

September 20, 2018

Ms. Barcy F. McNeal, Secretary
Ohio Power Siting Board
Docketing Division
180 East Broad Street, 11th Floor
Columbus, Ohio 43215-3793

**Re: Case No. 16-1871-EL-BGN, In the Matter of the Application of Icebreaker Windpower Inc. for a Certificate to Construct a Wind-Powered Electric Generation Facility in Cuyahoga County, Ohio.
Deposition of Richard Brown (Redacted Version)**

Dear Ms. McNeal:

Ohio Administrative Code Rule 4906-2-18(M) provides that any depositions to be used as evidence must be filed with the Ohio Power Siting Board ("OPSB") prior to commencement of the hearing. In accordance with this rule, Icebreaker Windpower Inc. ("Icebreaker") is hereby filing the deposition of Richard Brown, which was taken on July 25, 2018.

A portion of Richard Brown's deposition contains confidential information. Please note that the transcript from the later portion of Richard Brown's deposition has the notation "Attorneys' Eyes Only" on each page. This notation was at the request of Icebreaker in order to protect the confidential information discussed. Icebreaker has reviewed both the deposition transcript and Exhibit 3 to the transcript, which also contains confidential information, and has redacted the confidential information in an effort to put the nonconfidential portion of the documents in the open record.

Along with this filing, we will also provide to the Docketing Division paper copies of the unredacted pages, and will file a Motion for Protective Order and Memorandum in Support requesting protective treatment of the confidential information contained therein.

Respectfully submitted,

/s/ Christine M.T. Pirik

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Enclosure

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08-06-2018

Jonathan Secrest
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Via e-mail: jsecrest@dickinsonwright.com

IN RE: IN RE: APPLICATION OF ICEBREAKER WINDPOWER

Dear Mr. Secrest:

Enclosed please find the errata-addendum for the transcript of **Richard Brown** taken **07/25/2018**.

Please do not hesitate to contact us if you have any questions or concerns.

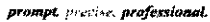
Sincerely,

PRI Court Reporting, LLC

Enclosure

cc: Christine Pirik, Robert Haffke, John Jones, Michael Settineri, Miranda Leppla

ref: AS315640



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Richard E Brown

IN THE MATTER OF: APPLICATION OF ICEBREAKER WINDPOWER

Deposition of
Richard Brown
July 25, 2018



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1 BEFORE THE OHIO POWER SITING BOARD

2

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4 IN THE MATTER OF THE)
5 APPLICATION OF ICEBREAKER)
6 WINDPOWER, INC., FOR A)
7 CERTIFICATE TO CONSTRUCT A) Case No.
8 WIND-POWERED ELECTRIC) 16-1871-EL-BGN
9 GENERATION FACILITY IN)
10 CUYAHOGA COUNTY, OHIO)

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DEPOSITION OF

15

RICHARD E. BROWN

16

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Taken at the offices of
BENESCH LAW

18

41 South High Street, Suite 2600
Columbus, Ohio 43215

19

on July 25, 2018, at 10:03 a.m.

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21

Reported by: Angela R. Starbuck, RDR/CRR/CRC

22

23

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1 APPEARANCES:

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on behalf of Icebreaker windpower.

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11 on behalf of the Intervenor:
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on behalf of Sierra Club.

1 APPEARANCES (Continued):

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8 on behalf of Business Network
9 for Offshore Wind, Inc.
10
11
12

13 ALSO PRESENT:

14 Beth Nagusky, LEEDCo
15 David Karpinski, LEEDCo
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STIPULATIONS

It is stipulated by and among counsel
for the respective parties that the deposition
of RICHARD E. BROWN, a witness herein, called by
Icebreaker Windpower under the applicable Rules
of Civil Procedure may be taken at this time by
the notary pursuant to notice and by agreement;
that said deposition may be reduced to writing
in stenotypy by the notary, whose notes
thereafter may be transcribed out of the
presence of the witness, and that the proof of
the official character and qualification of the
notary is waived.

--0--

1 RICHARD E. BROWN

2 being first duly sworn, as hereinafter
3 certified, deposes and says as follows:

4 EXAMINATION

5 BY MR. SECREST:

6 Q. Good morning, Doctor. Will you please
7 state your full name for the record.

8 A. Richard E. Brown.

9 Q. Thank you. Where do you currently
10 reside?

11 A. In Castle Pines, Colorado.

12 Q. Doctor, I assume you've been deposed
13 before?

14 A. Yes.

15 MR. SECREST: And just for some
16 houseclean -- housekeeping, for those of you on
17 the phone, we had a discussion prior to going on
18 the record and opening up the conference line.
19 Chris and Chris, can you please confirm that you
20 both have signed the protective agreement in
21 this proceeding.

22 MR. TAVENOR: So Randy has sent that out
23 on behalf of OEP.

24 MR. SECREST: Excellent. Thank you.

1 For purposes of this deposition, we are
2 going to treat the entire transcript as
3 confidential and attorney eyes only.

4 MR. ZOELLER: And this is Chris Zoeller,
5 I am exempt per our rules as a staff attorney.

6 MR. SECREST: Thank you very much,
7 Chris. For those -- for the benefit of those on
8 the phone as well, we will go around the room
9 and just note our appearances.

10 This is Jon Secrest of Dickinson Wright
11 on behalf of Icebreaker windpower, Inc.

12 MS. PIRIK: This is Chris Pirik with
13 Dickinson Wright.

14 MS. NAGUSKY: Beth Nagusky with LEEDCo.

15 MR. KARPINSKI: Dave Karpinski with
16 LEEDCo.

17 MR. HAFFKE: This is Rob Haffke of
18 Benesch Friedlander on behalf of the Bratenahl
19 Intervenors.

20 MR. SETTINERI: Yeah, and on behalf of
21 the Business Network for Offshore Wind, Inc.,
22 Mike Settineri, the law firm of Vorys, Sater,
23 Seymour & Pease, 52 East Gay Street, Columbus,
24 Ohio 43215.

1 BY MR. SECREST:

2 Q. Doctor, if you could approximate, how
3 many times have you given deposition testimony?

4 A. Maybe 15.

5 Q. And how many Ohio Power Siting Board
6 proceedings have you been involved in?

7 A. Just one other.

8 Q. And which one was that?

9 A. I can't recall the specific name but it
10 was for a gas-fired turbine project.

11 Q. And we'll get to your CV in a minute,
12 but was that South Field?

13 A. I believe so, yes.

14 Q. And we'll skip all the usual deposition
15 instructions given your experience being
16 deposed.

17 --0--

18 (Exhibit 1 marked.)

19 --0--

20 BY MR. SECREST:

21 Q. Doctor, let me hand you what I've marked
22 as Exhibit 1. Doctor, have you seen this
23 document before?

24 A. Yes.

1 Q. will you please identify it for me.

2 A. This is the retention letter for the
3 Icebreaker Windpower project that was submitted
4 to the law firm Benesch, signed by me.

5 Q. And it's signed by you and it also notes
6 Exponent. You are currently employed by
7 Exponent, correct?

8 A. Correct.

9 Q. what is your job title?

10 A. Is principal engineer.

11 Q. what are your job duties?

12 A. To provide consulting services for
13 clients primarily focused on the electric
14 utility industry and related industries.

15 Q. And when you say provide consulting
16 services, what percentage of the consulting
17 services include expert witness testimony, if
18 that is, in fact, included in consulting?

19 A. Yeah, so by -- by revenue, I would say
20 about half of my work is for -- we call it
21 reactive work. This would be regulatory type
22 and/or civil type proceedings. And then about
23 half of my work is what we call proactive
24 consulting, which is engaging with clients just

1 to help their business performance, those types
2 of things. About half and half.

3 MR. SECREST: And for the record, John
4 Jones with the AG's office on behalf of staff
5 has just joined the call; is that correct?

6 MR. JONES: That is correct.

7 MR. SECREST: Thank you.

8 MR. JONES: Thank you.

9 BY MR. SECREST:

10 Q. Doctor, have you ever been retained by
11 the law firm Benesch, Friedlander, Coplan &
12 Aronoff prior to this engagement?

13 A. Yes.

14 Q. How many times, do you know?

15 A. That was one time, I believe.

16 Q. And what was that in regards to?

17 A. That was for the South Field project.

18 Q. Who specifically at Benesch retained
19 you, do you recall?

20 A. That was John Stock as well.

21 Q. Do you know if any Exponent employee or
22 independent contractors or agents have been
23 engaged by the law firm of Benesch, Friedlander,
24 Coplan & Aronoff in the last 10 years other than

1 yourself?

2 A. If Exponent has had other retentions
3 with Benesch?

4 Q. Correct. Correct.

5 A. I -- I don't know for sure. I'm
6 guessing yes, though. Exponent's a pretty
7 big -- pretty big firm.

8 Q. I understand. Just wanted to see if you
9 were aware of any. Thank you.

10 This letter, Exhibit 1, is dated
11 September 11th, 2017. Do you recall how it came
12 to pass that you were engaged in this matter?

13 MR. HAFFKE: I'm going to object to the
14 extent it calls for privileged information, but
15 you can answer.

16 A. I had done work for John Stock before.
17 He was involved with this project and was
18 interested in retaining my services, so my
19 understanding is that John Stock was interested
20 in using me.

21 Q. So Mr. Stock reached out to you, not
22 vice versa?

23 A. That's correct, yes.

24 Q. And do you recall when it was that you

1 first discussed this project with Mr. Stock?

2 A. I don't specifically recall. It would
3 have been probably within a couple weeks of the
4 retention letter most likely.

5 Q. So most likely a couple weeks prior to
6 September 11th, 2017?

7 A. Correct. Yes.

8 Q. Thank you. If you look at the second
9 paragraph of Exhibit 1, it says, our scope of
10 services is anticipated to include engineering
11 consulting as requested on the above matter.
12 This project shall be performed at the direction
13 of Benesch, Friedlander, Coplan & Aronoff, LLP,
14 but is generally expected to include expert
15 witness support related to the Icebreaker
16 windpower project including issues related to,
17 number one, the economic viability of a small
18 wind turbine fleet. Two, the general economics
19 of wind power generation in the United States.
20 And, three, the impact of extensive wind farm
21 development on current PJM baseload and price
22 impact.

23 Has your engagement during the course of
24 these proceedings stayed true to those three

1 enumerated topics or subjects?

2 MR. HAFFKE: Objection; vague.

3 But go ahead.

4 A. So in terms of the economic viability of
5 a small wind turbine fleet, certainly the report
6 addresses that. The general economics of wind
7 power generation in the United States, the
8 report does address certain aspects of that.
9 The impact of extensive wind farm development on
10 current PJM baseload and price impact, it does
11 address that a little bit in certain large
12 deployment scenarios.

13 And so I would say, yes, the report does
14 touch on those three to greater or lesser
15 extent.

16 Q. You are aware that the Icebreaker
17 windpower project is a six turbine project,
18 correct?

19 A. Correct. Yes.

20 Q. What is the relevance of the general
21 economics of wind power generation in the United
22 States to this project?

23 A. This is the -- the issue of market
24 distortion in the overall United States can be

1 applied to what might occur with large scale
2 deployment in Ohio, so there is a history of
3 large scale wind deployment in certain parts of
4 the U.S. For example, Texas. And that can be
5 useful in understanding what might occur in Ohio
6 should widespread deployment happen here.

7 Q. A six wind turbine project is not large
8 scale, is it?

9 A. The -- item three says the impact of
10 extensive wind farm development on the current
11 PJM baseload, and so extensive wind farm
12 development would be a scenario beyond this
13 project.

14 Q. This project does not, in your view,
15 qualify as extensive wind farm development; is
16 that accurate?

17 A. The description of the project in the
18 application and the feasibility study links this
19 project to wider deployment, so to the extent
20 that this project is a, you know, sort of the
21 tip of the spear, I would disagree with that.

22 Q. You disagree that this project -- strike
23 that.

24 You believe this project qualifies as

1 extensive wind farm development?

2 A. I believe that this project is linked to
3 greater development than just these six wind
4 farms as described in the application itself.

5 Q. Specifically what was described, do you
6 recall?

7 A. That the purpose of this project was
8 to -- I don't know the exact quote, but
9 basically to stimulate the offshore wind
10 industry in Lake Erie and the Great Lakes area.
11 This is in the application.

12 Q. You are aware that the Ohio Power Siting
13 Board is only considering an application for a
14 six wind turbine project, correct?

15 A. This would be the project that they
16 would be approving, correct, in this
17 application.

18 Q. Although I appreciate your response, I
19 don't think you actually answered the question
20 of what the relevance of number two, the general
21 economics of wind power generation in the United
22 states, has to this particular project.

23 MR. HAFFKE: I'm going to object to
24 form. Is that a question?

1 A. Again, if you were going to have large
2 scale deployment of wind in Ohio, then you could
3 look to large scale deployment in the greater
4 United States to inform what may happen in the
5 market of Ohio.

6 Q. So would the general economics of wind
7 power generation in the United States only be
8 relevant if there is going to be large scale
9 development in Ohio?

10 A. I think that's fair, yes.

11 Q. Doctor, in the third paragraph,
12 second-to-last sentence, states, Exponent
13 charges \$430 per hour for my services in
14 calendar year 2017.

15 We are now obviously in calendar year
16 2018. Has your rate gone up?

17 A. Yes. It is \$450 an hour this year.

18 Q. Thank you. And it states, other
19 Exponent staff members will be utilized where
20 appropriate.

21 Did you utilize other Exponent staff
22 members?

23 A. No.

24 Q. The fourth paragraph on Page 1 of

1 Exhibit 1, the second sentence, it is our
2 understanding that Exponent's retention on this
3 project is with Benesch, Friedlander, Coplan &
4 Aronoff, LLP, on behalf of Murray Energy
5 Corporation, in parens, Murray Energy, and as
6 such, all charges, in parens, i.e. fees and
7 expenses, end parens, incurred by Exponent on
8 this project will be billed to your office but
9 will be the responsibility of Murray Energy,
10 independent of other parties/payees involved.

11 what involvement does Murray Energy have
12 in this project?

13 A. Beyond paying -- being responsible for
14 payment, I do not know.

15 Q. what is the basis for including Murray
16 Energy as the client in this engagement letter?

17 MR. HAFFKE: Objection to the extent it
18 calls for privileged information.

19 Go ahead.

20 A. Yeah, my understanding is that they are
21 the people that are, you know, funding this
22 intervention and that's who's responsible for
23 payment. So just at direction of who's going to
24 be responsible for the bills, that's why this is

1 included here.

2 Q. What -- do you know what interest Murray
3 Energy has in this proceeding?

4 A. No.

5 Q. That hasn't been communicated to you?

6 A. Correct.

7 Q. Have you spoken with anyone at Murray
8 Energy regarding your engagement in this matter?

9 A. No.

10 Q. Have you exchanged any e-mails with
11 anyone from Murray Energy regarding your
12 engagement in this matter?

13 A. No.

14 Q. Have you seen any documents related to
15 your service in this matter with the name Murray
16 Energy other than this Exhibit 1?

17 A. No.

18 Q. Do you know who the intervenors are in
19 this matter?

20 A. I did ask and, you know, I know who the
21 intervenors that I'm representing are. I can't
22 quote their names right now. And then I
23 think -- I can't say them off the top of my
24 head, but I think they have been listed to me

1 before.

2 Q. Do you know how many intervenors there
3 are?

4 A. I don't, no.

5 Q. You just indicated you're representing
6 the intervenors. However, Exhibit 1 says your
7 client is Murray Energy, does it not?

8 A. That's -- that is who is going to pay
9 for this.

10 Q. Prior to this proceeding, had you
11 personally represented Murray Energy or served
12 in any capacity on behalf of Murray Energy in
13 any other undertaking?

14 A. So I believe they, in a similar
15 situation, were the people that were funding the
16 intervention in the South Field project. That
17 would be the only one.

18 Q. And what is your basis for that belief?

19 A. My recollection is that -- that the
20 retention letter that went out was similar to
21 this retention letter.

22 Q. Have you received payment in this matter
23 directly from Murray Energy?

24 A. I don't know. Exponent has a separate

1 billing department that sends those bills out.

2 I assume that they were sent out and that, as
3 project manager, I would have been notified had
4 payment not occurred. But I don't have active,
5 positive knowledge that that has happened. I
6 assume so.

7 Q. Thank you. And I understand Exponent is
8 quite large. Are you aware of any other
9 Exponent employee or independent agent providing
10 any other services for Murray Energy?

11 A. No.

12 Q. And the last sentence of the fourth
13 paragraph on Page 1 of Exhibit 1, quote, for
14 purposes of the terms and conditions of
15 agreement, in parens, client shall mean Murray
16 Energy.

17 I think that's consistent with what you
18 just testified, that the client is Murray
19 Energy?

20 A. Correct. And the terms and conditions
21 generally relate to payment terms, which is why
22 that is there.

23 Q. Did Murray Energy provide you any
24 direction as to your opinion or expert report?

1 A. No.

2 Q. On the second page of Exhibit 1, based
3 on the information you have provided, we have
4 performed a conflict of interest check for the
5 following parties.

6 First bullet is Murray Energy
7 Corporation. Second bullet is Bonheur ASA.

8 why was that listed, do you know?

9 A. Whenever I do these retentions -- I
10 don't specifically recall, but generally what I
11 do is I ask counsel who the potential interested
12 parties are so that I can run a conflict check
13 and make sure that we don't have a conflict --
14 me personally, I would know that -- or Exponent
15 more broadly. So this would be a list that
16 would have been provided to me by counsel at
17 request.

18 Q. Okay. Do you have any understanding
19 what Bonheur ASA is?

20 A. No idea.

21 Q. Do you have any understanding of what
22 Lake Erie Energy Development is?

23 A. Yeah, I believe in the application there
24 is a history of the -- of the developer in this

1 case, and I think that Lake Erie Energy
2 Development is part of all of those
3 consolidations and partnerships and everything.
4 That's my understanding.

5 Q. And what is your understanding with
6 regard to who LEEDCo is?

7 A. Same -- same answer as the above bullet.

8 Q. Icebreaker wind is fairly
9 self-explanatory.

10 A. Yes.

11 Q. How about Fred.Olsen Renewables?

12 A. Yeah, my understanding is that they are
13 going to be the owner/operator of this project
14 but, you know, same sort of thing, part of the
15 mix.

16 Q. As part of your service in these
17 proceedings on behalf of Murray Energy, did you
18 perform any research of Fred.Olsen Renewables?

19 A. No. There was information about
20 Fred.Olsen Renewables in the application with
21 regards to, I believe, experience in offshore
22 wind in Europe. This was not -- so beyond
23 reading the materials listed in my appendix, no.
24 But I -- there was information about Fred.Olsen

1 in the materials that I looked at.

2 Q. And just generally, do you recall any of
3 Fred.Olsen's experience in renewable energy?

4 A. Yeah, I think they had pretty extensive
5 offshore experience in Europe. I think a very
6 large holder and operator of offshore wind in
7 the U.K., if I recall correctly. So seemed to
8 be fairly established over in Europe in offshore
9 wind.

10 Q. And prior to this project, what has been
11 your experience in offshore wind?

12 A. No direct project experience.

13 Q. Prior to this project, what was your
14 experience in onshore wind?

15 A. So when I was doing production cost
16 modeling at ABB, we did look at onshore wind
17 farms as part of these models, and so that would
18 really be the extent of it is including onshore
19 wind farms in power system production costing
20 models.

21 Q. Any other experience?

22 A. No.

23 --0--

24 (Exhibit 2 marked.)

2 BY MR. SECREST:

1 A. I didn't look.

2 Q. But if you turn to what's Bates stamped
3 BR10 --

4 A. Yes.

5 Q. -- that has time up to and including
6 April 13th, 2018. And just reviewing this
7 Exhibit 2, I did not see time any more recent
8 than that. Please review Exhibit 2 and confirm
9 that 4-13-2018 is the most recent.

10 A. That's correct, yes.

11 Q. I assume you have devoted time to this
12 project in your engagement on behalf of Murray
13 Energy since April 13th 2018; is that accurate?

14 A. Yes. So there was a break after I
15 submitted the initial draft report and when it
16 became time to be submitted, and then there were
17 some -- and the confidential information was
18 provided to me, I then did a little bit of work
19 to develop the new section that's based on the
20 confidential information. So this was the bulk
21 of the report and then the work since then would
22 have been just the analysis using the
23 confidential information.

24 Q. Okay. Thank you. And since April 13,

1 2018, obviously not including today, do you know
2 how much time you've devoted to this project?

3 A. I would have to guess. Not a lot,
4 though.

5 Q. And the total reflected on these
6 invoices for time and charges from Exponent is
7 \$46,780. Feel free to add it up yourself, but
8 does that sound like about --

9 A. Subject to check, that sounds about
10 right.

11 Q. Subject -- subject to the -- and the
12 fact that I'm a lawyer and not good at math,
13 that sounds about right?

14 A. Sounds about right for this type of --
15 for the amount of material reviewed and the
16 report, that's about right.

17 --0--

18 (Exhibit 3 marked.)

19 --0--

20 BY MR. SECREST:

21 Q. Doctor, I'm handing you Exhibit 3.
22 Please take a moment to review and identify this
23 document for the record.

24 A. Yes, this is the expert --

1 MR. SECREST: Yes, Mike, you have
2 something?

3 MR. SETTINERI: I just want to go off
4 the record briefly.

5 MR. SECREST: Sure.

6 (Discussion off the record.)

7 MR. SECREST: Discussion off the record,
8 since there has been no confidential information
9 up until this point, we will designate the
10 deposition transcript up to this point not as
11 confidential. So from here on out, the rest of
12 the deposition will be confidential and attorney
13 eyes only.

14 Is everyone on the phone in agreement
15 with this?

16 MR. JONES: Yes.

17 MR. TAVENOR: Yes.

18 MR. SECREST: Thank you.

19 (Thereupon, the following testimony was
20 marked confidential and placed in a separate
21 transcript.)

22

23

24

CERTIFICATE

I, Angela R. Starbuck, RDR/CRR/CRC, a
Notary Public in and for the State of Ohio, do
hereby certify that I reported the foregoing
proceedings and that the foregoing transcript of
such proceedings is a true and correct
transcript of my stenotypy notes as so taken.

I do further certify that I was called
there in the capacity of a court reporter, and
am not otherwise interested in this proceeding.

In witness whereof, I have hereunto
set my hand and affixed my seal of office at
Columbus, Ohio, on this 25th day of July, 2018.

Angela R. Starbuck

Angela R. Starbuck, RDR/CRR/CRC
Notary Public, State of Ohio.

My commission expires: December 10, 2021

IN RE: APPLICATION OF ICEBREAKER WINDPOWER

ATTORNEYS' EYES ONLY

Deposition of
Richard Brown
July 25, 2018



prompt. precise. professional.

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1 BEFORE THE OHIO POWER SITING BOARD

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3 IN THE MATTER OF THE)
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5 WINDPOWER, INC., FOR A)
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Case No.
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13 DEPOSITION OF

14 RICHARD E. BROWN

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16 Taken at the offices of
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18 41 South High Street, Suite 2600
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on July 25, 2018, at 10:03 a.m.

20 Reported by: Angela R. Starbuck, RDR/CRR/CRC

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STIPULATIONS

It is stipulated by and among counsel
for the respective parties that the deposition
of RICHARD E. BROWN, a witness herein, called by
Icebreaker Windpower under the applicable Rules
of Civil Procedure may be taken at this time by
the notary pursuant to notice and by agreement;
that said deposition may be reduced to writing
in stenotypy by the notary, whose notes
thereafter may be transcribed out of the
presence of the witness, and that the proof of
the official character and qualification of the
notary is waived.

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1

INDEX OF EXAMINATION

2

PAGE

3

BY MR. SECREST:

26

BY MR. SETTINERI:

105

4

5

6

INDEX OF EXHIBITS

7

EXHIBIT

DESCRIPTION

PAGE

8

4

Document titled, "Direct
Testimony of Richard E. Brown
on behalf of Duke Energy
Ohio, Inc., In Support of
Stipulation"

100

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RICHARD E. BROWN

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being first duly sworn, as hereinafter

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certified, deposes and says as follows:

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(Thereupon, the following

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nonconfidential testimony was placed in a

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separate transcript.)

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BEGINNING OF CONFIDENTIAL PORTION

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19 BY MR. SECREST:

20 Q. Sorry to interrupt, Doctor. Exhibit 3,
21 please identify that for the record.

22 A. Yes, this is the expert report that I
23 submitted for this project.

24 Q. Thank you. And I believe you indicated

1 other than yourself, no one else at Exponent
2 worked on this report or helped you prepare
3 this?

4 A. Correct.

5 Q. Thank you. If you turn to the second
6 page of Exhibit 3, it bears a date of July 14th,
7 2018. Is that the date you completed your
8 expert report in this matter?

9 A. Yes.

10 Q. Do you know why it was that we did not
11 receive the expert report until July 23rd, 2018?

12 A. I submitted this before I went on
13 vacation. I think that July 14th is probably a
14 Friday. And then I was comfortable with this,
15 but we left time open for editorial reviews,
16 should they be needed, and so based on where I
17 was, it was unsure whether a close read and
18 edits would be needed. And then it turned out
19 that none were needed and so the -- what I
20 submitted on July 14th was what was submitted.
21 That was the process.

22 Q. Thank you. Please turn to Page 3 of
23 Exhibit 3.

24 A. Roman numeral ii?

1 Q. No.

2 A. The actual --

3 Q. Yes.

4 A. Okay.

5 Q. The last paragraph states, the remainder
6 of this report assesses the facility from the
7 perspective of project economics, the need for a
8 demonstration project, baseload generation,
9 market distortion, and application deficiencies.

10 what is your understanding of what the
11 term "demonstration project" means?

12 A. This was the term that was used in the
13 application, so I'm just using the word that
14 they used.

15 Q. What's your understanding of what that
16 term means, based upon your review of the
17 application?

18 A. So this is -- I can't read the minds of
19 the authors. What I can say is that this
20 initial project was presented as a pilot project
21 to explore technical issues and solve technical
22 problems, one of them being icing on the
23 turbines. And then when the application came
24 out, they do not present any technical issues in

1 the application, and so as far as I can tell,
2 they just could no longer call it a pilot
3 project and so they chose demonstration project
4 because it was no longer a pilot project. That
5 seems to be what happened to me.

6 Q. And so you believe there's a distinction
7 between demonstration project and pilot project;
8 is that accurate?

9 A. From my background in the utility
10 industry, the term pilot project is a small
11 scale deployment of new technologies to make
12 sure that these technologies work correctly
13 before widespread deployment, and this is for
14 cost recovery reasons based on utility
15 rate-making.

16 And so as originally described, I would
17 agree that that pilot -- that the project was a
18 pilot because they were trying to look at new
19 technologies. And then I would also agree that
20 based on my understanding of the term pilot,
21 that the application does not describe a pilot
22 project anymore and therefore -- and it is small
23 scale and so demonstration seems to mean just a
24 small scale deployment of something that could

1 potentially be large scale.

2 Q. In your review of the application, did
3 you see the phrase mono bucket?

4 A. I know in the staff report that I read
5 more closely, it does talk about the foundations
6 being mono bucket. In the application, things
7 that were not related to what I was looking at,
8 I skimmed over, so I am not sure -- if it's in
9 the application, I probably saw it skimming over
10 it, but I don't have recollection of seeing that
11 in the application.

12 Q. So do you know if any existing wind
13 turbines use mono bucket?

14 A. Just to the extent of what I read in
15 the -- in the staff report, and I think the
16 staff report did say that this was something
17 that was commonly used in offshore.

18 Q. You're not aware, though, personally
19 whether it's commonly used offshore?

20 A. No.

21 Q. And do you know the specific model of
22 turbines intended for use at the Icebreaker wind
23 project?

24 A. Again, I think this is in the staff

1 report. They're Mitsubishi turbines. I don't
2 know the specific model number.

3 Q. So do you know whether those specific
4 turbines are used at other offshore wind
5 projects?

6 A. That, I don't know.

7 Q. If not used at other offshore wind
8 projects, wouldn't you agree that would be new
9 wind technology?

10 A. No.

11 Q. Your statement on the last paragraph of
12 Page 3 refers to application deficiencies.
13 Prior to this project, how many OPSB
14 applications had you reviewed?

15 A. One.

16 Q. Which was?

17 A. That was the South Field project.

18 Q. And are those deficient -- application
19 deficiencies you referenced based on any OPSB
20 rule requirements that you're aware of?

21 A. Some of them, yes. Some of them are
22 just generally what would be needed to do an
23 adequate public assessment of the -- of the
24 project.

1 Q. Assessment from what standpoint?

2 A. Public need perspective. Public
3 necessity.

4 Q. How do you define public necessity?

5 A. In this case, public necessity would be
6 is generation needed in this market and is
7 renewable generation needed in this market. And
8 potentially other ancillary services, but that's
9 not relevant for a wind farm.

10 Q. And what do you believe with regard to
11 the question of is generation needed in this
12 market?

13 A. So PJM -- for this particular project,
14 this is very small, so it's really immaterial.
15 Clearly the PJM market does not need a small six
16 turbine wind farm for capacity reasons. Also,
17 the amount of wind generation is also largely
18 immaterial. And there's a robust renewables
19 market that you have access to, and so just
20 because of the small size of the project, it's
21 not needed for that reason either.

