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, Operate, Control, Manage, 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-2014-0207

REPLY TO STAFF AND OTHER PARTIES' RESPONSES AND COMMENTS REGARDING THE ADDITIONAL INFORMATION SUBMITTED BY GRAIN BELT EXPRESS CLEAN LINE LLC

Grain Belt Express Clean Line LLC ("Grain Belt Express" or "Company") provides the following reply to the responses and comments of Commission Staff ("Staff"), Missouri Landowners Alliance ("MLA"), Missouri Farm Bureau ("Farm Bureau"), and Show Me Concerned Landowners ("Show Me"), filed on May 13, 2015 regarding the Company's April 13, 2015 Response to the Commission's Order Directing Filing of Additional Information:

I. There are Numerous Technical Errors in the Staff and Show Me Responses.

A. Response to Staff.

1. Grain Belt Express has performed three rounds of production cost modeling to measure the Project's impact on wholesale power markets in Missouri and the broader region. The first two rounds of modeling were presented in the Direct Testimony of Gary Moland and the Surrebuttal Testimony of Robert Cleveland. See Ex. 116-117. A final round was presented in the Company's April 13, 2015 filing. See Supp. Ex. 13. The three rounds of analysis:

- Were conducted by independent, expert witnesses with years of experience in performing production cost analysis.
- Used PROMOD, the electricity industry's standard tool for production cost modeling, which is used by Missouri's regulated electric utilities, as well as by SPP and MISO.

- Considered four future scenarios (Business As Usual, Slow Growth, Robust Economy and Green Economy) with a range of assumptions on fuel prices, load growth, emissions regulation and other inputs.
- Demonstrated benefits from the Project to Missouri and to the region across all metrics and across all four scenarios.

2. No other party has produced ***any*** production cost modeling studies to dispute the favorable impacts of the Grain Belt Express Project on the wholesale electric market. However, Staff and Show Me continue to raise objections to the Company's studies, particularly Supplemental Exhibit 13.

3. Staff claims Grain Belt Express has stated that "it is not possible for it to create reliable models to create reasonable estimates" of the Project's wholesale power market impacts. See Staff's May 13, 2015 Memorandum ("Staff Memorandum") at 7. This is certainly not the Company's position. In this case Staff asked for many changes to the production cost modeling beyond what is standard and typical, even for RTO planning. Grain Belt Express advised Staff that some of these refinements are not possible due to the limitations of the PROMOD software or the lack of available data. Nevertheless, it is very possible to develop reasonable projections, to refine the projections based on parties' input, and to test the robustness of these projections by varying inputs. This is exactly what Grain Belt Express has done in this case through the three rounds of PROMOD studies.

4. In its response to the study contained in Supplemental Exhibit 13, Staff raises three substantive issues. First, the Staff Memorandum at page 7 and Schedule 2-1 contend that Grain Belt Express should have incorporated a non-horizontal "slope" or non-linear heat rate curve for natural gas generators in the PROMOD analysis. Staff misstates what the Company actually did. The study did not assume that all natural gas generators produce electricity at the

same efficiency at any given level of output. The study included a model of each turbine at a natural gas generation facility, each with its own heat rate. For example, Ameren Missouri's Audrain facility has eight turbines, and the study used a heat rate specific to each turbine. In addition, the study used an appropriate minimum generation level for each turbine. The PROMOD software will not dispatch a natural gas turbine below this minimum level because it is presumed to be uneconomic.

5. All of these assumptions were clearly set forth in documents distributed to Staff and the other parties for their review and comment before and at the March 5, 2015 workshop conducted at the Commission. See Attachment A (copy of the Feb. 27, 2015 email to the parties with data assumptions, including spreadsheets, and a written summary of the production cost modeling study assumptions and inputs provided for comment). These assumptions were based on the best information available to the Company and to Mr. Cleveland of Leidos Engineering, who prepared the study contained Supplemental Exhibit 13. These are standard industry assumptions and are consistent with the approaches used by SPP, MISO and other regional transmission organizations. Staff had the opportunity to provide specific suggestions on how to modify the modeling of heat rates, but did not do so.

6. The Staff Memorandum at Schedule 2-1 appears to suggest that heat rate curves should decrease for each unit, meaning the fuel cost would decrease as energy increases. This would result in a decreasing bid curve for natural gas generators bidding into the RTO market, meaning that prices would decrease as more energy clears the market. However, a decreasing bid curve is not allowed under MISO and SPP market rules.[1] Therefore, Staff's suggestion is not appropriate.

[1] See MISO Business Practices Manual 002-r13 (https://www.misoenergy.org/Library/BusinessPracticesManuals); Southwest Power Pool Integrated Market Protocol at p. 138 (http://www.spp.org/publications/Integrated%20Marketplace%20Protocols%2030.zip).

7. Second, Staff claims that Grain Belt Express did not use a reasonable estimate of natural gas prices. Although it had the opportunity to review the Company's inputs and provide alternative suggestions, Staff again declined, stating only in its comments provided on March 12, 2015 that the Company should use "[a]ny reasonable updates or corrections of assumptions related to fuel prices." See Sched. 1-1, Staff Memorandum. By failing to provide any specific inputs on what the updates or corrections should be, Staff is asking Grain Belt Express to play a guessing game.

