

FILED  
June 28, 2023  
Data Center  
Missouri Public  
Service Commission

# Exhibit No. 100

Staff – Exhibit 100  
Alan J. Bax  
Rebuttal Testimony  
File No. EA-2023-0017

*Exhibit No.:*  
*Issue(s):* *Project Description*  
*Witness:* *Alan J. Bax*  
*Sponsoring Party:* *MoPSC Staff*  
*Type of Exhibit:* *Rebuttal Testimony*  
*Case No.:* *EA-2023-0017*  
*Date Testimony Prepared:* *April 19, 2023*

**MISSOURI PUBLIC SERVICE COMMISSION**

**INDUSTRY ANALYSIS DIVISION**

**ENGINEERING ANALYSIS DEPARTMENT**

**REBUTTAL TESTIMONY**

**OF**

**ALAN J. BAX**

**GRAIN BELT EXPRESS, LLC**

**CASE NO. EA-2023-0017**

*Jefferson City, Missouri*  
*April 2023*



1 **PROJECT DESCRIPTION**

2 Q. Please provide a brief description of the Project, its history, and the currently  
3 proposed Amendment.

4 A. The CCN was issued in conjunction with a request to design and construct  
5 an approximate 800 mile High Voltage Direct Current (“HVDC”) transmission line,  
6 rated +/- 600 kilo-volts (“kV”), between South-West Kansas (“SW Kansas”) and the boundary  
7 line of Illinois/Indiana near Sullivan, Indiana (“Sullivan, Indiana”), a distance of nearly  
8 800 miles described as “the Project” (“Project”). Originally, the intent was to transmit eastward  
9 4,000 MegaWatts (“MWs”), the output produced and/or generated in SW Kansas, in its entirety,  
10 to the terminating point near Sullivan, Indiana. Subsequently, the Project was modified to  
11 include a converter station to be installed in Ralls County, Missouri along with associated  
12 alternating current (“AC”) connections to an existing nearby HVAC line in order to inject  
13 500 MWs into the bulk electric system in Missouri. GBE also entered into a contract to sell  
14 200 MWs to a group of municipal electric systems in Missouri affiliated with the Missouri Joint  
15 Municipal Electric Utility Commission (“MJMEUC”). The remaining 3,500 MWs  
16 generated/produced in SW Kansas would be transmitted to Sullivan, Indiana, as previously  
17 planned. The CCN granted in 2017, in conjunction with Case No. EA-2016-0358, was in  
18 accordance with the Project, as modified.

19 Q. Please describe the proposed Amendment to the aforementioned CCN being  
20 requested in the current case.

21 A. GBE is first proposing that the CCN be amended in consideration of increasing  
22 the original capability of transmitting 4,000 MWs that is generated/produced in SW Kansas to  
23 5,000 MWs. This revised amount of 5,000 MWs will conceptually be subdivided in two equal

1 injections of 2,500 MWs into a converter station in Missouri and 2,500 MWs in Sullivan,  
2 Indiana. However, the location of the converter station in Ralls County, Missouri, and the  
3 nearby HVAC transmission line, cannot accept an injection of five times the originally intended  
4 injection of 500 MWs. Therefore, a second item GBE is currently requesting is to relocate the  
5 converter station from Ralls County into Monroe County to the west, a location on the path of  
6 the previously approved HVDC line. Further, GBE purports a desire to divide this 2,500 MWs  
7 delivered to the converter station, which is relocated to Monroe County, MO, to be injected into  
8 two points of interconnection (“POIs”). The first injection of approximately 1,000 MWs would  
9 be made at an existing substation in Callaway County Missouri, the McCredie substation, which  
10 is owned by Associated Electric Cooperative Incorporated (“AECI”). The second injection of  
11 approximately 1,500 MWs is to be made in a “yet to be constructed substation” that GBE indicates<sup>1</sup>  
12 will be built about ½ mile to the east of the McCredie substation, also in Callaway County, and  
13 will be owned by Ameren Missouri.<sup>2</sup> The McCredie substation is connected to the existing  
14 Overton to Montgomery 345 kV HVAC line segment in the bulk electric system. The second  
15 POI, the “yet to be constructed” substation, will also be connected to the Overton to  
16 Montgomery 345 kV line segment.

17 Q. How does GBE propose to connect the relocated converter station in Monroe  
18 County to these two POIs in Callaway County?