22 Q. So would your answer be different if
23 this was a large scale wind project?

24 A. So if it was a large scale wind project,

1 Ohio does have pretty aggressive increasing
2 requirements for renewables. There is a market
3 for renewables that you can purchase in state
4 and out of state so that renewable power will be
5 available. So then it becomes a question of is
6 it attractive -- would this be attractive
7 compared to what other options you would have
8 available.

9 So would Ohio be able to meet its
10 targets without large scale deployment in the
11 Great Lakes? Yes, there's a market for it.
12 Would that market be more attractive for Ohio
13 should this widespread development happen? That
14 would be a question that you would look at and
15 answer.

16 Q. And when you say, "meet targets," are
17 you referring to renewable energy targets?

18 A. Renewable energy target requirements in
19 Ohio, yes, which I believe are increasing up to
20 2026.

21 Q. And do you know if some of those
22 renewable energy targets are met by onshore wind
23 farms?

24 A. I'm sure they are, yes.

1 Q. Do you know whether any onshore wind
2 farm has been permitted in the last two years in
3 the State of Ohio?

4 A. That, I do not know.

5 Q. Are you aware that the answer is zero?

6 A. I'm not aware that the answer is zero or
7 not zero.

8 Q. Are you familiar with setbacks?

9 A. Yes.

10 Q. Are you familiar with Ohio's setback
11 rule?

12 A. No.

13 Q. On Page 4, under the title, "Author
14 Qualifications," you state in the second
15 sentence, I have submitted expert witness
16 testimony to regulatory commissions in
17 California, Florida, Maryland, Massachusetts,
18 North Carolina, Ohio, Virginia, Texas, British
19 Columbia, and Alberta.

20 Is that list still current?

21 A. Yes.

22 Q. Let's turn to Page 38 of Exhibit 3.

23 A. Okay.

24 Q. And looking specifically at the heading

1 "Expert Witness for Regulatory Proceedings,"

2 Number 2 --

3 A. Yes. All roads lead to Columbus.

4 Q. That's right. It states, I represented
5 Duke and justified targets for distribution
6 system reliability indices.

7 A. Yes.

8 Q. Are you still currently representing
9 Duke Energy?

10 A. So I have not closed out that project.
11 My role now is over in these hearings. They're
12 combined hearings that include rider and rate
13 case hearings, so I did testify -- short answer
14 is probably my role is over. That will probably
15 be appealed in this ruling, but not based on
16 my -- my content. My content, that's not where
17 they're drawing the battle lines on that one.

18 Q. And you prefiled written testimony in
19 that matter, correct?

20 A. Correct. Yes.

21 Q. Moving backwards a bit, Number 1 is a
22 reference to this matter, correct?

23 A. Correct.

24 Q. You state, I represented three local

1 resident intervenors by addressing deficiencies
2 in the application and discuss the overall
3 economics of the project and the resulting
4 impact to ratepayers.

5 Your statement, "I represented three
6 local resident intervenors," is that accurate?

7 A. I don't remember if there were two or
8 three. To the extent that they are local
9 residents, it's correct. As to the number, I --
10 when I wrote this, my understanding is it was
11 three. The number may be different.

12 Q. Well, based upon your engagement letter,
13 which is Exhibit 1, and your identification of
14 Murray Energy as the client, wouldn't it more
15 accurately state, I represent Murray Energy by
16 addressing?

17 A. No.

18 Q. Why not?

19 A. These are the intervenors in the case,
20 and regardless of who is, you know, paying the
21 bills, I'm representing the intervenors here.

22 Q. Number 3, I represented Dominion in this
23 case by developing a benefit cost assessment for
24 the second phase of the Dominion \$2 billion

1 proposed program and realized benefits from the
2 completed phase.

3 what is Dominion?

4 A. Dominion is a -- well, they're a holding
5 company, but Dominion Virginia Power is the
6 largest utility in Virginia, electric utility.
7 They do gas as well.

8 Q. And Number 4, you represented Duke
9 Energy?

10 A. Yes.

11 Q. And Number 5, again, represented
12 Dominion?

13 A. Yes. This was a separate engagement,
14 but basically related to Number 3. There was
15 different phases that they were going through
16 and so I did 5, and they retained me again for 3
17 since it was an extension.

18 Q. And if you turn to the next page,
19 Page 39, Number 6.

20 A. Yes.

21 Q. And we discussed this a little bit
22 already. This states, prepared direct testimony
23 for the application of South Field Energy for a
24 certificate of environmental compatibility and

1 public need to construct an electric generation
2 facility in Columbiana County, Ohio. Lists the
3 case number.

4 Did you prepare prefiled written
5 testimony for this matter?

6 A. I don't -- it says prepared direct
7 testimony, and so I -- I don't specifically
8 recall that. I know I -- I wrote a report, and
9 I know that -- I can't remember if they actually
10 got status as intervenors, and so I don't know
11 if that report got officially filed or -- you
12 know, there's other ways that you can get the
13 report in. And so I don't have the details on
14 that. My understanding is that in one way or
15 another, the report got in. If -- if they
16 didn't get intervenor status, I assume that
17 there was not direct testimony, so that may be
18 an error.

19 Q. That's fine. Just seeking
20 clarification.

21 A. Okay. Sure.

22 Q. Because based upon what I reviewed, it
23 looked like they were not granted intervenor
24 status.

1 A. I need to update that.

2 Q. What is Unitel or Unitil?

3 A. Unitil is a holding company in
4 Massachusetts. They acquired the utility
5 Fitchburg Gas & Electric.

6 Q. Do you know when they acquired it?

7 A. It would have been probably a couple
8 years before I did this case, I'm guessing.

9 Q. And when you say "this case," referring
10 to Number 8 or Number 9?

11 A. Oh, Number 9. Yes. I don't know when
12 they -- when they acquired Fitchburg
13 Gas & Electric.

14 Q. And of the matters for which -- well,
15 strike that.

16 Under the heading "Expert Witness for
17 Regulatory Proceedings," how many of those
18 engagements were not rate cases?

19 A. Probably 80 percent of them were not
20 rate cases.

21 Q. Did any of those involve wind power?

22 A. No.

23 Q. Please turn to Page 41.

24 A. Okay.

1 Q. There's a heading, "Expert Witness for
2 Civil Proceedings," and feel free to review it,
3 but I count five times that you have represented
4 First Energy.

5 A. So First Energy is a holding company.
6 They have, depending upon how you count, seven
7 or eight regulated utilities under them. But
8 they have a centralized claims, and so, yeah,
9 your count is probably right. But that would
10 have been for different utilities that are owned
11 by First Energy, not all the same.

12 Q. Okay. Thank you.

13 Looking back at Page 4 of Exhibit 3
14 under author qualifications, the last sentence,
15 from 1996 to 2003, I worked for ABB in various
16 roles.

17 And you touched on ABB earlier, but what
18 is ABB?

19 A. They are a large equipment manufacturer,
20 and a large percentage of their business is
21 developing equipment that would be purchased by
22 electric utilities and large industrial
23 facilities that have utility-like systems.

24 Q. And I believe you had indicated you had

1 some exposure and/or involvement related to wind
2 power while you were at ABB?

3 A. Yes.

4 Q. And what was that again?

5 A. So when I was in their consulting group,
6 they -- we -- my group, I was in charge of all
7 of the software used by consulting. We
8 developed a production costing model which
9 basically simulates power production and
10 transmission over the transmission lines to bulk
11 power delivery points and identifying which
12 generators would be on at which times, which
13 would be off, and how it flowed through the
14 transmission system and what that would cost in
15 terms of producing that energy.

16 This was a commercial software that has
17 been merged in various ways, but that was -- it
18 was called grid view at the time.

19 Q. And you were employed by ABB from 1996
20 to 2003; is that accurate?

21 A. Correct.

22 Q. Between 2003 and the present, what
23 undertakings have you been involved with that
24 relate to or involve wind power?

1 A. Yeah, specifically wind power -- so I do
2 teach continuing education classes to primarily
3 engineers and utilities, looking at planning,
4 and these do look at sources of generation,
5 including onshore wind and offshore wind. So in
6 terms of teaching the subject, I have been doing
7 that continuously, one or two classes a year at
8 least. Since then, in terms of specific project
9 work, though, no specific project work.

10 Q. And when you say one or two classes a
11 year, are we talking about seminars?

12 A. It could be in-house, but primarily what
13 it is is it would be a marketed course where
14 people from different utilities will sign up for
15 that course and then I will go and I will teach
16 that course. Typically like a two-day course.

17 Q. And specifically with relation to wind
18 power, what are you teaching?

19 A. Right. And so we go through the
20 different generation technologies and the
21 different aspects of those generation
22 technologies, the impact to -- to dispatch and
23 unit commitment and economics, potential impacts
24 of widespread deployment. For example, utility

1 scale solar and onshore and offshore wind. So
2 all of these aspects, I would be teaching.

3 Q. And who are these courses marketed
4 through or sponsored by?

5 A. So sometimes I'll go directly with the
6 utility itself, but more commonly I go through a
7 company called EUCI is the name of the company,
8 Electric Utility Consulting, Incorporated, I
9 believe is the acronym. And coincidentally,
10 they're based out of Denver. I did courses with
11 them before I was in Denver and they -- I'll
12 typically do my courses through them.

13 Q. And when you say sometimes you do it
14 directly through or with the utility, what
15 utilities?

16 A. So the last one I did a couple courses
17 directly for was Central Louisiana, CLECO. And
18 then -- yeah, not recently, but I've done a lot
19 of courses for Dominion and Commonwealth Edison
20 and others. I do less of that now.

21 Q. When you say others, what others do you
22 recall?

23 A. So I've done courses for Dominion, I've
24 done courses for Ameren, which now has been

1 acquired by Duke. I've done courses for
2 Commonwealth Edison in Chicago, which is now
3 under Exelon. I've done courses for Israel
4 Electric in Israel. There are others. Those
5 are the ones that come to mind.

6 Q. Any for Murray Energy?

7 A. No.

8 Q. Any for First Energy?

9 A. No, I don't think so. I'm trying to
10 think -- First Energy -- no for First Energy.
11 I'm sorry. I just wanted to make sure I gave
12 you the correct answer.

13 Q. That's okay. I appreciate it. I prefer
14 correct answers, so take your time.

15 Looking at Page 5, the second paragraph,
16 from July of 2006 through February of 2012, I
17 was the vice-president of consulting for Quanta
18 Technology from July 2007 through the present.

19 That's confusing, but I read it
20 correctly. So that's all I want is
21 clarification of what dates relate to the VP of
22 consulting for Quanta.

23 A. That's a cut-and-paste error. On
24 Page 33 of my CV, those do have the correct

1 dates, and so the Quanta Technology dates were
2 July of 2006 through February of 2012.

3 Q. Okay. Thank you.

4 A. So, yeah.

5 Q. Turn to Page 6 of Exhibit 3, please.

6 A. Okay.

7 Q. There's a heading, "Project Economics"
8 and a subheading "Assessment Using Public
9 Information." And the first sentence of the
10 second paragraph under "Assessment Using Public
11 Information" states, and preliminary but more
12 detailed economic description of the facility is
13 provided in the document, quote, Great Lakes
14 wind energy feasibility study, final feasibility
15 study, end quotes.

16 Do you recall what date that feasibility
17 study was completed?

18 A. The date of that report is April 2009.

19 Q. Do you know if in that feasibility
20 report, whether the turbines referenced in it
21 are the same ones that the project now intends
22 to use?

23 A. I don't know specifically, but my -- my
24 assumption would be that they are not. They --

1 there were various sizes that were being
2 proposed in that feasibility report, so I don't
3 even think they had specific turbines in mind is
4 my -- is my understanding.

5 Q. The next paragraph states, the
6 feasibility report makes it clear that the
7 facility is not economically viable from a pure
8 competitive market perspective.

9 what is your definition of "economically
10 viable"?

11 A. That the revenue of the facility can
12 cover your operations and maintenance costs and
13 your cost of capital.

14 Q. For this statement, you're tying it to
15 the competitive market perspective, correct?

16 A. Correct.

17 Q. Do you know whether the power generated
18 by the Icebreaker wind project will be sold on
19 the competitive or wholesale market?

20 A. Yes.

21 Q. You believe it will be?

22 A. The application states that one-third of
23 the electricity is going to be sold on PJM
24 market if they can't get PPAs for it, and PPAs

1 are also part of the competitive market as well.
2 So 100 percent, in my view, of the energy is
3 being sold on the competitive market, PPAs being
4 included.

5 Q. So you do consider PPAs to be on the
6 competitive market?

7 A. Absolutely.

8 Q. Are you familiar with bilateral
9 agreements?

10 A. Yes.

11 Q. What are those?

12 A. Bilateral agreements are just agreements
13 between two parties.

14 Q. Do you know how many permits OPS has
15 issued for projects that will not be competitive
16 on the wholesale market?

17 A. No.

18 Q. Do you know whether OPSB has permitted
19 projects where the power will not be competitive
20 on the wholesale market?

21 A. So it will be easy for me to say no, but
22 in the rate case that I was just in about three
23 weeks ago, one of the issues are some power
24 plants that were specifically built for, I

1 believe, a uranium refinery that was
2 decommissioned, and there's some question as to
3 whether those plants, where there's shared
4 interest in them, are competitive or not.

5 And my understanding is that they have
6 been given recovery treatment, but I'm not sure
7 if the siting board was involved in that. That
8 was a pure commission ruling.

9 And so it's possible if those are -- if
10 those -- if the siting board is involved in
11 that, it wouldn't be permitting. And if not,
12 then no.

13 Q. Are you aware of anywhere in the OPSB
14 rules where it states that part of the
15 permitting process consideration is whether the
16 power will be competitive on the wholesale
17 market?

18 A. I don't know.

19 Q. The last sentence of the last full
20 paragraph on Page 6, in other words, this is a,
21 quote, pilot project, end quote, that is too
22 small to be considered, quote, commercial scale,
23 end quote, and that wind speeds in for the
24 facility are lower than for typical offshore

1 commercial scale wind farms.

2 when you're referring to typical
3 offshore wind farms --

4 MR. SECREST: Break in the question.
5 whomever just joined the meeting, will you
6 identify yourself?

7 MS. LEPPLA: Yes, this is Miranda Leppla
8 with OEP and Sierra Club as well.

9 MR. SECREST: Great, thank you.

10 THE WITNESS: This is confidential. Has
11 she signed a waiver?

12 MR. SECREST: She has, yes.

13 BY MR. SECREST:

14 Q. So the question is, when you state
15 typical offshore commercial scale wind farms,
16 what are you referring to?

17 A. I'm referring to the feasibility report
18 itself which states this.

19 Q. The 2009 feasibility report?

20 A. Correct. Yes.

21 Q. So do you know when it refers to
22 offshore commercial wind farms, how many
23 turbines that entails?

24 A. They don't specifically say in the

1 feasibility study, but the other scenarios that,
2 you know, these groups put out included 1,500
3 megawatt and 5,000 megawatt scenarios for Lake
4 Erie as compared to this, you know, 20.7
5 megawatt scale. So offshore wind farms are
6 typically several hundred megawatts or more.

7 Q. What do you base that on?

8 A. Based on just looking at actual
9 operating wind farms that have been developed in
10 the last five years or so.

11 Q. And when you state wind speeds in for
12 the facility are lower than for typical offshore
13 commercial scale wind farms, what do you base
14 that statement on?

15 A. Yeah, so "in for" is a typo.

16 Q. Sure.

17 A. "In" can be crossed out.

18 But this is just, again, citing the
19 feasibility report. This is describing what the
20 feasibility report itself describes. So this is
21 what the -- the feasibility report says about
22 the project.

23 Q. Are you aware of specific technological
24 advances in the wind power industry since April

1 of 2009?

2 A. I mean, technology is always advancing
3 and so I would assume that, you know, turbines
4 that are more efficient at lower wind speeds are
5 constantly being worked on and would not
6 surprise me.

7 Q. Sure. You'd agree with me that
8 technology in the wind power industry has
9 improved since April 2009?

10 A. I would agree.

11 Q. Generally?

12 A. I would agree generally, yes.

13 Q. And that improvements in technology can
14 result in increased efficiency, correct?

15 A. I agree with that, yes.

16 Q. Have you ever performed any wind speed
17 studies yourself?

18 A. No.

19 Q. Have you ever reviewed any wind speed
20 studies related to wind farms?

21 A. So, no. In my area, I do deal with wind
22 speeds quite a bit and so, again, I want to be
23 clear in my answer, but not in the context of
24 wind farms.

1 Q. If you turn to Page 7, please.

2 A. Okay.

3 Q. The first full paragraph. It states,
4 although the application states, quote,
5 Icebreaker wind is designed to be a
6 demonstration scale project, end quote, refers
7 to Page 3, it does not mention that the facility
8 is not economically viable without extensive
9 subsidies in terms of grants and/or purchase
10 power agreements with prices dramatically higher
11 than -- I assume than --

12 A. Uh-huh. Correct.

13 Q. -- PJM wholesale prices.

14 I don't want to put words in your mouth,
15 but essentially you're stating that without
16 grants and/or PPAs with higher prices than the
17 market, this project is not economically viable,
18 correct?

19 A. So the feasibility report is very clear
20 that this is not being done because it's going
21 to be able to produce competitive electricity.
22 The economics in the application are not
23 significantly different than the feasibility
24 report except for the higher capacity factor.

1 But none of the descriptions of, you
2 know, economics that exist in the feasibility
3 report, which are pretty extensive, appear in
4 the application.

5 And I'm simply pointing that out here.
6 Feasibility highlights this. Application is
7 silent on this.

8 Q. So feasibility would include things such
9 as grants, correct?

10 A. Yes.

11 Q. And you just used a phrase, "competitive
12 electricity." Are you defining competitive
13 electricity solely by price?

14 A. So in this case, if you're looking just
15 at wholesale electricity, you would look at PJM
16 day-ahead market prices. If you were looking at
17 purchased power agreements, you would look at
18 other purchased power agreements generally or
19 for wind specifically. And if you're looking
20 for renewable energy, you would look at the
21 price of getting renewable energy on markets as
22 well.

23 And so how much does it cost you to
24 produce your electricity, including cost of

1 capital, and how does that compare to these
2 different categories that exist today.

3 Q. Do you agree with me that there are
4 benefits associated with wind power not related
5 to cost or price?

6 A. There are benefits and disadvantages
7 both.

8 Q. Wind power does not generate emission of
9 pollutants, correct?

10 MR. HAFFKE: I'm just going to object.
11 This calls for testimony outside of the subject
12 matter of this expert report and expert
13 testimony.

14 You can answer the question.

15 A. So the operation of a wind farm does not
16 generate emissions. Clearly the construction of
17 a wind farm and the manufacturing of the wind
18 farm equipment does produce emissions.

19 Q. Operation of a wind farm does not
20 produce emission of any toxic substance, does
21 it?

22 A. Correct.

23 Q. Operation of a wind farm does not
24 generate waste, does it?

1 A. Correct.

2 Q. Would you not agree with me that in
3 considering whether to purchase wind power,
4 those attributes are something that a consumer
5 might consider independent of price?

6 A. There's already a wind market that you
7 can purchase wind energy from for a fraction of
8 the price of -- of this project, so I agree with
9 you. But to say that price isn't a
10 consideration, I don't think is a correct way to
11 look at it since wind energy is already
12 available for purchase.

13 Q. I'm not suggesting price is not a
14 consideration, but wouldn't you agree with me
15 that there's other considerations associated
16 with purchasing wind power other than price?

17 A. Yes, I agree with that.

18 Q. Are you aware that the demand for wind
19 power in Ohio currently exceeds the supply?

20 MR. HAFFKE: Objection to form.

21 A. I don't know one way or another if
22 that's true.

23 Q. Have you looked at any studies related
24 to the demand for wind power in Ohio?

1 A. Not specifically in Ohio. I just know
2 the amount that is in Ohio, the amount of
3 current construction that's in Ohio. And then I
4 looked at the statistics for wind pricing for
5 the overall U.S. I couldn't find it
6 specifically for Ohio.

7 Q. And when you say you're aware of the
8 current construction in Ohio, what is currently
9 being constructed in Ohio?

10 A. Well, not construction, but what is
11 currently constructed in Ohio.

12 Q. Oh, okay. Thank you.

13 And the statement, it does not mention
14 that the facility is not economically viable
15 without extensive subsidies. Isn't that the
16 case for any new emerging technology; that it's
17 relying upon subsidies?

18 A. Wind farms are a very mature technology,
19 and so to the extent that new technologies need
20 subsidies, no, I don't think that's the case at
21 all. There's lots of new technologies in the
22 electric utility industry that are employed
23 without subsidies. Sometimes that's the case.
24 A lot of times that's not the case.

1 Q. Are you aware of any offshore wind
2 projects in freshwater in the United States?

3 A. No.

4 Q. Would you consider an offshore wind
5 project in freshwater in the United States an
6 emerging technology?

7 A. This is a project, not a technology, so
8 I disagree with that.

9 Q. Do you know whether the nuclear power
10 industry has received any subsidies?

11 A. I know they're sure fighting for trying
12 to get some. In terms of direct subsidies, I'm
13 not certain. In terms of indirect subsidies
14 from all of the work that's done in the national
15 labs, absolutely they have.

16 Q. Are you aware of subsidies that have
17 been sought by the coal industry or received
18 from the coal industry?

19 A. This is a state-by-state answer and I
20 don't believe some states have taken measures to
21 try to prevent the closing of existing coal
22 plants. Some states have -- specific
23 recollection, I don't know, but yes, I think
24 that some states have done that. Not for new

1 construction but for trying to prevent the
2 shutdown of existing, I think that's happened.

3 Q. And based upon your -- your knowledge,
4 are you aware that Murray Energy has sought
5 bailouts from the federal government?

6 MR. HAFFKE: Objection; argumentative
7 and misleading.

8 A. I'm not aware yes or no.

9 Q. You seem generally opposed to the
10 Icebreaker Windpower project receiving subsidies
11 and that effect that subsidies would have on
12 its -- using your term -- economic viability; is
13 that accurate?

14 A. No.

15 MR. HAFFKE: I'm going to object to the
16 mischaracterization earlier to the testimony and
17 to the argumentative nature of the question.

18 MR. SECREST: That's why I asked if it
19 was accurate. If it's not accurate --

20 A. No, that's not accurate.

21 Q. Okay. Why not?

22 A. So I have no general objections to
23 subsidies like the DOE grant and things like
24 this. What I have a strong objection to is

1 getting those subsidies through electricity
2 rates. I think that is inconsistent with basic
3 rate-making principles and it's a way to avoid
4 actually having to vote on a tax. That's what I
5 have a problem with.

6 Q. On this Page 7, you have a Figure 3-1.
7 what does that depict?

8 A. So this predicts historical PJM prices
9 going back from 2005 through January 2017. It's
10 sort of showing the day-ahead price and price
11 trends. You can kind of see the volatility.
12 You can also see how these prices track natural
13 gas prices. The intent here was to look at the
14 opportunity cost of this energy, how much would
15 you be paying if you were to get this on the
16 market, and also how much could the energy from
17 this facility be sold to if they went through
18 the PJM market.

19 Q. Do you know what gas prices will be in
20 five years?

21 A. No.

22 Q. You don't know what gas prices will be
23 in 10 years, do you?

24 A. There are energy futures that can inform

1 you on this. There are also EIA projections of
2 gas prices going out 30 or 40 years, so there
3 are pretty credible predictions of what future
4 gas prices are expected to be, but nobody has a
5 crystal ball, an accurate one, that I know of.

6 Q. On Page 8, the paragraph reads, although
7 the public version of the application redacts
8 estimated O & M costs, the feasibility study
9 estimates a range of 63.4 to 82.5 dollars per
10 megawatt hour, in brackets, Pages 11 to 8.

11 These O & M costs alone are significantly higher
12 than the cost of PJM wholesale energy. That is,
13 even if the facility could be designed and built
14 for free, it would require prices much higher
15 than wholesale to avoid losing money.

16 Is that statement assuming that the
17 power generated by the project is sold on the
18 wholesale market?

19 A. This is a general statement, so if
20 you're getting prices higher than the wholesale
21 market through a PPA, that would be consistent
22 with this statement. So the statement doesn't
23 assume anything. It just says, you know, what
24 you would have to be getting for your sold

1 electricity to cover your O & M costs.

2 Q. So if, in fact, the project was
3 receiving prices higher than wholesale, it would
4 not be losing money or potentially not losing
5 money; is that accurate?

6 A. If the -- assuming the O & M costs are
7 within this range, if you are able to sell
8 electricity for higher than this range, then
9 your revenue would be able to cover your O & M
10 costs.

11 Q. Skip one paragraph. Move down to the
12 last full paragraph on Page 8, please. It
13 should be noted that a key economic assumption
14 in all wind power projects is capacity factor.

15 Prior to your service on this project,
16 have you ever seen the term "capacity factor"
17 before related to wind power?

18 A. Yes.

19 Q. Have you ever done an energy yield
20 assessment?

21 A. A what?

22 Q. An energy yield assessment?

23 A. For solar, not for wind.

24 Q. In that paragraph, the third sentence,

1 the CF assumptions in the feasibility study
2 range from 31.53 to 30.13. In parens, the
3 feasibility study does not provide any
4 justification for those values, end parens. In
5 contrast, the application assumes a 41.4 percent
6 CF, representing an increase of about one-third
7 when compared to the feasibility study.

8 And, again, the feasibility study was in
9 April 2009, correct?

10 A. Yes.

11 Q. And you aren't aware, but I think you
12 said you assumed that the specific turbines that
13 were referenced in the feasibility study are now
14 not those that are intended for the project?

15 A. I think that there were not specific
16 turbines referenced in the feasibility study,
17 and then the application does have specific very
18 expensive turbines in mind.

19 Q. So when you state the application does
20 not justify this CF assumption nor does it
21 explain why its CF assumption is so much higher
22 than those used in the feasibility study, could
23 it be that different turbines are now intended
24 for the project?

1 MR. HAFFKE: Objection.

2 A. It's possible, but an increase in
3 efficiency of that much would surprise me and I
4 would be skeptical until I saw how that -- how
5 the original numbers were derived or at least
6 how this current number was derived. This is --
7 you know, would be one of the highest performing
8 plants in the world in a suboptimal location.
9 So it's -- I'm skeptical of that number.

10 Q. You are skeptical of that number. Are
11 you aware that banks finance wind projects based
12 on capacity factor numbers?

13 A. I'm pretty sure if I was a bank, I
14 wouldn't finance this project.

15 Q. You said suboptimal location. Explain
16 the basis for that statement, please.

17 A. Based on wind energy density, and so if
18 you look at the energy density of this location
19 compared to the -- like the best performing
20 plants over offshore Europe, the energy density
21 at this location is significantly lower than at
22 those locations. You have less energy available
23 to convert into electricity at this location.

24 Q. And what have you reviewed to form that

1 opinion?

2 A. This was in my report, the wind energy
3 density maps --

4 Q. Are you referring to Page 9, Figure 3.2?

5 A. Yes, correct.

6 Q. Other than those wind energy density
7 maps, did you review anything else that informed
8 that opinion?

9 A. No.

10 Q. Figure 3.2, as well as Page 8, refers to
11 offshore commercial wind farms in Denmark and
12 Germany. Do you know how many turbines are
13 associated with each one of those wind farms?

14 A. They are significantly larger than this
15 project for sure. However, if you're stacking
16 wind turbines behind each other and you're not
17 just presenting a front, you're actually going
18 to be less efficient than more efficient because
19 you're slowing down the wind. And so larger
20 does not necessarily mean more efficient. But
21 certainly these would be larger, much larger
22 than what we're talking about here.

23 Q. And what are the names of those
24 projects, do you know?

1 A. I don't know off the top of my head.

2 Q. And when you say the lifetime capacity
3 factors, what do you mean?

4 A. This would be the capacity factor since
5 they were commissioned during service, so it may
6 vary from year to year. Efficiencies of the
7 equipment may decline over time, or what have
8 you, so this would just be, again, you know,
9 what they've experienced since commissioning.

10 Q. And do you know when those offshore
11 commercial wind farms you reference were
12 commissioned?

13 A. It's in the reference. I don't know
14 them off the top of my head.

15 Q. Do you know if, generally, capacity
16 factors have remained constant in the wind power
17 energy in the last 20 years?

18 A. I don't think they have. I think they
19 have increased.

20 Q. And why do you think that?

21 A. Just when wind farms started to be
22 deployed in the U.S., you know, people talked a
23 lot about -- about capacity factors, impact to
24 the grid, and these capacity factors initially

1 were lower than this. You know, high 30s, low
2 40s value at that time. Clearly they're higher
3 now.

4 MR. SECREST: Good time to take a break?

5 MR. HAFFKE: Yeah.

6 MR. SECREST: Great.

7 (Recess taken.)

8 BY MR. SECREST:

9 Q. Doctor, we're still referring to -- or
10 at least I'm still referring to Exhibit 3. Can
11 you turn your attention to Page 9, please.

12 A. Okay.

13 Q. The second-to-last sentence on Page 9
14 states, the application does not state the price
15 that electricity will be sold under this PPA,
16 which is a material omission.

17 what do you mean by "material omission"?

18 A. If the public wants to look at the
19 economics associated with this project, since
20 two-thirds of the energy are going to be sold
21 under that PPA, it's impossible to understand
22 the economics of this project without knowing
23 that price.

24 Q. And what do you mean, if the public

1 wants to look at the economics of this project?

