  
17 particular requirement that would point to the fuel  
18 source?

19          MS. WACHSPRESS:  Objection, asked and  
20 answered.  And the witness is not an attorney, and we  
21 are asking for legal opinions here.

22          ALJ PARROT:  I think we have already  
23 established that the witness is not an attorney, is  
24 not offering legal opinions today.

25          So with that, I am going to instruct the

1 witness to answer the question.

2 A. I have answered it from a technical  
3 standpoint that that particular requirement requires  
4 an analysis of the environmental impacts of the  
5 system that is being proposed to meet whatever needs.

6 In this case the system includes  
7 combustion of fuel and that fuel has to come from  
8 somewhere including extrusion from the ground. So  
9 its environmental impacts are subsumed within the  
10 analysis that has to be done to meet that requirement  
11 and that includes an analysis of the fuel source.

12 THE WITNESS: Your Honor, there is a  
13 little triangle by Mr. Lindgren and I don't know what  
14 that means.

15 ALJ PARROT: It means he is having  
16 connectivity issues. Give him just a minute.

17 THE WITNESS: Sure.

18 ALJ PARROT: Let's go off the record.

19 (Discussion off the record.)

20 ALJ PARROT: Let's go back on the record.

21 MR. LINDGREN: Again, I apologize.

22 ALJ PARROT: I'm not sure where we left  
23 off. Did you have a question pending, Mr. Lindgren?

24 MR. LINDGREN: No. I have no further  
25 questions, so I'll just stop.

1 ALJ PARROT: Okay. With that any  
2 redirect, Ms. Wachspress?

3 MS. WACHSPRESS: Yes, your Honor.

4 - - -

5 REDIRECT EXAMINATION

6 By Ms. Wachspress:

7 Q. Okay. So, Dr. Sahu, can you tell me --  
8 you discussed some of the clients you represented  
9 with Mr. Alexander. Can you tell me a little bit  
10 more about the clients that you represented in your  
11 role as an expert?

12 A. Sure. I -- if you look at even my CV, I  
13 have broadly three categories of clients. I have  
14 what I call industrial clients or private sector  
15 clients, people that have industrial plants or land  
16 developers and things of that sort. I do work for  
17 different levels of government as expert including  
18 the Department of Justice and the EPA several states.  
19 And then I do have nongovernmental organizations such  
20 as the Sierra Club and Earthjustice that were  
21 mentioned. It includes all three types of clients.

22 Q. Do you recall Mr. Alexander asking you  
23 questions about the number of times that you  
24 represented Sierra Club as an expert?

25 A. I do.

1           Q.    And what proportion would you say of your  
2 work is for nonprofit -- nonprofits such as, but in  
3 addition to, Sierra Club, so all of the nonprofits  
4 that you serve as an expert for? What proportion?

5           A.    If you look at it over a period of a  
6 reasonable time frame like several months or a year,  
7 it turns out to be about a third. On a given day I  
8 might be working all for the government or all for a  
9 particular private client, but as you look on an  
10 average basis, about a third.

11           Q.    And do you recall Mr. Alexander asking  
12 questions about your familiarity with heating  
13 systems?

14           A.    Yes.

15           Q.    Can you tell me -- could you tell me more  
16 about your experience with working on heating  
17 systems?

18           A.    Well, that experience actually goes back  
19 to my engineering degree back in India from IAT. We  
20 designed heating systems including for small plants  
21 and many district heating systems in India. We have  
22 plenty of those. It included work that I did  
23 designing equipment, heat exchangers and so on, for  
24 the first three years after I left graduate school,  
25 designing actual equipment like were already

1 mentioned, chillers, heat exchangers, and things of  
2 that sort.

3           And then about 10 years, I worked for a  
4 large engineering company between 1990 and 2000  
5 roughly called Parsons, and they had many clients  
6 with refiners, power plants, all kinds of clients  
7 that had specific projects dealing with heat exchange  
8 and heating and cooling systems, HVAC systems, so  
9 it -- it covers all of that.

