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Witness: Edward C Pfeiffer
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Clean Line LLC
Case No.: EA-2016-0358
Date Testimony Prepared: February 21, 2017

MISSOURI PUBLIC SERVICE COMMISSION
CASE NO. EA-2016-0358

SURREBUTTAL TESTIMONY OF
EDWARD C. PFEIFFER
ON BEHALF OF
GRAIN BELT EXPRESS CLEAN LINE LLC

February 21, 2017

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1 **I. INTRODUCTION**

2 **Q. Please state your name, present position, and business address.**

3 A. My name is Edward C. Pfeiffer and I am an Executive Advisor at Quanta Technology,
4 LLC (“Quanta Technology”). My business address is 4020 Westchase Boulevard,
5 Suite 300, Raleigh, NC 27607.

6 **Q. Have you previously submitted prepared testimony in this proceeding?**

7 A. Yes, I submitted direct testimony on August 29, 2016.

8 **Q. What is the subject matter of this surrebuttal testimony?**

9 A. In my direct testimony I introduced a Loss of Load Expectation (“LOLE”) study
10 (“Previous LOLE Study”) performed under my direction and supervision which
11 quantified how the Grain Belt Express Clean Line transmission project (“Grain Belt
12 Express Project” or “Project”) reduces the risk that power supplies committed to meeting
13 Missouri’s energy demands will be unable to do so. In this surrebuttal testimony, in
14 response to the Missouri Public Service Commission Staff (“Staff”) discussion in their
15 testimony (“Staff Rebuttal Report” or “Staff Report”), I will explain the assumptions I
16 used in the Previous LOLE Study. I will also present the results of an update of the
17 Previous LOLE Study with modified and updated assumptions to address discussion in
18 the Staff Report (“Updated LOLE Study”).

19 **II. PREVIOUS LOLE STUDY – CLARIFICATIONS**

1 **Q. On page 10 of the Staff Report, Mr. Beck asserts that the Previous LOLE Study’s**
2 **assumption that “500 MW of capacity is guaranteed to be delivered to Missouri at**
3 **any given time” is flawed. Is it a valid assumption that 500 MW is continuously**
4 **available to Missouri from the Project?**

5 A. Yes, it is. The 500 MW of supplemental capacity represented by the Project is
6 transmission tie-capacity which, although providing preferential access to the firm
7 subscribers on the Project such as wind generators in western Kansas, also provides
8 access to a diverse fleet of power generators in other regions of the country in Southwest
9 Power Pool (“SPP”) and PJM Interconnection (“PJM”). The 500 MW of deliverability
10 represented by the Project is a very small fraction of the total generation within the SPP
11 and PJM regions.

12 There are several reasons why my assumption is reasonable. SPP, MISO and
13 PJM have substantial load diversity, meaning they hit peak loads at different hours and
14 seasons of the year. In addition, there is an extremely low probability of concurrent
15 capacity contingency events over as wide a footprint as SPP, MISO and PJM. As a
16 result, SPP, MISO and PJM need the maximum available generation at different times.
17 Load diversity and the extremely low probability of overlapping contingent events will
18 result in a constant value of supplemental emergency capacity available to be delivered
19 by the Project. Grain Belt Express witness Dr. Galli provides further discussion why 500
20 MW can be transmitted from SPP or PJM to the Missouri converter station.¹

21 **Q. On pages 10-11 of the Staff Report, Mr. Beck asserts that it is possible that there**
22 **will not be any direct tie between the Project and SPP. Will there be transmission**
23 **connections between the Project and SPP?**

¹ Surrebuttal Testimony of Dr. Anthony Wayne Galli, P.E., pp. 31-33.

1 A. Absolutely. Given that Grain Belt Express' has always intended that the Project has a
2 direct physical tie to SPP, Grain Belt Express sent Staff a data request to clarify its
3 statement in the Staff Report. In response, Staff confirmed that the intent of their
4 statement in the Staff Report was, in fact, to assert that there is no way to know whether
5 there will be an interconnection between the Project and the SPP system.² Further, Staff
6 states there "there is also the possibility that very weak interconnections might exist that
7 provide a tie to SPP but the capacity of that tie is very small and nowhere near the 4000
8 MW of capacity that is discussed in the Application and direct testimony."³

9 There is no basis for Staff to question whether there will be transmission
10 interconnections between the Project and SPP. Based on my understanding of the Project
11 description⁴ and the interconnection agreement between Grain Belt Express and SPP,⁵ a
12 physical tie-line will absolutely exist. Further, there is no expectation that the
13 interconnection between the Project and SPP would need to be rated at 4,000 MW. For
14 my analysis, it is sufficient to assume that the interconnection between the Project and
15 SPP supports delivery of 500 MW of capacity to the Missouri HVDC Converter Station.