2 How is that relevant?

3 A. So this is a project that's going to be
4 built on public lands, and it's appropriate, in
5 my opinion, for the public to be able to
6 understand whether what's going there is going
7 to be an economically healthy facility or not.

8 Q. And do you believe the Icebreaker wind
9 project will be a healthy economic facility?

10 A. Short answer is if this facility was
11 just viewed in isolation, if this was being
12 built so that it could recover its costs given
13 the PPA that's in place and the O & M costs, for
14 any reasonable assumption for cost of capital,
15 no, this is not an economically healthy project,
16 just viewed narrowly in terms of the project
17 itself.

18 Q. So you don't believe the project will
19 recover its costs, is that what you just stated?

20 A. If you include the cost of capital, no.

21 Q. And is that based upon an assumption
22 that two-thirds of the power will be sold
23 pursuant to the PPA that you've reviewed?

24 A. Yes. So my revenue assumptions, I did

1 three scenarios. Each of those scenarios
2 assumed that two-thirds of output will be sold
3 at \$[REDACTED] per megawatt hour, and then it assumed
4 that the balance would be sold on a PJM market
5 for \$40. Then I ran the model using the 41
6 point whatever capacity factor that's listed in
7 the application to view the economics under that
8 scenario.

9 I then took the feasibility report
10 number as sort of the low end, and then I took a
11 mid point as well, and then took the revenue
12 from that project per year expected and then --
13 and this is just assuming -- and then subtracted
14 out the O & M costs that are in the confidential
15 part of the application, and then the remainder
16 is available for, you know, servicing cost of
17 capital. And in any of the scenarios, even with
18 the high capacity factor, there is not enough
19 revenue to cover any reasonable cost of capital
20 value.

21 So unless somebody wants to donate the
22 money for this project, it doesn't make economic
23 sense, but can recover its O & M costs.

24 Q. And you indicated those three scenarios

1 assumed that a third of the power is sold to the

2 PJM market, correct?

3 A. That's correct, yes.

4 Q. Have you run any scenarios where the
5 remaining third of the power is sold through any
6 PPA?

7 A. I did not, no. There was no information
8 as to any other PPA or the amounts. But it
9 would be a simple thing to do the analysis
10 assuming 100 percent of it was sold through this
11 PPA.

12 I mean, you could do any scenario you
13 wanted.

14 Q. But you have not done those scenarios,
15 correct?

16 A. No. But, again, the dominant factor is
17 the -- is the two-thirds that are sold through
18 the ■■■, and then it's pretty easy to do the
19 analysis assuming 100 percent was sold through
20 that PPA. It wouldn't make a difference in my
21 economic analysis; it still wouldn't cover the
22 cost of capital.

23 Q. Do you know how this project is being
24 financed?

1 A. No. I will say that when they did their
2 net present value of O & M costs, they used the
3 discount rate of 10 percent, and assuming that
4 they chose that number because it's a meaningful
5 number, I chose a cost of capital of 10 percent
6 in my analysis and that's to use the same number
7 that they used, so I'm assuming that there is a
8 cost of capital.

9 They also state that they have delay
10 costs which would be associated to interest on
11 capital, and so -- I don't have zero information
12 on financing. It does appear like there are
13 costs associated with -- with capital, but I
14 don't have all of the details I would like to
15 have.

16 Q. Paragraph 10 -- I'm sorry, Page 10, last
17 full paragraph. You stated it's not clear how
18 pricing for the PPA was negotiated.

19 Are you aware that the PPA is a result
20 of an arm's length transaction?

21 MR. HAFFKE: Objection to form.

22 A. I don't know how this PPA came about.

23 Q. So not knowing how it was negotiated,
24 can you state that the PPA and the rates therein

1 are not competitive?

2 A. Yes.

3 Q. Solely based on price on the wholesale
4 market, correct?

5 A. And price for wind power in the U.S.,
6 those two things, yes.

7 Q. Price for onshore and offshore wind
8 power in the U.S.?

9 A. In terms of a renewable resource, I
10 don't see a distinction in purchasing wind
11 power. You're purchasing a renewable source
12 which has the same impact to the grid, same
13 environmental issues. So I don't make a
14 distinction in pricing for onshore and offshore
15 wind. But these prices would be based on
16 facilities that were onshore.

17 Q. That paragraph carries on, since the
18 facility owner is a nonprofit, it is reasonable
19 to assume that pricing is based on the facility
20 recovering its cost but not making a material
21 profit. If this is the case and the pricing is
22 based on a 41.4 percent CF, there is significant
23 risk of the facility experiencing future
24 financial distress if the actual CF is

1 significantly lower than 41.4 percent.

2 what do you mean by significantly lower?

3 Do you have a bracket or a scale?

4 A. So if you are a nonprofit and so you're
5 trying to match revenues with costs, then
6 normally if you are going to have -- if you're
7 at a break even point for a typical business,
8 you know, if you get, you know, sustained
9 revenues below about 10 percent of your break
10 even, then that's not going to be sustainable.
11 That's going to end up in insolvency.

12 Q. And does this statement factor in any
13 grants?

14 A. I do not know how the grants were
15 factored in in this pricing, so I don't -- it's
16 possible, yes, and it's also possible no.

17 Q. Turn to Page 12, please.

18 A. Okay.

19 Q. The first full paragraph, Icebreaker
20 windpower, Inc. claims to have extensive
21 experience in the construction of offshore wind
22 farms in Europe. Clearly this experience did
23 not translate to reliable turbine cost estimates
24 in the application, raising questions of whether

1 other values in the application could also be
2 off.

3 Did you find any instances in which
4 values in the application were, quote, off by
5 significant amounts?

6 A. I didn't do the analysis, so no.

7 Q. And as you sit here today, are you aware
8 of any changes in the turbines that would have
9 affected the cost estimates? Change to model?

10 A. No, I'm just pointing out that what was
11 in an actual application was almost 100 percent
12 off in terms of cost. That's all I'm pointing
13 out here.

14 Q. And you state, Icebreaker Windpower,
15 Inc. claims to have extensive experience in the
16 construction of offshore wind farms in Europe.

17 Do you have any reason to dispute the
18 claim to experience in the construction of
19 offshore wind farms?

20 A. So to the extent that the actual entity
21 that has experience, you know, is going to bring
22 that experience to Icebreaker, no.

23 Q. Turn to Page 13, please.

24 A. Okay.

1 Q. Table 3-3, it's titled, "Operating
2 Margin Scenarios."

3 Are these the three scenarios you
4 previously referred to in your testimony?

5 A. Yes. And those also link to Table 3-2,
6 which shows the -- you know, which also shows
7 those three scenarios.

8 Q. And those three scenarios are all based
9 on -- well, strike that.

10 Two of those scenarios in Table 3.2 and
11 3.3 are based on a capacity factor lower than
12 what the Icebreaker windpower application has
13 claimed will be the capacity factor; is that
14 accurate?

15 A. Yes, the 31.3, the low end, was the
16 number from the feasibility study. The 41.4 is
17 from the application. So if we're just looking
18 at the application itself, it would be the top
19 line. And then just because there's such a
20 large range, I just put the average of those two
21 in the middle. Just to kind of see the
22 sensitivity.

23 Q. And all of these scenarios, again,
24 assumed that a third of the power sold into the

1 PJM market and specifically for \$40 per megawatt
2 hour?

3 A. Yes.

4 Q. So obviously if a third of the power is
5 sold at rates in excess of \$40 per megawatt
6 hour, these scenarios change, correct?

7 A. Yes, they would make the economics look
8 more attractive than these numbers.

9 Q. Page 14, please. Second full paragraph
10 states, recall that the latest estimate of
11 project cost is [REDACTED]. A 20-year mortgage
12 of [REDACTED] with a discount rate of 10
13 percent results in about a [REDACTED] per year
14 loan payment.

15 And I think you previously testified you
16 pulled the 10 percent discount rate from the
17 application; is that right?

18 A. Yes. The application uses, when it's
19 coming up with its NPV, its net present value
20 amount for its discounted O & M costs, it uses a
21 10 percent discount rate, so I'm simply using
22 the same discount rate that's used in the
23 application.

24 Q. When you reference a 20-year mortgage of

1 [REDACTED], where are you getting these figures
2 from?

3 A. So [REDACTED], that's from the updated
4 cost amounts that were provided. The current
5 projected costs that were submitted. So that is
6 the number. 20-year was based on the expected
7 life of this project. So assuming that you're
8 financing it over the project's expected life.

9 Q. And you're assuming the entirety of the
10 project is being financed, correct?

11 A. The money has to come from somewhere,
12 and so presumably equity financiers want a
13 return. So like I said before, unless people
14 are willing to give this project money for free,
15 then this would -- this -- my assumption is,
16 yes, that the people that are providing money
17 for the project expect a return on that money.

18 Q. Well, you say a 20-year mortgage of [REDACTED]
[REDACTED], so are you assuming that the full
20 project cost is being financed through a bank or
21 a loan?

22 A. Debt and equity. So this would be the
23 weighted average cost of capital in this. I
24 don't know the specific financing terms of this.

1 Q. Do you know what information this
2 project will provide the wind industry with
3 regard to effects of offshore wind on wildlife?

4 A. Do I know what the effects of this --

5 Q. What information --

6 THE WITNESS: I'm sorry, can you read
7 back the question, please?

8 MR. SECREST: Please.

9 (Record read as requested.)

10 A. My understanding is that this is going
11 to depend on what the outcome of this is, but it
12 seems like this is going to result in --
13 presuming it's constructed -- radar monitoring
14 of migrating bats and birds, which would then
15 actually provide information that isn't
16 available now in that resolution.

17 This is based on the -- I did review a
18 deposition after this that was -- I forget his
19 name, but he does talk about using existing data
20 versus, you know, radar data, and the staff
21 report talks about their recommendation for
22 monitoring should the project be built.

23 That's my -- that's the extent of my
24 knowledge.

1 Q. Okay. So when you say your
2 understanding, you're referring to the
3 deposition transcript you reviewed and the staff
4 report?

5 A. Correct. Yes.

6 Q. Anything else?

7 A. No.

8 Q. And the deposition you reviewed, do you
9 know whose deposition that was?

10 A. I would know the name. It was the guy
11 that said he wasn't a radar expert and kept
12 getting asked questions about radar.

13 Q. On Page 16 of Exhibit 3, you state all
14 of these benefits -- sorry, I'm on the third
15 paragraph. All these benefits may be attractive
16 to Cleveland and Cuyahoga County politicians,
17 but it is clear from the feasibility study that
18 the facility will not produce economical
19 renewable energy and that the broader benefits
20 will only occur if large scale offshore wind
21 development occurs.

22 The benefits you reference as being
23 attractive to Cleveland, do you believe those
24 are of public interest?

1 A. Let me read specifically in the previous
2 paragraph --

3 Q. Sure.

4 A. -- what I'm referring to.

5 So let's, I guess, go through them.

6 So the feasibility study states that the
7 facility will, quote, benefit the offshore wind
8 industry. That I agree with, and I have no
9 problem with industries promoting themselves. I
10 do the same.

11 Establish Cuyahoga County as a primary
12 hub for wind energy in North America. So some
13 people I think, you know, people that are
14 interested in the local economy would find that
15 a -- you know, a positive. There's probably
16 some people that maybe don't like that. So
17 that's going to be a mix. Me personally, I have
18 no problem with that as a benefit.

19 Attract turbine suppliers and other
20 organizations to add to the region's
21 manufacturing base. And so that's the same as
22 the previous one. A lot of people that are
23 interested in growing local economy would like
24 that. Other people that are antigrowth, not so

1 much.

2 And then make Cleveland an iconic symbol
3 of revitalization and forward thinking. This
4 is -- you know, this is basically a meaningless
5 statement to me.

6 Q. Do you know how many jobs would be
7 created by the Icebreaker windpower project
8 during its construction phase?

9 A. I did review this, not in depth, but
10 there was -- reference 8, this studied the
11 potential impact -- economic impacts of Ohio
12 associated with the emergence of Lake Erie
13 offshore wind industry. And so this was, I
14 think, not specific to this project. This
15 talked generally about what the impact could be.

16 And then the staff report addressed
17 the -- you know, what the local temporary
18 construction jobs would be and I did review
19 that, but I don't recall those numbers. It's in
20 there, though.

21 Q. And when you just referred to Number 8
22 and the study, that was on Page 32 of Exhibit 3,
23 correct?

24 A. Yes.

1 Q. Thank you.

2 On Page 17 of Exhibit 3, the
3 second-to-last paragraph, it states, if built,
4 the facility will certainly, quote, deliver
5 clean, renewable electricity to the Ohio bulk
6 power transmission system, end quote. However,
7 this purpose is largely meaningless without
8 addressing the associated cost to ratepayers,
9 which is not addressed in the application.

10 A. I'm on Page 18. Am I on the wrong page?

11 Q. I'm sorry, did I say 18? I meant 17.

12 A. Okay. Page 17.

13 Q. The second-to-last full paragraph.

14 A. Are you asking me if you read that
15 correctly?

16 Q. Well, I'm asking you, when you state,
17 however, this purpose is largely meaningless
18 without addressing the associated cost to
19 ratepayers, do you know whether ratepayers are
20 also concerned with the delivery of clean and
21 renewable energy and not just price?

22 A. So for these specific ratepayers, I have
23 not seen any surveys for these specific
24 ratepayers, but more broadly I have seen lots of

1 residential customer surveys, and generally some
2 customers are willing to pay more for green
3 energy. You have certain areas of the country
4 where there is retail choice and you can opt to
5 go with retail providers that source from green
6 sources, and some customers do elect to do that.

7 The majority of customers do not elect
8 to pay more for green energy, and so -- depends
9 on how you ask the question. If you ask, do you
10 like green energy? Most people will say -- or
11 nonemitting energy, renewable energy -- most
12 will say yes. If you start asking them -- if
13 you give them the choice to pay more for it or
14 to not pay more for it, you're going to get a
15 different answer.

16 Q. Do you know whether the intervenors in
17 this action support green energy?

18 A. I think we went through before that I am
19 not -- I don't know who all of the intervenors
20 are in this case. So -- again, I think that's
21 not a specific enough description to even answer
22 that question if I knew these intervenors well.

23 Q. So the answer's no, you don't know if
24 the intervenors support green energy?

1 A. No, my answer is I don't think it's a
2 meaningful question.

3 Q. Well, despite what you think as to the
4 meaningfulness of the question, I'm going to ask
5 that you respond to it.

6 MR. HAFFKE: I'm going to object that
7 it's outside the expert testimony in the report
8 that's been offered in this case.

9 A. If somebody's asked to bankrupt
10 themselves to buy green energy, they're not
11 going to support it. If somebody is asked to
12 pay a minuscule amount more for green energy,
13 they're going to support it. Like I say in my
14 report, you cannot decouple the economics from
15 the question.

16 Q. Doctor, I felt like my question was
17 pretty straightforward. Are you not
18 understanding the question? Because you have
19 not answered the question yet.

20 Do you know whether the intervenors in
21 this action support green energy?

22 MR. HAFFKE: Same objection. Objection
23 being argumentative.

24 A. The answer is no.

1 Q. Thank you.

2 In your prior testimony just a little
3 bit ago, you acknowledged some customers are
4 willing to pay more for green energy, correct?

5 A. That's true, yes.

6 Q. Do you know if the intervenors are
7 examples of those such customers or consumers?

8 A. No.

9 Q. Do you know where the intervenors
10 purchase their power from?

11 A. No.

12 Q. Are you aware that they do not purchase
13 it from Cleveland Public Power?

14 MR. HAFFKE: Objection; argumentative.
15 Go ahead.

16 A. I don't know anything about the
17 intervenors.

18 Q. Doctor, please turn to Page 18. The
19 first full paragraph, starting with the third
20 full sentence. In this sense, the application
21 is correct in describing the facility as a
22 demonstration project rather than a pilot
23 project. The facility, if built, will
24 demonstrate at a small scale what is involved in

1 the full construction process, the actual visual
2 impact, the actual noise impact, the actual
3 animal impact, and other aspects of an offshore
4 wind facility.

5 would you agree with me that
6 demonstrating the actual construction process,
7 the actual visual impact, the actual noise
8 impact, the actual animal impact, are benefits
9 of this project?

10 A. Yes.

11 Q. And when you state, quote, and other
12 aspects of an offshore wind facility, did you
13 have anything specific in mind?

14 A. Nothing specific in mind. You never
15 know what's going to come up, though, when you
16 do a project like this.

17 Q. At the bottom of Page 18, it starts, the
18 following should be clearly understood by the
19 Ohio Power Siting Board and by CPP ratepayers.
20 And then you have five statements on Page 19.

21 when you state, the following should be
22 clearly understood by the Ohio Power Siting
23 Board, why do you believe they should be clearly
24 understood?

1 A. Because I think these are points that
2 are really avoided in the application and so
3 unless you really kind of put the pieces
4 together, these points are not obvious in the
5 application, but I think they're important when
6 making their decision.

7 Q. And are these points tied to any
8 specific Ohio Power Siting Board rule or any
9 specific Ohio Revised Code statute?

10 A. Public need and necessity. All of these
11 points go to public need and necessity.

12 Q. Do you believe there's public need or
13 necessity for any scale of offshore wind project
14 in Ohio?

15 A. It's possible. There are capacity
16 markets in PJM that wind facilities -- proposed
17 wind facilities can bid into, and if these bids
18 make it through the PJM capacity market, that
19 would demonstrate the necessity for those
20 facilities.

21 So it's possible yes and it's possible
22 no.

23 Q. Do you believe that there would be a
24 public need for an offshore wind power project

1 in the State of Ohio if the power was just being
2 sold on the wholesale market?

3 A. So if the renewable energy credit issue
4 was being difficult to accomplish through other
5 mechanisms that were less expensive and this
6 became the least expensive option to achieve
7 those goals, then I think there would be a need.
8 But if you're able to achieve these renewable
9 targets through whatever it was, lower cost
10 alternatives, then I think there would not be a
11 need for it.

12 Q. When you say lower cost alternatives,
13 are you referring to solar energy?

14 A. Onshore wind, solar energy, geothermal.
15 You know, whatever things would qualify under
16 Ohio statute as -- as meeting these renewable
17 energy targets.

18 Q. On Page 19 when you state, the facility
19 is not economically viable without massive
20 subsidies, what do you consider to be massive
21 subsidies?

22 A. Well, I consider paying [REDACTED] the
23 wholesale rate through the PPA, that's one
24 massive subsidy. And then the federal grant of

1 40 million, that's also a massive subsidy. And
2 then even those two together don't really allow
3 this project to recover its cost of capital.
4 And so even more than that -- so if you take the
5 PPA and you take the \$40 million grant, even
6 those together doesn't make this an economically
7 attractive project. So massive would be more
8 than that.

9 Q. And that response, is that assuming a
10 third of the power is sold on the wholesale
11 market?

12 A. Yes.

13 Q. Please turn to Page 21.

14 A. Okay.

15 Q. The second sentence states, the
16 electricity produced by wind will not produce
17 emissions, but most new traditional generation
18 in Ohio has been combined cycle natural gas
19 plants which have low emissions.

20 First off, what percent of generation in
21 Ohio is new, do you know?

22 A. Well, I don't define it here, but I
23 would say new would be built within the last 10
24 years.

1 Q. Do you know what percent in Ohio would
2 qualify as new?

3 A. What percentage? Those statistics are
4 available, but I'm not sure.

5 Q. And when you say combined cycle natural
6 gas plants which have low emissions, are you
7 only looking at the stack?

8 A. You mean am I looking at the gas line
9 supply?

10 Q. Well, when you say low emissions, are
11 you considering the extraction process?

12 A. When I am looking at the natural gas in
13 here, I'm looking at the power plant emissions,
14 not the fuel supply emissions.

15 Q. Okay. So not extraction or
16 transportation associated with the gas?

17 A. Correct.

18 Q. Will you please turn to Page 25 of
19 Exhibit 3.

20 A. Okay.

21 Q. This is part of the section of your
22 report that begins on Page 24 titled, "Market
23 Distortion."

24 The second-to-last paragraph on Page 25

1 states, market distortion due to the PTC was
2 already an issue for PJM 2011 and can only be
3 expected to get worse as wind generation
4 subsidized by PTCs increase.

5 what do you mean by this statement?

6 A. So here -- so showing here, if you look
7 at the second paragraph here about halfway down
8 the page, it says that -- this analysis, which
9 was published in like 2011, 2012, showed that
10 from 2006 to 2011, you had a four -- fourfold
11 increase in the number of -- in the number of
12 hours of negative prices during that time, and
13 as you get -- if you were to build more wind
14 farms, then this number would increase, the
15 number of hours per year with negative prices
16 would be expected to increase.

17 Q. Page 27, the third sentence. A large
18 scale offshore wind deployment in the Great
19 Lakes presents a real possibility of wind farm
20 graveyards.

21 First off, the Icebreaker wind project
22 is not large scale, is it?

23 A. Correct.

24 Q. What is the relevance of the discussion

1 of a large scale project with regard to the
2 permitting for Icebreaker?

3 A. You asked this question before. I'll
4 try to give you the same answer, and that is the
5 application itself says that the purpose of this
6 is to stimulate the -- the development of
7 offshore wind in Lake Erie and the Great Lakes.

8 Q. In reviewing the application, did you
9 review the decommissioning section?

10 A. I reviewed the decommissioning section
11 in -- as summarized in the staff report. So I
12 am familiar with it through staff report. The
13 application, I just skimmed over that and don't
14 recall the specifics. I assume the staff report
15 is accurate.

16 Q. Are you aware there's a decommissioning
17 fund?

18 A. I believe that there is a -- well, I
19 don't know if there's one now, but the
20 requirement as proposed by staff is to have, I
21 believe, a surety bond.

22 Q. And do you know whether -- strike that.

23 If there's a requirement for a surety
24 fund for decommissioning of wind turbines, how

1 is there ever going to be this, quote, wind farm
2 graveyard in Lake Erie?

3 A. If all of them have decommissioning
4 surety bonds or similar financial instruments,
5 then correct. But if they don't, then this
6 statement would be correct.

7 Q. Your last sentence on Page 27, this
8 raises the question of whether it is appropriate
9 to build the facility before policies are in
10 place that would make commercial scale offshore
11 wind farms on the Great Lakes economically
12 viable.

13 Seems to me that's kind of putting the
14 cart before the horse. Wouldn't it make more
15 sense to have a project like Icebreaker
16 demonstrate that it can operate and the
17 technology works in Lake Erie before policies
18 are in place for large scale efforts?

19 MR. HAFFKE: Objection; argumentative.

20 A. No, I don't agree with that.

21 Q. Why not?

22 A. The point of -- as stated in the
23 application of this project, is to stimulate the
24 development of wind farms on Lake Erie and the

1 Great Lakes. That's the intent. However, by
2 its own admission, current economics would not
3 make even these commercial scale farms
4 economically attractive without changes to
5 federal and/or state level benefits for the
6 industry.

7 And so if their intent is to use this
8 project to get development -- widespread
9 development on Lake Erie but right now there's
10 no -- right now it makes no sense, you wouldn't
11 want to move down that road until you got
12 agreement by the legislature that, yeah, it does
13 make sense and we're going to give you these
14 benefits to develop.

15 They haven't weighed in on this issue
16 yet, so let the voters and the politicians weigh
17 in on this issue before you start going down
18 that road.

19 That's my opinion.

20 Q. If you turn to Page 28, please. This is
21 a section titled, "Application Deficiencies."

22 A. Yes.

23 Q. Number 1 states, the application does
24 not explain why there is a public need for the

1 facility. In terms of power generation, public
2 need is related to sufficient baseload
3 generation, other aspects of system reliability,
4 economic benefit, environmental benefit, or the
5 ability to meet renewable energy portfolio
6 standards.

7 So based upon this statement, do you
8 believe that public need is also -- one of the
9 public needs is related to the environmental
10 benefit of this project?

11 A. There are environmental impacts to this
12 project as well, and so my intent with that
13 environmental benefit would be not for wind
14 power projects, it could be for other projects.
15 This is general. What you're stating would be
16 better categorized as the last item, meet
17 renewable energy portfolio standards.

18 Q. Well, based upon your experience and
19 involvement related to the Icebreaker Windpower
20 project, do you believe there is an
21 environmental benefit to the project?

22 MR. HAFFKE: Objection; calls for
23 testimony outside of his expert report and
24 engagement.

1 A. Insignificant, I would say. It's too
2 small. Doesn't really matter one way or
3 another.

4 Q. Turn to Page 31, please.

5 A. Okay.

6 Q. Number 7, the development of offshore
7 wind facilities will not eliminate the need for
8 new traditional baseload generation, most likely
9 using natural gas as fuel.

10 Is that the case for any scale offshore
11 wind facility?

12 A. Yes.

13 Q. So are you opposed to any scale offshore
14 wind facility?

15 A. No, I just think when making decisions,
16 people need to be clear that when you build
17 these, it doesn't mean that you're not going to
18 be building baseload generation facilities, and
19 so this is just making sure that important --
20 important items related to this are not
21 misunderstood, such as if we build a wind farm,
22 we won't have to build a power plant. That's
23 just not the case.

24 Q. Number 8 states, production tax credits

1 for wind generation facilities result in market
2 distortions that directly conflict with the
3 performance and operational needs of the
4 electric system.

5 without going back and rereading your
6 whole market distortion section, what does this
7 mean?

8 A. Yes. So production tax credits are
9 specifically for wind, and they allow wind to
10 bid negative prices into the market and then
11 still be profitable because of the production
12 tax credit.

13 what this does is this can cause
14 existing baseload facilities to become
15 unprofitable and go out of business. It can
16 also disincentivize the baseload from building
17 in the area. And from a pure energy standpoint,
18 that's not really an issue, but what is an issue
19 is that these other baseload facilities, they
20 provide what's called ancillary services that
21 the grid needs for reliability purposes.

22 For example, you know, if the wind stops
23 blowing, you need to have spinning reserves that
24 can ramp up quick enough to prevent grid from

1 becoming unstable, you need to have frequency
2 regulation capabilities, and on and on.

3 And so there are a lot of
4 reliability-related services that these baseload
5 plants provide that wind farms cannot provide.
6 And when you start making these unprofitable or
7 less attractive to bid in capacity markets, that
8 can impact the reliability of the system.

9 And I am simply stating what was written
10 in the -- in the paper, which I agree with. So
11 this was the conclusion of -- this was the
12 conclusion of reference 9 on Page 32, negative
13 electricity prices and the production tax credit
14 by the NorthBridge Group. And so this is their
15 conclusion and I agree with their conclusion.

16 Q. And was their conclusion related to wind
17 generation facilities in any specific location?

18 A. They looked at all of the various
19 markets and a lot of their analysis was based on
20 where there's significant wind penetration,
21 which is the Texas market, but they did look at
22 all markets.

23 Q. Is there significant wind penetration in
24 Ohio, do you know?

1 A. Well, I actually have the amount of
2 installed generation in Ohio with wind, and if
3 you look at Figure 6-1 on Page 26, it has all
4 renewables at 2.2 percent, and so that would
5 really -- and this is energy. And so that would
6 be an upper bound of what the wind would be.
7 Some of that's going to be solar, maybe other
8 categories, but typically the bulk of that at a
9 state level is going to be wind.

10 Q. And in this statement in Number 8 on
11 Page 31, are you opposed to production tax
12 credits for wind generation facilities?

13 A. So there's a couple different opinions I
14 have on that. In terms of starting --
15 kick-starting an industry that has potential,
16 you know, national benefits, I have no problems
17 with, you know, the government providing help to
18 nascent industries that have strategic interest
19 or other national interests. And so 20 years
20 ago, no, I think the production tax credit is
21 fine.

22 Once the industry is mature, though,
23 then I don't like the government sort of picking
24 favorites among different technologies, and I

1 think that the wind industry is mature in this
2 case and so the concept of production tax
3 credit, no. Do I think that probably it's time
4 to phase this out, which is happening, yes, I do
5 think that that's time.

6 But then there's the other issue of how
7 you are going to help nascent industries, and
8 the production tax credit -- nobody really
9 envisioned negative clearing prices in markets
10 when the production tax credit came into play.
11 This is just something that turns out happened,
12 and so because of this effect, then I think that
13 should you choose to support at a federal level
14 or state level an industry, wind for example, I
15 think there are better mechanisms than the
16 production tax credit to do it.

17 So there's whether any support should
18 exist at all, that's the first part. The second
19 part is should you help -- should you want to
20 support an industry, how should you do it.

21 Q. Forgive me if my interpretation of that
22 is not accurate, but that sounds, again, like
23 you're opposed to wind generation facilities in
24 general, assuming that they receive PTCs.

11 Q. And when you say "produce competitive
12 electricity," are you referring to the price of
13 electricity on the wholesale PJM market?

14 A. It could be that, it could be what --
15 what you could get for PPAs or bilateral
16 contracts from other suppliers. It could be
17 renewable energy that's -- that's available for
18 purchase, and so it's -- it's a host of other
19 alternatives that you have available for you for
20 getting energy in general or renewable energy
21 specifically.

23 (Exhibit 4 marked.)

24 --0--

1 A. Hot off the presses.

2 Q. That's right.

3 Doctor, I've handed you what's been
4 marked as Exhibit 4, and I will represent to you
5 that this is a copy of your prefiled -- it's
6 titled, "Direct Testimony of Richard E. Brown on
7 Behalf of Duke Energy Ohio, Inc. In Support of
8 Stipulation."