10           Q.    And do you recall Mr. Alexander asking  
11 you questions about the costs associated with fourth  
12 generation heated hot water systems?

13           A.    Yes.  He asked a few different questions  
14 on costs.

15           Q.    And was there anything in the application  
16 or the feasibility study or any other documents  
17 produced by OSU in support of their application that  
18 conducted this comparison?

19           A.    I did not see any such thing.

20           Q.    And do you recall Mr. Alexander asking  
21 you questions about the steam needs of OSU?

22           A.    Steam needs, did you say?

23           Q.    Yes.

24           A.    Yes.

25           Q.    Could you distinguish for me the

1 difference between thermal needs and steam needs?

2           A.    Sure.  Thermal is the larger umbrella  
3 within which you have the heating needs and cooling  
4 needs.  That's the sort of big division and in this  
5 particular case steam is going to be used for a  
6 substantial portion, it appears, of the heating needs  
7 that the campus will be -- the campus leans on  
8 heating that will be met by steam.  So that's the  
9 hierarchy.  Thermal is at the top, heating and  
10 cooling below that, and steam is a portion of the  
11 heating.

12           Q.    And do you recall Mr. Alexander asking  
13 you questions about geological conditions and their  
14 relationship to geothermal generation?

15           A.    Yes, I do.

16           Q.    What geological conditions are required  
17 for the use of geothermal generation?

18           A.    Well, as I said, the main attraction of  
19 geothermal resources for meeting heating needs,  
20 especially using heated hot water, lower temperature  
21 heating needs, is a fact that the earth once you go  
22 below maybe about 5 or 10 feet has a constant  
23 temperature so that can be used as a very convenient  
24 way to exchange and store energy.  Then, thereafter,  
25 if you go further down, the temperature increases as

1 you go further down in the earth. In particular  
2 places those temperature differences can be enhanced  
3 by -- by volcanic or fracture and other rock types,  
4 and we have parts of the world where geothermal  
5 resources that steam comes out of the ground or hot  
6 steam can come out of the ground. We are familiar  
7 with those.

8           So from a geothermal standpoint, you  
9 always have assurance that temperature is going to be  
10 uniform. That doesn't require geology. That happens  
11 anywhere. But then besides that you might have  
12 particular opportunities for enhanced geothermal  
13 resources in particular places given the local  
14 geology. That's how I would look at geological  
15 characterizations for geothermal research.

16           Q. And that general availability based on  
17 the constancy under the earth can be used as part of  
18 a heated hot water system, correct?

19           A. That's correct, yes.

20           Q. Do you recall when Mr. Alexander asked  
21 you about whether there were any solar facility --  
22 Ohio solar facilities that bid on NIPSCO's request  
23 for proposal?

24           A. I do remember that, and he showed me,  
25 pointed me to a figure like a map. I remember that.



1 Q. And is Indiana close to Ohio?

2 A. Yes. It's the state immediately to the  
3 west, I believe.

4 Q. Is there any reason why the cost of solar  
5 in Ohio would vary significantly from the cost of  
6 solar generation in Indiana?

7 A. I would not think so.

8 Q. And Ohio and Indiana likely have similar  
9 solar resources with respect to the amount of sun per  
10 day?

11 A. Yes, if they are about the same in  
12 latitude and -- extent and latitudes, yes.

13 Q. Do you recall when Mr. Alexander asked  
14 you about green hydrogen?

15 A. Yes.

16 Q. Are there any currently operating green  
17 hydrogen electrical generating facilities?

18 A. Not to my knowledge, there are not.

19 Q. And are there any facilities in the  
20 progress of being built or planned?

21 A. Again, not to my knowledge.

22 Q. Is the use of green hydrogen hypothetical  
23 at this point in time?

24 A. I would call it conceptual at this point.

25 Q. And how do you distinguish conceptual

1 from hypothetical?

2 A. That somebody may have done a little  
3 research on a lab scale or a bench scale someplace.  
4 That would be a very, very small scale as proof of  
5 concept as opposed to hypothetical which would be  
6 conjecture basically that it might happen.

