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Witness: Gary Moland  
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Clean Line LLC  
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**MISSOURI PUBLIC SERVICE COMMISSION**

**Case No. EA-2014-0207**

**DIRECT TESTIMONY OF**

**GARY MOLAND**

**ON BEHALF OF**

**GRAIN BELT EXPRESS CLEAN LINE LLC**

**March 26, 2014**

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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 Gary Moland. I am the Director of Power Markets & Transmission Analysis  
4 at DNV GL (formerly GL Garrad Hassan). My business address is 9665 Chesapeake  
5 Drive, Suite 435, San Diego, CA 92123.

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

7 A. I received a Bachelor of Science degree in nuclear engineering from the Georgia Institute  
8 of Technology and a Master of Science degree in mathematics and computer science  
9 from Emory University in Atlanta, Georgia.

10 I am currently employed by DNV GL, a global engineering consulting company  
11 headquartered in Norway. I have been employed by DNV GL since December 2010. I  
12 oversee analysis performed by DNV GL in regards to economic planning and simulation  
13 of U.S. energy markets. In this role, I manage consulting engagements that include  
14 economic benefit analysis for new transmission projects, congestion studies for  
15 generation projects both existing and under development, locational marginal price  
16 (“LMP”) forecasting studies, curtailment risk studies for wind generators, and analysis of  
17 wind integration impacts and costs.

18 Prior to joining DNV GL, I spent 20 years working for Ventyx, the vendor of the  
19 PROMOD simulation software used by DNV GL and many utilities for economic  
20 planning studies. Ventyx employed me as a software developer for PROMOD, client  
21 support specialist for PROMOD users (primarily major utilities), manager of PROMOD  
22 technical development, manager of the PowerBase energy market database project, and  
23 vice president in the “Ventyx Advisors” consulting group. My full Curriculum Vitae is  
24 provided in **Schedule GM-1** to this testimony.

1 **Q. Please describe your background in performing transmission economic analysis.**

2 A. In my work as a consultant over the past ten years, I have performed numerous studies to  
3 assess the economic impact of new transmission projects, including several benefit  
4 studies that have formed the basis for testimony before state public service commissions  
5 and other regulatory agencies. Specific transmission projects I have studied include:

- 6 • Rock Island Clean Line high voltage direct current transmission project located in  
7 Iowa and Illinois;
- 8 • Axtell-Spearville-Comanche 345 kV, located in the Southwest Power Pool, Inc.  
9 (“SPP”), a regional transmission organization (“RTO”);
- 10 • CREZ Scenario 2 transmission expansion, located in the Electric Reliability  
11 Council of Texas (“ERCOT”); and
- 12 • Atlantic Wind Connection offshore high voltage direct current transmission  
13 project, located in PJM.

14 In the course of conducting these studies, I designed and created future scenarios to  
15 assess the economic impacts of a proposed transmission project across a range of possible  
16 market conditions.

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

18 A. The purpose of my testimony is to describe the assumptions, methodology, and results of  
19 the analysis conducted by DNV GL to measure the economic and environmental impacts  
20 of the Grain Belt Express transmission project (“Grain Belt Express Project” or  
21 “Project”) proposed by Grain Belt Express Clean Line LLC (“Grain Belt Express” or  
22 “Company”). The testimony will detail the economic and environmental benefits under  
23 four assumption scenarios or “futures” and will demonstrate that the Project will result in

1 lower overall demand costs for energy in Missouri and throughout the region, lower  
2 energy production costs, and reduced overall emissions of pollutants.

3 **II. ECONOMIC MARKET STUDY**

4 A. Study Methodology, Scenarios and Data Assumptions

5 **Q. Please summarize the economic study performed by DNV GL to analyze the impacts  
6 of constructing and operating the Grain Belt Express Project.**

7 A. DNV GL used the PROMOD production cost modeling software package to perform  
8 simulations of future energy markets for a representative study year (2019) to assess the  
9 economic impact of the Grain Belt Express Project on system operations in Missouri.  
10 The year 2019 was chosen because it is the first full year the Project is scheduled to be in  
11 operation. PROMOD is proprietary modeling software, which incorporates extensive  
12 details in generating unit operating characteristics, transmission grid topology and  
13 constraints, and market system operations to support economic transmission planning.  
14 The simulations encompassed RTO energy markets and transmission grids throughout the  
15 eastern United States, including SPP, PJM Interconnection, LLC (“PJM”), Midcontinent  
16 Independent System Operator, Inc. (“MISO”), the New York Independent System  
17 Operator, the Ontario Independent Electricity System Operator, Entergy, and Tennessee  
18 Valley Authority, as well as most other utility systems in the eastern U.S. not currently  
19 participating in RTOs. In order to develop a robust view of impacts and benefits,  
20 simulations were performed across several possible future market scenarios both with and  
21 without the Grain Belt Express Project.