19 A. Unlike the converter station in Ralls County being located near an existing  
20 HVAC line in the bulk electric system, in order to gain access to these two newly proposed

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<sup>1</sup> GBE’s Response to Staff Data Request No. 0055 states, “The second POI is at the proposed Burns 345kV substation, which will be located approximately a half mile east of the McCredie Substation. This substation would be operated by Ameren as part of the MISO regional electric grid.”

<sup>2</sup> Ameren Missouri has initiated a request for a CCN in Case No. EA-2023-0226 that includes this substation, referenced as the Burns Substation.

1 | aforementioned POIs, GBE is also additionally introducing the construction of a new, nearly  
2 | 40-mile HVAC transmission line, called the “Tiger Connector” to the Project. On Page 18 of  
3 | his direct testimony, Mr. White downplays the significance of the Tiger Connector, when he  
4 | states, “...The Project has always included AC interconnecting facilities to be constructed by  
5 | Grain Belt Express to connect the converter station to the existing AC grid.” However, the  
6 | CCN, as proposed, has the converter station located in Ralls County “near” an existing HVAC  
7 | line capable of accepting the proposed 500 MW injection. The necessary AC connection will  
8 | not be anywhere near 40 miles. In contrast to the description of GBE witness Mr. White, the  
9 | Tiger Connector does certainly introduce a substantial change in the necessary AC connectivity  
10 | to the bulk electric system, as this Tiger Connector is approximately 40 miles in length from  
11 | the relocated converter station in Monroe County to the two newly proposed POIs. This also  
12 | creates a new group of property owners/landowners that were not associated with the Project in  
13 | conjunction with the previously approved CCN for the Project in 2017.

14 |       Q.     Will the injection of 2,500 MWs at this location of the POIs result in required  
15 | improvements being needed to reinforce the existing bulk electric system?

16 |       A.     Yes. GBE has reached an agreement with AECI in regard to the proposed  
17 | injection of approximately 1,018 MWs into its McCredie substation and the resultant system  
18 | improvements required in conjunction with its effects on AECI’s system operations. GBE  
19 | witness Carlos Rodriguez identifies the current cost of this contract being at least \$98,600,000.

20 |       Q.     What about the proposed injection in the yet to be constructed substation that is  
21 | indicated will be owned by Ameren Missouri?

22 |       A.     While there have been some preliminary studies performed by the Midwest  
23 | Intercontinental System Operator (“MISO”) regarding such injection levels at this proposed

1 location, the associated cost of system improvements have yet to be determined. Moreover,  
2 these associated costs for system improvements will certainly exceed the corresponding costs  
3 of the improvements identified in the contract with AECI when considering an injection of up  
4 to 1,500 MWs. These studies are further discussed in the rebuttal testimony of Staff witness  
5 Shawn E. Lange, PE.

6 Q. Would Ameren Missouri customers be charged for these necessary system  
7 improvements associated with an injection of this magnitude?

8 A. Yes, these necessary system improvements will be part of Ameren Missouri's  
9 revenue requirement in relation to the operating zone associated with the formula rate set by  
10 the Federal Energy Regulatory Commission.

11 Q. Has GBE entered into a similar agreement with Ameren Missouri as it has with  
12 AECI regarding required system improvements that will be needed associated with an injection  
13 at this proposed substation location?

14 A. No, not to my knowledge.

15 Q. Are there other items to mention as to GBE's proposed amendment to the  
16 existing CCN?

17 A. Yes. GBE proposes that the Project would also be designed and constructed in  
18 two Phases: Phase I and Phase II. Phase I is said to be the portion of the Project from SW  
19 Kansas to the revised location of the converter station in Monroe County, Missouri plus the  
20 newly proposed Tiger Connector. Phase II entails the remaining portion of the HVDC line  
21 between the converter station in Monroe County, Missouri and the terminating station in  
22 Sullivan, Indiana. Staff witness Michael L. Stahlman discusses further this new proposal of  
23 GBE to construct the "amended" Project in two phases.

Rebuttal Testimony of  
Alan J. Bax

1 Q. Will GBE enable a bi-directional functionality to the Project?

2 A. In its Response to Staff Data Request No. 0054, GBE acknowledges that they  
3 are currently not planning to undertake the incremental investment necessary to allow for bi-  
4 directional operation.

5 Q. What recommendation do you propose concerning the engineering design of the  
6 Project and possibly the proposed Amendment should it be approved?

