

Public Service Commission of Wisconsin  
Direct Testimony of Ajinkya Rohankar  
Division of Energy Regulation

American Transmission Company LLC, ITC Midwest LLC, and Dairyland Power Cooperative  
Docket 5-CE-146

April 26, 2019

1 **Q. Please state your name, business address, and occupation.**

2 A. My name is Ajinkya P. Rohankar. My business address is 4822 Madison Yards Way,  
3 Madison, Wisconsin 53707-7854. I am employed by the Public Service Commission of  
4 Wisconsin (Commission) as a Public Service Engineer – Advanced in the Division of  
5 Energy Regulation.

6 **Q. Please describe your educational background, professional qualifications, and work  
7 experience.**

8 A. I have a Bachelor of Technology degree in Electrical Engineering from University of  
9 Mumbai, India. I also have a Master of Science degree in Electrical Engineering with a  
10 major in Power Systems from Michigan Technological University. I have worked for a  
11 natural gas distribution company in India as a Trainee Project Engineer for about one year.  
12 I joined the Commission full time in June 2015 as a Public Service Engineer – Senior.

13 Since joining the Commission, I have worked on multiple electric generation and  
14 transmission construction projects. I have performed the need analyses using Electric  
15 Generation Expansion Analysis System computer model for dockets 3270-CE-127<sup>1</sup> and  
16 5-BS-228.<sup>2</sup> In addition, I have used and am continuing to use PowerWorld software to

---

<sup>1</sup> Application of Madison Gas and Electric Company for a Certificate of Authority for Construction, Installation and Placement in Operation of a Wind Electric Generation Facility Known as the Saratoga Wind Farm, in Howard County, Iowa, 2017.

<sup>2</sup> Joint Application of Madison Gas and Electric Company and Wisconsin Public Service Corporation for Approval to Acquire Ownership Interests in Solar Electric Generating Facilities, filed 2018.

1 analyze the need and alternatives for dockets involving major transmission facilities,  
2 including 137-CE-185,<sup>3</sup> 5820-CE-104,<sup>4</sup> 137-CE-184,<sup>5</sup> and 137-CE-186.<sup>6</sup>

3 **Q. What are your responsibilities in this docket?**

4 A. I am one of the project review engineers for this project. My analysis primarily focuses  
5 on the review of the PowerWorld models American Transmission Company LLC (ATC),  
6 ITC Midwest LLC (ITC), and Dairyland Power Cooperative (DPC), (together,  
7 applicants) submitted to show the reliability benefits of the proposed Cardinal-Hickory  
8 Creek 345 kilovolt (kV) transmission line project (Cardinal-Hickory Creek). I was also  
9 responsible for writing some sections of Chapter 3 of the draft Environmental Impact  
10 Statement for the proposed Cardinal-Hickory Creek project.

11 **Q. What are the purposes of your testimony?**

12 A. The purposes of my testimony are to:

- 13 1. explain the applicants' PowerWorld modeling analyses performed regarding the  
14 proposed Cardinal-Hickory Creek project;
- 15 2. summarize Commission staff's PowerWorld modeling results; and
- 16 3. comment on avoided reliability projects and economic benefits analysis  
17 performed by the applicants.

---

<sup>3</sup> Pre-Application of American Transmission Company LLC as an Electric Public Utility for Authority to Construct and Place in Service a New, Double-Circuit 345 kV Transmission Line from an Existing ATC Transmission Line in the Village of Pleasant Prairie, Kenosha County, Wisconsin to a Proposed New Substation in the Village of Wadsworth, Illinois, filed 2017, application withdrawn 2018.

<sup>4</sup> Application of Superior Water, Light and Power Company to Construct 1.9 miles of Double-Circuit 115 kV Transmission Line, One-Half Mile of Single-Circuit 115 kV Transmission Line, and New Nemaaji Switching Station, Located Near the Calumet Superior Refinery in the City of Superior, Douglas County, Wisconsin, filed 2017.

<sup>5</sup> Application of American Transmission Company LLC to Rebuild the Existing 69 kV Transmission Line Between the Finger Road Substation in the City of Green Bay, Brown County, Wisconsin, and the Canal Substation in the City of Sturgeon Bay, Door County, Wisconsin, filed 2016.

<sup>6</sup> Application of American Transmission Company LLC, as an Electric Public Utility, for Authority to Construct a New 345 kV Transmission Line, Substation and Related Facilities, from the Existing 345 kV Transmission System, to Interconnect a New Electric Generating Facility, to be Located in the Town of Beloit, Rock County, Wisconsin, filed 2017.