8. Even in its May 13 response, Staff does not provide the specific values it wanted the Company to use for gas prices. Staff reproduced a graph from MISO showing a range of "peak gas prices" from approximately $4.00-$7.75 per MMBtu for 2019, which is consistent with the range used by Grain Belt Express.[2] In the studies that the Company provided the Commission on April 13, Grain Belt Express examined a large range of natural gas prices across the four assumption scenarios (from $1.74 per MMBtu to $7.74 per MMBtu). All four scenarios showed that the Project will yield benefits across all metrics.

9. Third, Staff states that Grain Belt Express has not provided an estimate of the cost of each Missouri utility to procure energy and serve its load. The Company has provided an estimate of the cost to serve load for Ameren Missouri, as well as the entire state. Both estimates show a decrease in this cost in all four assumption scenarios. See Grain Belt Express Supp. Ex. 13. The additional detail described by Staff for each utility was not called for by the Commission's February 11 Order and is unnecessary to confirm the overall positive impacts of the Project on the State of Missouri.

10. Staff provided additional comments on the Grain Belt Express studies in Schedule 2 to its May 13 pleading. However, these comments are difficult to interpret because they rely

[2] See Sched. 2-2, Staff Memorandum.

on a color-coding system, rather than a detailed, textual explanation of the issues. Grain Belt Express has attempted to decipher Staff's comments and responds in the attached Appendix 1.

11. In response to Staff's comment on Paragraph 5 regarding the HVDC converter station, the Company states that it provided a diagram of the Missouri converter station in Supp. Ex. 4, not a "typical" converter station.

12. In its comment regarding the Grain Belt Express response to Paragraph 6 concerning commitments from wind energy producers, Staff stated the Project description in the record is contrary to the Company's statement in its April 13 Response that "[w]ind generators who purchase capacity on the Project will connect directly to the Company's Kansas converter station via an AC collection system of tie lines." See Staff Memorandum at 4. However, that is not the case.

13. Company witness A.W. Galli testified that the Project "will run from a tap of the new Spearville to Clark County 345 kV line in southwestern Kansas near Dodge City," noting that "the electrical interconnection with SPP is primarily required to facilitate the alternating current ('AC') to direct current ('DC') conversion process and therefore will be designed to have minimal power exchange with the SPP system during normal operations." See Direct Testimony of A.W. Galli at 4: 6-8, 10-12. Dr. Galli additionally stated that the Project was designed so "there is nominally zero active power exchange and very little, if any, reactive power exchange between the Grain Belt Express AC bus and the SPP grid." Id. at 13:5-7. This is consistent with the System Impact Study prepared for SPP by Excel Engineering, Inc. in September 2013 that reported: "The project is designed to have a normal power exchange with SPP of 0 MW and 0 Mvar." Id., Sched. AWG-4 at 8. Other studies filed by the Company indicated that wind generation will be directly connected to the converter station (also termed a "rectifier station") through an AC collection system. See SPP Dynamic Stability Assessment prepared by Siemens,

p. vii[3] (Mar. 2013) (Supp. Ex. 18 at 8); SPP Steady State Assessment prepared by Siemens, p. vii[4] (Jan. 7, 2013) (Supp. Ex. 19 at 9). The collector system is illustrated in the SPP Steady State Assessment. See Supp. Ex. 19 at 7-2 and 7-3. Accord, Generation Interconnection Facilities Study Report prepared by ITC Great Plains for Grain Belt Express HVDC Facility in Ford County, Kansas, p. at 3[5] (Mar. 19, 2015) (Supp. Ex. 17).

14. Regarding Staff's comments to Paragraph 11 concerning the Commission's request for updated investment in the Project, Grain Belt Express responded fully. Supplemental Exhibit (HC) 12 states the total amount that has been "invested" and "spent" on the Project, which amounts are identical. The Company also provided information on the Project's total cost and indicated other amounts related to network upgrades and attachment facilities.

15. Staff requests an opportunity for the parties to provide a response on the sufficiency of materials to be submitted in the future by Grain Belt Express, such as engineering drawings, final project design plans, and interconnection studies and agreements. Any such opportunity should be afforded consistent with the Company's request that such documents be submitted to the Commission without the necessity of a series of post-hearing proceedings that would create uncertainty for the Project. Under Missouri law the Commission would continue to retain broad authority to review or investigate any information filed by Grain Belt Express.

[3] "It is expected that the wind generation is collected using a 138 kV transmission network connecting the wind parks to main 345 kV stations and then ultimately transferred to the HVDC rectifier station via a 345 kV transmission network. For this analysis, the wind generation was directly connected to the HVDC rectifier station via a 345kV network without modeling of the 138 kV collection system [emphasis added]."

[4] "The generation associated with the Project, for purposes of this study, are direct-connect wind [turbine] generators (WTG's) [that] … will be directly connected to the GBX HVDC Project substation at 345kV which is then directly connected to the Clark County 345kV substation … [emphasis added]."

[5] Grain Belt Express "is responsible for constructing all sole-use facilities such as the HVDC convertor station, AC collector station, and the radial 345kV lines from the collector station to the new [ITC Great Plains] switching station."

B. Response to Show Me.

16. In its May 13 pleading, Show Me makes two points regarding the additional PROMOD runs in the Company's April 11 filing. First, Show Me states that "just as with the earlier PROMOD runs, the base case against which the Kansas Wind via GBE's DC transmission is compared is a case in which wind energy from a MISO source is not included." See Show Me Response at 13. However, Show Me continues to ignore the Surrebuttal Testimony of Robert Cleveland, which showed that the Project produces substantially higher production cost savings, higher reductions in LMPs, and more emissions reductions than a MISO wind alternative. See Surrebuttal Testimony of R. Cleveland at 6-7 (Ex. 117). Grain Belt Express did not repeat this analysis, and the Commission's February 11 Order did not require it.