9 And it's filed in a number of combined
10 cases. I won't list them all, but the first
11 being 17-32-EL-AIR before the Public Utilities
12 Commission of Ohio. And I think we've
13 referenced this testimony a couple times already
14 today.

15 A. Yes.

16 Q. On Page 1 of your direct testimony,
17 starting at Line 7, as a principal engineer with
18 Exponent, my primary role is to provide
19 consulting services to electric utilities and
20 related industries.

21 And I assume given how recently this
22 testimony was filed, that that is an accurate
23 description of your current role with Exponent?

24 A. Yes.

1 Q. Thank you. On Page 2, starting at
2 Line 1, I have also helped numerous utilities
3 develop cost-justified reliability improvement
4 plans.

5 what utilities, specifically, to the
6 extent that we didn't cover that at the outset
7 of your deposition?

8 A. Yeah, so there's many. So Snohomish
9 County Public Utility District; the former
10 Carolina Power & Light, which is Duke; Florida
11 Progress; Florida Power & Light. I mentioned
12 Ameren before; Puget Sound Energy; Pacific
13 Gas & Electric; Southern Cal Edison; San Diego
14 Gas & Electric; TXU, Texas Utilities; First
15 Energy as well.

16 I'm sure there's many more. I've got a
17 list of projects in my CV, I believe.

18 Q. Sure.

19 A. Lots, though.

20 Q. On Page 3, starting at Line 14, it
21 states, I have consulted for Duke Energy Ohio
22 regarding its reliability performance
23 initiatives and have assisted the company in
24 evaluating its programs and identifying new

1 initiatives and best practices to maintain and
2 improve reliability of its electric delivery
3 system.

4 when you say you've consulted for Duke
5 Energy, is that an ongoing engagement?

6 A. No, this would be within the last two
7 years. And so they have rider treatment of a
8 lot of their distribution capital programs, so
9 they engaged me to sort of evaluate what they
10 were doing and what they were going to propose,
11 and so that was the initial engagement. And
12 then that was done.

13 And then when this consolidated hearing
14 came up, they kind of called me up again and
15 said --

16 Q. Right. And I believe you indicated
17 earlier that engagement is nearing its end or
18 you believe so?

19 A. I still have it open. I expect I won't
20 be working on it anymore, though.

21 Q. Doctor, are you aware of any PJM studies
22 relating to how much wind energy can be
23 introduced to the system without compromising
24 reliability?

1 A. I know that they do do these studies and
2 I am not -- I'm not specifically aware of them.
3 I know that they exist, though.

4 Q. You don't contend that introduction of
5 the power generated by Icebreaker will
6 compromise the reliability of the PJM system, do
7 you?

8 A. Oh, I'm certain it won't.

9 MR. SECREST: Could we go off the record
10 briefly?

11 (Recess taken.)

12 BY MR. SECREST:

13 Q. Back on briefly, Doctor. Exhibit 3,
14 which is your expert report, your conclusion
15 Number 8, and I'll just read the start of it.
16 Production tax credits for wind generation
17 facilities result in market distortions.

18 Do subsidies for other forms of energy
19 result in market distortions?

20 A. So what I am referring to here
21 particularly is the negative bids, and so in --
22 and these negative bids are for realtime markets
23 or day-ahead markets. And so other types of --
24 you're talking about other types of subsidies?

1 Q. For other type of -- subsidies for other
2 types of energies, do those result in market
3 distortion?

4 A. So, yeah, if other types of subsidies
5 are based on -- are based on production volume,
6 then yes. But other types that are not based on
7 production volume, including those for wind,
8 would not result in realtime bidding market
9 distortions. That was the intent of this
10 conclusion here.

11 MR. SECREST: Okay. Thank you, Doctor.
12 I do not have anything further. I believe
13 Mr. Settineri does, though.

14 EXAMINATION

15 BY MR. SETTINERI:

16 Q. Good afternoon, Dr. Brown.

17 A. Good afternoon.

18 Q. My name's Mike Settineri. I represent
19 The Business Network for Offshore Wind. I'm
20 just going to run through some questions with
21 you here.

22 Tell me, what is Cleveland Public Power?

23 A. So Cleveland Public Power is the
24 electric utility that serves the Cleveland area.

1 Q. And do you know who if any -- you're not
2 a lawyer, correct?

3 A. Correct.

4 Q. Okay. Do you know who has oversight
5 over Cleveland Public Power?

6 A. I assume it's the city.

7 Q. Okay. And so in preparing your opinion,
8 you did not assume that the board has oversight
9 over CPP, correct?

10 A. That's correct, yes.

11 Q. And you'd also agree that the board
12 doesn't have oversight -- let me ask this: In
13 preparing your opinion, you did not believe that
14 the board has oversight over CPP and its
15 wholesale power purchase decisions, correct?

16 A. That's correct, yes.

17 Q. When you talk about subsidies
18 ratepayers -- strike that.

19 when you talk about in your expert
20 report that ratepayers are being -- are
21 subsidizing this project, who are the ratepayers
22 that you're describing?

23 A. So the CPP customers that are served
24 by -- the customers that are served by CPP, they

1 are paying above -- well above market prices for
2 this, which will be reflected in -- in the rates
3 that they pay.

4 To the extent that other PPAs are in
5 place, then it could be additional, but the ones
6 that I'm aware of now would be the CPP
7 customers.

8 Q. All right. Any other ratepayers besides
9 CPP?

10 A. Not that I'm aware of now.

11 Q. Okay. Okay. If the project was
12 expanded beyond six turbines, would you expect
13 the board to have -- have to approve that
14 expansion?

15 A. No.

16 Q. Okay.

17 MR. HAFFKE: Objection. It calls for
18 speculation and matters outside of -- of what
19 he's provided an opinion on.

20 BY MR. SETTINERI:

21 Q. Let me ask it another way. You, in your
22 expert report, discuss -- you have a concern
23 that this demonstration project would lead to a
24 large commercial scale project, correct?

1 MR. HAFFKE: Object to the extent it
2 mischaracterizes his earlier testimony.

3 You can answer.

4 A. I am simply describing what the
5 application itself says the intent of this
6 project is.

7 Q. Okay. And you would agree with me,
8 wouldn't you, that if a large commercial scale
9 project was to be constructed, that the board
10 would have to approve that large scale
11 commercial project, correct?

12 MR. HAFFKE: Objection; calls for a
13 legal conclusion.

14 A. That's my understanding.

15 Q. Okay. All right. And in developing
16 your opinion here, would it be your
17 understanding that such a -- that if a large
18 commercial scale project was to be constructed,
19 that it would be through a separate application
20 to the board?

21 A. Yes.

22 Q. Okay. If this project was constructed
23 and was economically viable, would you consider
24 that to be a successful demonstration project?

1 A. So if this project were constructed and
2 were able to be economically healthy, selling
3 100 percent of its power to the PJM market, this
4 would be a successful project. It wouldn't even
5 need to be described as a demonstration project.

6 Q. Okay. And in your current -- let me ask
7 this: Do you have any experience in developing
8 forecasts for the wholesale power markets?

9 A. A little bit, but not extensive.

10 Q. Okay. Do you consider yourself an
11 expert in forecasting wholesale power markets?

12 A. To the extent I can look at futures
13 markets, but beyond that, no.

14 Q. Have you ever developed a forecast for
15 the wholesale power markets?

16 A. I have, yes.

17 Q. Have you presented that in any -- well,
18 let's see -- any rate proceedings?

19 A. No.

20 Q. Okay. And when did you develop a
21 long-term forecast?

22 A. A project that I did for my MBA.

23 Q. Okay. And when was that?

24 A. When?

1 Q. Yes. Approximately.

2 A. Yeah, it's in my CV, but it was -- I'm
3 horrible with dates. This was in roughly 2002.

4 Q. Okay. And you have not prepared any
5 forecasts since that time?

6 A. Correct. Yes.

7 Q. Would you agree with me that the CPP
8 PPA, which is an offtake of this project, is not
9 before the board for approval in this
10 proceeding?

11 MR. HAFFKE: Objection; calls for a
12 legal conclusion.

13 A. I -- they're not approving this, if
14 that's what your question is. It's not up to
15 the board to approve the CPP. If that's your
16 question, then correct, yes, I agree.

17 Q. And in preparing your report, that was
18 your understanding, correct?

19 A. Yes.

20 Q. Okay. Do you believe the board should
21 consider a project's economic availability in
22 siting generation facilities?

23 A. Yes.

24 Q. And why is that?

1 A. It goes to public need and necessity.

2 Q. And how do you define necessity?

3 A. I'm not an attorney and so if there are
4 loaded legal implications, then I won't be able
5 to speak to that, but the ability to provide --
6 a utility's job is to provide safe and reliable
7 and low cost power. To the extent the project
8 is needed to do that, that would be necessity
9 with regards to electric utility and generation
10 projects.

11 Q. And you'd agree with me that the owner
12 of this project is not a public utility,
13 correct?

14 A. Yes.

15 Q. If this project is constructed and its
16 revenues are not sufficient to meet its cost,
17 cost of capital, who bears those losses?

18 A. The owners.

19 Q. Anyone else that would bear those
20 losses?

21 A. Well, to the extent you've issued debt,
22 you default on debt then, you know, debt issuers
23 would also be impacted.

24 Q. And you mentioned -- you're not certain

1 how this project will be financed, correct?

2 A. Correct.

3 Q. But it would be your -- based on your --

4 I assume you have -- well, let me strike that.

5 would it be your assumption, though,
6 that financing could be a combination of both
7 debt and equity?

8 A. That's usually the way it is.

9 Q. Okay. Would it be your opinion -- or
10 would it be -- let me ask this: Do you have an
11 opinion on whether this project would be
12 constructed if it is unable to get financing?

13 A. well, if it's not able to get financing,
14 it would not be constructed.

15 Q. Is it fair to say, then, that the final
16 judge of economic viability of a project would
17 be the lenders and the equity investors?

18 A. Yes, that's correct.

19 Q. which, in your opinion, would have a
20 higher capacity factor -- let me strike that.

21 would you expect an offshore wind
22 project to have a higher capacity factor than an
23 onshore wind project?

24 A. If it's sited with -- you know, in a

1 place with good wind energy density, then yes.

2 Q. And here, where this project is sited in
3 Ohio, would you expect this project to have a
4 higher wind capacity than other projects that
5 have been sited in Ohio?

6 A. You said wind capacity. If you mean
7 capacity factor --

8 Q. I did.

9 A. -- then I would suspect yes.

10 Q. And in preparing your expert report,
11 which is marked as Exhibit 3, did you review any
12 of the capacity factors for the wind projects
13 that the board has previously approved to be
14 sited in Ohio?

15 A. No.

16 Q. Okay. If this project is delayed for
17 any reason, including litigation, who bears the
18 risk of that delay, in your opinion?

19 A. The investors.

20 Q. For this project specifically, do you
21 see -- in your opinion, are there any
22 positive -- any benefits to this project?

23 A. Yes, I -- we went through those in the
24 previous questioning. They're listed in my

1 report.

2 Q. You listed some but, for example, would
3 you believe that taxes being paid by the project
4 to the State of Ohio would be a benefit?

5 A. You may be asking the wrong guy about
6 taxes.

7 MR. HAFFKE: Objection. This line's
8 outside of the scope of the testimony provided.

9 A. This is a benefit for -- for tax
10 revenue. That's what I'll say.

11 Q. Right. And you'd also see the creation
12 of jobs as a benefit, correct?

13 MR. HAFFKE: Same objection.

14 A. Yes.

15 Q. And are you familiar with the concept of
16 direct, indirect, and induced economic benefits?

17 A. Yes.

18 Q. And would you, in your opinion, would
19 you expect that this project would create
20 direct, indirect, and induced benefits, economic
21 benefits, if constructed and operated?

22 A. So during construction for sure. The
23 staffing requirements after it's built would be
24 significantly less.

1 Q. Okay. If you could turn to Exhibit 3,
2 and I have a note here, Page 18. You have a
3 Figure 4-1. Do you see that?

4 A. Yes.

5 Q. Okay. And I believe the source for 4-1,
6 is that noted in footnote 5 on Page 17?

7 A. Yes.

8 Q. And so you developed your -- was that
9 graph taken directly from the source identified
10 in footnote 5 in Exhibit 3?

11 A. Yes, this is an EPA website, and I
12 simply took a screenshot and pasted it in my
13 report. I did not create this through data.

14 Q. So you don't know what type of projects,
15 in terms of scale of projects, from which this
16 data was used -- or from which -- the data was
17 used to create this graph, correct?

18 A. Correct.

19 Q. All right. And you do not know whether
20 this graph represents all wind and solar PPAs
21 that had been executed, correct?

22 A. Correct. Yes.

23 Q. Okay. So let me ask you this, for this
24 project specifically, this project will not

1 create a grid reliability issue, correct?

2 A. Correct.

3 Q. Okay. And for this project
4 specifically, it will not create wholesale
5 market distortions, correct?

6 A. Correct.

7 Q. Okay. And for this project
8 specifically, it will provide a benefit to
9 Ohio's economy, correct?

10 A. So --

11 Q. If it's constructed.

12 A. So to be consistent with my previous
13 answers where the more precise answer is it's
14 immaterial, then my answer to this is also, it's
15 immaterial.

16 Q. Let me rephrase it, though. This
17 project specifically will, if constructed and
18 operated, will create some level of economic
19 impact and benefit to Ohio's economy, correct?

20 A. So it'll have a little bit of a positive
21 influence, but it could also have a little bit
22 of negative influence counteracting that. If
23 you're saying will there be positive aspects,
24 yes. On net will it be positive? I -- I don't

1 know the answer to that.

2 Q. And what would be the negative aspects?

3 A. So if this sends a signal to, you know,
4 existing baseload plants that are kind of on the
5 margin that this is the road we're heading and
6 so they were to decommission earlier based on
7 this as a signal, if there were baseload
8 generations that were going to bid in the
9 capacity market but they were kind of on the
10 fence and this is a signal that maybe we're not
11 going to pursue that, those could be negatives.

12 Q. Okay. And so it's your opinion that the
13 6 megawatt project, if it was constructed and
14 operated -- let me strike that.

15 It's your opinion that this project --
16 and I'll paraphrase, but it's your opinion that
17 this project, if constructed and operated, could
18 send a signal to baseload generation that if
19 large commercial scale -- that if a large
20 commercial scale project is coming, it could
21 then impact them and it could trigger them to
22 retire early?

23 A. That's right. As a signal to these --
24 to these power plant owners.

1 Q. Okay. Any other negative aspects that
2 you think this project will have as to Ohio's
3 economy?

4 A. You know, if tourists don't want to come
5 to Cleveland and look at offshore wind farms,
6 that could be a negative. If boaters like that
7 very specific area and don't want to be around
8 wind farms, that could be a negative. Again,
9 this is going to be small, just like the
10 benefits are small, for this small project.

11 Q. And going back to baseload, I'll ask you
12 this question: This project specifically will
13 not create -- will not result in any decrease or
14 increase in baseload generation, correct?

15 A. So this project, if it's assigned the
16 typical -- the typical capacity credit will
17 result in a tiny little increase in -- in
18 baseload at PJM, but it's immaterial. It's
19 noise. So effectively, no.

20 MR. SETTINERI: I don't have any other
21 questions. Thank you very much.

22 MR. SECREST: I do not have any further
23 questions. Does anyone on the phone have any
24 questions for Dr. Brown?

1 MR. JONES: No questions, thank you.

2 MS. LEPPLA: No questions, thank you.

3 COURT REPORTER: I'm sorry, who was
4 that?

5 MR. JONES: John Jones representing
6 staff.

7 COURT REPORTER: Thank you.

8 MS. LEPPLA: And no questions from OEP
9 and Sierra Club, either. This is Miranda
10 Leppla.

11 MR. HAFFKE: I have no questions.

12 (Discussion off the record.)

13 (Signature not waived.)

14 --O--

15 Thereupon, the testimony of July 25,
16 2018, was concluded at 1:02 p.m.

17 --O--

18

19

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22

23

24

1 CERTIFICATE

2 STATE OF OHIO :
3 COUNTY OF FRANKLIN : SS:

4 I, Angela R. Starbuck, RDR/CRR/CRC, a
5 Notary Public in and for the State of Ohio, duly
6 commissioned and qualified, do hereby certify
7 that the within-named RICHARD E. BROWN was first
8 duly sworn to testify to the truth, the whole
9 truth, and nothing but the truth in the cause
10 aforesaid; that the testimony then given was
reduced to stenotypy in the presence of said
witness, afterwards transcribed; that the
foregoing is a true and correct transcript of
the testimony; that this deposition was taken at
the time and place in the foregoing caption
specified.

11 I do further certify that I am not a
12 relative, employee or attorney of any of the
13 parties hereto; that I am not a relative or
14 employee of any attorney or counsel employed by
15 the parties hereto; that I am not financially
interested in the action; and further, I am not,
nor is the court reporting firm with which I am
affiliated, under contract as defined in Civil
Rule 28(D).

16 In witness whereof, I have hereunto
17 set my hand and affixed my seal of office at
Columbus, Ohio, on this 30th day of July, 2018.

18

19

20

21

22

23

24 My commission expires: December 10, 2021

Angela R. Starbuck

Angela R. Starbuck, RDR/CRR/CRC
Notary Public, State of Ohio.

Exponent

Exponent
149 Commonwealth Drive
Menlo Park, CA 94025

telephone 650-326-9100
facsimile 650-326-8072
www.exponent.com

September 11, 2017

John Stock, Esq.
Partner
Benesch, Friedlander, Coplan & Aronoff LLP
41 South High Street, Suite 2600
Columbus, OH 43215

Subject: Icebreaker Windpower
Exponent Project No. 1707425

Dear Mr. Stock:

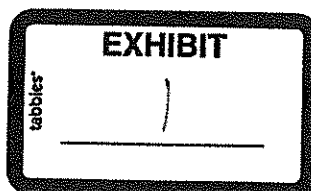
Thank you for your interest in retaining Exponent, Inc. (Exponent) to provide services related to the above-referenced project. This letter presents our current understanding of the scope of services sought and the terms of the engagement.

Our scope of services is anticipated to include engineering consulting as requested on the above matter. This project shall be performed at the direction of Benesch Friedlander Coplan & Aronoff LLP, but is generally expected to include expert witness support related to the Icebreaker Windpower project including issues related to (1) the economic viability of a small wind turbine fleet; (2) the general economics of wind power generation in the United States; and (3) the impact of extensive wind farm development on current PJM baseload and price impact.

Exponent's services will be provided on a time-and-expense basis. Charges will include professional fees, equipment use fees, and other out-of-pocket expenses according to our *Schedule of Rates & Charges*, a copy of which is enclosed and made a part hereof by reference. Exponent charges \$430 per hour for my services in calendar year 2017. Other Exponent staff members will be utilized where appropriate.

Exponent's services are provided only in accordance with our *Terms and Conditions of Agreement*, a copy of which is enclosed and made a part hereof by reference. It is our understanding that Exponent's retention on this project is with Benesch, Friedlander, Coplan & Aronoff LLP, on behalf of Murray Energy Corporation (Murray Energy), and, as such, all charges (i.e., fees and expenses) incurred by Exponent on this project will be billed to your office but will be the responsibility of Murray Energy, independent of other parties/payees involved. Please verify the contact information for billing purposes in the table at the end of this letter. If it is not correct, please provide the updated information. For purposes of the *Terms and Conditions of Agreement*, "client" shall mean Murray Energy.

1707425.000 - 0045



BR000015

John Stock, Esq.
September 11, 2017
Page 2

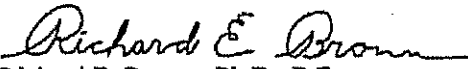
Based on the information you have provided, we have performed a conflict-of-interest check for the following parties:

- Murray Energy Corporation
- Bonheur ASA
- Lake Erie Energy Development
- LEEDCo
- Icebreaker Wind
- Fred.Olsen Renewables

Using this information, Exponent has determined that it does not currently have a conflict that would preclude us from assisting you in this matter. Please inform us as soon as possible if this list of parties is inaccurate or incomplete, and if other parties become involved as this matter proceeds.


This proposed retention letter is valid for 15 days from the date first set forth above. Please sign and return this letter if you would like us to proceed with this work. If you have any questions or require additional information, please do not hesitate to contact me at (303) 882-6469. We look forward to working with you.

Sincerely,


Richard E. Brown, Ph.D., P.E.
Principal Engineer & Practice Director

Enclosures (2)

Accepted by:


Authorized Signature

John F. Stock, Partner
Name and Title

Beresh, Friedland, Cohn & Cumoff, LLC
Organization

9/13/17
Date

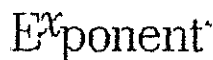
John Stock, Esq.
September 11, 2017
Page 3

INVOICE TRANSMITTAL ADDRESS

By default, Exponent will email invoices to the email address(es) listed below. Please verify the email address(es) as well as any reference information that should be contained on the invoice.

If you wish to receive hard copies of invoices via US Mail, please check the box below and provide the address(es) to which the hard copies should be mailed.

Invoice Reference Number(s):	
Name/Title	
Email	
John Stock, Esq. / Partner	jstock@Beneschlaw.com
Please send hard copy of invoices via US Mail: Yes <input type="checkbox"/> No <input type="checkbox"/>	
Physical address for invoicing:	
Other Notes:	



SCHEDULE OF RATES AND CHARGES

PROFESSIONAL FEES

Exponent charges its clients for services provided according to the qualifications and experience level of the individuals assigned to the client's project at each employee's specific current hourly rate. These rates are modified annually on or about January 1. Exponent provides the following staff classifications that designate relative experience, training, and accomplishment within a technical field, together with the range of hourly rates. Payment is required in U.S. dollars within 30 days after the date of the invoice, or interest charges may be applied.

Principal/Officer	Senior-level technical or management person, responsible for technical direction or general management or administration.	\$275-\$750
Senior Manager	Senior technical professional providing high-level or individual consulting assignments, or overall technical direction of projects, may have management responsibility for a technical field.	\$250-\$500
Manager	Senior technical professional providing high-level or individual consulting assignments or overall technical direction of projects.	\$200-\$425
Senior Engineer/ Scientist/Associate	Experienced technical professional skilled in planning, organizing, controlling, and executing complex, higher-order projects or assignments.	\$175-\$325
Engineer/Scientist/ Associate	Trained/degreed professional responsible for executing technical assignments in support of client projects.	\$150-\$275
Technical/Research Specialist	Personnel experienced in instrumentation, programming, testing, library science, or the development or execution of research methodologies in support of projects.	\$135-\$200
Technical/Research Assistant	Laboratory, data processing, engineering-graphics, engineering technician, or other personnel responsible for the execution of specialized tasks in support of projects.	\$90-\$150
Non-technical Assistant	Personnel who assist technical staff in various non-technical areas, including scheduling, report productions, communications, logistics, and project support.	\$ 75-\$125

TECHNICAL EQUIPMENT, SOFTWARE AND LAB CHARGES

Exponent personnel may utilize Exponent's technical equipment and software to assist them in the performance of client's project. Exponent charges an hourly or daily usage fee for selected equipment, software and labs (e.g., scanning electron microscope, finite element software and biomedical laboratory).

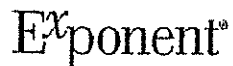
TRAVEL AND MEAL EXPENSES

Travel and meal expenses are charged at Exponent's cost. Local mileage is charged in accordance with I.R.S. guidelines. The most effective air travel for the project will be utilized and personnel below the Principal classification will charge coach fares.

OTHER PROJECT EXPENSES

Project expenses including materials, subcontractors and third-party vendors are charged at cost plus fifteen percent. If the client prefers to procure the project expenses directly to avoid the additional fifteen percent charge then notify Exponent at the initiation of the engagement. Consumable materials may be charged on an applied rate rather than an incurred cost basis.

1. Work performed on a time-and-expenses basis will be billed in accordance with Exponent's most current Schedule of Rates and Charges. Work performed under a fixed-price arrangement will be billed at the agreed fixed amount. A payment in advance or a suitable retainer may be required from the client. Exponent will hold any retainer until the final invoice is prepared, at which time it will reconcile the client's account. Following Exponent's completion of work, the client is responsible for and may be charged for the storage and disposal of evidence, exemplars and samples. Exponent will charge taxes where applicable.
2. Invoices are typically rendered monthly or in accordance with the agreed upon payment schedule, and are due in U.S. dollars within 30 days of the date of the invoice. Exponent, without liability, may withhold delivery of reports and other data, and may suspend performance of its obligations to the client, pending payment of outstanding charges. Exponent reserves the right to decline further work with any client who has been delinquent in payment of Exponent's invoices.
3. Exponent will perform its services consistent with the professional skill and care ordinarily provided by professionals practicing in the same or similar locality under the same or similar circumstances. In the event that Exponent fails to meet the foregoing standard of care or that the client has any other claim, client's sole and exclusive remedy shall be limited to Exponent re-performing the work at Exponent's expense, or reimbursing the client up to the amount the client paid Exponent for the work. No other warranty, express or implied, is made concerning work performed under the agreement.
4. The client assumes full and complete responsibility for all uses and applications of Exponent's recommendations or work under this agreement, or failure to use recommendations or work, and agrees to indemnify and hold harmless Exponent, its affiliates, officers, directors, employees, agents, and stockholders against any and all liabilities, damages, losses, claims, demands, actions, causes of action, and costs including attorney's fees and expenses resulting from the death or injury to any person or damage to any property or any other alleged or actual damages resulting from the aforementioned use, application, or nonuse of Exponent's recommendations or work under this agreement.
5. In no event shall Exponent, its affiliates, officers, directors, employees, agents, or stockholders be liable for any incidental or consequential damages.
6. Exponent will hold in confidence all information provided by the client that the client designates and/or marks as confidential or proprietary. If Exponent and the client have entered into a separate non-disclosure agreement, it is deemed incorporated herein. All deliverables and any improvements to the client's processes or products arising from this agreement shall be and remain the property of client; however, Exponent has a right to retain a copy of such deliverable(s). Exponent shall retain all rights, title, and interest in and to its proprietary information (along with any modifications or improvements to such information), including, but not limited to Exponent's know-how, methodologies, techniques, processes, tools, test fixtures, technologies, trade secrets, software, data, databases, algorithms, source code, computational engines, logic formulas, non-interface worksheets, macros, and other materials used by Exponent in connection with providing its services.
7. Anybody required to be present at Exponent's laboratories for the project, including other parties and the like, will be required to sign an agreement that contains confidentiality obligations and a general release of claims for injuries or damages to property related to the visit.
8. Client understands that evidence, materials, test articles or the like ("Articles") may be damaged or destroyed during testing and as such Exponent is not responsible for any loss or damage thereto. The client shall bear the risk of loss of the Articles while they are in transit. Notwithstanding any language to the contrary herein, should Exponent be obligated to replace the Articles, the cost of such replacement shall be its fair market value and not any implicit value. Exponent, unless other specific arrangements are made, will maintain technical files and evidence for 30 days after the completion of work. Exponent will retain financial records according to I.R.S. requirements, but in no event less than 1 year after completion of the work.
9. Client shall not use Exponent's (or any of its affiliates' or its personnel's) name(s), trade names, service marks, trademarks, trade dresses, logos, symbols, or the like in any form for advertising, publicity, marketing, or in any way that could be construed as endorsement or promotion and the like without the prior written consent of Exponent in each instance.
10. This agreement is solely between, and may only be enforced by, Exponent and the client, and this agreement shall not create or be construed to create any third party rights, obligations, or liabilities including, but not limited to, affiliates, employees, contractors, stockholders, licensees, or the like. Any deliverables, recommendations, or service provided by Exponent shall be for the client's use only. Exponent's services are expressly limited to the terms herein and are not modified or supplemented by terms from the client's purchase order. Exponent will reference the client's purchase order for billing purposes only.
11. Upon receipt of written notice from the client, Exponent will terminate work under this agreement. Work under a fixed-price agreement that is terminated before completion will be billed on a percentage of completion basis. Exponent may terminate work under this Agreement only for cause. "Cause" includes, but is not limited to, development of a material conflict of interest, delinquency in payment, judicially required participation in onerous discovery or other legal process outside the intended scope of the work, or the presence of circumstances beyond Exponent's control, such as natural disasters or government intervention. Exponent shall not be liable for any delay or failure to perform resulting from unforeseen causes beyond its reasonable control.
12. If Exponent is required to testify or to produce information regarding work under this agreement in any third party litigation, including but not limited by subpoena or court order, the client agrees to provide counsel of its choosing and to pay Exponent's reasonable time and expenses, including attorney's fees associated with responding to such request. In the event of any such request, Exponent will promptly notify the client to enable the client to object to any such testimony or production. This paragraph is not intended to apply to claims between Exponent and the client.
13. This agreement shall be construed, and the legal relations between the parties hereto shall be determined, in accordance with the internal laws of the state of California, without regard to the conflicts of laws principles of such state. The parties to this agreement consent to the jurisdiction of any state or federal court located in San Francisco, California. The prevailing party in any action shall recover from the losing party its reasonable attorney's fees and costs of suit incurred in addition to any other relief granted.