7 Q. Do you recall when Mr. Alexander asked  
8 you about the protectiveness of the particulate  
9 matter NAAQS?

10 A. Yes.

11 Q. And the adverse health effects increase  
12 with the increased concentration of particulate  
13 matter of less than 2.5 microns?

14 A. That's right. As you increase, correct,  
15 the adverse health effects tend to increase and those  
16 rates again depend on who is being exposed, children,  
17 healthy adults, people that are otherwise impaired in  
18 some way and senior, whether you are ill, for  
19 example, such as if you have a pandemic going around.  
20 So it depends on the exposure, exposed individual  
21 but, as a general rule, yes.

22 Q. And there's no level at which there -- no  
23 level of particulate matter of less than 2.5 microns  
24 in the area at which a study has shown there to be no  
25 adverse effects.

1           A.     That's correct.  That's the current state  
2 of the signs and people have tested at low -- lower,  
3 lower, and far lower than the NAAQS level and have  
4 not found a safe level where there is no adverse  
5 incremental health effect.

6           Q.     And have studies conducted since 2012  
7 confirmed the linear relationship between particulate  
8 matter of less than 2.5 microns, the concentration of  
9 those particulate matter, and adverse health effects?

10           MR. ALEXANDER:  I am going to object as  
11 to leading.

12           Q.     All right.  I'll rephrase.  What have  
13 studies since 2012 shown about the relationship  
14 between particulate matter of -- of less than  
15 2.5 microns and adverse health effects?

16           A.     So because there has been no proof of a  
17 safe threshold, it's assumed that the -- if you  
18 plotted the adverse health effect and concentration  
19 would go to zero.  In other words, there would not be  
20 an offset which would indicate a tolerable level that  
21 might be safe.  So because it goes to zero, now the  
22 question is the shape of the curve.  Depending on  
23 studies they are linear, they could be piecewise  
24 linear so there is different shapes but with the  
25 understanding that the curves have to go to zero.

1 Q. But no research since 2012, I am asking  
 2 specifically about the time period, have changed that  
 3 conclusion.

4 A. That is correct.

5 MR. ALEXANDER: Objection, leading again.

6 ALJ PARROT: Excuse me. Overruled.

7 MS. WACHSPRESS: I can rephrase or --  
 8 yeah.

9 ALJ PARROT: Overruled.

10 Q. (By Ms. Wachspress) And so will an  
 11 increase in particulate matter of less than  
 12 2.5 microns into the atmosphere around the proposed  
 13 facility increase the concentration of particulate  
 14 matter of less than 2.5 microns around the facility?

15 A. Yes. That's typically how it works.  
 16 It -- what you emit from a stack will disperse but  
 17 you will have progressively higher concentrations  
 18 locally, and then they diminish as you get away from  
 19 the source.

20 Q. And will these increased concentrations  
 21 in your opinion likely be associated with increased  
 22 adverse health effects?

23 A. Yes. That's the point I make in my  
 24 testimony.

25 Q. Do you recall Mr. Alexander asking you

1 about modeling of ozone by TRC? Do you recall that?

2 A. Yes, I do recall the question on that.

3 Q. Okay. And you stated that the TRC did  
4 not conduct a model of ozone concentration, correct?  
5 Sorry. What did you -- what did you conclude about  
6 the study that TRC conducted with respect to ozone?

7 A. What TRC did is an analysis. As I  
8 mentioned, ozone is created in the atmosphere due to  
9 reactions from precursor compounds like nitrogen  
10 oxides and volatile organic compounds. And they  
11 along with sunlight, they form complex reactions.

12 And one of those reactions or several of  
13 them cause ozone to be formed in the atmosphere so  
14 it's called photochemical pollutant. It's not  
15 directly emitted. It's created from precursors, so  
16 to properly model ozone emissions and formation, you  
17 would have to run what are called photochemical  
18 commodities. The AERMOD model that was mentioned by  
19 Mr. Alexander that TRC used is not a photochemical  
20 model. It's a physical dispersion model. It cannot  
21 take into account any chemistry in the atmosphere.