1 **Q. Have you prepared any exhibits accompanying your testimony?**

2 A. Yes, the following exhibits accompany my testimony:

- 3 • Ex.-PSC-Rohankar-1 Summary of Results of the PowerWorld Analysis
- 4 • Ex.-PSC-Rohankar-2 North American Electric Reliability Corporation (NERC)  
5 Transmission System Planning Performance Requirements Standard TPL-001-4
- 6 • Ex.-PSC-Rohankar-3 ATC 2019 10-Year Assessment Preliminary Needs  
7 Presentation, dated February 28, 2019

8 **Applicants' PowerWorld Modeling**

9 **Q. Please describe the applicants' PowerWorld modeling.**

10 A. Co-applicant ATC performed all the modeling on behalf of the applicants. ATC used  
11 Power System Simulator for Engineering (PSS®E)<sup>7</sup> to assess the reliability benefits of the  
12 proposed Cardinal-Hickory Creek project. PSS®E is a modeling software that can be used  
13 to perform a wide variety of analysis functions, including power flow, dynamics, short  
14 circuit, contingency analysis, and other analyses. ATC used the PSS®E model to evaluate  
15 reliability impacts of each of the studied alternatives. To determine the reliability benefits,  
16 ATC calculated the power flows in Wisconsin, with and without the proposed  
17 Cardinal-Hickory Creek project. Commission staff uses PowerWorld Simulator which has  
18 similar capability and is interchangeable with the modeling software used by ATC.

19 The reliability analysis used four models originally created in the first quarter of  
20 2017 for ATC's 10-Year Assessment. These models represent the expected electric  
21 system in 2027, for varying load forecasts during different times of the year. All the  
22 models included in the reliability analysis were based on Midcontinent Independent

---

<sup>7</sup> Information on PSS®E is available at: <https://new.siemens.com/global/en/products/energy/services/transmission-distribution-smart-grid/consulting-and-planning/pss-software/pss-e.html>.

1 System Operator, Inc. (MISO) Transmission Expansion Planning 17 (MTEP17)  
2 assumptions. While the ATC portions of the models were updated as a part of the 2017  
3 10-Year Assessment, the remainder was taken from MISO 2016 Multiregional Modeling  
4 Working Group models. Loads included in this study were taken from the 2016 load  
5 forecast, and any modifications determined by the various Load Serving Entities within  
6 MISO. The four PowerWorld models were:

- 7 • 2027 Summer Peak (2027S);
- 8 • 2027 Summer Peak 90/10 (2027S 90/10);
- 9 • 2027 Shoulder Peak (2027SH); and,
- 10 • 2027 Shoulder Peak West-to-East Bias (2027SH W-E Bias).

11 As part of the application, ATC evaluated the following alternatives: the proposed  
12 Cardinal-Hickory Creek project; a Non-Transmission Alternative (NTA); a Low-Voltage  
13 Alternative (LVA); and a No-Action alternative (NA) (referred as the “Base” case in my  
14 analysis). ATC modeled each alternative using all the four models.

15 **Q. Please explain the steady state reliability analysis performed by the applicants.**

16 A. ATC performed a steady state reliability analysis for each alternative using the planning  
17 event contingencies defined in NERC Standard TPL-001-4. I have included the copy of  
18 this standard as Ex.-PSC-Rohankar-2. In particular, NERC standard TPL-001-4 sets  
19 forth the requirements that transmission owners need to abide by to ensure that the bulk  
20 electric system continues to successfully operate in the event of failure of one or more  
21 transmission system elements.

22 ATC studied various No Load Loss Allowed (NLL) contingencies that focused on  
23 the Alliant Energy, Madison Gas and Electric Company, DPC, and ITC areas, but also  
24 included selected contingencies in MidAmerican Energy Company, Xcel Energy

1 (Northern States Power Company-Wisconsin (NSPW) and Northern States Power  
2 Company-Minnesota), and Commonwealth Edison Company areas as well. The  
3 controlled Load Loss Allowed contingencies, specifically the events that would be  
4 categorized as NERC planning event category P3 and category P6 contingencies, focused  
5 on a smaller area within southwest and southcentral Wisconsin with 69 kV, 138 kV,  
6 161 kV, and 345 kV transmission system elements.

