

Exhibit No.: ____
Issues: Generation Capacity and Reliability
Witness: Edward C Pfeiffer
Sponsoring Party: Grain Belt Express
Clean Line LLC
Type of Exhibit: Direct Testimony
Case No.: EA-2016-0358
Date Testimony Prepared: August 30, 2016

MISSOURI PUBLIC SERVICE COMMISSION

CASE NO. EA-2016_0358

DIRECT TESTIMONY OF

EDWARD C. PFEIFFER

ON BEHALF OF

GRAIN BELT EXPRESS CLEAN LINE LLC

August 30, 2016

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1 **I. WITNESS INTRODUCTION AND PURPOSE OF TESTIMONY**

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, LLC
4 (“Quanta Technology”). My business address is 4020 Westchase Boulevard, Suite 300,
5 Raleigh, NC 27607.

6 **Q. What is the business of Quanta Technology?**

7 A. Quanta Technology is a full service consulting firm providing a variety of services to the
8 utility industry with clients that include utilities, Regional Transmission Organizations
9 (“RTOs”), as well as industry research and support organizations, among others. Included
10 in the many services we provide are transmission and resource planning services.

11 **Q. What are your duties and responsibilities as an Executive Advisor?**

12 A. As an Executive Advisor, I provide direction to our analysis teams in the performance of
13 their study work. I also perform various analytical studies for and provide technical
14 expertise to our clients.

15 **Q. Please describe your education and professional background.**

16 A. I received a Bachelor of Science in Electrical Systems and Sciences Engineering from
17 Southern Illinois University, Carbondale in 1975 and a Master of Science degree in
18 Electrical Systems and Sciences Engineering from Southern Illinois University,
19 Carbondale in 1978. I was employed by Union Electric, which became Ameren, from 1978
20 until 2009. During my time at Ameren, I performed a variety of engineering studies
21 including transmission interconnection, generation interconnection, transmission service,
22 and import/transfer capability studies. I was the Supervising Engineer of the operational
23 planning group and was the Manager of Transmission Planning when I retired from
24 Ameren. I was a member of the North American Electric Reliability Corporation

1 (“NERC”) Planning Committee and the chair of the SERC Engineering Committee. While
2 serving on the NERC Planning Committee I was a member of the Transmission
3 Availability Data System Task Force and the Generation and Transmission Reliability
4 Models Task Force. I participated in several planning groups and committees at the
5 Midcontinent Independent System Operator (“MISO”, formerly the Midwest Independent
6 Transmission System Operator), including observing the Loss of Load Expectation
7 (“LOLE”) Working Group materials to keep abreast of transmission issues related to
8 resource adequacy. I also participated in the Ameren Integrated Resource Plan for
9 Missouri as it pertained to transmission issues. Since leaving Ameren, I have provided
10 consulting services to different clients, including the assessment of transmission and
11 generation interconnections, evaluation of the availability of transmission service, and
12 participation in the Eastern Interconnection Planning Collaborative on behalf of a
13 consortium of Non-Government Organizations. Finally, I am a licensed Professional
14 Engineer in the State of Missouri.

15 **Q. Please describe the study teams’ and your background in performing reliability**
16 **benefit studies.**

17 A. I collaborated with Alex Schneider, PE of Quanta Technology, in performing the LOLE
18 analyses, which is supported by my testimony. Mr. Schneider has extensive experience in
19 performing a variety of statistical analyses, including LOLE studies. Mr. Schneider
20 performed LOLE studies when he was a staff member at the Mid-American
21 Interconnection Network reliability entity. He has also performed LOLE studies for
22 various clients as a consultant. As the Manager of Transmission Planning for Ameren, I
23 was directly responsible for assessing the reliability of the Ameren transmission system,
24 ensuring compliance with NERC Planning Standards, developing a long range

1 transmission plan to maintain the reliability of the Ameren transmission system, and
2 assessing the benefits to the Ameren system of proposed transmission expansion plans.

3 **Q. What is the purpose of your direct testimony?**

4 A. I am testifying to the reliability benefits that the Grain Belt Express Clean Line
5 transmission project (the “Grain Belt Express Project” or “Project”) will provide to the
6 State of Missouri. Specifically, I will describe the LOLE study for the Project that Quanta
7 Technology performed and which is attached hereto as Schedule **ECP-1**. In addition, I
8 will describe the intent of an RTO’s interconnection study process for the Project and the
9 benefits of interregional transmission access provided by the Project.