**INVOICE**

Please make checks payable to:
Exponent, Inc.
P.O. Box 200283 Dept. 002
Dallas, TX 75320-0283
Federal Tax ID: 77-0218904

January 4, 2018

Project No: 1707425.000

Invoice No: 349622

John Stock
Benesch Attorneys at Law
41 South High Street
Suite 2600
Columbus, OH 43215

Icebreaker Windpower

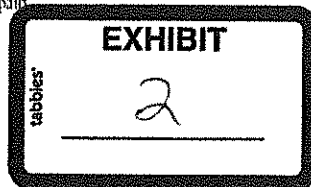
Email to jstock@Beneschlaw.com

Professional Services through December 31, 2017

Professional Personnel

	Hours	Rate	Amount
Principal			
Richard Brown	32.00	430.00	13,760.00
Totals	32.00		13,760.00
Total Labor			13,760.00
Total this Invoice			\$13,760.00

1. This invoice may not include expense items such as communication, freight and outside services for which we have yet to be billed.
2. Payments received 30 days past invoice date are subject to 10.0% per annum charge until paid.
3. To insure proper credit, please reference the invoice number on your check.

**PAYMENT DUE
UPON RECEIPT**

BR000005

Project	1707425.000	Icebreaker Windpower	Invoice	349622
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Exponent

Billing Backup

January 4, 2018

Project 1707425.000 Icebreaker Windpower

Professional Personnel

			Hours	Rate	Amount
Principal					
03566	Richard Brown	12/11/2017	4.00	430.00	1,720.00
	Draft report				
03566	Richard Brown	12/12/2017	4.00	430.00	1,720.00
	Draft report				
03566	Richard Brown	12/13/2017	4.00	430.00	1,720.00
	Draft report				
03566	Richard Brown	12/14/2017	8.00	430.00	3,440.00
	Draft report				
03566	Richard Brown	12/18/2017	4.00	430.00	1,720.00
	Draft report				
03566	Richard Brown	12/19/2017	4.00	430.00	1,720.00
	Draft report				
03566	Richard Brown	12/20/2017	4.00	430.00	1,720.00
	Draft report				
	Totals		32.00		13,760.00
	Total Labor				13,760.00
			Total This Invoice		\$13,760.00

1. This invoice may not include expense items such as communication, freight and outside services for which we have yet to be billed.
2. Payments received 30 days past invoice date are subject to 10.0% per annum charge until paid.
3. To insure proper credit, please reference the invoice number on your check.

**PAYMENT DUE
UPON RECEIPT**

Page 2

BR000006

**INVOICE**

Please make checks payable to:
Exponent, Inc.
P.O. Box 200283 Dept. 002
Dallas, TX 75320-0283
Federal Tax ID: 77-0218904

February 14, 2018

Project No: 1707425.000

Invoice No: 353251

John Stock
Benesch Attorneys at Law
41 South High Street
Suite 2600
Columbus, OH 43215

Icebreaker Windpower

Email to jstock@Beneschlaw.com

Professional Services through January 26, 2018

Professional Personnel

	Hours	Rate	Amount
Principal			
Richard Brown	19.00	450.00	8,550.00
Totals	19.00		8,550.00
Total Labor			8,550.00
Total this Invoice			\$8,550.00

1. This invoice may not include expense items such as communication, freight and outside services for which we have yet to be billed.
2. Payments received 30 days past invoice date are subject to 10.0% per annum charge until paid.
3. To insure proper credit, please reference the invoice number on your check.

**PAYMENT DUE
UPON RECEIPT**

BR000007

Project	1707425.000	Icebreaker Windpower	Invoice	353251
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Exponent

Billing Backup

February 14, 2018

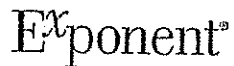
Project	1707425.000	Icebreaker Windpower
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Professional Personnel

			Hours	Rate	Amount
Principal					
03566	Richard Brown	1/3/2018	4.00	450.00	1,800.00
	Draft report				
03566	Richard Brown	1/4/2018	4.00	450.00	1,800.00
	Draft report				
03566	Richard Brown	1/5/2018	4.00	450.00	1,800.00
	Draft report				
03566	Richard Brown	1/18/2018	1.00	450.00	450.00
	Draft report				
03566	Richard Brown	1/19/2018	2.00	450.00	900.00
	Draft report				
03566	Richard Brown	1/25/2018	2.00	450.00	900.00
	Draft report				
03566	Richard Brown	1/26/2018	2.00	450.00	900.00
	Draft report				
	Totals		19.00		8,550.00
	Total Labor				8,550.00
			Total This Invoice		\$8,550.00

1. This invoice may not include expense items such as communication, freight and outside services for which we have yet to be billed.
2. Payments received 30 days past invoice date are subject to 10.0% per annum charge until paid.
3. To insure proper credit, please reference the invoice number on your check.

**PAYMENT DUE
UPON RECEIPT**

**INVOICE**

Please make checks payable to:
Exponent, Inc.
P.O. Box 200283 Dept. 002
Dallas, TX 75320-0283
Federal Tax ID: 77-0218904

May 15, 2018

Project No: 1707425.000

Invoice No: 360225

John Stock
Benesch Attorneys at Law
41 South High Street
Suite 2600
Columbus, OH 43215

Icebreaker Windpower

Send via Email
jstock@Beneschlaw.com
Professional Services through April 27, 2018

Professional Personnel

	Hours	Rate	Amount	
Principal				
Richard Brown	36.00	450.00	16,200.00	
Totals	36.00		16,200.00	
Total Labor				16,200.00
Total this Invoice				\$16,200.00

1. This invoice may not include expense items such as communication, freight and outside services for which we have yet to be billed.
2. Payments received 30 days past invoice date are subject to 10.0% per annum charge until paid.
3. To insure proper credit, please reference the invoice number on your check.

**PAYMENT DUE
UPON RECEIPT**

BR000009

Project	1707425.000	Icebreaker Windpower	Invoice	360225
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Exponent

Billing Backup	May 15, 2018
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Project 1707425.000 Icebreaker Windpower

Professional Personnel

			Hours	Rate	Amount
	Principal				
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	Draft report				
03566	Richard Brown	4/5/2018	4.00	450.00	1,800.00
	Draft report				
03566	Richard Brown	4/6/2018	4.00	450.00	1,800.00
	Draft report				
03566	Richard Brown	4/9/2018	2.00	450.00	900.00
	Draft report				
03566	Richard Brown	4/10/2018	2.00	450.00	900.00
	Draft report				
03566	Richard Brown	4/11/2018	4.00	450.00	1,800.00
	Draft report				
03566	Richard Brown	4/12/2018	8.00	450.00	3,600.00
	Draft report				
03566	Richard Brown	4/13/2018	8.00	450.00	3,600.00
	Draft report				
	Totals		36.00		16,200.00
	Total Labor				16,200.00
			Total This Invoice		\$16,200.00

1. This invoice may not include expense items such as communication, freight and outside services for which we have yet to be billed.
2. Payments received 30 days past invoice date are subject to 10.00% per annum charge until paid.
3. To insure proper credit, please reference the invoice number on your check.

**PAYMENT DUE
UPON RECEIPT**

Page 2

BR000010

**INVOICE**

Please make checks payable to:
Exponent, Inc.
P.O. Box 200283 Dept. 002
Dallas, TX 75320-0283
Federal Tax ID: 77-0218904

November 8, 2017

Project No: 1707425.000

Invoice No: 345241

John Stock
Benesch Attorneys at Law
41 South High Street
Suite 2600
Columbus, OH 43215

Icebreaker Windpower

Email to jstock@Beneschlaw.com
Professional Services through October 29, 2017

Professional Personnel

	Hours	Rate	Amount	
Principal				
Richard Brown	14.00	430.00	6,020.00	
Totals	14.00		6,020.00	
Total Labor				6,020.00
		Total this Invoice		\$6,020.00

1. This invoice may not include expense items such as communication, freight and outside services for which we have yet to be billed.
2. Payments received 30 days past invoice date are subject to 10.0% per annum charge until paid.
3. To insure proper credit, please reference the invoice number on your check.

**PAYMENT DUE
UPON RECEIPT**

BR000011

Project	1707425.000	Icebreaker Windpower	Invoice	345241
Exponent				

Billing Backup	November 8, 2017
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Project 1707425.000 Icebreaker Windpower

Professional Personnel

			Hours	Rate	Amount
	Principal				
03566	Richard Brown	10/16/2017	6.00	430.00	2,580.00
	Material review				
03566	Richard Brown	10/17/2017	8.00	430.00	3,440.00
	Material review				
	Totals		14.00		6,020.00
	Total Labor				6,020.00

Total This Invoice \$6,020.00

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**INVOICE**

Please make checks payable to:
Exponent, Inc.
P.O. Box 200283 Dept. 002
Dallas, TX 75320-0283
Federal Tax ID: 77-0218904

March 29, 2018

Project No: 1707425.000

Invoice No: 356485

John Stock
Benesch Attorneys at Law
41 South High Street
Suite 2600
Columbus, OH 43215

Icebreaker Windpower

Send via Email
jstock@Beneschlaw.com
Professional Services through February 25, 2018

Professional Personnel

	Hours	Rate	Amount
Principal			
Richard Brown	5.00	450.00	2,250.00
Totals	5.00		2,250.00
Total Labor			2,250.00
Total this Invoice			\$2,250.00

Outstanding Accounts Receivable

Invoice #	Date	Balance
353251	2/14/2018	8,550.00
Total		8,550.00

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BR000013

Project	1707425.000	Icebreaker Windpower	Invoice	356485
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Exponent

Billing Backup

March 29, 2018

Project	1707425.000	Icebreaker Windpower
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Professional Personnel

			Hours	Rate	Amount
Principal					
03566	Richard Brown	1/29/2018	2.00	450.00	900.00
	Draft report				
03566	Richard Brown	2/1/2018	2.00	450.00	900.00
	Draft report				
03566	Richard Brown	2/2/2018	1.00	450.00	450.00
	Draft report				
	Totals		5.00		2,250.00
	Total Labor				2,250.00

Total This Invoice	\$2,250.00
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UPON RECEIPT**

Page 2

BR000014

Exponent[®]

Engineering Sciences

**Assessment of Icebreaker
Offshore Wind Project**

EXHIBIT

3

tabbles[®]



Assessment of Icebreaker Offshore Wind Project

Prepared for:

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41 South High Street, Suite 2600
Columbus, OH 43215-6164
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Prepared by:

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July 14, 2018

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Contents

	<u>Page</u>
Limitations	iii
1. Introduction	1
2. Author Qualifications	4
3. Project Economics	6
Assessment Using Public Information	6
Assessment Using Confidential Information	11
4. Demonstration Project Need	15
5. Baseload Generation	20
6. Market Distortion	24
7. Application Deficiencies	28
8. Conclusions	31
Appendix A – Reviewed Materials	32
Appendix B – CV of Richard E. Brown	33

Limitations

At the request of Benesch, Friedlander, Coplan & Aronoff LLP, Exponent conducted an assessment of the facts related to the proposed Icebreaker offshore wind project, before the Ohio Power Siting Board, Case No. 16-1871-EL-BGN, filed by Icebreaker Windpower Inc.

The opinions and comments formulated during this assessment are based on observations and information available at the time of the assessment.

The findings presented herein are made to a reasonable degree of engineering certainty. If new data becomes available or there are perceived omissions or misstatements in this report regarding any aspect of those conditions, we ask that they be brought to our attention as soon as possible so that we have the opportunity to fully address them.

1. Introduction

The company Icebreaker Windpower Inc. has submitted an Application to the Ohio Power Siting Board for approval of construction of a new offshore wind farm called the Icebreaker Wind Farm (Facility). The Application, filed in Jan. 2017, describes the Facility as follows in its introduction:

PROJECT SUMMARY. The Applicant is proposing to construct the Facility in Lake Erie, Cuyahoga County, which would consist of 6 wind turbine generators, along with submerged electric collection cables, and a Facility substation. The energy generated at the Facility will deliver power to a single point of interconnection on the existing Cleveland Public Power (CPP) electric grid – 138 kilovolt (kV) Lake Road Substation.

General Purpose of the Facility. The general purpose of the Facility is to produce wind-powered electricity that will maximize energy production from Project Area wind resources in order to deliver clean, renewable electricity to the Ohio bulk power transmission system to serve the needs of electric utilities and their customers. Increasing reliance on Ohio's vast offshore wind resource will add fuel diversity to the state's and region's electric supply mix, help reduce air pollution in an area that historically has been a non-attainment area for 2.5 micron particulate matter, lead, and ozone, reduce greenhouse gas emissions, and create local jobs and spur economic development. The electricity generated by the Facility will be transferred to the transmission grid owned by CPP. Two-thirds of the Facility's output has been sold to CPP under a long-term power purchase agreement. The balance of the power will be delivered to the grid operated by PJM Interconnection, LLC (PJM) and sold in the wholesale market or under bi-lateral power purchase agreement(s).

Description of the Facility. The Facility turbines will be constructed on the Lake Erie lake bed, on leased submerged state land off the coast of the City of Cleveland, in Cuyahoga County, Ohio. These rights were obtained through a Submerged Land Lease with the State of Ohio. The Facility presented herein consists of 6 wind turbine generators, each with a nameplate capacity rating of 3.45 megawatts (MW) for a total generating capacity of 20.7 MW. The Facility is expected to operate for approximately 8,200 hours annually, and have an approximate capacity factor of 41.4%, generating approximately 75,000 megawatt-hours (MWh) of electricity each year.

The Application introduction describes the Facility project schedule as follows:

Project Schedule. Acquisition of land rights began in January 2011 and was completed in February 2014. A public information meeting was held on November 3, 2016 to facilitate public interaction with the Applicant and expert consultants, and included information on visual/aesthetics, ecological studies, project purpose and need, and Facility component technology (e.g., wind turbine, foundation, and submerged electrical collection cables). This Certificate Application was officially submitted in February 2017, and it is anticipated that the Certificate will be issued in 2017. Construction is anticipated to begin in May 2018 and be completed by October 2018. The Facility will be placed in service by November 2018.

The Application introduction describes future plans for the Facility as follows:

Plans for Future Generation Capacity at the Site. Icebreaker Wind is designed to be a demonstration-scale project, as it is the first proposed freshwater offshore wind farm in North America. The 20.7 MW Project will have the capacity to generate approximately 75,000 MWh of emissions-free electricity that will collect to an electric substation in the City of Cleveland, Cuyahoga County. Although this Facility is meant to be a demonstration-scale project to help assess the potential success for future larger-scale offshore wind farms in Lake Erie and other Great Lakes, the Applicant does not currently have future plans with respect to this point of interconnection.

The Application introduction describes the applicant and operator of the Facility as follows:

Description of Applicant and Operator. The Applicant was formed through the collaboration of the Lake Erie Energy Development Corporation (LEEDCo) and Fred Olsen Renewables (FOR). LEEDCo was created by the Great Lakes Energy Development Task Force, then developed and launched by NorTech Energy Enterprise, the Cleveland Foundation, City of Cleveland, Cuyahoga and Lorain Counties, Ohio. It was founded as a public-private, nonprofit (501(c)3) regional corporation to advance the development of a demonstration scale project in Lake Erie, and help stimulate a Great Lakes offshore wind industry. In 2010, Lake and Ashtabula Counties joined; Erie County, Pennsylvania was added in 2014, bringing together the necessary constituencies and stakeholders from Lake Erie's coastal counties.

In May 2015, FOR established its U.S. headquarters in Cleveland, Ohio under the name of Fred. Olsen Renewables USA (FORUSA), to develop, construct, and operate the Facility. FOR has been developing wind farms across Europe since 1992 and controls assets for over 2,000 MWs of generation. FOR's business model starts with an idea and develops the project all the way through operation for the life of the project and then considers either repowering or decommissioning. As such, they are the largest independent power producer in the United Kingdom (UK). FOR also has assets in France, Sweden, and Norway, and almost 25 years of experience in wind power development.

And so, a summary of the Facility as self-described in the Application is:

- A 6-turbine, 20.7 MW facility;
- An assumed 41.4% capacity factor;
- Interconnection to a Cleveland Public Power (CPP) substation at 138 kV;
- 67% of output pre-purchased by CPP through a long-term contract;
- 33% of output to be sold into the PJM market or through PPAs;
- Target in-service date of Nov. 2018;
- Characterized as a “demonstration-scale project to help assess the potential success for future larger-scale offshore wind farms in Lake Erie and other Great Lakes;”
- Project owner is a non-profit corporation formed specifically to “advance the development of a demonstration scale project in Lake Erie, and help stimulate a Great Lakes offshore wind industry;” and
- The facility will be built and operated by a company with extensive experience in Europe, but with no experience in North America.

The remainder of this report assesses the Facility from the perspective of project economics, the need for a demonstration project, baseload generation, market distortion, and Application deficiencies.

2. Author Qualifications

I am an internationally-recognized expert on electric power systems, electric utility economic assessment, and benefit-to-cost assessment. I have submitted expert witness testimony to regulatory commissions in California, Florida, Maryland, Massachusetts, North Carolina, Ohio, Virginia, Texas, British Columbia, and Alberta. I am the author of over ninety peer-reviewed technical papers and the books *Electric Power Distribution Reliability* and *Business Essentials for Utility Engineers*.

I received my BSEE, MSEE, and PhD degrees from the University of Washington in Seattle, and my MBA from the University of North Carolina at Chapel Hill.

From 1991 to 1993, I worked as an Electrical Engineer at Sverdrup Corporation (now Jacobs Engineering) performing design work for electric distribution systems. Responsibilities included engineering design of medium voltage and low voltage electrical systems for industrial facilities, institutional facilities, and public works. Typical work included design, value engineering, specification writing, construction document generation, and construction support.

From 1994 to 1996, I worked as a teaching and research assistant for the University of Washington while attending graduate school. My research was in the area of distribution system reliability assessment, storm reliability, and design optimization. In addition to research, I served as a teaching assistant for various power systems and controls courses at the undergraduate and graduate level.

From 1996 to 2003, I worked for ABB in various roles. From 1996 to 1999, I was a Senior Engineer in the corporate research department with responsibilities of research, product development, consulting, and project management. From 1999 to 2001, I was a Principal Engineer for the Distribution Solutions group with the goal of providing customers with complete solutions based on functional requirements including design, build, own, operate, maintain, and finance. From 2001 to 2003, I was the Director of Technology for the Consulting business with the responsibility for research and development of algorithms and software tools.

From May of 2003 through June 2006, I was the Vice President of Asset Management for KEMA. As a charter member of the T&D Consulting division in the US, my role was to provide management and technical consulting services in the areas of power system reliability and asset management.

From July of 2006 through Feb. of 2012, I was the Vice President of Consulting for Quanta Technology from July 2007 through the present. As a charter member, I was responsible for growing the business in the areas of planning, engineering, operations, reliability, and asset management.

From March of 2012 through Feb. of 2014, I served as the Vice President of the U.S. Power Networks division of WorleyParsons. In this role I was responsible for development and execution of business strategy for my division.

From March of 2014 through the present, I have been a Principal Engineer at Exponent, Inc.

I am a Fellow of the IEEE. The grade of Fellow is conferred by the IEEE Board of Directors for an extraordinary record of industry accomplishments, and is limited to one-tenth of one percent of the total voting membership per year. I was the committee Vice Chair of the Power System Planning and Implementation Committee from 2006 through 2008 and Chair of the committee's Power Delivery Reliability Working Group from 1997 to 1999.

I am a registered professional engineer. My CV is provided in Appendix B. This includes a list of cases in which I have provided sworn testimony at trial and/or by deposition.

Any, and all, of the opinions expressed herein are held to a reasonable degree of engineering and professional certainty. The information on which I relied consists of the type of information that is reasonably relied upon in my field of expertise.

3. Project Economics

The Application has a section titled “Economic Impact and Public Interaction.” In the public version of the Application all of the capital, intangible, operations, and maintenance cost values have been redacted. Therefore, I first perform a project economic assessment based solely on non-redacted information.

Assessment Using Public Information

The Application cites a 2015 NREL study and states, “... costs of projects in 2014 averaged \$5,925 per kW. These costs are not substantially different from the average cost estimated for the Facility.” Since the Facility will be 20.7 MW, it can be inferred from public data that the installed cost of the Facility will not be “substantially different” than $20.7 \text{ MW} \times 1000 \times \$5,925 = \$122.6 \text{ million}$.

An preliminary but more detailed economic description of the Facility is provided in the document “Great Lakes Wind Energy Feasibility Study: Final Feasibility Report” (Feasibility Report) This report examines Facility sizes ranging from 5 MW to 20 MW. The actual Facility will be slightly over 20 MW, making the assessment of the high-end option of the Feasibility Report most relevant.

The Feasibility Report makes it clear that the Facility is not economically viable from a pure competitive market perspective. When compared to on-shore wind options, the Feasibility Report state, “... higher capital and operating costs, as well as the Pilot Project’s subscale size lead to a higher levelized cost of energy (assuming no special subsidies or grants) than would be the case for onshore wind projects and larger, commercial-scale offshore wind projects in locations with higher wind speeds.” [p. 1-2]. In other words, this is a “pilot project” that is too small to be considered “commercial-scale,” and that wind speeds in for the Facility are lower than for typical offshore commercial-scale wind farms.

It should be noted that the Feasibility Report is clear in describing the Facility as a “pilot project” whereas the Application describes the Facility as a “demonstration project.” The Feasibility

Report states, “A Pilot Project will undoubtedly provide solutions to technical challenges (i.e., icing) and further reinforce the viability of large-scale offshore wind energy development on Lake Erie.” [p. 1-3] and that “... investments associated with a Pilot Project will benefit the offshore wind industry in the Great Lakes.”

Although the Application states, “Icebreaker Wind is designed to be a demonstration-scale project...” [p. 3], it does not mention that the Facility is not economically viable without extensive subsidies in terms of grants and/or purchase power agreements with prices dramatically higher than PJM wholesale prices. This omission in the Application requires project economics from public data to be examined through the Feasibility Report.

The basic economic theme of the Feasibility Report is that the Facility is a pilot project intended to provide solutions to technical challenges, and requires subsidies to be economically viable. It states, “... it is likely that the power purchase agreement (PPA) pricing would need to be two to three-times current wholesale electricity market pricing in the region. PPA pricing estimates range between approximately \$160 and \$220 per megawatt hour...”

Figure 3-1 shows PJM monthly average wholesale power prices from Jan-05 through Jan-17, with later prices hovering around \$30 per MWh.¹ This figure also shows that wholesale electricity prices track natural gas prices closely, and can therefore be expected to rise and fall as natural gas prices rise and fall.

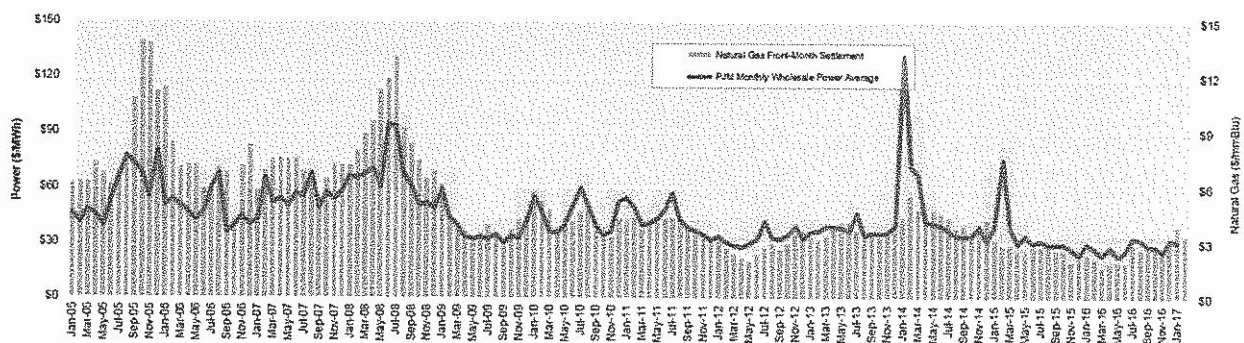


Figure 3-1. PJM Monthly Average Wholesale Power Prices (\$/MWh)

¹ From www.patriotenergygroup.com/market_intel.php, which extracts data from the PJM historical price database.

Bases on a PJM historical typical price of \$40 per MWh, the Feasibility Study required PPA price of between \$160 and \$220 per MWh represents a price that is between 4 and 5.5 times the price of electricity that can be bought on the PJM market.

Although the public version of the Application redacts estimated O&M costs, the Feasibility Study estimates a range of 63.4 to 82.5 \$/MWh [p. 11-8]. These O&M costs alone are significantly higher than the cost of PJM wholesale energy. That is, even if the Facility could be designed and built for free, it would require prices much higher than wholesale to avoid losing money.

The position of the Feasibility Study is that current economics would not allow even a commercial-scale wind farm to be economically viable. It states, "... the future build-out of the offshore wind industry in Ohio – will require new policies to better incentivize offshore wind in Ohio." [p. 1-5] It suggest policies such as "elevated Renewable Energy Credits" and an "offshore wind 'carve out'" in the Ohio portfolio standard. Basically, the Feasibility Study advocates for offshore wind in Ohio since offshore wind is a renewable energy source. However, it does not justify why offshore wind should be made economically viable through significant new subsidies when other renewable options are already economically viable (e.g., onshore wind, utility-scale solar).

It should be noted that a key economic assumption in all wind power projects is capacity factor (CF). CF is the percentage of produced energy over a year when compared to the energy that would be produced over a year 100% output. The CF assumptions in the Feasibility Study range from 31.53 to 30.13 (the Feasibility Study does not provide any justification for these values). In contrast, the Application assumes a 41.4% CF, representing an increase of about one third when compared to the Feasibility Study. The Application does not justify this CF assumption, nor does it explain why its CF assumption is so much higher than those used in the Feasibility Study.

Actual offshore commercial wind farms in Denmark, and Germany have lifetime capacity factors of approximately 41.9% and 38.5%, respectively.² Wind energy density maps from The Global

² Denmark: <http://energynumbers.info/capacity-factors-at-danish-offshore-wind-farms>;

Wind Atlas (globalwindatlas.info) are shown in Figure 3-2. This shows that the offshore wind density off of Denmark and Germany is significantly higher than at the Facility location.

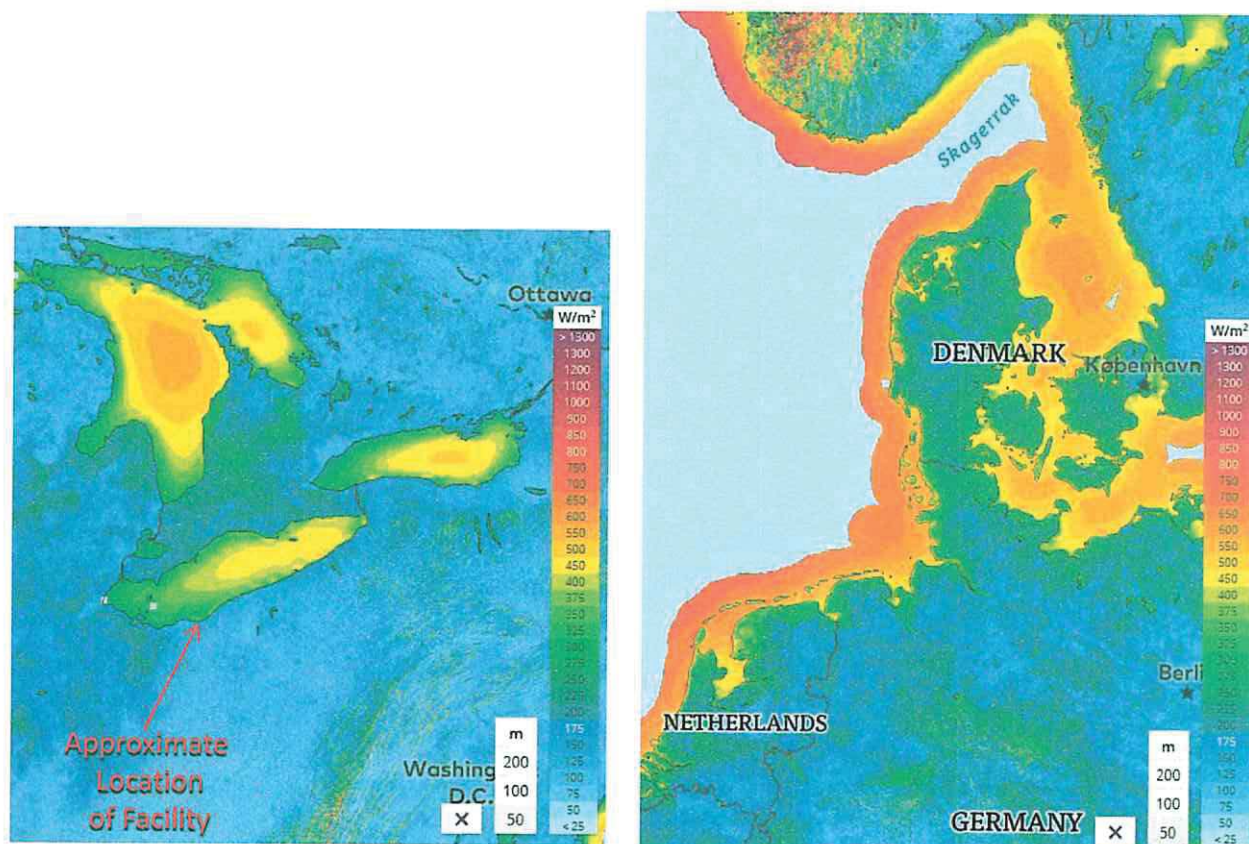


Figure 3-2. Wind Energy Density Maps

It is possible that the CF value in the Application is too high and the original CF in the Feasibility Study is a more reasonable estimate of what the actual CF of the Facility will be if constructed. In any case, justification should be provided for the CF assumed in the Application.

