Exhibit No ._____
Issues: RTO Interconnection study process;
coordination with other utilities;
emergency restoration standards
Witness: Anthony Wayne Galli
Type: Additional Direct Testimony
Sponsoring Party: Grain Belt Express
Clean Line LLC
Case No.: EA-2014-0207
Date: June 27, 2014

MISSOURI PUBLIC SERVICE COMMISSION

CASE NO. EA-2014-0207

ADDITIONAL DIRECT TESTIMONY OF

DR. ANTHONY WAYNE GALLI, P.E.

ON BEHALF OF

GRAIN BELT EXPRESS CLEAN LINE LLC

June 27, 2014

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

A. My name is Anthony Wayne Galli. I am Executive Vice President – Transmission and Technical Services of Clean Line Energy Partners LLC ("Clean Line"). Clean Line is the ultimate parent company of Grain Belt Express Clean Line LLC ("Grain Belt Express" or "Company"), the Applicant in this proceeding. My business address is 1001 McKinney Street, Suite 700, Houston, Texas 77002.

Q. Have you previously submitted testimony and exhibits in this proceeding?

A. Yes, I have previously submitted direct testimony, dated March 26, 2014, and accompanying schedules identified as AWG-1 through AWG-8.

Q. What is the subject matter of this additional supplemental direct testimony?

A. The purpose of the additional supplemental direct testimony is to provide more background on: (1) the PJM Interconnection, LLC ("PJM") and Midcontinent Independent System Operator, Inc. ("MISO") interconnection study process, (2) the status of the Grain Belt Express Project ("Project") with respect to the PJM and MISO interconnection processes, (3) Grain Belt Express's plans for coordinating with gas utilities regarding pipelines that the Project crosses or parallels, and (4) the emergency restoration standards that Grain Belt Express plans to adhere to.

Q. **Please describe the interconnection study process in PJM and MISO.**

A. The interconnection study processes within FERC-approved Regional Transmission Organizations ("RTOs") PJM and MISO are meant to ensure that a reliable interconnection is achieved, and that all associated impacts are identified and mitigated. Overall, the processes involve many stakeholders and hundreds, if not thousands, of work-hours of studies and reviews that will lead to an interconnection that will not degrade the reliability

of the system. I will first explain the PJM study process as it relates to the studies that are being performed for the Project since the majority of the Project's requested interconnection level is in PJM.

PJM Interconnection Study Process

The PJM generation and merchant transmission queue interconnection processes are performed together and by queue priority on a "first-in, first-out" basis. Requests that are accepted into the interconnection process are studied in groups that are identified with a letter (e.g., "S" which would come after "R") or a letter and a number (e.g., "X3" which would come after "X2"). Any queue position with an "S" designation would be part of the "S queue." Once an interconnection customer submits a request to interconnect its project, that project receives a queue position number, for example X3-028 (in the case of the Grain Belt Express Project), corresponding to the queue letter and the position among the rest of the queue positions in the "X3" queue. The reliability study process consists of three phases.

Phase one is a Feasibility Study. This is a peak load study that PJM conducts to provide the interconnection customer a preliminary assessment of the feasibility of the project as proposed by the customer. This study is not typically as thorough as the next study phase, but provides only a high level review of whether the points-of-interconnection proposed by the customer, along with the project's planned power injection levels, are feasible.

Phase two is a System Impact Study ("SIS") which involves a more robust analysis of the thermal, voltage, and stability impacts that the project could have on the PJM system based on the planned project size and a single point-of-interconnection. The SIS involves

steady-state and stability analyses under both peak and light load conditions. The SIS provides a high-level cost estimate of any required reinforcements that might be needed to enable the interconnection of the new project. During the SIS phase, PJM identifies impacts to the reliability of the system and then works with the affected transmission owners to mitigate those impacts. PJM can perform additional "re-tools" of the system impact study if certain events, defined within the PJM Tariff, trigger such a re-tool.

The third and final study phase of the PJM interconnection process is the Facilities Study. The interconnection customer executes a Facilities Study agreement which includes a list of the system reinforcements that must be made in order to accommodate the interconnection of the new project. This list comes from the results of the System Impact Study. The Facilities Study provides a more detailed cost estimate of any system reinforcements, as well as a timeline for when those reinforcements must be completed. After the Facilities Study is complete, the customer negotiates and executes an Interconnection Service Agreement and a Construction Service Agreement prior to commercial operation of the project. No project seeking to interconnect to PJM will be allowed to inject power until all the necessary reliability studies are completed and the Interconnection Service Agreement has been fully executed.