22 So what TRC did is -- that's what I meant  
23 when I said I think they did not directly model ozone  
24 increases due to the emissions of the precursor.

25 They used an approach, a proportional approach called

1    MERP, M-E-R-P, which basically stands in for the  
2    proposition that there is some proportionality  
3    between the NOx and the VOC emissions, and you can  
4    infer from proportional relationships what the ozone  
5    levels might be.  It is really a very rudimentary, if  
6    you will.  It simplifies all of the very complex  
7    chemistry into a proportional relationship.  And it's  
8    a first cut, if you will, at getting a handle on what  
9    that might be.  It is by no means a reliable estimate  
10   of the incremental ozone that you might get from  
11   actual modeling of the precursor.

12           Q.    And did TRC provide the underlying data  
13   associated with this summary report?

14           A.    I only saw the July 6 summary report, 7  
15   or 8 pages.  I didn't see any other supporting or  
16   underlying information.

17           Q.    And the report describes 12 scenarios  
18   utilized to produce these values.  Did TRC identify  
19   what those values were?

20           A.    No.  I think the 12 is mentioned in a  
21   parenthetical, and I don't think there was any  
22   discussion of what those 12 might have -- what  
23   conditions those 12 scenarios might have been.

24           Q.    And do you recall Mr. Alexander asking  
25   you questions about the charts on page 4 of this

1 document, the TRC summary report?

2 A. Yes, I do.

3 Q. Okay. And if you'll direct your -- if I  
4 can direct your attention to the top chart, it says  
5 PM2.5 24-hour. What -- what does this line in the  
6 chart show?

7 A. So that -- that first line under  
8 pollutant PM2.5 24-hour, first, that represents a  
9 24-hour average concentration for that pollutant, for  
10 PM2.5 that you can get from your modeling. Then it  
11 shows five different numbers pertaining to that. I  
12 don't know. Did you want me to walk through those  
13 five or?

14 Q. Well, mostly just interested in the one  
15 on the far right. Can you describe --

16 A. Oh, yeah.

17 Q. The one that says 5.8, can you tell me  
18 what that one means?

19 A. That one is supposedly the project impact  
20 so if you look at the project impact in microgram per  
21 cubic meter, that is, according to TRC, 1.51  
22 micrograms per cubic meter, and my understanding is  
23 the last line, 5.8 percent, is the ratio of 1.51  
24 divided by 26.

25 Q. So it shows the impact as a proportion of

1 the total -- of the total background versus the  
2 impact.

3 A. Right. Subject to my discussion that the  
4 background itself probably -- not probably, is  
5 incorrect, it does show that relationship. It just  
6 divides 1.51 by the background. It does so for every  
7 other line, every other pollutant line in that table.

8 Q. Okay. If I could direct you to your  
9 testimony at page 12.

10 A. Okay.

11 Q. Line -- page 12, lines 20 through 24.

12 A. Okay.

13 Q. And when you state "the impacts are  
14 simply not flagged at all," what did you mean by  
15 "impacts"?

16 A. Let me read that sentence, if you don't  
17 mind.

18 Q. Of course.

19 A. Right. Are the impacts in terms of their  
20 incremental health is what I meant when I wrote that  
21 sentence.

22 Q. And you recall Mr. Alexander asking you  
23 about Table 16 of the application which is on page  
24 54.

25 A. Yes, I do recall him asking that. I can



1 go back to that. Yes, I'm there.

2 Q. And does Table 16 show the impacts of  
3 emissions from the proposed facility on the impacts  
4 that you described?

5 A. No. Table 16 has to do with the  
6 emissions. Setting aside their accuracy, just shows  
7 the emissions of the different line items. These are  
8 not impacts. These emissions are in tons per year,  
9 so they are annual estimated emissions for the  
10 various items shown in that table.