16 **Q. On page 11 of the Staff Report, Mr. Beck asserts that limiting the geographic area**
17 **of the LOLE study is flawed because many utilities that serve load in Missouri also**
18 **serve load in adjoining states. Is the analysis flawed due to limiting the scope to the**
19 **State of Missouri?**

² Staff Responses to Grain Belt Express Clean Line LLC's First Set of Data Requests Directed to Staff Witness Beck, Question and response #3.b., p. 2.

³ Staff Responses to Grain Belt Express Clean Line LLC's First Set of Data Requests Directed to Staff Witness Beck, Question and response #3.c., pp. 2-3.

⁴ Direct Testimony of Dr. Anthony Wayne Galli, P.E., p.4, lines 2-11 and p.5, lines 5-22.

⁵ Surrebuttal Testimony of Dr. Anthony Wayne Galli, P.E., p.30 and fn.50.

1 A. Not at all. The intent of my LOLE study is to quantify the LOLE benefit that the load
2 customers within the State of Missouri would derive from the Project. The study was not
3 intended to justify the Project as necessary to meet the resource adequacy metrics of
4 specific utilities or regional transmission organizations (“RTOs”) within the State of
5 Missouri.

6 The loads modeled in my analyses were limited to those physically within the
7 State of Missouri in addition to external obligations and real power losses as described in
8 Schedule ECP-1.⁶ These adjustments attempt to address the “operational realities for
9 Missouri utilities” Mr. Beck describes in his Staff Report.⁷ Mr. Beck goes on to discuss
10 several generator assumptions for which I provide clarification later in this testimony.

11 Importantly, my study calculates the *probability of lost service* to Missouri load
12 customers based on a set of assumptions that look at Missouri as an autonomous region.
13 That *probability of lost service* decreases with the Project’s introduction of supplemental
14 emergency capacity via a new transmission path that interconnects to the SPP and PJM
15 regions. In this kind of analysis, what really matters most is the difference between the
16 two cases and not the specific assumptions regarding which loads or generators were
17 included or excluded and why. As long as no changes were made to those assumptions
18 between the cases with and without the Project – and none were made – the results are
19 reliable and should be considered as one of the benefits provided by an interregional,
20 controllable transmission path like the Project.

21 **Q. Mr. Beck states, on pages 10-11 of the Staff Report, that SPP’s 79,000 MW of**
22 **installed capacity cannot be available to Missouri customers because Staff’s opinion**

⁶ Schedule ECP-1, p.12

⁷ Staff Rebuttal Report, p.12.

1 **is that there is no way to determine the amount of [transmission] capacity that will**
2 **be “tied to the SPP integrated market.” Is it important to determine an amount of**
3 **the Project’s transmission capacity that will be “tied to the SPP integrated market”?**

4 A. No. The benefits are based on access to supplemental emergency capacity to augment
5 the generator capacity serving demand in the State of Missouri. Access to supplemental
6 capacity is a common practice in LOLE studies. My assumption is that 500 MW of
7 transmission capacity is available to serve load from the Missouri HVDC Converter
8 Station regardless of the power sources providing that load service. The fact that the
9 Project will provide direct access to both the SPP and PJM markets does guarantee the
10 ability, at any time, to provide 500 MW to Missouri customers from the Missouri HVDC
11 Converter Station. Mr. Beck states, on page 11 of the Staff Report, that it is unreasonable
12 to assume that Missouri would be given access to all 79,000 MW of SPP market capacity
13 to meet up to 500 MW of demand at the Missouri node.” But this is not the Previous
14 LOLE Study’s assumption. The assumption is that 500 MW, not 79,000 MW, of
15 additional capacity is available. Only a very small fraction of the resources in SPP and
16 PJM need to be available for my assumption to be correct.

17 Grain Belt Express has not stated that the capacity available via the Missouri
18 HVDC Converter Station is required by Load Serving Entities (“LSE”) in Missouri to
19 meet pre-existing resource adequacy metrics. Rather, the Project provides the option for
20 real-time assistance in times of generation deficits in Missouri. This is an undeniable
21 reliability benefit. A project need not solve a pre-existing reliability deficiency to
22 improve reliability.