MISO Interconnection Study Process

Unlike the PJM process described above, MISO has only a generation interconnection queue process which it administers on a "first-ready, first-served" basis. Requests that are accepted into the generation interconnection process are also studied using three phases, with the second phase being an optional phase (i.e., a party can proceed directly to the third phase after completion of the first phase).

Phase one is a Feasibility Study. This is a peak load study that MISO conducts to determine the number of constraints on the transmission system for the purpose of calculating a portion of the phase three Definitive Planning Process (DPP) entry milestone (also known as the "M2" milestone), discussed below. The Feasibility Study is not as thorough as the DPP study phase but provides a high level review of whether the points-of-interconnection proposed by the customer, along with the project's planned power injection levels, are feasible. Following the completion of the Feasibility Study, the customer has the option to: (i) proceed to phase two of the study process; (ii) proceed to phase three of the study process; or (iii) defer any study work for up to 18 months (also referred to by MISO as "parking" the project) if the customer is not ready to proceed to either phase two or phase three of the study process. By the end of the 18-month "park" period, the customer must provide the appropriate milestones and study deposits for either phase one or phase two of the study process or the customer's interconnection request will be withdrawn from the generation interconnection queue.

Phase two is the System Planning & Analysis ("SPA") Study. This is an optional phase that a customer can bypass and proceed directly to the third phase (i.e. the DPP phase) by providing the M2 milestone, which is a DPP entry deposit determined as part of the Feasibility Study, and a required study deposit (known as a "D3" deposit). As the SPA is an optional study, its scope is set by the customer. MISO study scope options include three pre-defined scope options (a regular SIS, a planning horizon study, or an operating horizon study) and one customizable scope option. Alternatively, scope selection may be combined by selecting a pre-defined scope and adding selections from the custom options. Thus, pending the scope selections made by the customer, the SPA may include the

following types of studies: power flow; short circuit; steady-state voltage; transient and voltage stability; system protection; loss analysis; and mitigation of constraints. Upon completion of the SPA phase, the customer can proceed to the third phase or "park" the project for up to 18 months before either: (i) completing a new SPA study, or (ii) proceeding to the third phase. As noted above, by the end of the additional 18-month "park" period, the customer must provide the appropriate milestones and study deposits for either phase two or phase three of the study process or the customer's interconnection request will be withdrawn from the generation interconnection queue.

Phase three is the DPP Study which consists of three stages: (i) a SIS stage; (ii) a Facilities Study stage; and (iii) the preparation and execution of a Generator Interconnection Agreement stage. The SIS includes a thermal analysis, a short circuit analysis, and a transient and voltage stability analysis. The study may also include system protection and loss analyses, depending on the recommendation from the ad hoc group, which is a technical group that MISO will convene consisting of MISO transmission owners such as Ameren. The SIS results will include a preliminary indication of the planning level estimate of cost and time that would be necessary to implement any MISO system network upgrades identified in the analysis. The Facility Study will determine the cost and time estimate to construct the MISO network upgrades and transmission owner's interconnection facilities necessary to physically and electrically interconnect the customer's project to the MISO transmission system. After the Facilities Study is complete, the customer negotiates and executes an Interconnection Service Agreement prior to commercial operation of the project, which will include an agreed upon construction schedule. No project seeking to interconnect to MISO can do so until all the

necessary reliability studies are completed and the Interconnection Service Agreement has been fully executed.

To ensure consistency between the PJM and MISO interconnection studies described above, both PJM and MISO will perform affected parties SIS. This occurs if each party identifies the other as an affected party for the portion of the Grain Belt Express Project that they are each studying in their respective interconnection processes. The requirement for PJM and MISO to coordinate their planning efforts is outlined in Section 9.3.3 of the *Joint Operating Agreement Between the Midwest Independent Transmission System Operator, Inc. and PJM Interconnection L.L.C.* at Article IX: Coordinated Regional Transmission Expansion Planning[1].

Q. What is the status of the Grain Belt Express Project in the PJM Interconnection Study process?

A. The Project, which has been assigned queue number X3-028 in the PJM transmission interconnection process queue, has already completed the Feasibility Study and is currently awaiting the results of the SIS which PJM initiated in February 2013. PJM has advised Grain Belt Express that the SIS results shall become available in July 2014.[2] Within 30 days of receipt of the SIS results, the Company plans to enter into a Facilities Study agreement with PJM and proceed into the Facilities Study phase of the PJM interconnection process. The Facility Study is expected to take 12-18 months from when it is initiated.