11 Q. And do you recall Mr. Alexander asking  
12 you some questions about AERMOD modeling?

13 A. Yes.

14 Q. Could you tell me a little bit more about  
15 your experience with the use of AERMOD?

16 A. AERMOD is a regulatory model that's been  
17 around as the recommended model by EPA for some time  
18 now, about 10 years, and it's a very standard model  
19 that is used for physical dispersions so as  
20 distinguishing from photochemical modeling.

21 So I have several sets of experiences  
22 with AERMOD. I have run the model itself for certain  
23 sources. I have interpreted the results from the  
24 AERMOD modeled runs done by others. I have looked at  
25 any number of analyses of dispersion modeling using

1 AERMOD. It happens it's a very commonly used model,  
2 so it's quite usual for sources to rely on AERMOD to  
3 do some predictive modeling, so it covers the gamut  
4 of all of those type of uses including running the  
5 model.

6 Q. And do you recall Mr. Alexander asking  
7 you questions about disruptions to the AEP grid?

8 A. Yes.

9 Q. If the AEP grid is operating, how could  
10 it come to be that electricity to OSU could be  
11 disrupted?

12 A. If the AEP grid is operating, my  
13 understanding is that that would continue to be a  
14 source of electrical supply to the OSU campus. At  
15 least that's my understanding of how the system is  
16 configured, that it would continue to have even after  
17 the CHP the local grid be a source of electricity.

18 Q. In general, if the grid is operating,  
19 how -- what are the points at which the electricity  
20 to OSU could be disrupted?

21 A. Well, the grid provides a connection, and  
22 we mentioned a couple substations, for example, the  
23 OSU substations and other substation so that's where  
24 the grid and then the local distribution comes in.

25 Of course, that electricity then has to

1 go to all the different loads on the campus, many  
2 buildings and other uses. There could be disruption  
3 of electrical supply at any point. I mean, we have  
4 voltage disruptions. We have a particular switch  
5 malfunctions, transformers can malfunction, so it  
6 depends on where in that ultimately it has to come to  
7 a point where the user can turn on the light switch,  
8 so to speak, and get that power for whatever load  
9 they had, so it could be disrupted behind the walls  
10 all the way up to the substation and points beyond.

11 Q. So some of that disruption would occur  
12 behind the -- is it -- is it -- can some of that  
13 disruption occur behind the meter?

14 A. Yes. Right up to the load, correct.

15 Q. And if that disruption occurs at the  
16 substation, would it disrupt electricity from any  
17 sources of the power that are running through that  
18 substation?

19 A. Right. If it's failure of the  
20 substation, let's say one of the main transformers  
21 failed and, of course, it could affect the connected  
22 loads from that substation.

23 Q. So do you recall Mr. Alexander asking you  
24 questions about hourly thermal load analysis?

25 A. Yes.

1           Q.    And do you recall Mr. Alexander asking  
2    you questions about analysis of heating and cooling  
3    loads?

4           A.    Yes.

5           Q.    Could you explain the difference --  
6    the -- what purpose those respective types of  
7    analyses serve?

8           A.    I'm sorry.  I want to understand the  
9    question.  Not what the loads themselves are but why  
10   you would do such an analysis?

11          Q.    Yes.

12          A.    I'm sorry.  Yeah, I think I explained  
13   that if you have heating loads, from an intuitive  
14   standpoint you should have heating loads during the  
15   winter because that's when you need comfort heating,  
16   for example.  And, correspondingly, you should have  
17   cooling loads in the summer.  That's when you need  
18   air conditioning and so on.

19                    It's a bit counterintuitive to imagine  
20   the extent of heating loads during the summer or  
21   cooling loads during the winter.  And yet when you  
22   look at a district heating system such as the  
23   University, those loads in these offseasons are not  
24   zero.  They can be quite substantial.  So doing an  
25   analysis, the hourly analysis or even finer analysis,

1 of those two types of loads separately shows you the  
2 actual heating loads and actual cooling loads as a  
3 function of time. And then you can see the extent to  
4 which both loads, those are happening simultaneously,  
5 and if there is that overlap and the extent of the  
6 overlap is there, it could provide a meaningful  
7 opportunity to effectively meet both of those loads  
8 by heat exchanging among themselves. You are -- you  
9 would take -- use the example of obtaining reject  
10 heat from the chillers. And, again, maybe slightly  
11 technical point, the reason chillers work is because  
12 they remove heat and dump it into the atmosphere much  
13 as you would walk by an air conditioning unit on the  
14 outside and actually feel warm. That's how the air  
15 conditioning works for inside the space, by dumping  
16 the extra heat on the outside.