7 The steady state reliability analysis monitored the thermal loading and bus  
8 voltages for ATC, DPC, ITC, and NSPW. The impacts of the studied planning event  
9 P1.1 contingencies within ATC were screened using the normal operation equipment  
10 ratings. The P1.1 contingencies external to ATC were studied using the emergency  
11 equipment ratings, consistent with all other P1-P7 contingencies. ATC used an  
12 alternating current (AC) power flow solution option for its planning analysis as a part of  
13 the application. In response to Commission staff's various data requests, however, the  
14 analysis used a direct current (DC) power flow solution option. The DC contingency  
15 analysis is useful since it is much faster and provides a very good approximation of a  
16 large AC system.

17 **Q. Discuss Commission staff's initial review of the reliability analysis performed by the**  
18 **applicants.**

19 A. ATC performed its reliability analysis using projected 2027 load models for all the  
20 alternatives considered. Upon receiving the models, Commission staff did verification  
21 runs as a part of the application completeness review process and was able to replicate  
22 the applicants' power flow modeling results using the same set of assumptions used and  
23 as described by ATC. Commission staff used DC contingency analysis during its review  
24 of the proposed Cardinal-Hickory Creek project. Later, Commission staff requested that

1 ATC update their models to ensure that they accurately reflect the configuration of the  
2 current electric system. These updates are discussed in detail in Commission staff  
3 witness Daniel Grant's direct testimony.

4 **Q. Please describe the updated PowerWorld models submitted by the applicants.**

5 A. The Commission's determination that the application was incomplete<sup>8</sup> also requested  
6 updates to the PowerWorld modeling. On September 25, 2018, ATC submitted updated  
7 modeling addressing Commission staff's requests.<sup>9</sup> As a part of the response, ATC made  
8 changes in two out of four models; 2027 S 90/10 and 2027 SH W-E Bias.

9 As a part of an additional data request,<sup>10</sup> Commission staff requested further  
10 updates to the models to include the transmission work intended to be performed as a part  
11 of the preferred river crossing. On December 10, 2018, ATC updated these two models  
12 as a part of its response.<sup>11</sup> I have performed my analysis using these two updated models.

13 **Q. Please describe the additional PowerWorld models submitted by the applicants.**

14 A. On February 11, 2019, as a part of the data request,<sup>12</sup> Commission staff requested  
15 additional PowerWorld modeling, which evaluates the reliability analysis with the  
16 proposed Hill Valley Substation being electrically connected to, and located in the  
17 vicinity of, the existing Hillman Substation in the Platteville, Wisconsin area. On March  
18 7, 2019, ATC provided the data request response.<sup>13</sup>

19 As a part of the same data request, Commission staff also requested additional  
20 PowerWorld modeling, which evaluates the reliability analysis for the "NA" alternative  
21 and proposed Cardinal-Hickory Creek project, under zero and negative load growth

---

<sup>8</sup> PSC REF#: 343192

<sup>9</sup> PSC REF#: 350642.

<sup>10</sup> Ex.-PSC-Data Request: Response 4.75, PSC REF#: 350157.

<sup>11</sup> Ex.-PSC-Data Request: Response 4.75, PSC REF#: 354949.

<sup>12</sup> PSC REF#: 359354

<sup>13</sup> Ex.-PSC-Data Request: Response 8.2, PSC REF#: 360975

1 futures. On March 15, 2019, ATC provided the data request response.<sup>14</sup> I have  
2 replicated these results as provided by the ATC. Commission staff witness Alexander  
3 Vedvik’s direct testimony discussed these results in detail.

#### 4 **Commission Staff’s PowerWorld Modeling**

##### 5 **Q. Describe Ex.-PSC-Rohankar-1.**

6 A. Ex.-PSC-Rohankar-1 summarizes the results of the steady state reliability analysis using  
7 updated 2027S 90/10 and 2027SH\_W-E Bias PowerWorld models. The exhibit  
8 compares the thermal loading of the monitored branches for different alternatives during  
9 various worst contingencies that could occur in the electric system. The branch flow is  
10 shown as a percentage of the applicable rating measured in amperes. The branch rating is  
11 shown in units of mega volt ampere (MVA) as a common convention. The different  
12 columns under “Branch Flow” represent different alternatives, as explained below:

13 1) Base: The “Base” case is the “NA” alternative, as discussed in the  
14 application. Under this alternative, no additional low or high voltage transmission  
15 lines are added to the system and is the alternative against which all other  
16 alternatives are compared to determine the reliability benefits of the proposed  
17 project.