1 **Q. Mr. Beck points out, on page 11 of the Staff Report, that some of the generators**
2 **included in the LOLE study as available to serve Missouri are also part of the**
3 **quoted 79,000 MW of installed capacity in SPP. Is this accurate?**

4 A. Yes. However, my intent in describing the amount of installed capacity in SPP (and
5 PJM) is to emphasize that the Project creates a new, interregional transmission path from
6 Missouri to these vast markets. As I will demonstrate below, even if the generators
7 already assumed to be available to serve Missouri are removed from the available SPP
8 capacity, there remains more than sufficient SPP capacity to provide 500 MW to the
9 Missouri converter station.

10 **Q. Do the generators that are already included in the LOLE study as available to serve**
11 **Missouri substantially reduce the number of generators in the SPP integrated**
12 **market to which the Project provides access?**

13 A. No. Table 2-1 of Schedule ECP-1, as I discuss in more detail later in this testimony, is a
14 summary of generators either located in Missouri and/or owned by utilities that operate in
15 Missouri. If all of the generators from Table 2-1 of Schedule ECP-1 that are located in
16 SPP were excluded from the 79,000 MW of installed capacity, the Project would instead
17 be providing access to approximately 66,700 MW of installed capacity within the SPP
18 market.

19 Further, if we reduce the installed capacity within the SPP market by the
20 combination of all of the external resources represented in Section 2.7 “Imports” of
21 Schedule ECP-1, SPP’s market still offers access to over 64,000 MW of installed
22 capacity above those resources already included in the LOLE analysis. This calculation
23 doesn’t take into consideration access to the additional supplemental resources in PJM –

1 an even larger market than SPP. Again, the scale of the SPP and PJM markets is so large
2 that Grain Belt Express must access only a small fraction to make the assumption in the
3 Previous LOLE Study correct.

4 **Q. Is it practical to assume that there would be enough surplus generator capacity**
5 **available within SPP to supplement the capacity from the Project-interconnected**
6 **generators in Kansas in order to deliver 500 MW of power to Missouri during**
7 **generation deficits?**

8 Yes. The SPP market has a reference reserve margin level of 12%. During the period of
9 2017 – 2026, projected peak SPP demand (including SPP loads in Missouri) will range
10 from 51,000 – 55,000 MW, resulting in a need for around 6,100 – 6,600 MW of installed
11 capacity reserves.⁸ SPP's generator resource projections for this same period are 63,000
12 – 65,000 MW. This means that SPP will meet their target reserve margin but will also
13 have no less than 1,200 MW of additional capacity above this reserve margin
14 requirement. This additional capacity could supply Missouri loads even if there were
15 concurrent peak load events across all of SPP and Missouri, which itself is a low
16 probability event. The Project is being designed to deliver 500 MW to the State of
17 Missouri at any given time; 500 MW is less than eight percent (8%) of the SPP reserve
18 capacity of 6,600 MW. I do not have to assume that any specific SPP generators are
19 designated to serve loads within the State of Missouri in order to have confidence that the
20 combination of SPP's generating resources and the Project-interconnected generators in
21 Kansas will be available to deliver 500 MW to the Missouri HVDC Converter Station at

⁸ *NERC 2016 Long-Term Reliability Assessment*, December 2016, pp.44-46, available at:
<http://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/2016%20Long-Term%20Reliability%20Assessment.pdf>; last accessed on 02/21/2017

1 any time. Moreover, even in the rare event that SPP generators might not be available,
2 generators in PJM would still be available to deliver to Missouri.

3 **Q. Does Table 2-1 in Schedule ECP-1 (“Generating Unit Population”) reflect the**
4 **generation resources which were modeled in your LOLE study?**