1 **Q. Please describe the study methodology for evaluating the economic and**  
2 **environmental benefits of the Project.**

3 A. The study methodology used to assess the economic benefits of the Grain Belt Express  
4 Project includes the following primary activities:

5 (1) Assumptions and scenario development: Study years and energy market scenarios  
6 are selected to provide several plausible futures under which to evaluate the  
7 economic and environmental benefits of the project. A scenario-based approach  
8 is critical to ensure that economic results are robust across a variety of future  
9 conditions. For each scenario, specific assumptions are developed for modeling  
10 inputs, such as future demand, future gas prices, new wind generation, and other  
11 key assumptions based on research and past modeling experience. Scenarios are  
12 constructed and tested to ensure that results reflect the intended data parameters.

13 (2) Base Case simulations: The first set of simulations is performed for the study year  
14 across multiple scenarios without the Grain Belt Express Project included.  
15 Extensive quality assurance checks are carried out on these Base Case results to  
16 validate data accuracy through a general comparison of results against historical  
17 operations.

18 (3) Grain Belt Express Project simulations: A second set of simulations is performed  
19 for the study year across multiple scenarios that include the Project along with the  
20 wind generation expected to supply energy delivered over the Project. An hourly  
21 energy profile for generation in western Kansas was provided by Grain Belt  
22 Express witness David Berry, Executive Vice President – Strategy and Finance  
23 of Clean Line Energy Partners LLC (the ultimate parent company of the  
24 Applicant in this case). I then modified this data to account for electrical losses at

1 the direct current converter stations and during transmission over the line. The  
2 added wind capacity is not interconnected into the existing transmission grid and  
3 can be delivered only via the Grain Belt Express Project. This benefit study is  
4 unique in that the economic feasibility of the Project and the new wind generation  
5 resources that will utilize it are directly intertwined, such that one cannot be  
6 reasonably modeled without the other. The Project serves no purpose without the  
7 new wind resources and the new wind resources would not be developed without  
8 the transmission access afforded by the Grain Belt Express Project. Quality  
9 assurance checks are carried out with a focus on the operation of the Project to  
10 ensure that the modeled line flow, electrical loss rates, and other results align with  
11 design parameters.

12 (4) Benefit Analysis: The Project simulations are compared to the corresponding  
13 Base Case for each scenario to assess the impact of the Project on system  
14 operations, costs, and emissions. The resulting economic and environmental  
15 benefits are wholly driven by new wind generation facilitated by the Grain Belt  
16 Express Project. This new wind generation offsets fuel and emission costs from  
17 conventional generation, and the low variable cost of the new wind generation  
18 also reduces LMPs in Missouri, lowering demand cost under RTO settlement  
19 processes.

20 **Q. What are “LMPs”?**

21 A. “LMP” stands for locational marginal pricing and represents the incremental cost of  
22 energy at a specific electrical bus (or collection of buses, often referred to as a “hub”) at a  
23 given point in time. LMPs are calculated every five minutes by the system operators in  
24 Missouri, and these prices are used in financial settlements to determine the cost to buy

1 and sell energy on the open wholesale market. LMPs include the cost of the next  
2 increment of energy needed to meet system-wide demand, the cost of transmission  
3 congestion impacts on a specific bus location, and the cost of electrical losses associated  
4 with a specific bus location.

5 **Q. Does the study incorporate SPP’s transition to its new “Integrated Marketplace”**  
6 **which began in March 2014?**

7 A. Yes, the commitment and dispatch processes in the study simulations are set up to reflect  
8 the rules of the SPP Integrated Marketplace.

9 **Q. Please describe the PROMOD software model used in the analysis.**

10 A. PROMOD is an integrated electric generation and transmission market simulation tool. It  
11 performs hourly chronological commitment and dispatch of generating resources that  
12 minimizes system operating costs while simultaneously adhering to a variety of  
13 constraints, including maximum capacity of generation sources, transmission limits, fuel  
14 and environmental costs, operating reserve requirements, and customer demand.  
15 PROMOD can be used to forecast hourly energy prices (LMPs), unit generation, fuel  
16 consumption, emissions output, regional energy interchange, transmission flows, and  
17 congestion costs based on the input market conditions specified by the user.