7 A. Mr. White has included “conceptual drawings” in his testimony of the HVDC  
8 tower diagrams, the newly proposed Tiger Connector (poles and associated assemblies,  
9 including tangent and dead-end structure renderings), and of the converter station. As offered  
10 by Mr. White, I would recommend that the Commission order GBE to provide “as-built”  
11 drawings of the various stages of the design, construction and installation of associated  
12 equipment included with the Project as they become available.

13 Q. Does this conclude your Rebuttal Testimony?

14 A. Yes, it does.



BEFORE THE PUBLIC SERVICE COMMISSION  
OF THE STATE OF MISSOURI

In the Matter of the Application of Grain Belt        )  
Express LLC for an Amendment to its                 )       Case No. EA-2023-0017  
Certificate of Convenience and Necessity            )  
Authorizing it to Construct, Own, Operate,         )  
Control, Manage, and Maintain a High Voltage,     )  
Direct Current Transmission Line and                )  
Associated Converter Station                            )

**AFFIDAVIT OF ALAN J. BAX**

STATE OF MISSOURI     )  
                                  )        ss.  
COUNTY OF COLE        )

**COMES NOW ALAN J. BAX** and on his oath declares that he is of sound mind and lawful age; that he contributed to the foregoing *Rebuttal Testimony of Alan J. Bax*; and that the same is true and correct according to his best knowledge and belief.

Further the Affiant sayeth not.

  
\_\_\_\_\_  
**ALAN J. BAX**

**JURAT**

Subscribed and sworn before me, a duly constituted and authorized Notary Public, in and for the County of Cole, State of Missouri, at my office in Jefferson City, on this 17<sup>th</sup> day of April 2023.

D. SUZIE MANKIN  
Notary Public - Notary Seal  
State of Missouri  
Commissioned for Cole County  
My Commission Expires: April 04, 2025  
Commission Number: 12412070

  
\_\_\_\_\_  
Notary Public

## **ALAN J. BAX**

I graduated from the University of Missouri - Columbia with a Bachelor of Science degree in Electrical Engineering in December 1995. Concurrent with my studies, I was employed as an Engineering Assistant in the Energy Management Department of the University of Missouri – Columbia from the Fall of 1992 through the Fall of 1995. Prior to this, I completed a tour of duty in the United States Navy, completing a course of study at the Navy Nuclear Power School and a Navy Nuclear Propulsion Plant. Following my graduation from the University of Missouri - Columbia, I was employed by The Empire District Electric Company as a Staff Engineer until August 1999, at which time I began my employment with the Staff of the Missouri Public Service Commission. My current position is an Engineer in the Engineering Analysis Department, within the Industry Analysis Division. I presented in a Peer Review of Power Quality Regulations in the National Association of Regulatory Utility Commissioners (NARUC) outreach program with the Public Utilities Commission of Sri Lanka (PUCSL), supported by the Bureau of Energy Resources (ENR) at the United States Department of State. I am a member of the Institute of Electrical/Electronic Engineers (IEEE).

TESTIMONY AND REPORTS  
BEFORE THE MISSOURI PUBLIC SERVICE COMMISSION

BY ALAN J. BAX

<u>COMPANY</u>	<u>CASE NUMBER</u>
Aquila Networks – MPS	ER-2004-0034
Union Electric Company d/b/a AmerenUE	EO-2004-0108
Empire District Electric Company	ER-2002-0424
Kansas City Power and Light Company	EA-2003-0135
Union Electric Company d/b/a AmerenUE	EO-2003-0271
Aquila Networks – MPS	EO-2004-0603
Union Electric Company d/b/a AmerenUE	EC-2002-0117
Three Rivers and Gascoage Electric Coops	EO-2005-0122
Union Electric Company d/b/a AmerenUE	EC-2002-1
Aquila Networks – MPS	EO-2001-0384
Empire District Electric Company	ER-2001-299
Aquila Networks – MPS	EA-2003-0370
Union Electric Company d/b/a AmerenUE	EW-2004-0583
Union Electric Company d/b/a AmerenUE	EO-2005-0369
Trigen Kansas City	HA-2006-0294
Union Electric Company d/b/a AmerenUE	EC-2005-0352
Missouri Public Service	ER-2001-672
Aquila Networks – MPS	EO-2003-0543
Kansas City Power and Light Company	ER-2006-0314
Macon Electric Coop	EO-2005-0076
Aquila Networks – MPS	EO-2006-0244
Union Electric Company d/b/a AmerenUE	EC-2004-0556
Union Electric Company d/b/a AmerenUE	EC-2004-0598
Empire District Electric Company	ER-2004-0570
Union Electric Company d/b/a AmerenUE	EC-2005-0110
Union Electric Company d/b/a AmerenUE	EC-2005-0177
Union Electric Company d/b/a AmerenUE	EC-2005-0313
Empire District Electric Company	EO-2005-0275
Aquila Networks – MPS	EO-2005-0270
Union Electric Company d/b/a AmerenUE	EO-2006-0145
Empire District Electric Company	ER-2006-0315
Aquila Networks – MPS	ER-2005-0436