17 Same thing behind your refrigerator,  
18 those coils are hot. But same way that chiller  
19 exhaust would be an opportunity to heat up the hot  
20 water, and so the extent of overlap would be -- would  
21 be revealed, if you will, and it would provide an  
22 opportunity to get very efficient, low exergy hot  
23 water heating to meet some of your load.

24 Q. And that heated hot water can be heated;  
25 it can have energy put into it by sources such as

1 geothermal energy or heat exchangers.

2 A. Right. So, first, you take whatever can  
3 be extracted for the temperature of hot water, you  
4 need 120 Fahrenheit is a good one or 130 Fahrenheit,  
5 and you heat up that extract the best you can from  
6 your chilling exhaust, and then you go to geothermal  
7 sources for the rest of your distribution, that's  
8 right.

9 Q. And based on the testimony you heard  
10 today, do you feel that OSU considered this  
11 combination of technologies as an alternative to  
12 constructing the proposed facility as a source for  
13 steam?

14 A. No, it did not. In fact, the testimony  
15 clearly said that from a district-wide perspective,  
16 those options were not looked at.

17 Q. Okay. And do you recall Mr. Alexander  
18 asking you questions about OSU's use of hot water?  
19 Do you recall those questions?

20 A. Yeah, I recall a few. I don't know if I  
21 recall all of them, yes.

22 Q. And is that use of hot water the same as  
23 the use of hot water you just described?

24 A. No. I think I pointed out the hot water  
25 from a district perspective, to the extent that it is

1 contemplated and was described was for few buildings  
2 where that hot water would be created by using steam  
3 as a source.

4 So steam would be used from the CHP to  
5 exchange heat creating hot water. That's totally  
6 different, very inefficient in my mind, and is not  
7 the same at all as using geothermal which is a type  
8 that they do have in those residence halls. That's  
9 where the hot water would be created directly from  
10 down sources but two very different ways of heating  
11 the hot water.

12 Q. Why is it very inefficient to use steam  
13 to heat a hot water system?

14 A. That's a thermodynamic question that has  
15 to do with exergy and available energy. I will just  
16 simplify it by saying any time you exchange energy,  
17 and thermal energy is one way, you -- you can only do  
18 that with a gradient, in other words, to move heat  
19 you have to go from a high temperature to low  
20 temperature. That's the only way heat flows, heat  
21 flows from high to low temperature, not the other way  
22 around.

23 And if that temperature difference is  
24 very large, steam is a good example, steam is at  
25 least 212 degrees Fahrenheit, and hot water that you

1 need doesn't have to be more than 120 degrees  
2 Fahrenheit, so when you have a large temperature  
3 difference, it creates thermodynamic inefficiencies.  
4 It creates loss of available energy. It increases  
5 what we call entropy.

6           Whereas, if you have a system that has a  
7 low temperature difference between the hot and the  
8 cold, you can exchange that heat at lower exergy, at  
9 more efficiency, less entropy, so it really has its  
10 root in thermodynamics and how quantities like heat  
11 and energy flow across differences.

12           Q.    And do you recall Mr. Alexander asking  
13 you questions about the replacement of the current  
14 steam distribution system?

15           A.    Yes.

16           Q.    And are there ways to replace steam  
17 distribution systems with hot water distribution  
18 systems without -- while reducing disruptions to the  
19 use of the buildings that rely on that heat?