17. Second, Show Me speculates that the production cost savings from the Project should have decreased because Grain Belt Express decreased its natural gas price assumptions. See Show Me Response at 13. Again, Show Me misreads the record. During the input process that the Company conducted in March, pursuant to the Commission's February 11 Order, Show Me suggested that Grain Belt Express use a "Business as Usual" gas price of $4.30 per MMBtu based on MISO's MTEP 16 assumptions. See Show Me Comments at 3-4 (circulated among the parties on Mar. 12, 2015). As noted on page 7 of the Company's Supplemental Exhibit 13, Grain Belt Express did not make the suggested change because it was already using a price of $4.29 per MMBtu, only one penny below that recommended by Show Me. Further, production cost savings are not a simple function of the price of natural gas, and are influenced by a number of assumptions, which are described in the Direct Testimony of Gary Moland (Ex. 116), the Surrebuttal Testimony of Robert Cleveland (Ex. 117), and Supplemental Exhibit 13.

18. In summary, none of Staff's or Show Me's objections raise any material questions about the validity of the Grain Belt Express production cost modeling studies. Based on these

studies, which consider a wide range of scenarios, the Commission can find that the Project decreases wholesale power prices, decreases adjusted production costs to serve load, does not cause transmission congestion, and reduces emissions and water usage.

II. MLA, Show Me, and Farm Bureau Misunderstand the Law In Their Responses.

19. MLA turns a blind eye to the reality that public utilities are unlikely to make a commitment to purchase energy delivered by the Project until Grain Belt Express has received a certificate of convenience and necessity ("CCN") from this Commission, and that wind generators won't make binding commitments to deliver or sell power until Grain Belt Express is authorized to build the Project. Instead, MLA presents a series of purely speculative hypotheses as to why Grain Belt Express has not provided something which it is impossible to provide at this point in the development of the Project. See MLA's May 13, 2015 Comments ("MLA Comments") at 3-6.

20. Show Me also criticizes the Company for failing to provide the impossible, equating this alleged failure with a deficiency in need for the Project. See Show Me's May 13, 2015 Response ("Show Me Response") at 6-7, 8-9. As Staff acknowledges and the Company has explained, aside from those statements by the City Council of Columbia and Ameren Missouri's Integrated Resource Plan, both of which are already in the record, the information requested by the Commission does not yet exist. See Staff Memorandum at 3. Indeed, the absence of purchased power agreements at this stage of the development of a large, multi-state transmission project like the Grain Belt Express is to be expected.

21. What's more, it is unnecessary to inquire whether any public utilities or wind generators have made binding commitments to the Company in the context of the need for the service provided by Grain Belt Express. Rather, the need for alternative sources of renewable energy, represented by legal and regulatory policy mandates driven by environmental concerns,

better informs the Commission's determination of need. See Reply Post-Hearing Brief of Applicant Grain Belt Express ("Company Reply Brief") at 6-9. The evidence shows that the open-access transmission service offered by the Company is necessary to meet the requirements of Missouri's Renewable Energy Standard contained in Section 393.1020,[6] as well as the renewable portfolio standard requirements of the other states served by MISO and PJM. See Initial Post-Hearing Brief of Applicant Grain Belt Express ("Company Initial Brief") at 12- 17; Company Reply Brief at 9-12. The record additionally supports the finding that utilities will commit to take energy and/or capacity from the Project, given the evidence concerning the low cost of renewable wind power from Kansas, existing and proposed federal environmental regulations, and the results of the Project's open solicitation (Supp. Ex. 5).

22. MLA, Show Me, and Farm Bureau further criticize the Company for not presently having the Section 229.100 assent of all county commissions along the proposed route. See MLA Comments at 6-11; Show Me Response at 5-6; Farm Bureau's May 13, 2015 Response ("Farm Bureau Response") at 7-9. These parties continue to misinterpret the governing statutes and authority of the Commission. First, MLA mischaracterizes the Section 229.100 assent as a required "franchise." See MLA Comments at 7-10. However, because Grain Belt Express is seeking a line CCN under Section 393.170.1, it is not required to obtain any franchise from any governmental body. See Company Initial Brief at 53-54; Company Reply Brief at 48-51. The necessity of municipal franchise only applies to the grant of an area CCN under 393.170.2. StopAquila.org v. Aquila, Inc., 180 S.W.3d 24, 32-34 (Mo. App. W.D. 2005); State ex rel. Harline v. PSC, 343 S.W.2d 177, 182-85 (Mo. App. W.D. 1960).

23. Show Me and Farm Bureau likewise misunderstand which statute is applicable, citing Section 393.170.2 as authority for municipal consent as a prerequisite to a CCN. See

[6] All statutory references are to the Missouri Revised Statues (2000), as amended, unless otherwise noted.

Show Me Response at 5-6; Farm Bureau Response at 8-9. But the relevant statute addressing CCN requirements -- Section 393.170.1 -- does not require municipal consent for the line certificate sought here, and any lack of Section 229.100 county consents does not prevent the Commission from granting a CCN conditioned upon the provision of such approvals once they have been received. See Section 393.170.3.