18 2) Base with Badger Hollow & Two Creeks solar: The “Base with Badger  
19 Hollow & Two Creeks solar” alternative represents the “Base” case with two  
20 added solar projects.<sup>15</sup> Two Creeks is a proposed 150 megawatt (MW) AC  
21 photovoltaic (PV) solar generating facility to be located in the in the town of Two  
22 Creeks and the city of Two Rivers, Manitowoc and Kewaunee Counties in

---

<sup>14</sup> Ex.-PSC-Data Request: Response 8.5, PSC REF#: 361520

<sup>15</sup> Solar is dispatched to 50 percent of the requested MW in all the models as per MISO MTEP 17 assumptions.

1 Wisconsin. Badger Hollow is a proposed 300 MW AC PV solar generating  
2 facility to be located in the southwestern Wisconsin near the villages of Montfort  
3 and Cobb in Iowa County. The Commission issued Final Decisions that approved  
4 the Certificate of Public Convenience and Necessity applications for these  
5 proposed solar projects in dockets 9696-CE-100<sup>16</sup> and 9697-CE-100<sup>17</sup> on April  
6 18, 2019.

7 3) Base with asset renewal: The “Base with asset renewal” alternative  
8 represents the “Base” case with certain transmission lines upgraded to new ratings  
9 consistent with current transmission equipment standards. These transmission  
10 lines need to be renewed irrespective of the construction of the proposed  
11 Cardinal-Hickory Creek project. In Ex.-PSC-Data Request: Response 4.78,<sup>18</sup>  
12 ATC provided the original in service date and expected remaining life of certain  
13 transmission lines. As stated in the response, the Turkey River-Stoneman 161 kV  
14 line (DPC portion) would require renewal in 2024, with remaining renewal (ITC  
15 portion) in 2028. Similarly, Townline Road-Bass Creek 138 kV line would  
16 require asset renewal in 2029, with line condition to be reviewed in 2024. In  
17 Ex.-PSC-Data Request: Response 9.4,<sup>19</sup> ATC provided the original in service  
18 date and expected remaining life of Portage-Columbia 138 kV transmission  
19 circuits 1 and 2. As stated in the response, this line is proposed to be  
20 reconducted in 2027.

---

<sup>16</sup> Application for a Certificate of Public Convenience and Necessity of Two Creeks Solar, LLC to Construct a Solar Electric Generation Facility, to be Located in Manitowoc and Kewaunee Counties, Wisconsin, filed 2018

<sup>17</sup> Application for a Certificate of Public Convenience and Necessity of Badger Hollow Solar Farm, LLC to Construct a Solar Electric Generation Facility, to be Located in Iowa County, Wisconsin, filed 2018

<sup>18</sup> PSC REF# 354949.

<sup>19</sup> PSC REF# 364045.

Ex.-PSC-Rohankar-3 is an ATC 2019 10-Year Assessment preliminary needs presentation, dated February 28, 2019. On page 12 of that presentation, for 2029 peak model, ATC discussed that the possible mitigation for Stage Coach to West Middleton 69 kV line and Timberlane Tap to West Middleton 69 kV line overloads due to P13, P32 & P33 category contingency, is a rebuild of that line. The “Base with asset renewal” alternative represents a “Base” case with all of above mentioned transmission lines upgraded to their new ratings. Following table lists the new ratings used in my analysis for this alternative:

**Table 1 Asset Renewal**

No.	Transmission Branch	Upgraded Rating (MVA)
1	Turkey River-Stoneman 161 kV Stoneman-Nelson Dewey 161 kV	478/504
2	Townline-Bass Creek 138 kV	321/426
3	Portage B2-Columbia 138 kV Columbia-Portage 138 kV	321/426
4	West Middleton-Timberlane Tap 69 kV Timberlane Tap-Stagecoach 69 kV	146/201

In Ex.-PSC-Data Request: Response 4.77,<sup>20</sup> ATC provided the new ratings for Turkey River-Stoneman-Nelson Dewey 161 kV line. For other transmission branches, the new ratings came from other existing 69 and 138 kV lines. For the Townline-Bass Creek<sup>21</sup> and Columbia-Portage 138 kV lines, I used the ratings of existing Townline Road-Paddock 138 kV line. For West Middleton-Timberlane Tap-Stagecoach 69 kV line, I used the ratings of existing Richmond-KAT 69 kV line.