And so, the Facility needs a PPA with significantly above-market prices in order to be economically viable. A PPA currently exists between the Facility owner and Cleveland Public Power (CPP). The application states, “Two-thirds of the Facility’s output has been sold to CPP under a long-term power purchase agreement.” The Application does not state the price that electricity will be sold under this PPA, which is a material omission. However, an article published by National Wind Watch and concludes the following:

Germany: <http://energynumbers.info/germanys-offshore-wind-capacity-factors>

CPP has agreed to purchase power at a not-to-exceed price of \$181.57 per megawatt-hour (MWh) for the first year the Icebreaker project is online, with a 16 year annual 1 percent price escalator.³ ... At the time this was written, a one-year strip of power in northern Ohio could be purchased for less than \$33 per MWh. In other words, the rate CPP is contracting for is 550 percent higher than prevailing market rates!

But what about 16 years of price certainty with only a 1 percent escalator? Isn't there value in establishing a rate ceiling? Not really.

Power markets are actually in a state of backwardation right now. That's a fancy way of saying the price goes lower – not higher – when you go farther out in time. Power prices a few calendar years out can be purchased for less than \$32 per MWh.

In all fairness, the wholesale prices I am quoting are from conventional generation sources, not renewable wind power. However, the market for renewable wind power has become quite affordable.

The premium one needs to pay to contract power from 100 percent wind sources equates to only a few additional dollars per MWh. ...

If you are a customer of CPP, you obviously have a vested interest in how much this Icebreaker project is going to unnecessarily raise your electric bill. ...

The Electric Service Agreement between the City of Cleveland and Cuyahoga County references a Power Purchase and Sale Agreement (PPSA) between the City of Cleveland and the Facility owner, Fred.Olsen Renwables (FORUSA). This document states that the Agreement is attached as Exhibit 1, which it is not. Therefore, for the assessment based on public data I will assume purchase price starting at \$182 and increasing 1% per year to about \$213 per MWh over 16 years.

It is not clear how pricing for the PPA was negotiated. Since the Facility owner is a non-profit, it is reasonable to assume that the pricing is based on the Facility recovering its costs, but not making a material profit. If this is the case and the pricing is based on a 41.4% CF, there is significant risk of the Facility experiencing future financial distress if the actual CF is significantly lower than 41.4%%. This is another reason why the Application needs to justify its CF assumption.

The Facility can also be financially impacted by delays. The Application states the following:

³ The 1% annual price escalation results in prices rising from about \$182 to about \$213 per MWh over 16 years.

Impact of Critical Delays. Critical delays may have material, adverse effects on the Facility. Due to weather conditions on the Lake and the obvious challenges with performing construction in the Lake, the Project construction can only be completed at a specific time during the year (mid-April through mid-October). Any permitting delays will be critical to the Project and could cause the construction to be delayed up to 6 months. Permitting delays will impair the Applicant's ability to procure competitive bids in accordance with the planned timelines from vendors who have been working with the limited window for installation due to weather conditions on the Lake. Permitting delays that stall the installation process will result in additional fees for management staff assigned to the Facility, as they will be unavailable for other activities during that time. Additional costs associated with delays could impact the rate of return for investors, which may jeopardize financing interest in the Facility. Additionally, delays may also jeopardize funding by grants received by the U.S. Department of Energy (DOE). See Section 4906-4-06(D) for additional details on cost of delays.

The Application assumes that Certificate of Environmental Compatibility and Public Need (Certificate) would be issued in 2017 and that the Facility will be in service by Nov. 2018. As of mid-2018 the Certificate has not been issued and the in-service date of Facility will therefore be at least a year behind schedule. The potential impact of this critical delay therefore raises additional concerns about the financial viability of the Facility.

Assessment Using Confidential Information

The Application estimates the total project cost for the Facility of \$ [REDACTED]. The current projected project cost for the Facility as stated on Page 5 of the Responses to OPSB Staff's Fifth Set of Interrogatories is \$ [REDACTED] corresponding to an increase of [REDACTED] %:

Table 3-1. Updated Project Costs

	Cost in Application	Current Projected Cost
Total Cost (\$)	██████████	██████████
Cost per kW (\$/kW)	██████████	██████████
% Cost	██████████	██████████

A large percentage of projected cost increases are due to turbine costs, which increase from \$██████████ in the Application to \$██████████ in the current projection. This represents an increase of ██████%.

Icebreaker Windpower Inc. claims to have extensive expertise in the construction of offshore wind farms in Europe. Clearly this experience did not translate to reliable turbine cost estimates in the Application, raising questions of whether other values in the Application could also be off by significant amounts.

Page 7 of the Responses to OPSB Staff's Fifth Set of Interrogatories states that delays prior to construction will cost between \$██████████ and \$██████████ per month. The original start of construction estimate in the Application is in May 2018. Due to required radar studies, it will not be possible for construction to begin until late 2019, representing a construction start delay of 16 months or more. A construction start delay of 16 months corresponds to delay costs between \$██████████ and \$██████████.

The above-referenced article published by National Wind Watch states that CPP has agreed to purchase power at a not-to-exceed price of \$181.57 per megawatt-hour (MWh) for the first year the Icebreaker project is online, with a 1 percent annual price escalator. The actual PPA has a price of \$██████████ per megawatt-hour (MWh) for the first year the Icebreaker project is online, with a 1 percent annual price escalator (██████████). This higher price will be beneficial for project economics, but requires CPP ratepayers to pay much higher for Facility energy when compared to energy that could be purchased from the PJM market (about ██████% higher if future PJM prices of \$40/MWh are assumed).

Page 8 of the Responses to OPSB Staff's Fifth Set of Interrogatories states a range of initial expected O&M costs from \$██████████ to \$██████████ with an average of \$██████████. Using a price escalation of 2% per year, a discount rate of 10%, and a 20-year term results in an

NPV for O&M costs of \$ [REDACTED] which is slightly higher than the Application assumption of [REDACTED]

A value of \$ [REDACTED] for Year 1 O&M cost corresponds to the following per-MWh costs assuming different capacity factors:

Table 3-2. O&M Cost Scenarios

Capacity (MW)	Capacity Factor	MWh/yr	O&M \$/yr	O&M \$/MWh
20.7	41.40%	[REDACTED]	[REDACTED]	[REDACTED]
20.7	35.77%	[REDACTED]	[REDACTED]	[REDACTED]
20.7	30.13%	[REDACTED]	[REDACTED]	[REDACTED]

The CF of 41.4% assumed in the Application corresponds to O&M costs of \$ [REDACTED] which by itself is higher than current and PJM wholesale electricity prices and projections through 2019.⁴

Confidential data shows that project economics are worse when compared to the assessment based on public data. Capital costs are 53% higher (\$ [REDACTED] vs. \$ [REDACTED]), but PPA prices are only [REDACTED] higher ([REDACTED] in Year 1 vs. [REDACTED]). Perhaps more important, the PPA price of [REDACTED] was in place at the time of the Application, when the lower capital costs were expected. This raises questions about the financial viability of the Facility given the much higher capital costs.

Operating margin is defined as revenue minus O&M costs. For the Facility, operating margin will be available to service debt. The following table calculates operating margin for Year 1 assuming that 67% of Facility output is sold through the PPA at \$ [REDACTED] MWh and 33% is sold into the PJM market for \$40/MWh:

Table 3-3. Operating Margin Scenarios

Capacity Factor	MWh/yr	PPA Revenue (67% at \$ [REDACTED])	PJM Revenue (33% at \$40)	Total Revenue (\$/yr)	O&M Cost (\$/yr)	Operating Margin (\$/yr)
41.40%	[REDACTED]	[REDACTED]	990,943	[REDACTED]	[REDACTED]	[REDACTED]
35.77%	[REDACTED]	[REDACTED]	856,065	[REDACTED]	[REDACTED]	[REDACTED]
30.13%	[REDACTED]	[REDACTED]	721,186	[REDACTED]	[REDACTED]	[REDACTED]

⁴ Average NYMEX futures for each month of 2019 as of 14-JUL18 is \$36.53 per MWh.

At an operating margin of 41.4%, operating margin is about [REDACTED] for Year 1. This operating margin can be expected to decrease over time since PJM revenue will only increase by 1% per year while O&M costs are expected to increase by [REDACTED] % per year.

Recall that the latest estimate of project cost is \$[REDACTED]. A 20-year mortgage of \$[REDACTED] with a discount rate of 10% results in about a [REDACTED] per year loan payment. This is more than double the operating margin that would result with the highest assumed capacity factor of 41.4%. It is about four times the operating profit assuming the capacity factor of 30.13% stated in the feasibility report.

Actual payments will be higher due to expected delay costs of between \$[REDACTED], but lower if the DOE grant of \$40 million is awarded. Even if the DOE grant is awarded and there are no delay costs, the Facility will not generate nearly enough operating margin to service its debt obligations should the project be financed with debt. It is also highly unlikely that equity investors would be interested in a project with these associated economics.

In summary, the Facility will be charging the City of Cleveland more than five times the rates of electricity that is likely to be available through the PJM market. Even with this extremely high price, and even with a \$40 million DOE grant should it be awarded, the Facility will not generate nearly enough revenue to service its debt should the debt be financed through bonds or loans.

4. Demonstration Project Need

The 2009 Feasibility Study describes the Facility as a “pilot offshore wind energy project” and the 2017 Application describes the Facility as a “demonstration-scale project.”

The Feasibility Study describes the purpose of the Facility as follows:

Purpose of Facility as Described in the Feasibility Study

- “... investments associated with a Pilot Project will benefit the offshore wind industry – especially in the Great Lakes – as supporting infrastructure, methods, and equipment are developed.” [pp. 1-2, 1-3]
- “The challenge of accessing offshore turbines presents research and development opportunities to investigate new access techniques and equipment.” [p. 1-3]
- “Ohio should adopt policies to make the initial build-out of the offshore wind industry economically attractive to private sector interests.” [p. 1-5]
- “it is the County’s and Task Force’s vision to establish Cuyahoga County as a primary hub for wind energy in North America, and a key hub for the offshore wind energy industry in the Great Lakes.” [p. 2-3]
- “... it would attract further investment in the regional wind energy industry while providing Cleveland with an iconic symbol of revitalization and forward-thinking.” [p. 2-4]
- “Designed to test and prove concepts, and promote technological and commercial development, the Pilot Project should not be expected to provide attractive economics as with a large-scale, commercial project.” [p. 13-6]
- “A pilot project will undoubtable provide solutions to technical challenges (i.e., icing) and further identify the viability of large-scale wind energy development.” [p. 13-7]
- “The Pilot Project will only help to attract turbine suppliers and other organizations to add to the region’s wind manufacturing base.” [p. 13-8] “It is highly likely that interest in larger scale development on Lake Erie will factor into the turbine manufacturer’s decision to participate in the Pilot Project.” [p. 14-3]

From a utility perspective, the purpose of a “pilot project” is generally understood to be a small-scale deployment of a new technology to reduce the risk of a future large-scale deployment. From this perspective, the Facility as described in the Feasibility Study is not, in the strict sense, a pilot project. The Feasibility Study itself states that “the results of the report conclude that construction of the [Facility] is technically feasible.” The only specific technical challenge mentioned in the Feasibility Study is icing. However, the specific icing challenges that are intended to be addressed by the Facility are not presented, other than minimizing the issue by stating, “... ice is not identified as a prohibiting factor for wind turbines in the Project area.” [p. 1-1]

It is clear from the Feasibility Study that the true intent of the Facility is to get a small offshore wind farm built that will increase the likelihood of large-scale offshore wind development on Lake Erie in particular and on the Great Lakes in general. The Feasibility Study states that the Facility will “benefit the offshore wind industry,” help to “establish Cuyahoga County as a primary hub for wind energy in North America,” “attract turbine suppliers and other organizations to add to the region’s wind manufacturing base,” and make Cleveland a “an iconic symbol of revitalization and forward-thinking.”

All of these benefits may be attractive to Cleveland and Cuyahoga County politicians, but it is clear from the Feasibility Study that the Facility will not produce economical renewable energy and that broader benefits will only occur if large-scale offshore wind development occurs.

The Application describes the purpose of the facility as follows:

Purpose of Facility as Described in the Application

- “The general purpose of the Facility is to produce wind-powered electricity that will maximize energy production from Project Area wind resources in order to deliver clean, renewable electricity to the Ohio bulk power transmission system to serve the needs of electric utilities and their customers.” [p. 2]
- “this Facility is meant to be a demonstration-scale project to help assess the potential success for future larger-scale offshore wind farms in Lake Erie and other Great Lakes.” [p. 3]

As can be seen, the Application no longer refers to the Facility as a pilot project intending to provide solutions to technical challenges. Rather, the Application states that the Facility will produce clean and renewable energy, and can help with the future development of larger scale offshore wind farms.

The Application addresses the issue of icing in the section titled “Ice Throw.” [p. 86] In the Feasibility Study, icing is described as a technical challenge, albeit with no specifics. In the Application, the risks related to ice throw are presented as fully understood and fully addressed:

- “The effects of ice accumulation can be sensed by the turbine’s computer controls and typically result in the turbine being shut down until the ice melts.”
- “The turbines proposed for the Facility will utilize appropriate ice detection equipment.”
- “The Facility’s proposed location and distance from permanent residents and adjacent property lines will protect the public from falling ice.”
- “... the number of boats on the water when conditions are favorable for ice formation would be minimal.”

In other words, the Application expresses no concern about icing and does not state that a purpose of the facility is to develop technical solution to problems such as icing.

If built, the Facility will certainly “deliver clean, renewable electricity to the Ohio bulk power transmission system.” However, this purpose is largely meaningless without addressing the associated cost to ratepayers, which is not addressed in the application.

The Facility plans to sell most of its electricity to CPP through a PPA at a price starting at \$ [REDACTED] and increasing [REDACTED] % per year over 16 years. This price can be compared to typical wind power PPAs as shown in Figure 4-1.⁵ Wind power PPAs have been consistently priced from 2013 through 2016 at about \$25 per MWh. This means that the average price of the Facility PPA with CPP is about [REDACTED] what CPP would pay if it chose to purchase “clean and renewable” wind power at current market rates.

⁵ <https://www.epa.gov/greenpower/green-power-pricing>

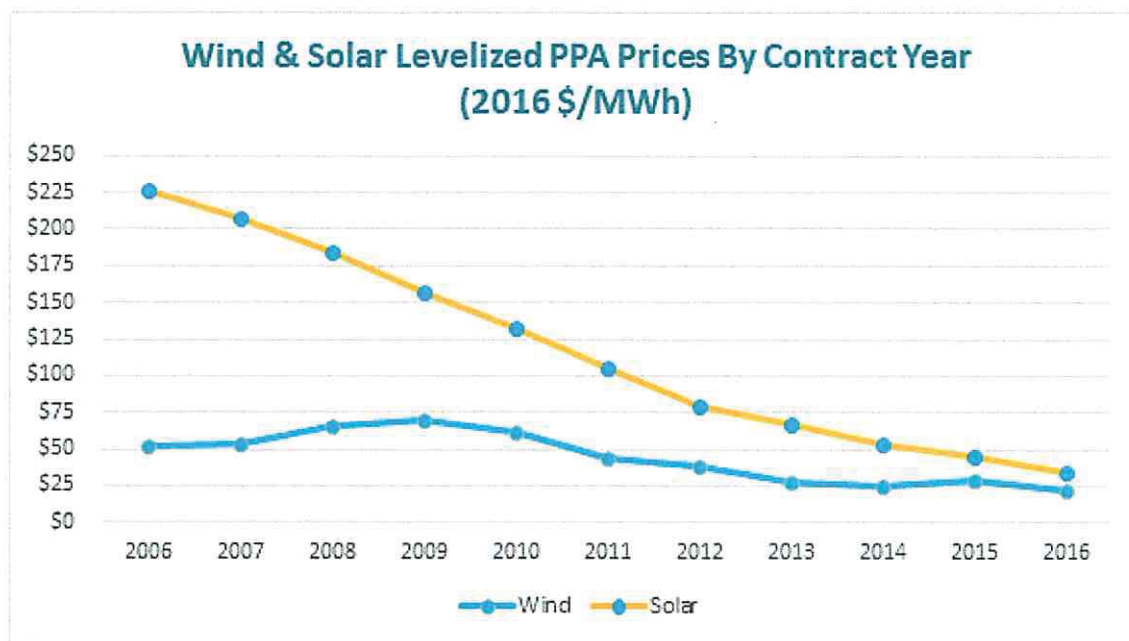


Figure 4-1. Wind and Solar PPA Prices

And so, this Facility is best understood as an initial step towards advancing large-scale offshore wind farm development in the Great Lakes. Its purpose is initial foot in the door, hoping that the door can be subsequently pushed wide open. In this sense, the Application is correct in describing the Facility as a demonstration project rather than a pilot project. The Facility, if built, will demonstrate at a small scale what is involved in the actual construction process, the actual visual impact, the actual noise impact, the actual animal impact, and other aspects of an offshore wind Facility.

All of this is appropriate for a demonstration project. What is not appropriate is for CPP ratepayers to be forced to pay for the demonstration project through electricity rates. To do so results in a hidden tax that benefits the offshore wind power industry. If the City of Cleveland and/or Cuyahoga County wish to spend taxpayer money to advance this issue, funding should be through city and/or county taxes. From both an electric ratepayer and an electric utility perspective, there is no need for a demonstration project and there is no need for a pilot project.

The following should be clearly understood by the Ohio Power Citing Board and by CPP ratepayers:

- The Facility is not needed to investigate any technical issues, including those associated with icing;
- The Facility is intended to be a first step towards large scale offshore wind farm development in the Great Lakes;
- The Facility is not economically viable without massive subsidies;
- The Facility will be subsidized by CPP ratepayers through a 16 year PPA with an annual price escalation, resulting in CPP paying about [REDACTED] more for Facility energy when compared to typical wind power PPAs.
- Even with the massive subsidies by CPP ratepayers, and even with a \$40 million DOE subsidy, the Facility is still not even close to being economically viable.

Perhaps the average CPP ratepayer wishes to subsidize the Facility in pursuit of large scale offshore wind farm development in the Great Lakes, and perhaps not. In any case, this issue should be transparent since the Facility could not be built without the CPP PPA or something similar.

5. Baseload Generation

A bulk electric power system can be thought of as having “baseload generation,” which is available to generate electricity at full output for a large percentage of the time, and non-baseload generation, which cannot. Wind generation facilities do not contribute significantly to baseload generation, since they can only provide electricity when the wind is blowing, and therefore may not be available when needed (e.g., it is not “dispatchable”).

Electricity markets such as PJM must ensure that there is enough baseload generation to supply peak electricity demand. The percentage of generation plant output that can be counted on to supply peak demand is called its “capacity credit.” Traditional sources of electricity such as coal-fired plants, natural-gas-fired plants, and nuclear plants have a capacity credit of 100%.

The percentage of a generation facility output over a year as compared to 100% continuous maximum output is called “capacity factor.” The PJM average capacity factor for wind farms in open/flat terrain is 17.6%, which is the capacity credit assigned to wind farms unless a special request is granted (as of June 1, 2017).

The low capacity credit of wind farms means that the construction of wind farms does not significantly reduce the need for new traditional generation. For example, assume that PJM forecasts the need for 1000 MW of new baseload generation. Now assume that 1000 MW of offshore wind generation is approved to be built. If the offshore wind generation is assigned a capacity credit of 17.6%, it will only contribute to 176 MW of the required new baseload generation, and 824 MW of new traditional generation will still have to be built. These two scenarios are:

Options for Meeting 1000 MW of PJM Demand Increase

1. Add 1000 MW of traditional generation; or
2. Add 824 MW of traditional generation and 1000 MW of offshore wind generation.

In Option 2, the same amount of energy will be produced through facilities costing much more to build, resulting in higher electricity rates. The electricity produced by wind will not produce emissions, but most new traditional generation in Ohio has been combined-cycle natural gas plants, which have low emissions.

The trend towards more electricity production based on natural gas is true for both the United States as a whole and for Ohio specifically. A chart showing U.S. historical electric generation capacity additions is shown in Figure 5-1.⁶

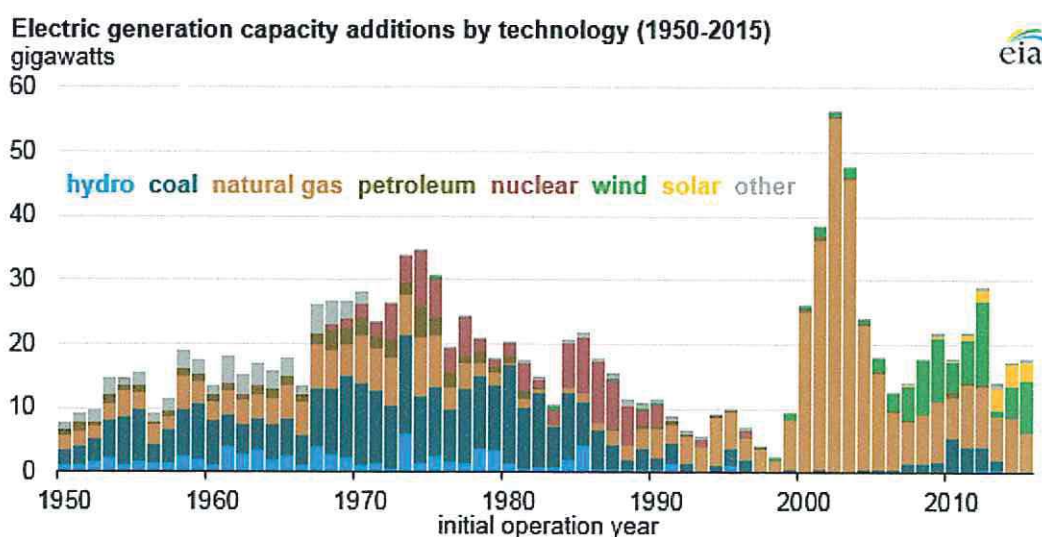


Figure 5-1. Electric generation capacity additions

As can be seen from Figure 5-1, coal plant capacity additions in the U.S. virtually stopped in the late 1990s, with many of the worst-emitting coal plants having been shut down. This, coupled with a simultaneous dominance in natural gas plant and wind farm capacity additions, has resulted in significantly lower overall power plant emissions in the U.S.

⁶ <http://www.eia.gov/todayinenergy/detail.cfm?id=25432>

In Ohio, the amount of electricity produced by natural gas and wind is increasing and the amount of electricity produced by coal is decreasing. Historical data is available from the U.S. Energy Information Agency (EIA).⁷ A graph based on EIA data is shown in Figure 5-2.

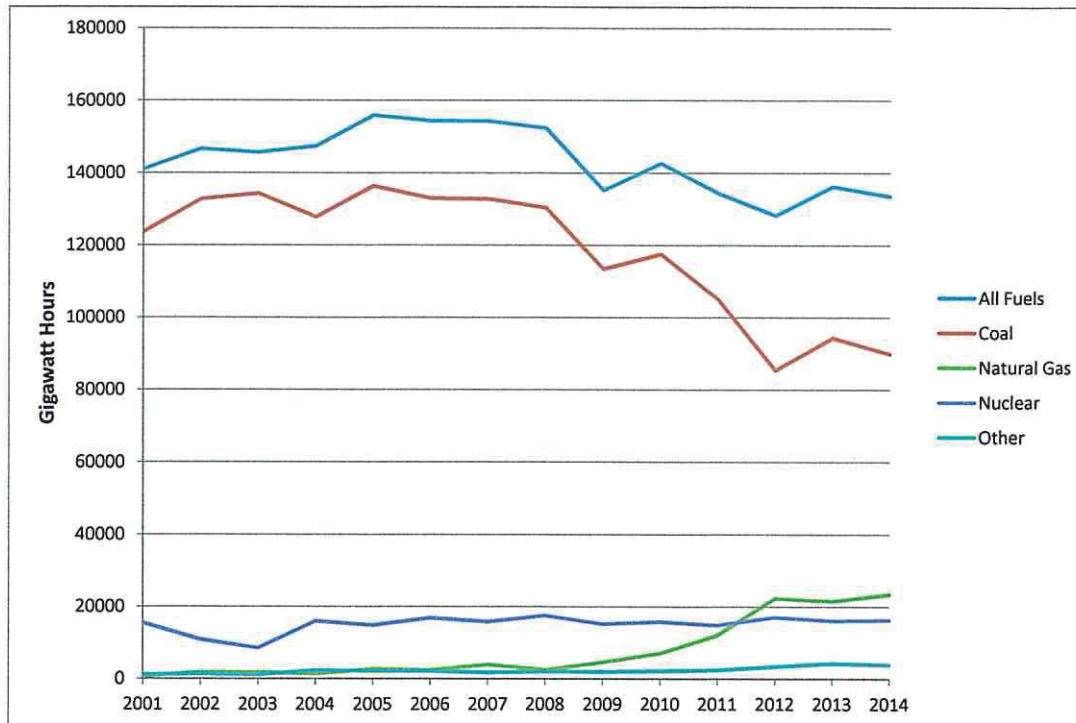


Figure 5-2. Historical Energy Production in Ohio

As can be seen, electricity generation from coal has dropped from a high of about 136,000 GWh in 2005 to a low of about 90,000 GWh in 2014, a drop of about 44%. At the same time, electricity generation from natural gas has grown from a low of about 0.7 GWh in 2001 to a high of about 23 GWh in 2014, growth of over 3000 percent. Electricity generation from “other” sources, including wind, has experienced a significant increase.

And so, PJM will have to build traditional baseload generation regardless of the extent to which new wind farm capacity is built. Virtually all of this baseload generation will be through efficient combined-cycle natural gas plants, which have low emissions. The effect of the Facility on the

⁷ EIA power generation data available at eia.gov/electricity/data/browser

PJM market will essentially be zero since it is so small. The effect of large amounts of new offshore wind capacity will not significantly impact the need for new baseload construction, but may deter baseload construction development due to market distortions, which is discussed in the next section.

The Facility will deliver power to PJM by being connected to the CPP Lake Road 138 kV substation, which connects to the ATSI zone of PJM. An interconnection study has determined that this connection will not cause any adverse system impacts and will not require any mitigation projects. This is not surprising since the Facility is very small.

As described in the previous section, the intent of the Facility is to be a first step towards large scale offshore wind farm development in the Great Lakes with examined scenarios including 1500 MW and 5000 MW in Lake Erie alone. Since the Facility will be 20.7 MW, the 1500 MW scenario represents about 72 projects of similar size and the 5000 MW scenario represents about 242 projects of similar size.

It is virtually certain that either of these large deployment scenarios will have a significant impact on the PJM system and will require expensive system upgrades. Recall that traditional baseload generation will have to be built regardless of offshore wind development. Therefore, any system upgrade costs due to large-scale offshore wind development will result in corresponding incremental costs to ratepayers in the form of higher transmission system charges.

6. Market Distortion

Since 1992, wind generation in the U.S. has been subsidized by a production tax credit (PTC), in which the Federal Government pays facilities for every MWh of wind generation produced. The PTC has been a strong incentive for new wind farm construction by developers, but has created significant distortion in wholesale electricity markets, including PJM.

The Energy Policy Act of 1992 originally enacted the PTC. After a history of lapses and re-authorizations, legislators in 2015 provided a 5-year PTC that will be phased out by 2020 at a rate of 20% per year, starting in 2017 (unless new legislation is passed). Details are as follows:

PTC for wind projects with construction starting in years 2015 - 2019

- 2015: receive a full value PTC of 2.4 cents per kilowatt hour.
- 2016: receive a full value PTC of 2.4 cents per kilowatt hour.
- 2017: receive 80 percent PTC, or 1.92 cents per kilowatt hour.
- 2018: receive 60 percent PTC, or 1.44 cents per kilowatt hour.
- 2019: receive 40 percent PTC, or 0.96 cents per kilowatt hour

And so, wind farms have been the beneficiaries of significant Federal subsidies for over 25 years. There have also been significant subsidies at the state level such as tax credits and renewable portfolio standards (RPS). For example, Ohio has an RPS that requires utilities to increase their production/procurement of energy from renewable energy sources to 12.5% by 2026, or pay significant penalties.

A problematic aspect of PTCs is that wind farms can bid negative prices into wholesale markets and still make a profit. For example, a wind farm with a PTC of \$24 per MWh can bid a price of minus \$20 per MWh and still make a marginal profit of \$4 per MWh (since there are no incremental production costs such as fuel). The former Texas Public Utilities Commission Chairperson Donna Nelson described the problem as follows:

“Federal incentives for renewable energy... have distorted the competitive wholesale market in ERCOT. Wind has been supported by a Federal production tax credit that

provides \$22 per MWh of energy generated by a wind resource. With this substantial incentive, wind resources can actually bid negative prices into the market and still make a profit. We've seen a number of days with a negative clearing price in the west zone of ERCOT where most of the wind resources are installed....The market distortions caused by renewable energy incentives are one of the primary causes I believe of our current resource adequacy issue... [T]his distortion makes it difficult for other generation types to recover their cost and discourages investment in new generation.”⁸

In other words, market distortion caused by PTCs paid to wind farms can cause financial problems for existing traditional generation facilities and discourages the construction of new traditional generation facilities. This issue is examined in a white paper by the NorthBridge Group titled “Negative Electricity Prices and the Production Tax Credit.” They describe how the percentage of hours with negative wholesale electricity prices has been increasing as installed wind capacity has been increasing. The analysis shows that the PJM Northern Illinois Hub as having negative prices about 0.5% of hours in 2006 but over 2% in 2011. The paper concludes the following (emphasis added):

Based on the evidence presented in this paper, it is apparent that the distortionary incentives and bidding practices caused by production-based wind subsidies, in particular the PTC, have caused high prevalence of negative prices in recent years. **These PTC-distorted price signals create a range of near- and long-term problems for electricity markets. The PTC subsidy for wind generation artificially dilutes the incentives for conventional generation – generation that is critical for maintaining reliability.** While the PTC was originally intended twenty years ago to jump-start a nascent wind industry, the wind industry today is a full-scale global industry and the PTC's primary effect in the current environment is to distort and disrupt incentives for the electricity industry as a whole.