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[1] http://www.pjm.com/~/media/documents/agreements/joa-complete.ashx

[2] While both MISO and PJM have regulatory timeframes in which they are required to deliver these studies to an interconnection customers, RTOs are often delayed, sometimes significantly, in processing the studies and working their way through the queues due to factors outside of the control of the interconnection customer.

Q. What is the status of the Grain Belt Express Project in the MISO interconnection study process?

A. The Grain Belt Express Project, which has been assigned queue number J255 in the MISO generation interconnection process queue, has already completed the Feasibility Study and is currently awaiting the results of the SPA study which MISO initiated in May of 2014. Grain Belt Express elected to proceed into the SPA study rather than the DPP study since it is awaiting the results of the PJM SIS, which will include the necessary PJM system upgrades required to accommodate the Project's injection into the PJM system. Some of these required PJM system upgrades are near MISO-PJM seams, which would need to be analyzed in the MISO DPP study to ensure that the DPP study results are accurate and consistent with the PJM studies. Grain Belt Express has been advised by MISO that the SPA results may be available as early as August 2014. When the SPA results become available, depending on the completion of the PJM SIS, Grain Belt Express will either enter into the DPP study phase or "park" its interconnection request until the PJM studies are completed.

Q. What do the MISO studies that have been completed show?

A. MISO completed a Feasibility Study for J-255 in October 2012, and the study is attached as **Schedule AWG-6** to my direct testimony. The Feasibility Study did not identify any constraints associated with the 500 MW injection into MISO in eastern Missouri.

Q. What do the PJM studies that have been completed show?

A. PJM completed the Feasibility Study for X3-028 in January 2013.[3] This study identified several system upgrades associated with the 3500 MW injection into PJM at the requested locations. However, as explained above, since a feasibility study a is not typically as thorough as the next SIS phase, it is expected that many of the identified system upgrades will be eliminated or reduced once a more detailed model of the Grain Belt Express HVDC line and improved system study assumptions are utilized.

Q. How can Missouri PSC Staff evaluate the Project without the completion of all the required MISO and PJM interconnection studies?

A. The PSC Staff can rely on PJM and MISO RTOs who under federal law are charged with managing the interconnection process to ensure that new projects such as the Grain Belt Express Project are interconnected to the interstate bulk electric grid in a manner that maintains its reliable operation. The RTOs will work with Grain Belt Express, Ameren, and other public utilities to ensure that the Project will be interconnected to the Missouri portion of the MISO system in a manner that maintains system reliability.

Q. Will Grain Belt Express obtain all required RTO interconnection studies prior to constructing the Project?

A. Yes. The Company is required by federal law and regulations to complete the required interconnection studies before it connects to PJM, MISO and Southwest Power Pool, Inc. ("SPP"). Therefore, Grain Belt Express will agree to obtain all required reliability studies from PJM, MISO and SPP, as well as sign all necessary interconnection agreements prior

[3] The PJM feasibility study can be viewed at the following location: http://www.grainbeltexpresscleanline.com/sites/grain_belt/media/X3-028_Sullivan_765_kV_Feasibility_Report.pdf

to constructing the Project as a condition of the Commission issuing a certificate of public convenience and necessity to the Company for the Project.

Q. What does Grain Belt Express expect to see from the MISO studies?

A. Aside from the actual Ameren interconnection facilities necessary to physically and electrically interconnect the Grain Belt Express Project to the MISO transmission system, the Company does not expect MISO to recommend or require substantial system upgrades, if any, given that the 345 kV point of interconnection identified in Missouri is robust enough to accommodate a 500 MW injection. This expectation is based on the Feasibility Study results received from the MISO (attached as **Schedule AWG-6** to my direct testimony), which indicate the ability of the current system to accommodate an injection level of 500 MW into a robust 345 kV transmission system.

Q. What does Grain Belt Express expect to see from the PJM studies?

A. In addition to the transmission owner's interconnection facilities necessary to physically and electrically interconnect the Project to the PJM transmission system, Grain Belt Express currently expects that a new 765-kV line will be required as a system upgrade in the PJM system. The full details of the PJM system upgrades required to accommodate the injection from the Project are expected to be known by July 2014, when PJM expects to finalize the SIS report.

Q. **Regarding other electric utilities, what do your studies show about the effect on their systems of the delivery of 500 MW via the proposed converter station in eastern Missouri?**

A. MISO is currently studying the point of interconnections (POI) at Ameren's Maywood substation (previously known as Palmyra Tap) and on a tap of the Maywood-Montgomery

345 kV line. As noted above, the latest MISO Feasibility Study results did not identify any constraints associated with the 500 MW injection into MISO at the requested locations. Therefore the injection from the Project into eastern Missouri will not have any adverse impact on other electric utilities in the MISO system.