10 **II. SUMMARY OF LOSS OF LOAD EXPECTATION ANALYSIS**

11 **Q. Please define LOLE and explain how it provides a gauge of system reliability.**

12 A. An LOLE or Loss of Load Probability (“LOLP”) analysis is a statistical comparison of the
13 electrical load of a given power system and the available generation resources to supply
14 that load. The statistical analysis takes into consideration peak load demand, hourly load
15 profile, generation capacity, and the availability of the generation capacity. LOLP
16 represents the probability that the available resources in any given hour are not sufficient
17 to meet the load. The sum of these hourly LOLP values over the course of a year can be
18 interpreted as the LOLE for the year, or the number of expected time periods in which there
19 will not be enough generation to meet load during a given year. The sum of the expected
20 energy needs unserved in a year, expressed in megawatt-hours, is the loss of energy
21 expectation (“LOEE”).

1 **Q. Are the LOLE study and the methodology you describe in this testimony generally**
2 **accepted in the electric industry as measures of reliability?**

3 A. Yes. LOLE studies have been conducted for several decades in the determination of proper
4 capacity reserve levels and remain an important component in the transmission expansion
5 planning processes of RTOs. The details of the methodology and inputs of this analysis
6 are described in **Schedule ECP-1**.

7 **Q. What was the geographic scope of your LOLE analysis?**

8 A. The geographic scope of this analysis was the State of Missouri. The analysis considered
9 limited interconnections to neighboring states representing the resources and obligations
10 of Missouri utilities which are physically located outside of Missouri.

11 **Q. What comparative cases were developed for the LOLE study?**

12 A. The LOLE analysis looked at two cases. One, the “Base Case”, considered Missouri, as
13 defined by the inputs available for this analysis, without the 500 MW of capacity made
14 available by the Grain Belt Express Project. The second case, the “Grain Belt Express
15 Case”, considered the same system as the Base Case plus the inclusion of the 500 MW of
16 capacity made available by the Grain Belt Express Project within Missouri. The difference
17 between these two cases is solely attributable to the addition of the Grain Belt Express
18 Project.

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

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

Index	Total
Loss of Load Expectation (Days)	.013
Loss of Load Expectation (Hours)	.040
Loss of Energy Expectation (MWh)	18.8

1 Leaving all other factors the same and inserting the 500 MW contribution of the
2 Grain Belt Express Project as described above, the LOLE is as follows.

Index	Total	Impact from the Project
Loss of Load Expectation (Days)	.004	-69%
Loss of Load Expectation (Hours)	.014	-65%
Loss of Energy Expectation (MWh)	6.5	-65%

3
4 **Q. Based on the results of your LOLE study, what is your conclusion as to whether**
5 **installation of the Grain Belt Express Project will increase the reliability of electric**
6 **service in Missouri?**

7 A. The Project has a substantial and favorable effect on the reliability of electric service in
8 Missouri. The primary measures of reliability are each improved by approximately 65 –
9 70%.

10 **III. ROLE OF THE REGIONAL PLANNING AUTHORITY AND BENEFITS OF**
11 **INTER-REGIONAL TRANSMISSION**

12 **Q. Have you worked with any RTO/ISO or other Regional Planning Authority?**

13 A. Yes. In my roles as a transmission planner and as the Manager of Transmission Planning
14 at Ameren, I have been involved in numerous planning activities, including generation
15 interconnection studies, regional transmission planning, calculation of Available
16 Transmission Capacity, and regional cost allocation.

17 **Q. What is the intent of the MISO interconnection study process?**

18 A. The intent of the MISO interconnection study process is to evaluate the impact of a
19 proposed new or modified interconnection project, such as the Grain Belt Express Project's
20 connection to the Ameren Missouri transmission system, to ensure that the proposed
21 interconnection does not have a negative impact on the reliability of the Ameren Missouri

1 transmission system or those of neighboring systems. MISO accomplishes this through
2 the commission of an impact study to assess the impact of the new or modified
3 interconnection project with respect to NERC Transmission Planning (“TPL”) standards.