<sup>20</sup> PSC REF# 354949

<sup>21</sup>ATC provided similar rating in case of rebuild of the Townline - Bass Creek 138 kV line as a part of avoided reliability projects & economic benefit analysis, PSC REF# 341714

1                    Since the reliability analysis performed by ATC used the projected load  
2 models for 2027 and most of the transmission lines described in Table 1 would  
3 require upgrade before or in 2027, I included this alternative in my analysis to test  
4 whether any targeted build projects are available which would provide similar  
5 reliability benefits to those provided by the proposed Cardinal-Hickory Creek  
6 project.

7                    4)     Base with asset renewal with Badger Hollow & Two Creeks solar: As  
8 name suggests, the “Base with asset renewal with Badger Hollow & Two Creeks  
9 solar” represents “Base with asset renewal” alternative with added two solar  
10 projects as discussed earlier.

11                    5)     Cardinal-Hickory Creek with river crossing at Nelson Dewey: This  
12 alternative represents the proposed Cardinal-Hickory Creek project with  
13 transmission work intended to be performed as a part of preferred Mississippi  
14 River crossing at the Nelson Dewey location.

15                    6)     Cardinal-Hickory Creek with river crossing at Nelson Dewey with Badger  
16 Hollow & Two Creeks solar: This alternative represents the proposed  
17 Cardinal-Hickory Creek project with preferred river crossing with the two added  
18 solar projects discussed earlier. I have included this alternative to show the effect  
19 on the branch flows when both Cardinal-Hickory Creek project and additional  
20 solar units exist in the system.

21                    7)     Cardinal-Hickory Creek with river crossing at Stoneman: This alternative  
22 represents the proposed Cardinal-Hickory Creek project as described in the  
23 application. This alternative assumes the existing Mississippi River crossing at  
24 the Stoneman location.

1 **Q. Please explain why you did not include the LVA and NTA in your analysis as**  
2 **performed by the applicants.**

3 A. As a part of the application, ATC included the LVA and NTA in order to evaluate  
4 whether these alternatives could provide the same overall net benefits as the proposed  
5 Cardinal-Hickory Creek project. The LVA is a combination of a new 138 kV and  
6 345 kV transmission lines assumed to follow the same general route as the Cardinal-  
7 Hickory Creek project. Unlike the proposed project, the LVA has not been approved for  
8 cost-sharing under MISO 2011 Multi-Value Project (MVP) portfolio. The NTA is a mix  
9 of local energy efficiency, demand response, residential solar facilities, and a utility-scale  
10 solar plant connected to the Nelson Dewey 138 kV substation. The NTA would not  
11 include a transmission connection between Iowa and Wisconsin and thus would not  
12 increase the transfer capability by nearly as much as the LVA or the proposed  
13 Cardinal-Hickory Creek project. Since the LVA does not qualify for the MVP treatment  
14 and NTA, as stated by the ATC, would not provide the overall net benefits as that of the  
15 proposed Cardinal-Hickory Creek project, preference was given to the NA alternative and  
16 the proposed Cardinal-Hickory Creek project for further analysis. Even though I did not  
17 include the LVA and NTA in my analysis, I have replicated the results as provided by the  
18 ATC.

19 **Q. Please summarize the results of your PowerWorld analysis.**

20 A. Ex.-PSC-Rohankar-1 summarizes the results of steady state reliability analysis for  
21 different alternatives. A summary of my analysis follows.

22 In the “Base” case, during different contingencies, branch flows are more than  
23 95 percent; and in most cases, more than 100 percent of the applicable rating. The “Base  
24 with Badger Hollow & Two Creeks solar” alternative results in a reduction for most

1 contingencies, meaning those transmission lines are no longer overloaded. Flows under  
2 “Base with Badger Hollow & Two Creeks solar” alternative compared to  
3 “Cardinal-Hickory Creek with river crossing at Nelson Dewey” alternative are similar  
4 during most of the contingencies with the exception of Turkey River–Stoneman–Nelson  
5 Dewey 161 kV lines. The “N/A” in the results means “not applicable,” as the Turkey  
6 River-Stoneman 161 kV branch is disconnected and a new Turkey River-Nelson Dewey  
7 161 kV line with updated rating is inserted as a part of the preferred Mississippi River  
8 crossing. For the Stoneman-Nelson Dewey 161 kV line, branch flows are negligible in  
9 “Cardinal-Hickory Creek with river crossing at Nelson Dewey” alternative as compared  
10 with other alternatives because of the change in transmission topography.