Q. Describe how Grain Belt Express plans to coordinate the Project's interactions with other utilities' facilities.

A. Since the Project is utilizing a dedicated metallic return, during normal operation no current from the Grain Belt Express line will flow into the ground, and it will not adversely affect any existing cathodic projection for gas pipelines. However, during lightning strikes on the line or the unlikely event where a pole conductor has fallen to the ground, there is the possibility for current to be momentarily injected into the ground and cause a step[4] or touch[5] potential on or around equipment associated with subsurface utilities that is exposed above ground (e.g., meter stations for a pipeline). Step and touch potentials are simply voltages that are created when a high current flows through a relatively low resistive object such as the earth (step potential) or exposed metallic equipment (touch potential). These voltages, if not mitigated, could create a safety issue for personnel during the faulted conditions. These risks will be studied in coordination with the gas pipeline utilities and other subsurface utilities that the Project will cross or parallel prior to construction of the Project and any appropriate mitigation measures will be identified. These studies typically take approximately a month or so to complete so there will be ample time to implement

[4] Step potential refers to a voltage gradient between a person's feet caused by ground current flowing through soil with high resistivity

[5] Touch potential refers to a voltage gradient between an energized object and the feet of a person making contact with the energized object

any appropriate mitigation measures during the construction process of the Project to ensure that the existing cathodic projection is not compromised and that the gas pipelines that the Project will cross or parallel will continue to operate at safe and reliable performance levels.

Q. What NERC standards related to emergency restoration will the Grain Belt Express Project follow?

A. Grain Belt Express will adhere to all applicable NERC standards related to emergency restoration. Currently, this includes the following standards listed under NERC's Emergency Preparedness and Operations (EOP) section of the NERC standards[6]:

EOP-001-2.1b – Emergency Operations Planning

"Each Transmission Operator and Balancing Authority needs to develop, maintain, and implement a set of plans to mitigate operating emergencies. These plans need to be coordinated with other Transmission Operators and Balancing Authorities, and the Reliability Coordinator."

EOP-005-2 – System Restoration from Blackstart Resources

"Each Transmission Operator shall have a restoration plan approved by its Reliability Coordinator. The restoration plan shall allow for restoring the Transmission Operator's System following a Disturbance in which one or more areas of the Bulk Electric System (BES) shuts down and the use of Blackstart Resources is required to restore the shut down area to service, to a state whereby the choice of the next Load to be restored is not driven

[6]http://www.nerc.com/pa/Stand/Reliability%20Standards%20Complete%20Set/RSCompleteSet.pdf

by the need to control frequency or voltage regardless of whether the Blackstart Resource is located within the Transmission Operator's System."

EOP-008-1 – Loss of Control Center Functionality

"Each Reliability Coordinator, Balancing Authority, and Transmission Operator shall have a current Operating Plan describing the manner in which it continues to meet its functional obligations with regard to the reliable operations of the BES in the event that its primary control center functionality is lost."

EOP-010-1 – Geomagnetic Disturbances (GMD) Operations

"Each Reliability Coordinator or Transmission Operator with a Transmission Operator Area that includes a power transformer with a high side wye-grounded winding with terminal voltage greater than 200 kV…shall develop, maintain, and implement a GMD Operating Plan that coordinates GMD Operating Procedures or Operating Processes within its Reliability Coordinator Area."

In addition to these NERC guidelines, once a final route is established across the entirety of the Project, Grain Belt Express will establish appropriate contracts with third party providers, hire appropriate personnel for emergency response, and develop an appropriate storage facilities plan along the route.

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 345 kV Transmission Line	)))))))	Case No. EA-2014-0207

AFFIDAVIT OF ANTHONY WAYNE GALLI

STATE OF Texas)
) **ss**
COUNTY OF Harris)

Anthony Wayne Galli, being first duly sworn on his oath, states:

1. My name is Anthony Wayne Galli. I am Executive Vice President – Transmission and Technical Services of Clean Line Energy Partners LLC .

2. Attached hereto and made a part hereof for all purposes is my Supplemental Direct Testimony on behalf of Grain Belt Express Clean Line, LLC consisting of 12 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.

Anthony Wayne Galli

Subscribed and sworn before me this 27 day of June, 2014.

DORCAS RUTH O'QUINN
Notary Public, State of Texas
My Commission Expires
January 06, 2018

Notary Public

My commission expires: January 6, 2018

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