24. MLA also ignores that the position of some county commissions that they cannot grant Section 229.100 approval until the Commission has first granted the Company's CCN Application. See Grain Belt Express April 11 Response at 3-6. In any event, it is clear that the Commission has the statutory authority to condition a line CCN upon a utility obtaining such county consents in the future. See Section 393.170.3. See also In re Transource Missouri, LLC, Report and Order at 35, No. EA-203-0098 (2013).

WHEREFORE, Grain Belt Express Clean Line LLC provides this reply to the May 13, 2015 responses and comments of Staff, MLA, Farm Bureau and Show Me, and respectfully requests that the Commission issue an order granting it a certificate of convenience and necessity to construct, own, operate, control, manage, and maintain the Grain Belt Express Missouri Facilities and a converter station and associated AC facilities in Ralls County, and waiving the reporting and filing requirements of 4 CSR 240-3.145, 4 CSR 240-3.165, 4 CSR 240-3.175 and 4 CSR 240-3.190(1), (2) and (3)(A)-(D) for good cause shown.

/s/ Karl Zobrist

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ATTORNEYS FOR GRAIN BELT EXPRESS CLEAN LINE LLC

CERTIFICATE OF SERVICE

I hereby certify that a copy of the foregoing was served upon all parties of record by email or U.S. mail, postage prepaid, this 19th day of May, 2015.

/s/ Karl Zobrist
Attorney for Grain Belt Express Clean Line LLC

APPENDIX 1: RESPONSE TO STAFF COMMENTS IN SCHEDULE 2 OF ITS MAY 13, 2015 MEMORANDUM

Staff Comment to Studies	Staff Position	Grain Belt Express Response
1. Refine wind energy injection shapes for: a. Reduced diversity to account for wind farm-specific delivery contracts. b. Any sharp drop off associated with hitting the operational minimum of each converter station (inputting and outputting). c. Reasonableness of hours of maximum throughput. d. Reasonableness of hours of 0 throughput.	Staff does not dispute that the items have been addressed in Supp. Ex. 13.	Grain Belt Express concurs with Staff and incorporated Staff's suggestions in Supp. Ex. 13.
2. Describe company protocols and identify impact on model for: a. Segregating output of the Missouri and Indiana converter stations on a scheduled basis. b. Segregating output of the Missouri and Indiana converter stations operationally. c. Dealing with curtailment of overbuild wind generation on a scheduled basis. d. Dealing with curtailment of overbuild wind generation operationally. 3. Model a representative increment of intra-hour variation to determine change to ancillary and reserve requirements, accounting for the items in 1 & 2.	Staff does not dispute that the items have been addressed in Supp. Ex. 13.	Grain Belt Express concurs with Staff and incorporated Staff's suggestions in Supp. Ex. 13. The Brattle Group's analysis of ancillary services (Supp. Ex. 14) showed there is no additional need for reserves or ancillary services, based on current MISO rules.
4. Revise PROMOD model to account for: a. Operational impacts and limitations determined in item 3 above, accounting for items 1 & 2.	It is unclear if revised modeling incorporates an increase in required reserve margin.	No revision was needed since there was no increase in ancillary service and reserve requirements found by the Brattle Group's analysis (Supp. Ex. 14).
b. [no comment]		

Staff Comment to Studies	Staff Position	Grain Belt Express Response
c. Known or reasonably anticipated changes in generation plant characteristics including, but not limited to: i. AQCS systems at LaCygne, Jeffrey, and Asbury. ii. Riverton 12 conversion to combined cycle. iii. KCPL/GPE announcement that Sibley 1 & 2, Montrose 1, 2, & 3 and Lake Road 6 would cease burning coal prior to or around the 2019 time period. iv. Addition of O'Fallon solar farm v. Position of Ameren Missouri that "we recently decided 9 to retire our Meramec Energy Center no later than 2022, and it may be retired earlier, if necessary, to comply with new environmental rules." (Pg. 13, Direct Testimony of Moehn in Case No. ER-2014-0258).	Items (i)-(iv) were incorporated. The status of item (v) is unclear.	Grain Belt Express concurs with Staff and incorporated Staff's suggestions in Supp. Ex. 13. Regarding item (v), in its IRP filing Ameren Missouri did not specify a retirement date for the Meramec Energy Center. It stated the plant would be retired no later than 2022 or earlier if necessary to comply with environmental rules. Therefore, Meramec was modeled as partially retired in scenarios Slow Growth and Robust Economy, and fully retired in scenarios Business As Usual and Green Economy.
d. Representative (if estimated) heat rate curves instead of average heat rates across all capacity stages	Staff disputes that this item has been addressed in Supp. Ex. 13.	As discussed in Paragraph 6 of the Reply, Grain Belt Express has modeled a minimum generation level and heat rate specific to each natural gas turbine. This is standard industry practice. Staff appears to suggest that Grain Belt Express should have modeled decreasing bid curves for natural gas generators which would contradict SPP and MISO market rules.
e. [no comment]		
f. Any omitted plants or improperly modeled plants. If the generator data tab in the Missouri Study Assumptions xls file is meant to be an exhaustive list for Missouri IOU owned generators. i. Missouri owned wind generators have been left off.	Staff does not dispute that the items have been addressed in Grain Belt Express Supp. Ex. 13.	Grain Belt Express concurs with Staff and incorporated Staff's suggestions in Supp. Ex. 13.