18 **Q. What future energy market scenarios were considered in the economic analysis?**

19 A. The economic analysis of the Grain Belt Express Project considered four different future  
20 scenarios. A high-level description of each scenario is provided below, and detailed data  
21 assumptions for each scenario can be found in my **Schedule GM-2**. All scenarios  
22 included approved future transmission upgrades in SPP and MISO (including MISO’s  
23 Multi-Value Projects) scheduled to be constructed by the 2019 study year. The study  
24 scenarios include:



1        Business As Usual: Energy demand grows under a moderate economic recovery with no  
2        major changes to existing environmental policy, generating technologies, fuel commodity  
3        prices, or other key energy market assumptions. Expansion of renewable generation is  
4        driven by current state mandates with moderate retirement of coal generation driven by  
5        market economics and existing environmental rules.

6        Slow Growth: Continuation of depressed economic conditions characterized by slow  
7        demand growth, continued low fuel commodity prices, and minimal  
8        transmission/generation expansion. Addition of new renewable generation expansion is  
9        driven by current state mandates with moderate retirement of coal generation driven by  
10       existing environmental rules.

11       Robust Economy: Strong recovery in economic activity characterized by accelerated  
12       growth in electrical demand, higher fuel prices and emission allowances prices, and  
13       increased activity in new generation and transmission projects. Expansion of renewable  
14       generation is based on current state mandates with the moderate retirement of coal  
15       generation driven by existing environmental rules. This scenario includes the addition of  
16       proposed transmission projects including RITELine Company's Potomac Appalachian  
17       Transmission Highline ("PATH"), designed to move energy eastward into markets in  
18       Indiana and Ohio, then on to the major demand centers near the eastern coast.<sup>1</sup> Although  
19       these specific projects are not currently approved or under development, they are  
20       generally representative of the anticipated expansion of the transmission grid needed to  
21       support robust load growth assumptions and to provide representative value of such

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<sup>1</sup> The PATH project was cancelled due to low load growth. It is reasonable to assume that the project will be renewed in a high load growth scenario.

1 expansions regardless of the specific likelihood of the construction of any such specific  
2 projects.

3 Green Economy: Expansion in environmental policy including carbon “cap and trade”  
4 legislation and a federal renewable portfolio standard. This scenario includes high  
5 demand growth and increases in fuel prices and emission allowance prices (including  
6 carbon). Expansion of renewable generation is significantly higher than current state  
7 mandates, with accelerated coal retirements driven by new emissions costs. This scenario  
8 includes the addition of proposed transmission projects including the RITELine and  
9 PATH transmission projects designed to move energy eastward into markets in Indiana  
10 and Ohio, then on to major demand centers near the eastern coast. Although these  
11 specific projects are not currently approved or under development, they are generally  
12 representative of the anticipated expansion of the transmission grid needed to support a  
13 green economy and to provide representative value of such expansions regardless of the  
14 specific likelihood of the construction of any such specific projects.

15 **Q. What other data assumptions were used in the economic analysis?**

16 A. In addition to the data assumptions presented in my Schedule GM-2 for each of the four  
17 study scenarios, DNV GL uses many other data assumptions in the study database.  
18 Along with the PROMOD simulation model, DNV GL licenses the “Simulation-Ready  
19 Data” product from Ventyx. This energy market database contains data for forecasted  
20 demand, forecasted fuel prices, detailed generating unit characteristics, transmission  
21 system configuration, and other information. DNV GL carries out validation activities to  
22 verify data accuracy and make enhancements in some areas such as modeling of wind  
23 generation and adding recently approved transmission projects. The Ventyx data is used

1 as a starting point for system planners across North America and undergoes rigorous  
2 review by a wide variety of product users.

3 **Q. What are the sources of operating and cost data on individual existing and planned**  
4 **generating units and transmission facilities that were used in the scenarios?**

5 A. The bulk of the study data for generators, fuel, electrical demand, and market operating  
6 rules is provided by Ventyx, the same company that licenses the PROMOD simulation  
7 software. Ventyx compiles electrical system data from public sources and combines it  
8 with detailed market research and analysis to provide databases for use in energy market  
9 simulation models. Ventyx is a leading data vendor for North America, providing  
10 simulation databases to many utilities, transmission and generation planners, consulting  
11 organizations, and system operators (including MISO, SPP, PJM, ERCOT, and the  
12 California ISO). Ventyx provides data updates twice a year to keep databases current  
13 with regard to forecasted fuel prices, demand forecasts, and new generation projections.  
14 The Ventyx data is used as a starting point for system planners across North America and  
15 undergoes rigorous review by a wide variety of product users. Transmission assumptions  
16 are based on industry-approved transmission powerflow cases published by the North  
17 American Electric Reliability Corporation along with information on recently approved  
18 major transmission projects provided by transmission planning organizations, such as  
19 MISO and SPP.