20           A.    Yes. It would depend on particular  
21 circumstances. I think one of the witnesses before  
22 mentioned that the steam system at OSU some of it is  
23 in the tunnels, and some of it is in trenches, for  
24 example, along with respective condensated return  
25 lines. So, you know, obviously you can change out,



1 you know, things that are in tunnels and things that  
 2 are in trenches and get to the point of the load, the  
 3 building perhaps. At that point you have to maybe  
 4 see what the specific requirements are to have the  
 5 hot water be the source of whatever heating needs.  
 6 If it's a cafeteria, it might go to some of the bulk  
 7 of the needs, and they may have a small, tiny boiler  
 8 for whatever local steam needs, and other, residence  
 9 hall, it might be just the hot water, so it depends  
 10 on the circumstances but, yes, you would have to look  
 11 at those specifics of the piping currently in the  
 12 steam system.

13 MS. WACHSPRESS: That's all I have, your  
 14 Honor.

15 Thank you, Dr. Sahu.

16 Your Honor, I have no further questions.

17 MR. ALEXANDER: Your Honor, I do have a  
 18 few follow-up.

19 ALJ PARROT: Go ahead, Mr. Alexander.

20 - - -

21 RECROSS-EXAMINATION

22 By Mr. Alexander:

23 Q. Let's start with the TRC report that  
 24 counsel directed you to --

25 A. Yes.

1 Q. -- at page 4. Are you there?

2 A. Sure, yes. Page 4, yes, I am there.

3 Q. Now, this table shows the overall highest  
4 predicted impact location, correct?

5 A. That's what is stated there. The first  
6 table, the top most one on that page?

7 Q. Yes, the one your counsel directed you  
8 to, the top table on the page.

9 A. Yes, yes, sir.

10 Q. So what this shows is of all the  
11 locations evaluated by TRC, this is the projected  
12 impact at -- at most impacted location, correct?

13 A. Yeah. There is a small caveat. I was  
14 hoping we didn't need to go to that, but since you  
15 raised the issue, remember, the impacts are only  
16 predicted at whatever points on the receptive grid  
17 that are put into the model; in other words, the  
18 model will simply tell you the concentrations and  
19 whatever grid point or other receptor point you  
20 specify. So the fineness of the grid will determine  
21 whether you truly capture the maximum or not.

22 Q. And in this case TRC evaluated 3,000  
23 locations, correct?

24 A. Yes. That's the total grid size but what  
25 is the spacing of the grid? In other words, if --

1 imagine if the grid -- they say the 70 meter spacing,  
2 it says that on the top of page 3, 3,000 regularly  
3 spaced 70 meter, see the parenthetical, that means  
4 each grid point was 70 meters which would be about  
5 200 feet apart.

6 And so the model simply looks at each of  
7 those 3,000 and picks the maximum, but it is not able  
8 to tell you if -- what might be the actual  
9 concentration between the two grid points, between  
10 one and its adjacent grid points because that would  
11 require a much finer grid to capture the two maximum.  
12 You can keep going. You can imagine if you had 10  
13 meter grids, you would have a lot more points, and  
14 you would be able to bracket that maximum a lot  
15 better. So it is that important sort of distinction  
16 of what that number means. It does tie to the grid  
17 space.

18 Q. So out of those 3,000 locations, let's  
19 focus on PM2.5, which is what your counsel asked you  
20 about, the total impact including the CHP is 27.51;  
21 is that correct?

22 A. That's -- yes, that's what is shown  
23 there.

24 Q. Okay. And then after -- even after the  
25 CHP impact is taken into account, that gets us to the

1 total, right? It's the current background plus the  
2 CHP impact combined, right?

3 A. That's right. Those are the two lines,  
4 two values, added to form the total impact.

5 Q. Okay. Now, the primary standard is 35,  
6 correct?

7 A. Yes.

8 Q. Okay. And now moving down the chart for  
9 more sensitive locations, the project -- project  
10 impact is also shown in the same way using the same  
11 columns, correct?