5 A. No. The table requires clarification and appears to have caused some confusion. As
6 noted in Section 2.1 of Schedule ECP-1, Table 2-1 represents “a population of generating
7 units in Missouri developed by [Grain Belt Express witness] Mr. Neil Copeland of GDS
8 Associates, Inc. ... based on the MISO “Business as Usual” scenario for 2022 from the
9 2015 MISO Transmission Expansion Plan (MTEP) model.” I continue in that Section to
10 state that “[t]he same population of generating units was used in this [LOLE] analysis.
11 This generator population, as provided by Grain Belt Express witness Mr. Copeland, was
12 used with minor modification, primarily in separating equivalent models of the entire
13 Keokuk, Osage and Taum Sauk hydro and pumped storage plants into individual unit
14 models.” In other words, I made several edits to the generating unit population in Table
15 2-1 before performing the Previous LOLE Study. In fact, many of the edits I made to the
16 generating unit population in the Previous LOLE Study already addressed concerns
17 provided by Staff witness Mr. Beck in his rebuttal testimony. For the purposes of clarity,
18 **Schedule ECP-3** attached to this testimony reflects all changes I made to the generation
19 database in the Previous LOLE Study, presented in the same format as Table 2-1 from
20 Schedule ECP-1. **Schedule ECP-3** reflects the changes made to Table 2-1 of ECP-1,
21 including the addition of external resources which are designated to serve loads within
22 the State of Missouri such as the Ameren Missouri resources in Illinois and Iowa, the
23 portion of the Wolf Creek Nuclear Unit committed to Missouri, the SWPA and Grand

1 River Dam Authority hydro capacity designated by Associated Electric, and other jointly
2 owned capacity. In addition, **Schedule ECP-3** reflects adjustments made to generation
3 capacity physically located in the State of Missouri which are designated for supply to
4 loads outside of Missouri. A list of the specific modifications to the generator database
5 summarized in Table 2-1 of Schedule ECP-1 is included as **Schedule ECP-4**.

6 **III. UPDATED LOLE STUDY – MODIFIED ASSUMPTIONS**

7 **Q. Staff witness Mr. Beck questions various generator assumptions on pages 11-15 of**
8 **the Staff Report. Do the clarifications about the Previous LOLE Study in Schedules**
9 **ECP-3 and ECP-4 address all of Mr. Beck’s concerns?**

10 A. Not all of them.⁹ After consideration of the generation assumptions actually used for the
11 Previous LOLE Study, as provided in Schedules ECP-3 and ECP-4, there remained a
12 handful of Mr. Beck’s concerns that the Previous LOLE study did not address. Based on
13 Mr. Beck’s comments in the Staff Report, I updated my generator assumptions and re-ran
14 my analysis (“the Updated LOLE Study”).

15 On page 11 of the Staff Report, Mr. Beck stated that the 200 MW Osborn Wind
16 Project, the 300 MW Rock Creek Wind Project, and the 250 MW Riverton Combined
17 Cycle unit all expect to achieve commercial operation this year and were missing from
18 the Previous LOLE Study generator database. These three facilities have been included
19 in the generator database of the Updated LOLE Study.

20 On page 13 of the Staff Report, Mr. Beck discusses the amount of capacity
21 allocated to serve Missouri loads from the two coal units at the La Cygne station. Mr.

⁹ All of the questions raised by Mr. Beck related to the following units were addressed by providing the list of units actually used in the Previous LOLE Study: La Cygne (Staff Rebuttal Report, p.13), JEC (p.13), Plum Point (p.13), Illinois and Kansas CT units (p.14), Spearville Wind (p.14), Hydro units (pp. 14-15), landfill gas units (p.15).

1 Beck highlights that allocating one unit versus another at the same plant would be
2 meaningful since they are likely to have different forced outage rates. It should be noted
3 that I used forced outage rates in my LOLE studies based on the technology of each unit
4 and not based on actual operational data.¹⁰ In this case, both La Cygne units would have
5 the same forced outage rate, therefore it does not matter which unit is allocated to
6 Missouri.

7 **Q. Does that conclude the modifications that you made for the Updated LOLE Study?**

8 A. No. I made some other, limited refinements to the generator database from the Previous
9 LOLE Study. These include (1) increased the coal capacity imports from 344 MW to 586
10 MW and reduced the gas-based imports by 35 MW,¹¹ (2) updated the nameplate rating of
11 the Farmers City Windfarm from 0 MW to 146 MW,¹² and (3) changed the capacity
12 value of the Hawthorne coal plant from 550 MW to 559 MW. **Schedule ECP-5**
13 summarizes the changes made to the generator assumptions used in the Updated LOLE
14 Study. **Schedule ECP-6** summarizes the generation, by-utility, and follows the same
15 format as **Schedule ECP-3**.