Staff Comment to Studies	Staff Position	Grain Belt Express Response
ii. Modeling multi-unit plants as one unit (Taum Sauk). iii. Retirement of units not captured (Asbury 2). iv. Lack of Ameren Missouri CTs located in Illinois (Raccoon Creek). v. Lack of Missouri IOU minority ownership coal plants (Jeffrey, Plum Point).		
g. Any reasonable updates or corrections of assumptions, including but not limited to: i. Fuel prices	Staff disputes that this comment was incorporated.	Staff provided no specific inputs or values. Grain Belt Express considered an appropriate range of natural gas fuel prices.
ii. Emissions prices	Staff does not dispute that the item has been addressed in Supp. Ex. 13.	Grain Belt Express concurs with Staff.
iii. Load shapes 1. Level of solar penetration, 2. Penetration of Demand Side Management and Energy Efficiency, 3. Items not captured in the 10 year load-shape normalization period, for example, changes in usage characteristics after the Joplin tornado.	Staff disputes that this comment was incorporated. Staff states that it was not given the opportunity to review the load data.	Staff provided no specific input values or suggestions, although it was provided the hourly load forecast data to review.
5. Using the outputs of items 3 & 4, provide for the Commission's review: a. A reasonable estimate of the **generation and reserve operations** of each generation facility located in Missouri, or owned by a Missouri-serving utility, or from which power is purchased to serve Missouri load by a Missouri-serving utility (with and without a Missouri converter station). b. A reasonable estimate of the **operating costs and market revenues** of each generation facility located in Missouri, or owned by a Missouri-serving utility, or from which power is purchased to serve Missouri load by a Missouri-serving utility (with and without a	Grain Belt Express provided these results, but they are not reliable because, among other reasons, PROMOD does not produce results that are accurate for producing plant-level data, and the natural gas related assumptions used in Grain Belt Express' modeling are not reasonable.	First, Grain Belt Express has not asked the Commission to make a determination on the accuracy of plant-level results. This additional level of detail was not requested by the Commission in its Feb. 11 Order, and was provided at the request of Staff. Staff's position is unclear and contradictory because it objects to a level of detail that they requested. Second, the Grain Belt Express assumptions regarding natural gas

Staff Comment to Studies	Staff Position	Grain Belt Express Response
Missouri converter station). c. A reasonable estimate of the **emissions released** by each generation facility located in Missouri, or owned by a Missouri-serving utility, or from which power is purchased to serve Missouri load by a Missouri-serving utility (with and without a Missouri converter station). d. [see below] e. A reasonable estimate for each Missouri-serving utility of the **gross value of its energy output** of its associated generation fleet (with and without a Missouri converter station). f. A reasonable estimate for each Missouri-serving utility of the **cost of producing its energy output** from its associated generation fleet (with and without a Missouri converter station). g. A reasonable estimate for each Missouri-serving utility of the **level of emissions released** by its associated generation fleet (with and without a Missouri converter station). h. A reasonable estimate for each Missouri-serving utility of the level of the **operational efficiency** of its associated generation fleet (with and without a Missouri converter station)		prices and generation efficiency are standard and reasonable.
d. A reasonable estimate for each Missouri-serving utility of the **cost of serving its load** (with and without a Missouri converter station).	Grain Belt Express did not provide this detail.	Grain Belt Express provided adjusted production cost results across four scenarios for Ameren Missouri and for Missouri as a whole, which is responsive to the Feb. 11, 2015 Order.

Staff Comment to Studies	Staff Position	Grain Belt Express Response
i. A reasonable estimate of transmission upgrades in MISO zones 4 and 5 that may be made economical given the congestion conditions that will exist with a Missouri converter station.	Staff does not dispute that the item has been addressed in Supp. Ex. 13 although the conclusions are not clearly stated.	Grain Belt Express concurs that the Supp. Ex. 13 study addresses this issue. It found the Project would not cause congestion in Missouri that would require transmission upgrades.
j. A reasonable estimate of the economic and operational feasibility of exporting energy through the Missouri converter station in hours when capacity is available.	Staff does not dispute that the item has been addressed in Supp. Ex. 13 although it contends the conclusions are not clearly stated.	Grain Belt Express concurs that Supp. Ex. 13 addresses this issue. It is not apparent what Staff finds to be unclear.
k. A reasonable estimate of the economic and operational feasibility of managing the variability of injected wind at or before the Kansas converter station.	Staff does not dispute that the item has been addressed in Supp. Ex. 13.	Grain Belt Express concurs with Staff's position.