4 **Q. What are the benefits of interregional transmission access as a result of the Grain Belt**
5 **Express Project?**

6 A. The Project will provide Missouri with the delivery of 500 MW of wind resources directly
7 connected to the western converter station in Kansas without any exposure to market
8 congestion in the intervening Southwestern Power Pool, Inc. (“SPP”) transmission system.
9 In addition, the Project will also provide access to available capacity and energy resulting
10 from market and load diversity from the 79,000 MW of installed capacity in SPP and the
11 185,000 MW of installed capacity in PJM Interconnection, LLC (“PJM”). Capacity and
12 energy, which can be delivered to the Grain Belt Express Project converter stations in either
13 of these markets, will be able to reach the Missouri loads without potential limitations or
14 added congestion charges that would otherwise result from transmission constraints on the
15 intervening alternating current (“AC”) networks. The ability to avoid such upstream
16 constraints and congestion charges will increase access for the State of Missouri to these
17 large reservoirs of capacity and energy.

18 **Q. Is there anything unique about Missouri with respect to its location that further**
19 **highlights the benefits of additional market access that is made available by the Grain**
20 **Belt Express Project?**

21 A. Yes. Missouri is electrically diverse in that there are four Transmission Service Providers
22 (“TSPs”) that operate within the state – SPP, MISO, Associated Electric Cooperatives, Inc.,
23 and Southwestern Power Administration. This means that the flow of power across, into,
24 and out of the State of Missouri could require multiple transmission wheels and

1 coordination with multiple TSPs. Additionally, the electric system within the State of
2 Missouri is overseen by three Reliability Coordinators (SPP, MISO, and the Tennessee
3 Valley Authority) and two NERC Regional Entities (SERC Reliability Corporation-
4 Gateway and SPP-North). Also, Missouri is in the MISO Central sub-region with limited
5 access to the MISO South sub-region to which it has a direct 500 kV connection. The
6 various entities providing oversight of reliability, energy markets, and resource and
7 transmission planning efforts introduces difficulty in identification of and cost allocation
8 for new cross-seams transmission projects. Therefore, by providing an interregional
9 transmission access point within the State of Missouri, the Grain Belt Express Project is
10 valuable because it 1) provides access to highly energetic renewables that would otherwise
11 find difficulty accessing Missouri loads across the existing AC transmission systems and
12 2) provides a new, direct transmission path between MISO and SPP as well as MISO and
13 PJM that is not cost allocated to load customers in these regions.

14 **Q. Are there any recent RTO studies or reports which discuss resource adequacy within**
15 **Missouri?**

16 A. Yes, the 2016 Organization of MISO States (“OMS”) MISO Survey Results discusses
17 resource adequacy across the MISO footprint. These results are attached hereto as
18 **Schedule ECP-2**. The results of the survey indicate that Load Resource Zone (“LRZ”) five
19 (5), which includes Ameren Missouri and the City of Columbia, was identified as having
20 an 800 MW and 1,300 MW capacity deficiency in the MISO assessment of Planning
21 Reserve Requirements for 2017 and 2021, respectively. The results of our LOLE analysis
22 indicate that access to an additional 500 MW of generation capacity via the Grain Belt
23 Express Project will improve the aggregate resource adequacy of the State of Missouri.
24 Also, the Grain Belt Express Project proposes to interconnect within MISO’s LRZ five (5),

1 therefore providing the opportunity for direct benefits to this LRZ in which OMS has
2 identified a likely need for capacity in the future.

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

4 A. Yes it does.

**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)

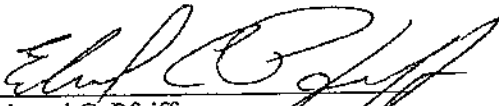
Case No. EA-2016- 0358

AFFIDAVIT OF EDWARD C. PFEIFFER

STATE OF Colorado)
) ss
 COUNTY OF Larimer)

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 Direct Testimony on behalf of Grain Belt Express Clean Line LLC consisting of 10 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 25 day of Aug, 2016.

Scott Mollinix
 Notary Public

SCOTT MOLLINIX Notary Public State of Colorado Notary ID 20154041437 My Commission Expires Oct 21, 2019

My commission expires: Oct 21, 2019