<u>COMPANY</u>	<u>CASE NUMBER</u>
Union Electric Company d/b/a AmerenUE	EO-2006-0096
West Central Electric Cooperative	EO-2006-0339
Kansas City Power and Light Company	ER-2006-0314
Union Electric Company d/b/a AmerenUE	EO-2008-0031
Union Electric Company d/b/a AmerenUE	EC-2009-0193
Empire District Electric Company	ER-2008-0093
Missouri Rural Electric Cooperative	EO-2008-0332
Grundy Electric Cooperative	EO-2008-0414
Osage Valley Electric Cooperative	EO-2009-0315
Union Electric Company d/b/a AmerenUE	EO-2009-0400
Union Electric Company d/b/a AmerenUE	EO-2008-0310
Aquila Networks – MPS	EA-2008-0279
West Central Electric Cooperative	EO-2008-0339
Empire District Electric Company	EO-2009-0233
Union Electric Company d/b/a/ AmerenUE	EO-2009-0272
Empire District Electric Company	EO-2009-0181
Union Electric Company d/b/a AmerenUE	ER-2008-0318
Kansas City Power and Light Company	ER-2009-0089
Kansas City Power and Light – GMO	ER-2009-0090
Union Electric Company d/b/a AmerenUE	ER-2010-0036
Empire District Electric Company	ER-2010-0130
Laclede Electric Cooperative	EO-2010-0125
Union Electric Company d/b/a AmerenUE	EC-2010-0364
Union Electric Company d/b/a AmerenUE	EO-2011-0052
Kansas City Power and Light Company	ER-2010-0355
Union Electric Company d/b/a AmerenUE	EO-2010-0263
Kansas City Power and Light – GMO	EO-2011-0137
Kansas City Power and Light – GMO	ER-2010-0356
Union Electric Company d/b/a AmerenUE	ER-2011-0028
Kansas City Power and Light – GMO	EO-2012-0119
Kansas City Power and Light Company	EO-2011-0137
Union Electric Company d/b/a AmerenUE	ER-2012-0121
Union Electric Company d/b/a/ Ameren Missouri	EX-2012-0332
Empire District Electric Company	EO-2011-0085
Empire District Electric Company	EO-2012-0192
Empire District Electric Company	EO-2013-0313
Union Electric Company d/b/a AmerenUE	ER-2012-0180
Union Electric Company d/b/a AmerenUE	EO-2013-0418

<u>COMPANY</u>	<u>CASE NUMBER</u>
City Utilities of Springfield	EO-2012-0441
Kansas City Power and Light – GMO	EO-2012-0367
Empire District Electric Company	ER-2011-0004
Union Electric Company d/b/a/ Ameren Missouri	ER-2012-0166
Kansas City Power and Light Company	ER-2012-0174
Union Electric Company d/b/a/ Ameren Missouri	ER-2013-0044
Kansas City Power and Light – GMO	ER-2012-0175
Central Missouri Electric Cooperative	EO-2015-0137
Empire District Electric Company	ER-2012-0345
Kansas City Power and Light Company	EO-2012-0367
Boone Electric Cooperative	EO-2015-0012
Transource Missouri, LLC	EA-2013-0098
Black River Electric Cooperative	EO-2015-0096
Union Electric Company d/b/a/ Ameren Missouri	EW-2012-0369
Empire District Electric Company	ER-2014-0351
Union Electric Company d/b/a/ Ameren Missouri	EO-2014-0044
Union Electric Company d/b/a/ Ameren Missouri	EO-2013-0418
Union Electric Company d/b/a/ Ameren Missouri	EE-2013-0511
Union Electric Company d/b/a/ Ameren Missouri	EO-2015-0017
Union Electric Company d/b/a/ Ameren Missouri	EO-2016-0087
Union Electric Company d/b/a/ Ameren Missouri	EO-2014-0009
Kansas City Power and Light Company	EO-2014-0128
Union Electric Company d/b/a/ Ameren Missouri	EO-2017-0358
Empire District Electric Company	EO-2016-0192
Empire District Electric Company	EO-2017-0217
Union Electric Company d/b/a/ Ameren Missouri	EO-2014-0296
Union Electric Company d/b/a/ Ameren Missouri	EO-2015-0328
Union Electric Company d/b/a/ Ameren Missouri	ER-2014-0258
Union Electric Company d/b/a/ Ameren Missouri	EX-2017-0153
Union Electric Company d/b/a/ Ameren Missouri	EO-2019-0391
Empire District Electric Company	EO-2018-0118
Empire District Electric Company	ER-2016-0023
Ozark Electric Cooperative Inc.	EO-2020-0163
Union Electric Company d/b/a/ Ameren Missouri	EC-2016-0235
Union Electric Company d/b/a/ Ameren Missouri	EO-2018-0058
Union Electric Company d/b/a/ Ameren Missouri	EE-2019-0395
Kansas City Power and Light – GMO	ER-2016-0156
Kansas City Power and Light – GMO	EO-2019-0061