Our findings lead us to conclude that the PTC should be allowed to expire under current law. **PTC-driven negative prices directly conflict with the performance and operational needs of the electric system** and with federal energy policies supporting well-functioning competitive wholesale markets.

Market distortion due to the PTC was already an issue for PJM 2011, and can only be expected to get worse as wind generation subsidized by PTCs increases.

The Public Utilities Commission of Ohio breaks down the 1016 Ohio production of electricity by source as shown in Figure 6-1.

⁸ Donna Nelson testimony before the Texas Senate Natural Resources Subcommittee, September 6, 2012,

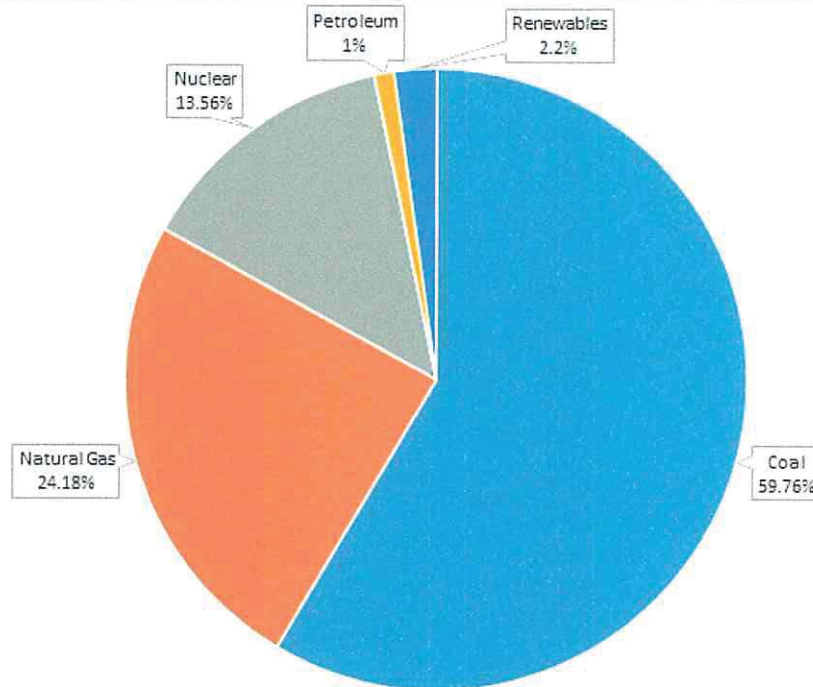


Figure 6-1. 2016 Ohio Electricity Production by Source

At the end of 2016, Ohio had approximately 545 MW of installed wind capacity. Clearly, the Facility's new 20.7 MW will not increase this amount by a high percentage. However, vision of the offshore wind industry is for extensive offshore wind capacity in Lake Erie. A 2010 report prepared on behalf of the Lake Erie Economic Development Corporation (LEEDCo) titled, "The Potential Economic Impacts in Ohio Associated with the Emergence of a Lake Erie Offshore Wind Industry" presents scenarios of 1500 MW and 5000 MW of offshore wind development in Lake Erie alone. The 1500 MW scenario represents an approximate 300% increase in installed wind capacity in Ohio and the 5000 MW scenario represents an approximate 900% increase. These increases would significantly exacerbate PJM market distortion issues as long as Federal PTCs are available.

To put these numbers in perspective, recall that the Facility consists of 6 wind turbines, each rated at 3.45 MW. The 1500 MW scenario would require about 435 offshore wind turbines of this size. The 5000 MW scenario would require about 1450 offshore wind turbines of this size.

It is appropriate to ask what will occur if the PTC and other wind farm subsidies expire. Recall from the Facility Study that typical offshore wind farm O&M costs range between \$25 and \$40 per MWh. Therefore, it is likely that offshore facilities in the Great Lakes without subsidies would not be able to financially survive by selling electricity into the PJM market, and would have to be shut down. A large-scale offshore wind deployment in the Great Lakes presents a real possibility of wind farm graveyards. This is perhaps one reason why the Feasibility Study states that “the offshore wind industry in Ohio – will require new policies to better incentivize offshore wind in Ohio,” and “To remain a committed leader in the Great Lakes offshore wind industry, Ohio should adopt policies to make the initial build-out of the offshore wind industry economically attractive to private sector interests.” In other words, offshore wind in the Great Lakes is not economically viable even at commercial scales. This raises the question of whether it is appropriate to build the Facility before policies are in place that would make commercial-scale offshore wind farms on the Great Lakes economically viable.

7. Application Deficiencies

This section only addresses application deficiencies related to the previous topics addressed in this report. It is not intended to be comprehensive and it is expected that there are additional Application deficiencies in other areas.

1. The Application does not explain why there is a public need for the Facility. In terms of power generation, public need is related to sufficient baseload generation, other aspects of system reliability, economic benefit, environmental benefit, or the ability to meet renewable energy portfolio standards.

PJM does not need the Facility for baseload generation, and has a robust capacity market to address any baseload requirements that may arise. PJM publishes an annual Regional Transmission Plan that includes state summaries (“Book 5”). The most recent state summary for Ohio is for the Jan.-Dec. 2014 period. This state summary identifies 1,260 MW of planned generation retirement in Ohio (pp. 249). It also identifies 2,523 MW of new generation in Ohio that is under construction (pp. 237). That is, the amount of new generation being constructed is about twice the amount of planned retirements. This analysis does not include additional proposed generation requests, which amount to 6,714 MW (pp. 237).

Any public need benefit associated with the Facility besides baseload generation can be achieved at a fraction of the cost by purchasing wind power from existing wind facilities through PPAs. The Application should explain why ratepayers should pay significantly more for Facility output when much cheaper sources of wind power is available.

2. The Application redacts economic information related to the cost of delays. The Application states that significant delays could jeopardize Federal funding and/or qualification for the Federal Investment Tax Credit. Now that project delays of at least a year are inevitable, the Application should publically quantify specific delay costs and determine whether, and to what effect, Federal funding will be impacted.

3. The Ohio Administrative Code Section 4906-13-05 addresses requirements for submission of capital and intangible costs and operation and maintenance costs. These costs have been redacted. The complete redaction of all capital and intangible costs and operation and maintenance costs makes for an incomplete public record. It also makes it impossible to make an independent assessment on issues related to capital and intangible costs based on publically-available data.
4. The Application states that two-thirds of the Facility's output has been sold to CPP under a long-term PPA, but does not provide any details of the PPA. For example, the Application does not provide the price that CPP will initially pay, the length of the PPA, exit clauses (if any), or price escalation of the term of the PPA. The Application should provide this information.
5. The Application states that Facility output not sold to CPP will be sold in the wholesale market or under bi-lateral PPAs. The Application does not state whether there are any potential additional PPAs under consideration. The Application also does not state the PJM price assumptions that were used to determine whether the project is economically viable. The Application also does not discuss the implications of selling Facility output to PJM at a lower rate than its O&M costs (redacted in the Application, but estimated to be between \$63.4 and \$82.5 per MWh in the Feasibility Study).
6. The Application states that Facility output not sold to CPP will be sold in the wholesale market or under bi-lateral PPAs. The Application should generally explain its expected wholesale market bidding strategy and whether it intends to potentially make negative price bids.
7. The Application should justify its use of a 41.4% capacity factor, and explain why this value is so much higher than the capacity factors assumed in the Feasibility Study.
8. The Application should explain the economic implications of building the Facility and experiencing an actual capacity factor significantly lower than 41.4% (e.g., the approximate 31% capacity factor assumed in the Feasibility Study).

9. The Application states that the Facility is meant to be a demonstration-scale project to help assess the potential success for future larger-scale offshore wind farms in Lake Erie and other Great Lakes. Since this is the stated purpose of the Facility, the Application should explain specifically how its construction and operation will help assess the potential success for future larger-scale offshore wind farms in Lake Erie and other Great Lakes. For example, the Application should list what the Facility might reveal that would make the potential success of future larger-scale offshore wind farms seem more likely. Similarly, the Application should list what the Facility might reveal that would make the potential success of future larger-scale offshore wind farms seem less likely.
9. The Application states that the Facility is meant to be a demonstration-scale project to help assess the potential success for future larger-scale offshore wind farms in Lake Erie and other Great Lakes. However, the Facility itself is not economically viable even with prices about 500% higher than current wind power PPAs and with significant DOE funding. The Application should address specifically (a) the required price of Facility output for it to be economically viable, and (a) the estimated required price of a commercial-scale wind farm in Lake Erie in order for it to be economically viable.
10. The Application should explain its specific assumptions with regards to the Production Tax Credit and the Investment Tax Credit, and the sensitivity of economic viability to these assumptions.

8. Conclusions

1. The primary purpose of the Facility as stated in the Application is to “advance the development of a demonstration scale project in Lake Erie, and help stimulate a Great Lakes offshore wind industry.”
2. There is no need for a demonstration scale project in Lake Erie; the Facility will not provide insight on any questions related to technical issues, financial issues, or any other issues. Therefore, the remaining purpose of the Facility is simply to help stimulate a Great Lakes offshore wind industry.
3. Facility energy prices in the PPA are about [REDACTED] higher than PJM prices.
4. The Facility is not needed for renewable energy; renewable energy can be currently purchased for a fraction of the PPA price.
5. The facility is not economically viable, even with the PPA price that is [REDACTED] higher than PJM prices, and even if it receives a large DOE grant.
6. Large-scale offshore wind facilities are also not financially viable in the Great Lakes.
7. The development of offshore wind facilities will not eliminate the need for new traditional baseload generation, most likely using natural gas as fuel.
8. Production tax credits for wind generation facilities result in market distortions that directly conflict with the performance and operational needs of the electric system.
9. CPP ratepayers should be forced to heavily subsidize the Facility through the PPA, which is essentially a hidden tax.

Dated: July 14, 2018



RICHARD E. BROWN
Practice Director and Principal Engineer
Exponent, Inc.

Appendix A – Reviewed Materials

1. Great Lakes Wind Energy Feasibility Study, Final Feasibility Report, April 2009.
2. Application to the Ohio Power Siting Board for a Certificate of Environmental Compatibility & Public Need for the Icebreaker Wind Farm, Case No. 16-1871-EL-BGN, Jan. 2017.
3. Substation and Cable Route Design Report, prepared for LEEDCo by DNV-GL, LEEDCo Icebreaker Project, Feb. 14, 2014.
4. Revised Generation Interconnection System Impact Study Report for PJM Generation Interconnection Request Queue, Position Z1-035, Lake Road 69 kV, May 2015.
5. Revised Generation Interconnection System Impact Study Report for PJM Generation Interconnection Request Queue, Position Z1-035, Lake Road 69 kV, May 2015.
6. Revised Generation Interconnection System Impact Study Report for PJM Generation Interconnection Request Queue, Position Z1-035, Lake Road 138 kV, Oct. 2017.
7. Petition to Intervene of Cuyahoga County Residents Vicci Weeks, Caryn Good Seward, and Steven Seward, Before the Ohio Power Siting Board, Case No. 16-1871-EL-BGN, Oct. 16th 2017.
8. The Potential Economic Impacts in Ohio Associated with the Emergence of a Lake Erie Offshore Wind Industry, prepared for NorTech Energy Enterprise by Kleinhenz & Associates, July 2010.
9. F. Huntowski, A. Patterson, and M. Schnitzer, “Negative Electricity Prices and the Production Tax Credit,” The NorthBridge Group, Sept. 14th 2012.
10. M. Brakely, “Cleveland’s Icebreaker wind project will be a costly boondoggle,” National Wind Watch, Jan. 24, 2018.
11. Electric Service Agreement between the City of Cleveland, Ohio, and Cuyahoga County, Ohio, under Resolution No. R2016-1037 and Resolution No. R2017-0095 Dec. 27, 2017.
12. Staff Report of Investigation, Icebreaker Wind Facility, Case No. 16-1871-EL-BGN, July 3, 2018.
13. Power Purchase and Sale Agreement between Fred Olsen Renewables USA, LLC and the City of Cleveland, Ohio, May 6th 2016.
14. Responses to OPSB Staff’s Fifth Set of Interrogatories, pp. 5-10.

Appendix B – CV of Richard E. Brown

Professional Experience

Title	Institution	Dates
Practice Director and Principal Engineer	Exponent	3/2014 - present
Vice President, USAC Power Networks	WorleyParsons	3/2012 - 2/2014
Vice President, Operations	Quanta Technology	7/2006 - 2/2012
Vice President, Asset Management	KEMA	5/2003 - 6/2006
Director of Technology	ABB Consulting	5/2001 - 4/2003
Principal Engineer	ABB Power Distribution Solutions	2/1999 - 4/2001
Senior Engineer	ABB Corporate Research	7/1996 - 1/1999
Research/Teaching Assistant	University of Washington	1/1994 - 6/1996
Electrical Engineer II-III	Jacobs Engineering	4/1991 - 12/1993

Dr. Brown has been an adjunct faculty member of North Carolina State University since 2008.

Education

Degree	Institution	Location	Year Received
M.B.A.	University of North Carolina (Kenan-Flagler)	Chapel Hill, NC	2003
Ph.D.	University of Washington	Seattle, WA	1996
M.S.E.E.	University of Washington	Seattle, WA	1993
B.S.E.E.	University of Washington	Seattle, WA	1991

Honors and Awards

- IEEE Technical Committee Working Group Recognition Awards: Electric Delivery System Reliability Tutorial Working Group (2007); Aging Power System Infrastructure (2007); T&D Asset Management (2006); Transmission Planning (2008)
- IEEE PES Walter Fee Outstanding Young Engineer Award (2003)
- ABB Award of Excellence: President's Award (1999)
- ABB Award of Excellence: Product Development (1998)
- Member, Eta Kappa Nu (Electrical Engineering Honor Society)
- Member, Beta Gamma Sigma (Business Honor Society)

Professional Registration and Professional Societies

- IEEE Fellow
- Registered Professional Engineer in the State of North Carolina (Certificate No. 23088)

IEEE Power Engineering Society Activities

- Elected IEEE Fellow in 2007 for "contributions to distribution system reliability and risk assessment." The grade of Fellow is conferred by the IEEE Board of Directors for an extraordinary record of industry accomplishments, and is limited to one-tenth of one percent of the total voting membership per year.
- Awards
 - Technical Committee Working Group Recognition Award (2008). *Awarded by the Power System Operations Committee for work on power system transmission planning.*
 - Technical Committee Working Group Recognition Award (2007). *Awarded by the Power System Analysis, Computing & Economics Committee for contributing to the development of an electric delivery system reliability tutorial.*
 - Technical Committee Working Group Recognition Award (2007). *Awarded by the Power System Operations Committee for work on Aging Power System Infrastructure.*
 - Technical Committee Working Group Recognition Award (2006). *For work which resulted in a special issue of the IEEE Power and Energy magazine, May 2005.*
 - Walter Fee Outstanding Young Engineer Award (2003). *For outstanding contributions in predictive reliability modelling of distribution systems.*
- Chair, Technical Awards Committee (2007 – 2010)

- Member, Power System Planning and Implementation Committee (1997-present)
 - Committee Vice Chair (2006-2008)
 - Chair, Distribution Working Group (2003-2006)
 - Chair, Power Delivery Reliability Working Group (1997-1999)
- Member, Distribution Subcommittee, Working Group on System Design (1997-2012)
- Technical Paper Reviewer
 - *IEEE Transactions on Power Systems* (1996-2012)
 - *IEEE Transactions on Power Delivery* (1996-2012)
 - *IEEE General Meeting* (2001-2012)
 - *IEEE T&D Conference and Exposition* (2001-2012)
 - *IEEE Power Systems Conference and Exposition* (2004-2012)
 - Power Systems Computation Conference 2008
- President, University of Washington Student Chapter (1994-1995)
- Vice President, University of Washington Student Chapter (1993-1994)

Books, Book Chapters, and Theses

1. **R. E. Brown**, *Business Essentials for Utility Engineers*, CRC Press, 2010.
2. **R. E. Brown**, *Electric Power Distribution Reliability, Second Edition*, CRC Press, 2009.
3. **R. E. Brown**, *Electric Power Distribution Reliability*, Marcel Dekker, 2002.
4. **D. J. Morrow and R. E. Brown**, "Future Vision: The Challenge of Effective Transmission Planning," Chapter 6, *Power System Analysis and Design*, 5th Edition, J. D. Glover *et al.* (Editor), pp. 295-304.
5. **R. E. Brown**, H. L. Willis, "Substation Asset Management," Chapter 19, *Electric Power Substations Engineering*, J. D. McDonald (Editor), Taylor & Francis (CRC Press), 2007, pp. 19-1 through 19-31.
6. **R. E. Brown**, "Power System Reliability" Section 13.5, *Electric Power Engineering Handbook*, L. L. Grigsby (Editor), CRC Press LLC, 2001, pp. 13-51 through 13-65.
7. **R. E. Brown**, "Predictive Distribution Reliability and Risk Assessment," Chapter 3, *IEEE Tutorial on Probabilistic T&D System Reliability Planning*, A. A. Chowdhury (Editor), IEEE 07TP182, 2007, pp. 29-36.
8. **R. E. Brown**, "Distribution System Reliability: Analytical and Empirical Techniques", Chapter 3, *IEEE Tutorial on Electric Delivery System Reliability Evaluation*, J. Mitra (Editor), IEEE 05TP175, 2005, pp. 39-51.
9. **R. E. Brown**, *Reliability Assessment and Design Optimization for Electric Power Distribution Systems*, Ph.D. Dissertation, University of Washington, Seattle, WA, 1996.
10. **R. E. Brown**, *An Intelligent Overload Relay for Extruded Dielectric Transmission Cable*, Masters Thesis, University of Washington, Seattle, WA, 1993.

Refereed Journal Papers

1. **R. E. Brown**, C. S. Wilson, and H. van Nispen, "Becoming the Utility of the Future," *IEEE Power and Energy*, Vol. 14, No. 5, Sept./Oct. 2016, pp. 57-65.
2. **R. E. Brown**, "The Perils of Reliability Benchmarking," *IEEE Power and Energy*, Vol. 10, Issue 2, March/Apr. 2012, pp. 125-130.
3. **R. E. Brown** and D. J. Morrow, "Future Vision," *IEEE Power and Energy*, Vol. 5, Issue 5, Sept./Oct. 2007, pp. 36-45.
4. **R. E. Brown** and H. L. Willis, "The Economics of Aging Infrastructure," *IEEE Power and Energy*, Vol. 4, No. 3, May/June 2006, pp. 36-43.
5. **R. E. Brown**, M. V. Engel, and J. H. Spare, "Making Sense of Worst Performing Feeders", *IEEE Transactions on Power Systems*, Vol. 20, No. 2, May 2005, pp. 1173-1178.
6. **R. E. Brown** and B. G. Humphrey, "Asset Management for Transmission and Distribution," *IEEE Power and Energy*, Vol. 3, No. 3, May/June 2005, pp. 39-45.
7. **R. E. Brown**, G. Frimpong, and H. L. Willis, "Failure Rate Modeling Using Equipment Inspection Data", *IEEE Transactions on Power Systems*, Vol. 19, No. 2, May 2004, pp. 782-787.
8. S. S. Venkata, A. Pahwa, **R. E. Brown**, and R. D. Christie, "What Future Distribution Engineers Need to Learn," *IEEE Transactions on Power Systems*, Vol. 19, No. 1, Feb. 2004, pp. 17-23.
9. F. Li and **R. E. Brown**, "A Cost-Effective Approach of Prioritizing Distribution Maintenance Based on System Reliability," *IEEE Transactions on Power Delivery*, Vol. 19, No. 1, Jan. 2004, pp. 439-441.

10. T. M. Taylor, **R. E. Brown**, M. L. Chan, R. H. Fletcher, S. Larson, T. McDermott, and A. Pahwa, "Planning for Effective Distribution," *IEEE Power and Energy*, Vol. 1, No. 5, September/October 2003, pp. 54-62.
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12. F. Li, L. A. A. Freeman and **R. E. Brown**, "Web-Enabling Applications for Outsourced Computing," *IEEE Power and Energy*, Vol. 1, No. 1, January/February 2003, pp. 53-57.
13. **R. E. Brown** and A. P. Hanson, "Impact of Two Stage Service Restoration on Distribution Reliability," *IEEE Transactions on Power Systems*, Vol. 16, No. 4, Nov. 2001, pp. 624-629.
14. **R. E. Brown**, A. P. Hanson, H. L. Willis, F. A. Luedtke, M. F. Born, "Assessing the Reliability of Distribution Systems," *IEEE Computer Applications in Power*, Vol. 14, No. 1, Jan. 2001, pp. 44-49.
15. **R. E. Brown** and J. J. Burke, "Managing the Risk of Performance Based Rates," *IEEE Transactions on Power Systems*, Vol. 15, No. 2, May 2000, pp. 893-898.
16. **R. E. Brown** and M. M. Marshall, "Budget Constrained Planning to Optimize Power System Reliability," *IEEE Transactions on Power Systems*, Vol. 15, No. 2, May 2000, pp. 887-892.
17. **R. E. Brown**, "The Impact of Heuristic Initialization on Distribution System Reliability Optimization," *International Journal of Engineering Intelligent Systems for Electrical Engineering and Communications*, Vol. 8, No. 1, March 2000, pp. 45-52.
18. **R. E. Brown** and J. R. Ochoa, "Impact of Sub-Cycle Transfer Switches on Distribution System Reliability," *IEEE Transactions on Power Systems*, Vol. 15, No. 1, Feb. 2000, pp. 442-447.
19. **R. E. Brown**, T. M. Taylor, "Modeling the Impact of Substations on Distribution Reliability," *IEEE Transactions on Power Systems*, Vol. 14, No. 1, Feb. 1999, pp. 349-354.
20. **R. E. Brown** and J. R. Ochoa, "Distribution System Reliability: Default Data and Model Validation," *IEEE Transactions on Power Systems*, Vol. 13, No. 2, May 1998, pp. 704-709.
21. **R. E. Brown**, S. Gupta, R. D. Christie, S. S. Venkata, and R. D. Fletcher, "Distribution System Reliability: Momentary Interruptions and Storms," *IEEE Transactions on Power Delivery*, Vol. 12, No. 4, October 1997, pp. 1569-1575.
22. **R. E. Brown**, S. Gupta, R. D. Christie, S. S. Venkata, and R. D. Fletcher, "Automated Primary Distribution System Design: Reliability and Cost Optimization," *IEEE Transactions on Power Delivery*, Vol. 12, No. 2, April 1997, pp. 1017-1022.
23. **R. E. Brown**, S. Gupta, R. D. Christie, S. S. Venkata, and R. D. Fletcher, "Distribution System Reliability Analysis Using Hierarchical Markov Modeling," *IEEE Transactions on Power Delivery*, Vol. 11, No. 4, Oct. 1996, pp. 1929-1934.
24. V. N. Chuvychin, N. S. Gurov, S. S. Venkata, and **R. E. Brown**, "An Adaptive Approach to Load Shedding and Spinning Reserve Control During Underfrequency Conditions," *IEEE Transactions on Power Systems*, Vol. 11, No. 4, Nov. 1996, pp. 1805-1810.

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1. A. Shahsiah, **R. E. Brown** and M. Ly, "Reliability and Life Expectancy of Modern SCADA Equipment in Underground Installations: SCADA Equipment in PG&E Secondary Underground Distribution Networks," *Resilience Week (RWS)*, Wilmington, DE, Sept. 2017.
2. **R. E. Brown** and Q. Tran, "Best Poles for Power Distribution," *DistribuTECH Conference and Exhibition*, San Diego, CA, Feb. 2017.
3. **R. E. Brown**, B. Hwang, R. Touzel, "Demand Response as a Dispatchable Resource," *POWER-GEN International*, Orlando, FL, Nov. 2013.
4. J. Romero Agüero and **R. E. Brown**, "Distribution System Reliability Improvement Using Predictive Models," *IEEE PES 2009 General Meeting*, Calgary, Alberta, July 2009.
5. J. Romero Agüero, **R. E. Brown**, J. H. Spare, E. Phillips, L. Xu, and J. Wang, "A Reliability Improvement Roadmap Based on a Predictive Model and Extrapolation Technique," *IEEE PES 2009 Power Systems Conference and Exposition*, Seattle, WA, March 2009.
6. J. Romero Agüero, **R. E. Brown**, J. H. Spare, E. Phillips, L. Xu, and J. Wang, "A Reliability Improvement Roadmap Based on a Predictive Model and Extrapolation Technique," *DistribuTECH Conference and Exhibition*, San Diego, CA, Feb. 2008.
7. **R. E. Brown**, "Asset Management Standards and Guidelines," *EPRI Fourth Power Delivery Asset Management Conference*, Chicago, IL, Oct. 2008.

8. **R. E. Brown**, "Impact of Smart Grid on Distribution System Design", *IEEE PES 2008 General Meeting*, Pittsburgh, PA, July 2008.
9. L. Xu and **R. E. Brown**, "A Hurricane Simulation Method for Florida Utility Damage and Risk Assessment", *IEEE PES 2008 General Meeting*, Pittsburgh, PA, July 2008.
10. **R. E. Brown**, "Hurricane Hardening Efforts in Florida", *IEEE PES 2008 General Meeting*, Pittsburgh, PA, July 2008.
11. L. Xu and **R. E. Brown**, "Simulation of Hurricane Damage to Utilities in Florida," *DistribUTECH Conference and Exhibition*, Tampa Bay, FL, Jan. 2008.
12. **R. E. Brown**, "Reliability Benefits of Distributed Generation on Heavily Loaded Feeders", *IEEE PES 2007 General Meeting*, Tampa, FL, June 2007.
13. **R. E. Brown**, "Pole Hardening Following Hurricane Wilma," 2007 Southeastern Utility Pole Conference, Tunica, MS, Feb. 2007.
14. B. Ramanathan, D. Hennessy and **R. E. Brown**, "Decision-making and Policy Implications of Performance-based Regulation," *IEEE Power Systems Conference and Exhibition*, Atlanta, GA, Oct. 2006.
15. **R. E. Brown**, "The Regulatory Usefulness of Reliability Reporting," 2006 IEEE Rural Electric Power Conference, Albuquerque, NM, April 2006.
16. M. Butts, J. H. Spare and **R. E. Brown**, "Practical and Verifiable Reliability Improvement at the Baltimore Gas and Electric Company," *DistribUTECH Conference and Exhibition*, Tampa Bay, FL, Feb. 2006.
17. **R. E. Brown**, "Project Selection with Multiple Performance Objectives," *2005 IEEE/PES Transmission and Distribution Conference and Exposition*, New Orleans, LA, Sept. 2005.
18. **R. E. Brown** and J. H. Spare, "The Effects of System Design on Reliability and Risk," *2005 IEEE/PES Transmission and Distribution Conference and Exposition*, New Orleans, LA, Sept. 2005.
19. **R. E. Brown** and J. H. Spare "A Survey of U.S. Reliability Reporting Processes," *2005 IEEE/PES Transmission and Distribution Conference and Exposition*, New Orleans, LA, Sept. 2005.
20. Y. Zhou and **R. E. Brown**, "A Practical Method for Cable Failure Rate Modeling," *2005 IEEE/PES Transmission and Distribution Conference and Exposition*, New Orleans, LA, Sept. 2005.
21. **R. E. Brown** and J. H. Spare, "Asset Management and Financial Risk," *DistribUTECH Conference and Exhibition*, San Diego, CA, Jan. 2005.
22. **R. E. Brown** and J. H. Spare, "Asset Management, Risk, and Distribution System Planning," *IEEE Power Systems Conference and Exhibition*, New York, NY, Oct. 2004.
23. **R. E. Brown**, "Identifying Worst Performing Feeders," *Probabilistic Methods Applied to Power Systems, PMAPS 2004*, Ames, IA, September 2004.
24. H. L. Willis, M. V. Engel and **R. E. Brown**, "Equipment Demographics – Failure Analysis of Aging T&D Infrastructures," *2004 Canada Power Conference*, Toronto, Canada, September 2004.
25. **R. E. Brown**, "Failure Rate Modeling Using Equipment Inspection Data", *IEEE PES 2004 General Meeting*, Denver, CO, June 2004.
26. **R. E. Brown**, "Coming to Grips with Distribution Asset Management," *2003 Real World Conference: It's All About Cost and Reliability*, Transmission and Distribution World, Ft. Lauderdale, FL, Oct. 2003.
27. **R. E. Brown**, "Reliability Standards and Customer Satisfaction," *2003 IEEE/PES Transmission and Distribution Conference and Exposition*, Dallas, TX, Sept. 2003.
28. A. Pahwa, S. Gupta, Y. Zhou, **R. E. Brown**, and S. Das, "Data Selection To Train A Fuzzy Model For Overhead Distribution Feeders Failure Rates," *International Conference on Intelligent Systems Applications to Power Systems*, Lemnos, Greece, Sept. 2003.
29. **R. E. Brown**, "Network Reconfiguration for Improving Reliability in Distribution Systems," *IEEE PES 2003 General Meeting*, Toronto, Canada, July 2003.
30. **R. E. Brown**, J. Pan, Y. Liao, and X. Feng, "An Application of Genetic Algorithms to Integrated System Expansion Optimization," *IEEE PES 2003 General Meeting*, Toronto, Canada, July 2003.
31. **R. E. Brown** and L. A. A. Freeman, "A Cost/Benefit Comparison of Reliability Improvement Strategies," *DistribUTECH Conference and Exhibition*, Las Vegas, NV, Feb. 2003.
32. S. Gupta, A. Pahwa, **R. E. Brown** and S. Das, "A Fuzzy Model for Overhead Distribution Feeders Failure Rates," *NAPS 2002: 34th Annual North American Power Symposium*, Tempe, AZ, Oct. 2002.
33. **R. E. Brown**, "Web-Based Distribution System Planning," *IEEE PES Summer Power Meeting*, Chicago, IL, July 2002.
34. **R. E. Brown**, "System Reliability and Power Quality: Performance-Based Rates and Guarantees," *IEEE PES Summer Power Meeting*, Chicago, IL, July 2002.