16 **Q. Does the Updated LOLE Study include two cases – the State of Missouri without the**
17 **Project and then with the 500 MW capacity injection from the Project after it is**
18 **operational?**

19 A. Yes. However, I also performed a third case using the unlikely scenario where only
20 power generated by the Project-interconnected wind generator facilities in Kansas can be
21 injected by the Missouri HVDC Converter Station. This scenario ignores the

¹⁰ Schedule ECP-1, Section 2.2 *Unit Forced Outages*, p.8.

¹¹ This reflects changing the Plum Point coal plant capacity from a Gas CT-based import to a Coal-based import.

¹² The Farmers City Windfarm was included in the Previous LOLE Study database but was not assigned a nameplate rating.

1 interregional nature of the Project and the access to the SPP and PJM markets that will be
 2 available due to the Project’s interconnections. However, the fact that even this scenario
 3 produces a reliability benefit demonstrates that the reliability benefit of the Project does
 4 not wholly depend on the ability to access generation in SPP and PJM.

5 **IV. UPDATED LOLE STUDY – RESULTS**

6 **Q. What is the expected impact on LOLE for the State of Missouri due to the Project?**

7 A. Without the Project, the 2022 Loss of Load Expectation, is as follows.

Index	Total
Loss of Load Expectation (Days)	0.004
Loss of Load Expectation (Hours)	0.007
Loss of Load Expectation (MWh)	1.9

8
 9 Leaving all other factors the same and inserting the more likely full 500 MW
 10 contribution of the Grain Belt Express Project, the LOLE is as follows.

Index	Total	Impact from the Project
Loss of Load Expectation (Days)	0.001	-75%
Loss of Load Expectation (Hours)	0.001	-85%
Loss of Load Expectation (MWh)	0.2	-89%

1 Leaving all other factors the same and inserting the less likely wind-weighted
2 capacity contribution of the Grain Belt Express Project,¹³ the LOLE is as follows.
3

Index	Total	Impact from the Project
Loss of Load Expectation (Days)	0.001	-75%
Loss of Load Expectation (Hours)	0.005	-28%
Loss of Load Expectation (MWh)	1.3	-31%

4
5 **Q. Based on the results of your Updated LOLE Study, what is your conclusion as to**
6 **whether installation of the Grain Belt Express Project will increase the reliability of**
7 **electric service in Missouri?**

8 A. The Project has a substantial and favorable effect on the reliability of electric service in
9 Missouri. The primary measures of reliability are each improved by approximately 75-
10 89% in the more likely scenario where 500 MW is available to Missouri from the Project
11 and 31-75% in the less likely scenario where only the Project-interconnected generator
12 facilities in Kansas are available to Missouri from the Project.

13 **Q. Does this conclude your surrebuttal testimony?**

14 A. Yes.

¹³ The wind-weighted capacity of the Project was assumed to be 19.5% based on the method described on Schedule DAB-5 in Grain Belt Express witness Mr. Berry's direct testimony. The estimate uses MISO's current accredited capacity for wind in Missouri, and increases the value based on the ratio of the capacity factor of Kansas wind generation to the capacity factor of Missouri wind generation.

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Grain Belt Express)
Clean Line LLC for a Certificate of Convenience and)
Necessity Authorizing it to Construct, Own, Control,)
Manage, Operate and Maintain a High Voltage, Direct)
Current Transmission Line and an Associated Converter)
Station Providing an Interconnection on the Maywood-)
Montgomery 345 kV Transmission Line)

Case No. EA-2016-0358

AFFIDAVIT OF EDWARD C. PFEIFFER

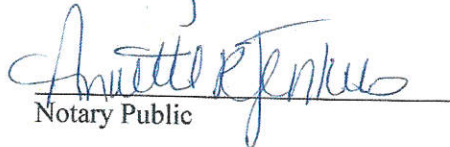
STATE OF Colorado)
COUNTY OF Larimer) ss

Edward C. Pfeiffer, being first duly sworn on his oath, states:

1. My name is Edward C. Pfeiffer. I am an Executive Advisor at Quanta Technology, LLC.
2. Attached hereto and made a part hereof for all purposes is my Surrebuttal Testimony on behalf of Grain Belt Express Clean Line LLC consisting of 1A pages, having been prepared in written form for introduction into evidence in the above-captioned docket.
3. I have knowledge of the matters set forth therein. I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded, including any attachments thereto, are true and accurate to the best of my knowledge, information and belief.


Edward C. Pfeiffer

Subscribed and sworn before me this 21 day of February, 2017.


Notary Public

My commission expires: January 25, 2019