<u>COMPANY</u>	<u>CASE NUMBER</u>
Kansas City Power and Light Company	ER-2014-0370
Union Electric Company d/b/a/ Ameren Missouri	EO-2017-0044
Kansas City Power and Light Company	ER-2016-0285
Empire District Electric Company	EO-2019-0381
Union Electric Company d/b/a/ Ameren Missouri	EE-2019-0395
Union Electric Company d/b/a/ Ameren Missouri	ER-2016-0179
Union Electric Company d/b/a/ Ameren Missouri	EO-2018-0278
Union Electric Company d/b/a/ Ameren Missouri	EO-2020-0315
Union Electric Company d/b/a/ Ameren Missouri	EO-2017-0127
Kansas City Power and Light Company	ER-2018-0145
Kansas City Power and Light Company – GMO	ER-2018-0146
Evergy Missouri West LLC	EO-2021-0388
Gridliance High Plains, LLC	EM-2022-0156
Union Electric Company d/b/a/ Ameren Missouri	EO-2021-0305
Union Electric Company d/b/a/ Ameren Missouri	EM-2021-0309
Union Electric Company d/b/a/ Ameren Missouri	ER-2019-0335
Union Electric Company d/b/a/ Ameren Missouri	EE-2019-0383
Osage Valley Electric Cooperative, LLC	EO-2022-0073
Osage Valley Electric Cooperative, LLC	EO-2023-0126
Ozark Border Electric Cooperative, LLC	EO-2022-0264
Evergy Missouri West LLC	EO-2021-0339
Union Electric Company d/b/a/ Ameren Missouri	EE-2021-0086
Union Electric Company d/b/a/ Ameren Missouri	EM-2022-0292
Liberty Utilities-Empire	EO-2021-0389
Laclede Electric Cooperative	EO-2022-0143
Empire District Electric Company	ER-2019-0374
Union Electric Company d/b/a/ Ameren Missouri	ET-2021-0082
Union Electric Company d/b/a/ Ameren Missouri	ER-2021-0240
Union Electric Company d/b/a/ Ameren Missouri	EO-2022-0226
Union Electric Company d/b/a/ Ameren Missouri	EO-2022-0190
Union Electric Company d/b/a/ Ameren Missouri	EO-2022-0332
Union Electric Company d/b/a/ Ameren Missouri	EO-2023-0256
NextEra Energy Transmission Southwest, LLC	EA-2022-0234
Evergy Missouri Metro	ER-2022-0129
Evergy Missouri West LLC	ER-2022-0130
Evergy Missouri West LLC	EO-2022-0320
Missouri Joint Municipal Utility Electric Commission	EM-2022-0156
Liberty Utilities-Empire	EO-2022-0226

<u>COMPANY</u>	<u>CASE NUMBER</u>
Liberty Utilities-Empire	EC-2022-0291
Union Electric Company d/b/a/ Ameren Missouri	EO-2021-0401
Union Electric Company d/b/a/ Ameren Missouri	EM-2022-0094
Union Electric Company d/b/a/ Ameren Missouri	EO-2022-0102
Union Electric Company d/b/a/ Ameren Missouri	ER-2022-0337
Liberty Utilities-Empire	EO-2022-0132
Liberty Utilities-Empire	ER-2021-0312