35. **R. E. Brown**, "Modeling the Reliability Impact of Distributed Generation," *IEEE PES Summer Power Meeting*, Chicago, IL, July 2002.
36. S. Gupta, A. Pahwa, **R. E. Brown**, "Data Needs for Reliability Assessment of Distribution Systems," *IEEE PES Summer Power Meeting*, Chicago, IL, July 2002.
37. **R. E. Brown**, "Meeting Reliability Targets for Least Cost," *DistribuTECH Conference and Exhibition*, Miami, FL, Feb. 2002.
38. S. Gupta, A. Pahwa and **R. E. Brown**, "Predicting the Failure Rates of Overhead Distribution Lines Using an Adaptive-Fuzzy Technique," *NAPS 2001: 33rd Annual North American Power Symposium*, College Station, TX, Oct. 2001.
39. P. R. Jones and **R. E. Brown**, "Advanced Modeling Techniques to Identify and Minimize the Risk of Aging Assets on Network Performance," *Utilities Asset Management 2001*, London, UK, July 2001.
40. **R. E. Brown**, "Distribution Reliability Modeling at Commonwealth Edison," *2001 IEEE/PES Transmission and Distribution Conference and Exposition*, Atlanta, GA, Oct. 2001.
41. **R. E. Brown**, "Distribution Reliability Assessment and Reconfiguration Optimization," *2001 IEEE/PES Transmission and Distribution Conference and Exposition*, Atlanta, GA, Oct. 2001.
42. **R. E. Brown**, J. Pan, X. Feng and K. Koutlev, "Siting Distributed Generation to Defer T&D Expansion," *2001 IEEE/PES Transmission and Distribution Conference and Exposition*, Atlanta, GA, Oct. 2001.
43. D. Ross, L. Freeman and **R. E. Brown**, "Overcoming Data Problems in Predictive Distribution Reliability Modeling," *2001 IEEE/PES Transmission and Distribution Conference and Exposition*, Atlanta, GA, Oct. 2001.
44. **R. E. Brown** and L. A. A. Freeman, "Analyzing the Reliability Impact of Distributed Generation," *IEEE PES Summer Power Meeting*, Vancouver, BC, Canada, July 2001.
45. **R. E. Brown**, P. R. Jones and S. Trotter, "Planning for Reliability," *Trans-Power Europe*, Vol. 1, No. 1. March 2001, pp. 10-12.
46. **R. E. Brown** and M. Marshall, "Microeconomic Examination of Distribution Reliability Targets," *IEEE PES Winter Power Meeting*, Columbus, OH, Jan. 2001, Vol. 1, pp. 58-65.
47. P. R. Jones and **R. E. Brown**, "Investment Planning of Networks Using Advanced Modeling Techniques," *Utilities Asset Management 2001*, London, UK, Jan. 2001.
48. **R. E. Brown**, "Probabilistic Reliability and Risk Assessment of Electric Power Distribution Systems," *DistribuTECH Conference and Exhibition*, San Diego, CA, Feb. 2001.
49. C. LaPlace, D. Hart, **R. E. Brown**, W. Mangum, M. Tellarini, J. E. Saleeby, "Intelligent Feeder Monitoring to Minimize Outages," *Power Quality 2000 Conference*, Boston, MA, Oct. 2000.
50. **R. E. Brown**, H. Nguyen, J. J. Burke, "A Systematic and Cost Effecting Method to Improve Distribution Reliability," *IEEE PES Summer Meeting*, Edmonton, AB, July 1999. Vol. 2, pp. 1037-1042.
51. **R. E. Brown**, T. M. Taylor, "Modeling the Impact of Substations on Distribution Reliability," *IEEE PES Winter Meeting*, New York, NY, Feb 1999, pp. 349-354.
52. **R. E. Brown**, A.P. Hanson, M.M Marshall, H.L. Willis, B. Newton, "Reliability and Capacity: A Spatial Load Forecasting Method for a Performance Based Regulatory Environment," *1999 Power Industry Computer Applications Conference*, Dayton, OH, February 1999, pp. 139-144.
53. **R. E. Brown**, A. P. Hanson, D. Hagan, "Long Range Spatial Load Forecasting Using Non-Uniform Areas," *1998 IEEE/PES Transmission and Distribution Conference*, New Orleans, LA, April 1999, Vol. 1, pp. 369-373.
54. **R. E. Brown**, W. S. Zimmermann, P. P. Bambao Jr., and L. P. Simpao, "Basic Planning for a New Fast Growing Area in Manila with a Total Electrical Load of 650 MVA," *12th Annual Conference of the Electric Power Supply Industry*, Pattaya, Thailand, November 1998.
55. X. Y. Chao, **R. E. Brown**, D. Slump, and C. Strong, "Reliability Benefits of Distributed Resources," *Power Delivery International '97 Conference*, Dallas, TX, December 1997.
56. **R. E. Brown**, "Competitive Distribution Systems: A Reliability Perspective," *American Power Conference*, Vol. 59-II, Chicago, IL, April 1997, pp. 1115-1120.
57. **R. E. Brown**, S. S. Venkata, and R. D. Christie, "Hybrid Reliability Optimization Methods for Electric Power Distribution Systems," *International Conference on Intelligent Systems Applications to Power Systems*, Seoul, Korea, IEEE, July 1997.
58. **R. E. Brown**, S. Gupta, R. D. Christie, S. S. Venkata, and R. D. Fletcher, "Automated Primary Distribution System Design: Reliability and Cost Optimization," *1996 IEEE/PES Transmission and Distribution Conference*, Los Angeles, CA, Sept., 1996, pp. 1-6.
59. **R. E. Brown**, S. S. Gupta, R. D. Christie, and S. S. Venkata, "A Genetic Algorithm for Reliable Distribution System Design," *International Conference on Intelligent Systems Applications to Power Systems*, Orlando, FL, January 1996, pp. 29-33.

Technical Articles

1. **R. E. Brown**, "Counterintuitive Strategies," *Transmission and Distribution World*, March 2013.
2. **R. E. Brown**, "Storm Hardening Distribution Systems," *Transmission and Distribution World*, June 2010, pp. 50-56.
3. **R. E. Brown**, "A Beautiful Grid?" *Transmission and Distribution World*, Feb. 2010.
4. **R. E. Brown**, "Business Realities," *Transmission and Distribution World*, Jan. 2009.
5. H. L. Willis and **R. E. Brown**, "What Happens with a Lack of Long Range T&D Infrastructure Planning?" *Natural Gas & Electricity*, Vol. 24, Issue 6, Jan. 2008, pp. 22-27.
6. **R. E. Brown**, "Increased Performance Expectations for Major Storms," *Electric Perspectives*, EEI, June 2007.
7. M. V. Engel, **R. E. Brown**, E. Phillips, and N. Bingel, "Extreme Winds Test Wood Pole Strength," *Transmission and Distribution World*, May 2007, pp. 34-38.
8. **R. E. Brown**, "Asset Management: Balancing Performance, Cost, and Risk," *EnergyPulse Special Issue on Asset Management*, www.energycentral.com, Feb. 2005.
9. P. Musser, **R. E. Brown**, T. Eyford, and C. Warren, "Too Many Routes of Reliability," *Transmission and Distribution World*, June 2004, pp. 17-22.
10. **R. E. Brown** and L. A. A. Freeman, "A Cost/Benefit Comparison of Reliability Improvement Strategies," *Electric Power and Light*, May 2003.
11. **R. E. Brown**, H. Kazemzadeh, B. R. Williams and C. B. Mansfield, "Engineering Tools Move into Cyberspace," *Transmission and Distribution World*, March 2003, pp. 27-36.
12. P. Perani and **R. E. Brown**, "Maintaining Reliable Power For Semiconductor Manufacture," *What's New in Electronics*, March 2002.
13. P. Perani and **R. E. Brown**, "Rock Steady: The Importance of Reliable Power Distribution in Microprocessor Manufacturing Plants," *ABB Review*, No. 3, 2002, pp. 29-33.
14. H. L. Willis and **R. E. Brown**, "Is DG Ready for the Last Mile?" *Power Quality (cover story)*, March 2002, pp. 16-21.
15. **R. E. Brown** and M. W. Marshall, "The Cost of Reliability," *Transmission and Distribution World (cover story)*, Dec. 2001, pp. 13-20.
16. **R. E. Brown** and B. Howe, "Optimal Deployment of Reliability Investments," *E-Source, Power Quality Series: PQ-6*, March 2000.

Expert Witness for Regulatory Proceedings

1. Prepared expert report for the Matter of the Application of Icebreaker Windpower, Inc., for a Certificate to Construct a Wind-Powered Electric Generation Facility in Cuyahoga County, before the Ohio Power Siting Board, Case No. 16-1871-EL-BGN. *I represented three local resident interveners by addressing deficiencies in the Application and discussed the overall economics of the project and the resulting impact to ratepayers.*
2. Prepared pre-filed direct testimony and testified at hearings for the submission of Duke Energy reliability targets in a regulatory proceeding in Ohio, before the Public Utilities Commission of Ohio, in the Matter of the Application of Duke Energy Ohio, Inc., to Establish Minimum Reliability Performance Standards Pursuant to Chapter 4901:1-10, Ohio Administrative Code, Case No. 16-1602-EL-ESS. *I represented Duke in justifying targets for distribution system reliability indices.*
3. Prepared written testimony and testified at hearings supporting the rider treatment of overhead-to-underground conversion of distribution facilities for Dominion Virginia Electric Power, North Carolina Public Utilities Commission Case No. PUE-2015-00114. *I represented Dominion in this case by developing a benefit-to-cost assessment for the second phase of the Dominion \$2 billion proposed program and realized benefits from the completed first phase.*
4. Developed criteria and methodologies for solar farm development interconnections in North Carolina including an initial screen based on system stiffness at the point of interconnection and advanced screening for various potential negative impacts should the initial screen fail. *I represented Duke Energy in this case with regards to the North Carolina Utilities Commission Docket No. E-100, Sub 101.*
5. Prepared written and testified at hearings supporting the rider treatment of overhead-to-underground conversion of distribution facilities for Dominion Virginia Electric Power, North Carolina Public Utilities Commission Case No. PUE-2015-00114. *I represented Dominion in this case by developing a benefit-to-cost assessment for the first phase of the Dominion \$2 billion proposed program.*

6. Prepared direct testimony for the Application of South Field Energy for a Certificate of Environmental Compatibility and Public Need to construct an electric generation facility in Columbiana County, Ohio. Case No. 15-1716-EL-BGN before the Ohio Power Siting Board. *I represented the Ohio Valley Jobs Alliance by addressing deficiencies in the Application and discussed broader energy policy issues related to fuel diversity.*
7. Prepared testimony supporting the 2012-2013 Deferral Accounts Reconciliation Application, for AltaLink to the Alberta Utilities Commission. *I represented AltaLink in this case by providing testimony that addressed the prudence of twenty-eight capital projects.*
8. This project prepared testimony to assist Unitil with regards to the Massachusetts Department of Public Utilities proposed set of new Service Quality guidelines in D.P.U. 12-120-B. *I represented Unitil by addressing the proposed revisions to current reliability standards, including the disparate effect that the proposed standards would have on small utilities compared to larger utilities.*
9. This project prepared testimony to assist Unitil with regards to the Massachusetts Department of Public Utilities proposed storm restoration requirements as proposed in D.P.U. 14-66. *I represented Unitil by addressing the issues of storm restoration criteria, wires down criteria, municipal liaisons, restoration priorities, and multi-agency coordination.*
10. Prepared written and testified at hearings for North Carolina Docket No. E-100, Sub 140, "Bi-Annual Avoided Cost Hearings." Prepared on behalf of the North Carolina Public Staff. *This testimony provided an assessment of the potential benefits and costs of utility-scale solar facilities in North Carolina, and the appropriateness of these costs and benefits to be included in avoided cost calculations.*
11. Prepared direct testimony for the State of Massachusetts Docket No. D.P.U. 12-120. Prepared on behalf of NSTAR, Western Mass Electric, and Unitil. *This testimony presented an assessment of proposed changes to utility reliability reporting standards, targets, and penalties.*
12. Prepared written testimony and testified at hearings, "Investigation of the reliability of Pepco's electric distribution system and the quality of the service it provides to customers," Prepared on behalf of Pepco and submitted to the Maryland Public Service Commission under Case No. 9240. *This testimony performed a review of the reports generated to assess the reliability of Pepco's reliability and customer service during both normal and major event conditions.*
13. "Impact of Aging Infrastructure on System Reliability at Southern California Edison," Workpaper prepared on behalf of SCE and submitted with the 2012 General Rate Case to Public Utilities Commission of the State of California, Docket U 338-E, 2010. *This report examines the impact of aging equipment on system reliability over twenty years, and calculates the benefit-to-cost ratios of proactive aging infrastructure replacement for both the overall system and for worst-performing circuits.*
14. "Hazard Trees: Benchmark Survey and Best Practices." Prepared for the Public Utilities Commission of Texas and filed under docket number 36375. The results of this report were presented to the commission in an open meeting on July 30th 2009. *A industry benchmark survey was performed to determine typical and best industry practices related to the identification and removal of trees with defects that have the potential to fall into power lines. The report identifies eighteen recommendations.*
15. "Distribution Hardening: Benchmark Survey and Best Practices." Prepared for the Public Utilities Commission of Texas and filed under docket number 36375. The results of this report were presented to the commission in an open meeting on July 30th 2009. *A industry benchmark survey was performed to determine typical and best industry practices related to hardening distribution systems so that they experience less damage during major storms. The report identifies eighteen recommendations.*
16. Prepared written testimony and testified at hearings, "Investigation by the Massachusetts Department Of Public Utilities on its Own Motion into the Preparation and Response of the Massachusetts Electric Distribution Companies to the December 12, 2008 Winter Storm," Prepared on behalf of the Massachusetts Attorney General Filed and submitted to the Massachusetts Department Of Public Utilities under Docket DPU 09-01-A. *This testimony presents an analysis of the technical aspects of Fitchburg Gas & Electric (FG&E) as they relate to the damage and restoration associated with the 2008 Ice Storm.*
17. "Cost-Benefit Analysis of the Deployment of Utility Infrastructure Upgrades and Storm Hardening Programs." Prepared for the Public Utilities Commission of Texas and filed under docket number 36375. The results of this report were presented to the commission in an open meeting on April 9th 2009. *This report examines the impact of hurricanes and tropical storms to electric and telecom utilities in Texas. It examines the cost-effectiveness of potential hardening programs such as vegetation patrols, hazard tree programs, ground-based inspections, locating substations outside of floodplains, emergency backup generation in central offices, underground conversion, smart grid technologies, targeted hardening, and post-storm data collection. This report determines the costs for each program, the direct utility benefits, and greater societal benefits.*

18. "Undergrounding Assessment Phase 1 Final Report: Literature Review and Analysis of Electric Distribution Overhead to Underground Conversion." Prepared for the Florida Electric Utilities and submitted to the Florida Public Service Commission per order PSC-06-0351-PAA-EI. The results of this report were presented to the commission in an internal affairs meeting. *This report describes the body of literature related to the costs and benefits of converting existing overhead distribution systems to underground, including the impact on non-storm reliability performance and storm reliability performance. Phase 2 of this project will examine for case studies for actual underground conversion projects that have been completed in Florida. Phase 3 of this project will develop a model that is able to predict the anticipated costs and benefits for potential underground conversion projects.*
19. "Undergrounding Assessment Phase 2 Final Report: Undergrounding Case Studies." Prepared for the Florida Electric Utilities and submitted to the Florida Public Service Commission per order PSC-06-0351-PAA-EI. The results of this report were presented to the commission in an internal affairs meeting. *This report details four actual undergrounding projects that have been completed in Florida with respect to realized benefits and incurred costs.*
20. "Undergrounding Assessment Phase 3 Final Report: Ex Ante Cost and Benefit Modeling." Prepared for the Florida Electric Utilities and submitted to the Florida Public Service Commission per order PSC-06-0351-PAA-EI. The results of this report were presented to the commission in an internal affairs meeting. *This report develops a methodology to assess the utility and customer costs and benefits of undergrounding and system hardening with an emphasis on hurricane performance. It also contains a user's guide to the software tool in which the methodology is implemented.*
21. "Technical Report: Post Hurricane Wilma Engineering Analysis." Prepared an expert report, gave deposition testimony and testified at hearings at the Florida Public Service Commission 2005 hurricane cost recovery hearings, Docket 060038-EI. A deposition was given on the findings of this report and Dr. Brown was called as an expert witness in the FPL storm cost recovery hearings. *This report examines the infrastructure damage that occurred on the FPL system following Hurricane Wilma, and determines whether this damage was consistent with prudent management decisions and therefore eligible for recovery of the associated recovery costs.*
22. "Hurricane Hardening." January 23rd 2006 (undocketed). Transcript available on the FPSC website. *Presented techniques at a staff workshop for strengthening electric power systems so that that they sustain less damage during hurricane.*
23. "Assessment of PBR Reliability Metrics and Related Systems and Processes." Prepared for Southern California Edison and submitted to the California Public Utilities Commission under Docket I.06-06-014. *This testimony examined the systems and processes of SCE related to reliability data gathering and reliability index calculations used for PBR metrics during the PBR period of 1997 through 2003. The focus of the testimony was on the ability of the SCE systems and processes to generate reliability metrics that are useful from a regulatory incentive perspective.*
24. "Asset Management and System Reliability Group Review," Prepared for Southern California Edison and submitted to the California Public Service Commission for the 2008 general rate case, Docket A.07-11-011. *This report examines, among other things, the impact that aging infrastructure will have on distribution reliability indices over time, and the mitigation impact of the proactive replacement activities proposed in the rate case.*
25. "A Better Measure for Distribution Reliability," Prepared for San Diego Gas & Electric and submitted to the California Public Service Commission for the 2007 general rate case, Docket A.06-12-009. *This report discusses the strengths and weaknesses of standard reliability indices when used for prioritizing reliability improvement projects. The report discusses potential difficulties associated with the most common indices (SAIDI, SAIFI, and MAIFI), examines alternatives, and proposes a new reliability index that is highly suitable for performance-based ratemaking.*
26. "Aging Distribution Infrastructure at Pacific Gas & Electric." Prepared for Pacific Gas & Electric and submitted to the California Public Service Commission for the 2006 general rate case, Docket A-05.12-002. *This report examines the state of the U.S. electric industry in terms of aging infrastructure and its impact on reliability performance. It then compares these findings to the situation at PG&E, and examines the appropriateness of related spending proposed in the general rate case with regards to cost and reliability benefits.*
27. Excel Energy – Assessment of Reliability Reporting Systems and Processes. *This project was a result of accusation that Excel Energy was manipulating reliability indices for the purposes of avoiding regulatory financial penalties. The scope of the project included a comprehensive assessment of systems and processes and their ability to generate reliability indices that are useful for their intended regulatory purpose. This included an industry benchmark study.*

28. Oklahoma Gas & Electric – Five-year reliability plan for rate case filing. *This engagement created a cost-versus reliability curve for the OG&E system. This curve to set five-year reliability improvement and spending targets for inclusion in their 2006 rate case filing.*

Expert Witness for Civil Proceedings

1. Provided consulting to counsel for the case of Thomas Joseph Estarella et. al. vs. West Coast Ambulance Corporation et. al., filed in the Superior Court of California, Los Angeles County – Central District, Case No. BC527749. *I represented Southern California Edison with regards to the location of a utility pole involved in an accident.*
2. Prepared an expert report, gave deposition testimony, and testified at trial for the case of David Harrison v. Jersey Central Power & Light Company and FirstEnergy Corp. and Robert J. Peterson, filed in the Superior Court of New Jersey, Law Division, Mercer County, New Jersey, Docket No. L-1863-14. *I represented FirstEnergy in a case involving a civilian injury related to a downed wire occurring in the aftermath of Hurricane Sandy.*
3. Prepared an internal expert report for the case of Valero Refining Company v. Pacific Gas & Electric Company, Case 2:17-at-00667, United States District Court, Eastern District of California. *I represented PG&E in a case involving the complete interruption of power to the Valery Refinery.*
4. Provided consulting to counsel in the case of Dylan Lutz v. Jersey Central Power & Light, et. al., Docket No. SSX-L-147-17, Superior Court of New Jersey Law Division: Bergen County. *I represented FirstEnergy in a case involving a civilian injury related to a downed tree occurring in the aftermath of Hurricane Sandy.*
5. Prepared a claim construction declaration, rebuttal declaration, and gave deposition testimony regarding U.S. Patent Nos. 7945502, 9569805, and 9256905 in the case of Grid Innovations LLC v. ERCOT, Civil Action No. 1:17-cv-234-SS, In The United States District Court for the Western District of Texas, Austin Division. *I represented Grid Innovations in this matter, who owned the patents at issue in an infringement case.*
6. Provided consulting to counsel in the case of Funtown Pier Amusements v. Jersey Central Power & Light, et. al., Docket No. OCN-L-2438-15 in the Superior Court of New Jersey Law Division: Ocean County. *I represented FirstEnergy in this case involving a fire on the Seaside Pier that destroyed more than 100 businesses.*
7. Prepared an expert report, gave deposition testimony, and testified at trial for the case of James Tiencken vs. Rosikiewicz, et al, Superior Court of New Jersey, Law Division – Morris County, Docket No.: MRS-L-2555-14. *I represented FirstEnergy in a case involving a civilian injury related to a damaged utility pole occurring in the aftermath of Hurricane Sandy.*
8. Prepared an expert report, rebuttal report, and deposition testimony for the case of ExxonMobil Corporation, a New Jersey corporation, Plaintiff, vs. Northwestern Corporation dba Northwestern Energy, a Delaware corporation, Defendant, Case No. 1:16-cv-00005-SPW-CSO, United States District Court for The District of Montana Billings Division. *I represented ExxonMobil and prepared a report assessing two complete power interruptions to their Billings Refinery and whether NWE met its standard of care as defined in the tariff agreement.*
9. Prepared an expert report for the case of The Estate of Paul Kohut vs. Sandra J. Weist and Pennsylvania Electric Company (a FirstEnergy Company), filed in the Court Of Common Pleas of Erie County, Pennsylvania, Docket No. 12617-2011. *I represented FirstEnergy in a case involving voltage quality issues at a home and whether FirstEnergy met its standard of care as defined in the tariff agreement.*
10. Prepared an expert report for the case Varentec v. Gridco, Case 1:16-cv-00217-RGA in the United States District Court for the District of Delaware. *I represented Gridco in their defense of a patent infringement case by writing an expert report that was submitted to the U.S. Patent and Trademark office in Inter Partes Review No. IPR2017- 01135. The patents related to the local control of switched sources of reactive power.*
11. Prepared an expert report for the case of Kosberg v. The Town of Palm Beach related to The Town of Palm Beach Resolution No. 090-270. *I represented a group of Palm Beach residents challenging a special assessment and its methodology based on the impacts of utility overhead-to-underground conversion to safety, reliability, and aesthetics.*
12. Provided consulting to counsel for the case of Barbara Connolly et. al v. LIPA and National Grid, Supreme Court of the State of New York, County of Queens, Index No. 6341/2013. *I represented LIPA/National Grid in a case where homeowners allege utility responsibility for home fires in the aftermath of Hurricane Sandy.*

13. Prepared an expert report and gave deposition testimony and trial testimony for the case of *Gregg A. Spindler et. al. (dba SGS Statistical Services) v. Virginia Electric Power Company (dba Dominion Virginia Power) and North American Transmission Forum*, United States District Court, Northern District of New York, Civil Action No. 5:15-cv-779. *I represented Dominion in a case where SGS accused them of unfair intellectual property appropriation related to transmission reliability benchmarking.*
14. "Refinery Outage Assessments," Represented Phillips 66 and assessed four power system outages that caused shutdowns of the Phillips 66 Alliance refinery in Louisiana. *Phillips 66 v. Entergy Louisiana*, 25th Judicial District Court Parish of Plaquemine, State of Louisiana, Docket No. 62-852.
15. "Infringement of CVR Patent," Represented Dominion and reviewed material related to alleged patent infringement and validity by Alstom Grid of a Dominion patent related to conservation voltage reduction (CVR). This included an expert report on infringement, two reports on invalidity, two depositions and trial testimony. U.S District Court for the Eastern District of Pennsylvania, Case No. 2:15-cv-00224-MAK. *Jury trial found for beneficial party on all counts.*
16. "Incident and Utility Response Assessment," Prepared a report and gave deposition testimony for JCP&L for the New Jersey civil case *Lexington Insurance (as subrogee of School Excess Liability Fund, including its Member, Sussex County Community College) vs. Jersey Central Power & Light*. *This report addressed the actions of JCP&L during restoration efforts after a snowstorm, where a community college experienced high voltages, a fire, and electronic equipment damage. This case settled for a nominal amount.*
17. "Enmax Vault Fire Investigation and Assessment," Prepared a report for Enmax assessing a vault fire in downtown Calgary. *This report discusses the methodology and results of a forensic analysis determining the cause and sequence of events for a vault fire that blacked-out a significant portion of downtown Calgary for multiple days.*
18. "Atmos Energy Easement Assessment." Prepared a report for Meritage Corporation for an easement dispute with Atmos Energy Corporation. *This report addressed the reasonable and necessary width of a natural gas pipeline easement that transects The Reserve at West Creek condominium subdivision.*
19. "Salem Harbor Station Assessment." Prepared a report and supplemental report for Dominion Energy for a case involving a boiler explosion resulting in three deaths. *The report performed a detailed review of the history, policies and procedures of the Salem Harbor Station related to plant processes, budgeting, spending, staffing, maintenance, and safety.*
20. "Utility Pole Placement Assessment." Prepared for FirstEnergy Corporation for the Pennsylvania civil case *Wein vs. Supportive Concepts for Families Inc. et. al.* Also gave a deposition testimony related to this report. *This report provides an assessment of Metropolitan Edison Company ("Met-Ed") with respect to utility pole NJ617 (Pole 617), in response to a vehicular collision. This report assesses whether the pole was located in an unsafe position, whether JCP&L had notice that the pole was located in an unsafe position, and whether the pole could be safely and efficiently relocated.*
21. "Utility Pole Placement Assessment." Prepared for FirstEnergy Corporation for the New Jersey civil case *Seals, et al. v. JCP&L, et al.* Also gave a deposition testimony and trial testimony related to this report. *This report provides an assessment of Jersey City Power & Light ("JCP&L") with respect to utility pole 50977-39347, in response to a vehicular collision. This report assesses whether the pole was located in an unsafe position, whether JCP&L had notice that the pole was located in an unsafe position, and whether the pole could be safely and efficiently relocated. The jury found the utility zero percent liable.*
22. "The Function of Electric Transmission and Distribution in the Overall Power System." Prepared for NextEra in support of a tax dispute in Texas. *This report discusses from a technical perspective whether the electric transmission and distribution system is comparable to the distribution systems used for tangible products. The Texas tax code does not allow distribution costs to be included in the calculation of cost-of-goods sold, and contends that the NextEra T&D system is not tax deductible.*
23. Performed an investigation and wrote a report for BC Hydro about a July 14th 2008 fire in a manhole in downtown Vancouver (resulted in the interruption of about 20% of the city). This report was submitted to the regulatory authority of British Columbia.

Developed Courses

Dr. Brown has designed the curriculum, developed the material, and taught the following courses:

1. Distribution System Reliability, 40 hour course.
2. Utility Asset Management, 32 hour course.
3. Business Essentials for Utility Engineers, 40 hour course.
4. Power System Reliability and Risk Modeling, 24 hour course.
5. Utility Infrastructure Hardening, 16 hour course.
6. Capital Project Justification, 8 hour course.
7. Introduction to Electric Utilities, 16 hour course.



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Summary: Deposition of Richard Brown (Redacted Version) electronically filed by Christine M. T. Pirik on behalf of Icebreaker Windpower Inc.