20 **Q. What metrics were developed in the economic analysis?**

21 A. PROMOD simulations provide several key metrics that were used to assess the economic  
22 benefits of the Grain Belt Express Project and the new wind generation it supports.  
23 These metrics include:

- 1           • Demand Cost (\$) – The hourly electrical demand (MWh) at each bus multiplied  
2           by the hourly LMP (\$/MWh) at that bus summed over all Missouri buses for all  
3           hours. This represents the total cost to purchase energy to supply total Missouri  
4           annual demand under RTO settlement rules.
- 5           • Production Cost (\$) – Total variable cost of generation to supply energy to meet  
6           annual demand including fuel costs, emission costs, variable operation and  
7           maintenance costs, and unit start up costs.
- 8           • LMP (\$/MWh) – Incremental cost of energy averaged across all electrical load  
9           buses in Missouri.
- 10          • Emissions Production (tons) – Total volume of emissions produced by generation  
11          units for sulphur dioxide (“SO<sub>2</sub>”), nitrogen oxide (“NO<sub>x</sub>”), mercury, and carbon  
12          dioxide (“CO<sub>2</sub>”).

13 B.    Results of the Economic Analysis

14 **Q.    What were the results of the economic analysis?**

15 A.    Schedule GM-2 shows the results of the economic analysis for each scenario in terms of  
16    demand costs, LMPs, and variable production costs. Schedule GM-2 also shows the  
17    emissions and water use reductions as calculated in the analysis. Scenarios run under  
18    each economic forecast showed positive economic impacts, including lower cost of  
19    production, lower demand and less pollution from generation.

20 **Q.    How were emissions reductions calculated?**

21    The study database licensed from Ventyx includes emission production rates for NO<sub>x</sub>,  
22    SO<sub>2</sub>, mercury, and CO<sub>2</sub> for each generator. The total number of tons produced for each  
23    of these effluents is calculated by PROMOD during the simulation of each scenario by  
24    multiplying the hourly output of each generator times the appropriate emissions

1 production rate. Reductions in mercury were calculated after completion of the  
2 PROMOD runs by multiplying unit-specific production rates for mercury times the  
3 annual energy production for each coal plant modeled in the study. Reductions in water  
4 usage (evaporation) were estimated using general water consumption rates for each unit  
5 type (e.g., coal, combined cycle, combustion turbine) combined with annual generation  
6 results from the PROMOD simulations. Reduction of each of these emissions is a direct  
7 result from the reduced need for conventional, emissions-producing generation due to the  
8 addition of new wind resources facilitated by the Grain Belt Express Project.

9 **Q. Please summarize the results of your studies of the Grain Belt Express Project and**  
10 **the interconnected wind generation.**

11 A. (1) The Grain Belt Express Project reduces total demand costs in Missouri under each of  
12 the four future scenarios.

13 (2) The Grain Belt Express Project lowers LMPs (\$/MWh) in Missouri in each of the  
14 future scenarios.

15 (3) The Grain Belt Express Project reduces total variable production costs in the eastern  
16 United States under each of the future scenarios.

17 (4) The Grain Belt Express Project reduces emissions of NO<sub>x</sub>, SO<sub>x</sub>, CO<sub>2</sub>, and mercury,  
18 and reduces water usage in power generation, in the eastern United States under each of  
19 the future scenarios.

20 **Q. Are your study results for 2019 representative of the impact of the Grain Belt**  
21 **Express Project and the new wind resources that will be connected to it in other**  
22 **future years?**

23 A. Yes, the study benefits and impacts for the Grain Belt Express Project presented here are  
24 expected to be generally representative of results for other future years.

1 **Q. Does this conclude your prepared direct testimony?**

2 **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 )  
345 kV Transmission Line )

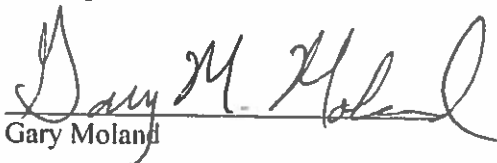
Case No. EA-2014-0207

AFFIDAVIT OF GARY MOLAND

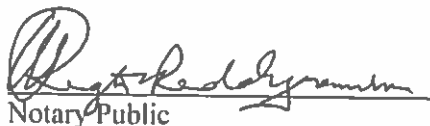
STATE OF Georgia )  
COUNTY OF Fulton ) ss

Gary Moland, being first duly sworn on his oath, states:

1. My name is Gary Moland. I am the Director of Power Markets & Transmission Analysis at DNV GL (formerly GL Garrad Hassan).
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 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.

  
Gary Moland

Subscribed and sworn before me this 20<sup>th</sup> day of March 2014.

  
Notary Public

My commission expires: Nov 1, 2014