EXHIBIT A

Zobrist, Karl

From:	Zobrist, Karl
Sent:	Friday, February 27, 2015 1:27 PM
To:	'paa0408@aol.com'; 'opcservice@ded.mo.gov'; 'terry@healylawoffices.com'; 'sahall@hammondshinners.com'; 'nathan.williams@psc.mo.gov'; 'jdlinton@reagan.com'; 'eperez@hammondshinners.com'; 'jeremy.knee@ded.mo.gov'; 'dmvuylsteke@bryancave.com'; 'giboney@smithlewis.com'; 'durley@smithlewis.com'; 'hrobertson@greatriverslaw.org'; 'reedsteven00@gmail.com'; 'ckurtz@dfrglaw.com'; 'dneil@dfrglaw.com'; 'swillman@dfrglaw.com'; 'jfischerpc@aol.com'; 'lwdority@sprintmail.com'; 'terri@caferlaw.com'; 'roger.steiner@kcpl.com'; 'rob.hack@kcpl.com'; 'dmvuylsteke@bryancave.com'; 'gddrag@lawofficeofgarydrag.com'; 'alexander.antal@psc.mo.gov'; 'cydney.mayfield@psc.mo.gov'
Cc:	David A. Berry (dberry@cleanlineenergy.com); Cary Kottler; Erin Szalkowski (ESzalkowski@cleanlineenergy.com); eelbert@cleanlineenergy.com; 'Mark Lawlor'; Wood, Eric
Subject:	Grain Belt Express (No. EO-2014-0207): Study Assumptions - Para 12
Attachments:	Clean Line Grain Belt - Missouri Study Assumptions DRAFT3 26Feb2015.xlsx

The attached document contains the assumptions that Grain Belt Express proposes to use in the studies called for by Paragraph 12 of the Commission's Feb. 11 Order Directing Filing of Additional Information.

The company would appreciate receiving your input and suggestions regarding these assumptions. It would be helpful for your comments to be as specific as possible, and if they could be provided sooner rather than later.

Clean Line representatives will be present in Room 316 of the Governor Office Building on Thursday, March 5 at 9 a.m. to discuss these assumptions, to answer any questions, and to accept your comments. You are also welcome to submit written comments, which can be directed to me.

Our plan is to collect all input by Friday, March 13 so that the studies can be completed and filed with the Commission by its deadline of April 11. If you have any questions, please let me know. Karl

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Scenario definitions for PROMOD assumptions
Grain Belt Missouri Simulations

Data Assumptions for Study Scenarios

2019 Assumptions	Business as Usual	Robust Economy	Slow Growth	Green Economy
Nat Gas Prices (Henry Hub Spot, $/MMBTU)	Medium: $4.74	High: Medium + $3	Low: Medium - $3	High: Medium + $3
Forced Coal Retirements (GW)	Medium: MISO - 13.5, PJM - 15.8	Low: MISO - 9.0, PJM - 11.1	Low: MISO - 9.0, PJM - 11.1	High: MISO - 21.8, PJM - 18.4
Carbon Pricing	No	No	No	Yes: $50/ton
NOx, SOx ($/ton)	Medium: NOx – 40.59, SOx - 0	Medium: NOx – 40.59, SOx - 0	Low: Medium -25%	High: Medium +25%
Load Growth	Medium: 1.4% peak, 1.7% energy	High: 2.1% peak, 2.5% energy	Low: 0.7% peak, 0.8% energy	High: 2.1% peak, 2.5% energy
Wind (Eastern US)	60.8 GW	60.8 GW	60.8 GW	111.6 GW
Transmission expansion	Approved Projects	Approved Projects + RITELine, PATH	Approved Projects	Approved Projects + RITELine, PATH

Scenario definitions for PROMOD assumptions
Grain Belt Missouri Simulations

Data Assumptions for Study Scenarios

2019 Assumptions	Business as Usual	Robust Economy	Slow Growth	Green Economy
Nat Gas Prices (Henry Hub Spot, $/MMBTU)	Medium: $4.74	High: Medium + $3	Low: Medium - $3	High: Medium + $3
Forced Coal Retirements (GW)	Medium: MISO - 13.5, PJM - 15.8	Low: MISO - 9.0, PJM - 11.1	Low: MISO - 9.0, PJM - 11.1	High: MISO - 21.8, PJM - 18.4
Carbon Pricing	No	No	No	Yes: $50/ton
NOx, SOx ($/ton)	Medium: NOx – 40.59, SOx - 0	Medium: NOx – 40.59, SOx - 0	Low: Medium -25%	High: Medium +25%
Load Growth	Medium: 1.4% peak, 1.7% energy	High: 2.1% peak, 2.5% energy	Low: 0.7% peak, 0.8% energy	High: 2.1% peak, 2.5% energy
Wind (Eastern US)	60.8 GW	60.8 GW	60.8 GW	111.6 GW
Transmission expansion	Approved Projects	Approved Projects + RITELine, PATH	Approved Projects	Approved Projects + RITELine, PATH

Scenarios | Demand | Generator data | Detailed Generator Data | Grain Belt Energy | Missouri Transmission

Grain Belt Express
Production Cost Modeling Study Assumptions
Workshop on March 5, 2015

I. OVERVIEW OF PRODUCTION COST MODELING

A PROMOD technical overview is provided below, describing the level of precision used in the production cost simulations.

Note: PROMOD does not utilize transmission loading curves. It employs a DC power flow model and incorporates the impact of transmission losses through loss penalty factors calculated dynamically based on line characteristics and system conditions.

For additional details please refer to the PROMOD Technical Overview Data Sheet:

http://www.ventyx.com/~/media/files/brochures/promod_technical_overview_data_sheet.ashx

PROMOD IV OVERVIEW

PROMOD IV is an integrated electric generation and transmission market simulation system that incorporates extensive details of generating unit operating characteristics and constraints, transmission constraints, generation analysis, unit commitment/operating conditions, and market system operations. It performs an 8,760-hour commitment and dispatch recognizing both generation and transmission impacts at the bus-bar (nodal) level. PROMOD IV forecasts hourly energy prices, unit generation, fuel consumption, bus-bar energy market prices, regional energy interchange, transmission flows, and congestion prices. It uses an hourly chronological dispatch algorithm that minimizes costs while simultaneously adhering to a variety of operating constraints, including generating unit characteristics, transmission limits, fuel and environmental considerations, ancillary services requirements, and customer demand.