12 A. Yes.

13 Q. Okay. Next topic, your counsel asked you  
14 about the AEP grid. Do you recall those questions?

15 A. Yes.

16 Q. And isn't it true that the AEP grid could  
17 be operating properly, but the distribution line  
18 to -- from that grid to Ohio State suffered an  
19 outage?

20 A. Yes. I think I covered that in the  
21 answer that it would be failures all the way from  
22 grid level right down to the wall socket.

23 Q. Sure, but I just want to be very clear,  
24 if there was an outage, it could occur anywhere from  
25 the PJM grid going -- the whole grid going down, to

1 the AEP system going down, to the distribution system  
 2 going down, all of which would occur prior to the  
 3 substation, correct?

4 A. That could happen, yes.

5 Q. Okay. Next, with regard to geothermal,  
 6 you would agree that you can't do geothermal without  
 7 the available land to do so, correct?

8 A. I disagree. We had a dispute on what  
 9 that available land means. You sink wells in  
 10 geothermal, and then you identify the resource. And  
 11 depending on configuration, you put your pipes in the  
 12 ground, you have to go to the ground, so the surface  
 13 use is still allowed, you oftentimes have geothermal,  
 14 people have heat pumps in their house, and they have  
 15 surface uses that are not restricted. I don't fully  
 16 understand available land and geothermal. You  
 17 brought it up several times now.

18 Q. Do you know how deep the Ohio State  
 19 geothermal well is?

20 A. I've seen geothermal wells that go about  
 21 3,000 feet. I have seen them go to, you know,  
 22 35 feet so they can be depending on what you want to  
 23 capture and system design.

24 Q. And the depth of the well would impact  
 25 the cost effectiveness of the well, correct?

1           A.    That I don't follow. I mean, it costs  
2 more to put a deeper well but that might be a great  
3 resource. I don't understand "cost effectiveness."

4           Q.    A deeper well would cost more, correct?

5           A.    To drill a deeper well typically costs  
6 more than a shallow well, yes.

7           Q.    Have you testified for any other client  
8 more than 20 times?

9           A.    I don't know. I haven't counted the  
10 number of times I have testified for governments  
11 including the DOJ, so I just haven't counted them.  
12 Probably more than 20 times for the government,  
13 different governments, yes.

14          Q.    So you are consolidating all governments?

15          A.    Mostly the Federal Government but I have  
16 testified at other levels as well.

17               MR. ALEXANDER: Okay. Nothing further.  
18 Thank you.

19               ALJ PARROT: Mr. Lindgren?

20               MR. LINDGREN: No questions, your Honor.

21               ALJ PARROT: Thank you very much.

22               Thank you, Dr. Sahu. I appreciate your  
23 time today.

24               THE WITNESS: Thank you, your Honor.

25               ALJ PARROT: All right, Ms. Wachspress.

1 I believe you have marked his testimony as Sierra  
2 Club Exhibit F. Are there any objections to its  
3 admission?

4 MR. ALEXANDER: No, your Honor.

5 ALJ PARROT: Okay. Hearing none, Sierra  
6 Club Exhibit F is admitted into the record at this  
7 time.

8 (EXHIBIT ADMITTED INTO EVIDENCE.)

9 ALJ PARROT: Is there anything else we  
10 need to address this evening? Okay.

11 MR. ALEXANDER: Just what time?

12 ALJ PARROT: Hearing nothing, we will  
13 reconvene tomorrow, Wednesday, at 10:00 a.m. Eastern  
14 Time. I believe Webex invitations have already gone  
15 out, so you should have those.

16 Anything else tonight?

17 MS. WACHSPRESS: No, your Honor. Thank  
18 you for your time.

19 ALJ PARROT: All right. Thank you. I  
20 will see you all tomorrow.

21 (Thereupon, at 9:00 p.m., the hearing was  
22 adjourned.)

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CERTIFICATE

I do hereby certify that the foregoing is a true and correct transcript of the proceedings taken by me in this matter on Tuesday, July 14, 2020, and carefully compared with my original stenographic notes.

---

Karen Sue Gibson, Registered  
Merit Reporter.

(KSG-6931)

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