11 For “Base with asset renewal” alternative, overall, flows are much lower than any  
12 other alternatives because of the upgraded MVA ratings of some of the transmission  
13 lines. When proposed solar projects were included with asset renewal alternative, branch  
14 flows are reduced further. I have added the two proposed solar projects in the “Cardinal-  
15 Hickory Creek with river crossing at Nelson Dewey” alternative as well to see how  
16 Cardinal-Hickory Creek would perform under these contingencies when additional solar  
17 units exist in the system. The flows are similar in “Cardinal-Hickory Creek with river  
18 crossing at Nelson Dewey” and “Cardinal-Hickory Creek with river crossing at Nelson  
19 Dewey with Badger Hollow & Two Creeks solar” alternatives. The flows in  
20 Cardinal-Hickory Creek alternatives are similar for most of the contingencies, as the only  
21 change in the models are the transmission facilities immediately adjacent to the river. I  
22 would note that in the 2027 S 90/10 model, certain monitored branches are still  
23 overloaded during some of the worst contingencies even when proposed  
24 Cardinal-Hickory Creek transmission line is present in the system.

1           The complete steady state reliability results with NLL, P2-P7, P3 and P6 category  
2 contingencies are included in Ex.-PSC-Rohankar-1, tables 1 through 8. The data under  
3 “Worst Contingency” column contains Critical Energy Infrastructure Information and is  
4 available for inspection at the Commission’s offices, subject to any and all confidentiality  
5 considerations.

## 6 **Avoided Reliability Projects and Economic Benefits Analysis**

7 **Q. Did you review the avoided reliability projects and economic benefits analysis as**  
8 **described by the applicants?**

9 A. Yes. For avoided reliability benefits calculation, ATC added cost estimates for projects  
10 that would be needed to eliminate the local reliability violations. These identified  
11 projects are needed to resolve system conditions for thermal overloads with NLL  
12 contingencies that could occur on the system. Additional overloads due to other NERC  
13 categories, such as P3, P6 and P2-P7 are not included in these calculations, as system  
14 adjustments can be made after the first contingency and before the second contingency.  
15 The economic benefit calculation includes conceptual projects needed to resolve three  
16 overloaded branches, namely; Turkey River-Stoneman 161 kV line, Stoneman-Nelson  
17 Dewey 161 kV line and Townline Road-Bass Creek 138 kV line.

18 **Q. Do you have any comments about these overloaded branches involved in the**  
19 **avoided reliability benefits calculation?**

20 A. Yes. From Ex.-PSC-Rohankar-1, Tables 1 and 2, it is clear that the proposed  
21 Cardinal-Hickory Creek project helps in relieving the NLL contingencies for these  
22 overloaded branches, however it is also clear that some of these contingencies can be  
23 relieved when the two proposed solar projects are present in the “Base” case.

1 Commission staff witness Mr. Vedvik discusses the avoided reliability projects and  
2 economic benefits analysis in detail in his direct testimony.

3 **Q. What do you conclude from your analysis?**

4 A. After reviewing various contingency analysis results, it is clear that the proposed  
5 Cardinal-Hickory Creek project would provide overall reliability benefits. However, my  
6 analysis also shows that the addition of more renewables (solar) in Wisconsin helps in  
7 improving the power flows on those monitored transmission branches. The “NA”  
8 alternative with two upcoming solar projects shows similar branch flows as the proposed  
9 Cardinal-Hickory Creek project for some of the monitored branches. The targeted build  
10 alternative, “Base with asset renewal” avoided all the overloads of the monitored  
11 branches by relieving some of the worst contingencies.

12 The results of any engineering model are only as good as the inputs considered by  
13 the modeler. I understand that my reliability analysis has its limitations; as it is  
14 impossible to anticipate and model each and every scenario. I also understand that the  
15 reliability analysis results could change as new electric generation comes online in the  
16 future within the Cardinal-Hickory Creek project study area. Since it is impossible to  
17 predict the future, the best one can do is to cover a range of alternatives when reviewing  
18 such complex project. As such, the intent of my analysis is to augment the applicants’  
19 analysis, not replace it.

20 **Q. Does this conclude your direct testimony?**

21 A. Yes it does, however I reserve the right to file supplemental direct testimony if needed.

AR:jar:jlt:DL: 01676715