TRANSMISSION SYSTEM REPRESENTATION

PROMOD IV captures the constraints and limitations inherent in electrical power transmission using a DC load flow algorithm. All major transmission equipment is modeled—voltage transformers, phase-angle regulators, DC ties, generation and load buses, and transmission lines with reactance and resistance inputs. The transmission topology data are fully integrated with the commitment and dispatch algorithm so that generators are scheduled, started, and cycled while transmission constraints are enforced. PROMOD IV simultaneously optimizes the transmission, generation commitment, and unit dispatch for all 8,760 hours under security-constrained unit commitment (SCUC) and economic-dispatch rules. PROMOD IV also models transmission interfaces, enforcing bidirectional limits on groups of lines.

The PROMOD IV tool includes both summer and winter normal-state ratings on power flow branches and interfaces to enforce normal flow limits on the transmission system. In addition, PROMOD IV recognizes contingency constraints, so that the dispatch will still be feasible if the system experiences any of a set of contingency events or combination of events. A single defined contingency can represent multiple transmission lines or generator outages (e.g., N-1, N-2, and more contingencies). Emergency

ratings (summer and winter) on power flow branches and interfaces can be used to define additional energy that can flow on lines during contingency events.

UNIT DISPATCH

PROMOD IV calculates dispatch lambdas for each unit capacity segment based on its variable costs, which include fuel (commodity, handling, and transportation); emissions; and operations and maintenance (O&M). Based on the reactance of the connected transmission lines, shift factors are calculated for each bus, so that injected generation will flow into the system while adhering to the physical characteristics of the grid. PROMOD IV incorporates each generator's costs, shift factors, and ramp rate limits into a linear program to optimize the dispatch across the entire system for each hour, honoring transmission constraints within a full security-constrained economic dispatch.

UNIT COMMITMENT AND DISPATCH

A multi-pass process is employed to establish day-ahead unit commitment for each generator based on forecast energy prices at the generator injection bus. Unit characteristics captured in the commitment and dispatch include multi-segment operation, minimum capacity, ramp-up and ramp-down limits, start-up costs, minimum runtime and downtime constraints, and operating reserve contribution. The unit-commitment process also captures system operational effects, including transmission congestion, marginal losses, phase angle regulators, DC line operation, regional interchange, and tariffs. PROMOD IV also co-optimizes spinning reserve decisions within hourly dispatch. The following paragraphs describe the steps in the unit-commitment and dispatch solution.

First, a preliminary unit dispatch is performed without enforcing unit runtime and downtime constraints, ramp rates, and start-up cost effects. This preliminary solution is designed to create a starting point for the price of energy in each hour that is not subject to multi-hour commitment constraints. This dispatch incorporates a full view of transmission congestion and other detailed operations. Wind units can be set up to be dispatched in the preliminary solution by designating them as "Firm" resources, or they can be excluded in the preliminary price formation by designating them as "Non-Firm." The preliminary dispatch is performed for a 7-day period, starting Monday at 1:00 a.m. and ending Sunday at 12:00 p.m. (midnight). This gives each generation injection site (bus) a unique 168-hour forecast for energy prices. The 168-hour look-ahead from Monday to Sunday is designed to be long enough to account for unit-commitment decisions based on multiday constraints (e.g., 48-hour minimum downtime).

The second step in the unit-commitment process is to optimize the operation of each generator given the price forecast at its bus, subject to unit-specific operating constraints and unit bid (or cost) inputs. A mixed-integer program is used to optimize unit profit. If energy prices are higher than the unit bid in a given hour, it is assumed the unit must be committed in that hour for load or reliability, and the program optimizes the run schedule for the surrounding hours to meet runtime constraints and maximize profits or minimize losses. If a unit runs at a loss for any day (including start-up cost), a new unit bid is calculated by determining the price increase needed to allow the unit to break even over the given run period. This new bid is added to the unit cost from the preliminary unit dispatch for the next dispatch pass. Each unit is processed individually based on the forecast prices at its injection bus. The unit commitment is done for the entire week without knowing if any forced outages will occur. If a forced outage does transpire during the week, the rest of the week is re-optimized from the hour in which the unit returns to service.

When all units have been processed, a second complete dispatch pass is done with all unit constraints in place and all commitment bid adders applied. The second dispatch results in a new forecast of bus prices and the commitment is re-optimized for each unit within the mixed-integer program to reflect the effect of unit operating constraints and bids on bus prices. This final commitment is then "locked in" for the final dispatch pass.

During the final dispatch, the commitment schedule from the final mixed-integer solution for each unit is honored. The final dispatch also includes forced outages that were not anticipated in the unit commitment process, and any Non-Firm resources that were not included in the preliminary passes. The dispatch process itself is a linear program optimization that includes a DC load flow solution to monitor flows on transmission lines, calculates and applies marginal loss factors at each generation node, recognizes market import-export tariffs, and co-optimizes for spinning reserve requirements.

II. SCENARIO ASSUMPTIONS

Data Assumptions for Study Scenarios

2019 Assumptions	Business as Usual	Robust Economy	Slow Growth	Green Economy
Nat Gas Prices (Henry Hub Spot, $/MMBTU)	Medium: $4.74	High: Medium + $3	Low: Medium - $3	High: Medium + $3
Forced Coal Retirements (GW)	Medium: MISO - 13.5, PJM - 15.8	Low: MISO - 9.0, PJM - 11.1	Low: MISO - 9.0, PJM - 11.1	High: MISO - 21.8, PJM - 18.4
Carbon Pricing	No	No	No	Yes: $50/ton
NOx, SOx ($/ton)	Medium: NOx – 40.59, SOx - 0	Medium: NOx – 40.59, SOx - 0	Low: Medium -25%	High: Medium +25%
Load Growth	Medium: 1.4% peak, 1.7% energy	High: 2.1% peak, 2.5% energy	Low: 0.7% peak, 0.8% energy	High: 2.1% peak, 2.5% energy
Wind (Eastern US)	60.8 GW	60.8 GW	60.8 GW	111.6 GW
Transmission expansion	Approved Projects	Approved Projects + RITELine, PATH	Approved Projects	Approved Projects + RITELine, PATH

III. DEMAND

Missouri's projected 2019 electric demand for the Business as Usual (BAU) scenario is shown in this tab. The total Missouri demand is comprised of six entities: Associated Electric Cooperatives, Inc. (AECI), Ameren Missouri, Empire District Electric Co., Kansas City Power & Light (KCPL), KCPL Greater Missouri Operations (KCPL GMO), and Missouri Other (which includes Columbia Water & Light Department, City Utilities of Springfield, Independence Power & Light). The figures represent only the Missouri portion of the entities' demand. The hourly demand for each entity is provided as well.

The demand for each entity comes from the Ventyx Simulation Ready Data, and is derived primarily from a FERC 714 with additional updates from ISO publications. From these, 10 year peak and energy forecasts are obtained and extrapolated an extra 20 years. Hourly load shapes are developed from historical hourly data into a "synthetic" load shape which is equivalent to the average load shape over several years (currently 2003-2013). This load shape is then processed for reasonability (for example, making sure a resulting ISO coincident peak is high enough).

Note that demand growth rates based on MISO Transmission Expansion Plan (MTEP) assumptions were applied to the Ventyx 2014 base demand data.

IV. GENERATOR DATA

Missouri generator data are provided in the excel spreadsheet given to the parties: generator name, type, fuel category, maximum capacity, average heat rate (at maximum capacity), operations and maintenance (O&M) costs, and minimum startup energy are provided. It is also noted whether the generator is retired in the BAU scenario.

The generator data comes from the Ventyx database, and the assumptions for existing generating units are sourced from Energy Velocity Suite which uses public sources including the EIA-860, EIA-411, EIA-867, EIA-412, EIA-759, FERC Form 1, FERC 423, and REA-12 and other utility and ISO publications. Information from these sources is also used to derive default data for generators that may have missing or incomplete filings. Data items supplied by EV include generator name, location (area assignment), summer/winter capacity, primary and secondary fuels, Generating Availability Data Systems (GADS) category, O&M costs, heat rates, projected capacity changes, projected retirement dates, and average monthly hydro energy. Detailed operational data from the Continuous Emissions Monitoring System (CEMS) is used to derive multiple capacity states with associated incremental heat rate data. Values for forced outage rates, forced outage durations, and scheduled maintenance requirements are taken from EV using data the NERC GADS and supplemented by Ventyx Advisors staff based on generator age. Emission production rates for SO2, NOx, and CO2 are sourced from EV and taken from documents published by the Environmental Protection Agency (EPA).

Data for nuclear planned refueling outage schedules and nuclear forced outage rates are developed internally by Ventyx based on publicly filed information from the Nuclear Regulatory Commission. Other operational modeling parameters such as unit minimum runtime, minimum downtime, contribution to spinning reserve, must-run status, etc., needed for simulation accuracy are supplied by Ventyx based on experience and knowledge of our models. Ventyx also provides assignments for all units to buses in the transmission grid for use in detailed LMP studies.

DETAILED GENERATOR DATA

More Missouri generator data is shown in this tab. For each generator, two to four capacity states are provided, with an associated heat rate for each state calculated by PROMOD. The calculated heat rates are defined in the database as one of three types: polynomial curve, exponential curve, or incremental.

The source for the data is the same as the "Generator data" tab.

V. GRAIN BELT EXPRESS ENERGY

The simulated 2019 hourly energy delivery to the Palmyra bus is shown in this tab. The base hourly wind pattern was derived from a combination of 10 separate NREL Eastern Wind Integration and Transmission Study (EWITS) sites in western Kansas. These wind patterns were scaled to the expected full production of wind farms delivering energy on the Grain Belt Express. The power on the line was then reduced for converter station and line losses. Finally, the delivered energy was split between the two injection points so that 3,500 MW was delivered at the Sullivan bus and 500 MW was delivered at the Palmyra Tap bus in hours where total production minus losses was 4,000 MW.

VI. MISSOURI TRANSMISSION

PROMOD powerflow branch data for transmission lines with at least one bus belonging to a Missouri powerflow area is shown in this tab. The start- and end-bus, voltage, normal and emergency flow limits are provided for each line. The data is derived from the Multi-regional Modeling Working Group (MMWG) 2018 Summer Peak powerflow case, produced by the Eastern Interconnection Reliability Assessment Group (ERAG) and supplied by Ventyx.