PLAINS & EASTERN

CLEAN LINE

PROJECT PROPOSAL
FOR NEW OR UPGRADED TRANSMISSION LINE PROJECTS
UNDER SECTION 1222 OF THE ENERGY POLICY ACT OF 2005

JULY 2010

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Notice

The development of a major infrastructure project like the Plains & Eastern Clean Line is a long-term undertaking. During the development process the Project will be modified and refined to reflect input from stakeholders and progress in the areas of permitting, public outreach, engineering, commercial relationships and others.

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KEY ABBREVIATIONS AND ACRONYMS

AC	Alternating Current
AWEA	American Wind Energy Association
AWS	AWS Truepower
CREZ	Competitive Renewable Energy Zones
E&E	Ecology & Environment, Inc.
EHV	Extra High Voltage
ERCOT	Electric Reliability Council of Texas
EWITS	Eastern Wind Integration and Transmission Study
FERC	Federal Energy Regulatory Commission
GW	Gigawatt (one billion or 10^9 watts)
GWh	Gigawatt-hours (one billion or 10^9 watt-hours)
HVDC	High Voltage Direct Current
ICF	ICF International
ISO	Independent System Operator
JCSP	Joint Coordinated System Plan
MISO	Midwest Independent Service Operator
MOU	Memorandum of Understanding
MW	Megawatt (one million or 10^6 watts)
MWh	Megawatt-hours (one million or 10^6 watt-hours)
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NREL	National Renewable Energy Laboratory
PJM	PJM Regional Transmission Organization
PMA	Power Marketing Administration
RES	Renewable Electricity Standard
RPS	Renewable Portfolio Standard
RTO	Regional Transmission Operator
SERC	Southeast Reliability Corporation
Siemens PTI	Siemens Energy Inc., Power Technologies International
SPP	Southwest Power Pool
SPS	Southwestern Public Service
Southwestern	Southwestern Power Administration
TO	Transmission Owner
TOP	Transmission Operator
TrAIL	Trans-Allegheny Interstate Line
Western	Western Area Power Administration
WECC	Western Electricity Coordinating Council

INTRODUCTION

Clean Line Energy Partners LLC, on behalf of itself and certain of its affiliated companies, respectfully submits this proposal to the US Department of Energy ("DOE") and the Southwestern Power Administration ("Southwestern") in response to the *Request for Proposals for New or Upgraded Transmission Line Projects Under Section 1222 of the Energy Policy Act of 2005*, 75 Fed. Reg. 32940 (June 10, 2010) ("RFP"). Clean Line wishes to work with Southwestern and provide it "contributed funds" for purposes of developing, constructing and operating two new overhead high voltage direct current ("HVDC") transmission lines that will be capable of moving more than 7,000 MW of power from renewable energy projects in western Oklahoma, southwestern Kansas and the Texas Panhandle to the service area of the Tennessee Valley Authority ("TVA") and the southeastern United States.[1] Development of these new lines will promote electric reliability, meet the needs of generators and utilities for new transmission capacity, and enable the construction of thousands of megawatts of new, cost-effective renewable electric generation capacity. This additional generation capacity will create new jobs, stimulate domestic manufacturing, and lead to cleaner air and water.

Clean Line respectfully requests that during or after their review of this application, DOE and Southwestern initiate negotiations with Clean Line to enter into a development partnership. Clean Line stands ready to immediately enter into those discussions and to make necessary contributed funds available to DOE and Southwestern.

1. The Challenge

The most vexing challenge blocking continued growth in the renewable energy industry is the expansion of the US electric transmission grid. The existing transmission system was primarily built as a result of local utility planning – connecting population centers with nearby fossil fuel power plants. In the last decade, the nation has expressed the desire to move away from fossil fuels and towards a clean energy economy. While the United States has the best renewable resources in the industrialized world, the transmission infrastructure does not yet exist to connect the bulk of these resources, predominantly located in remote areas, to distant load often located near urban centers. New long-haul transmission lines must be built to fully capture the potential of America's vast renewable resources and further the development of a clean energy economy.

2. The Solution

An effective transmission solution requires appropriate technology, a flexible business model, a methodical approach to development, and most importantly, the right project. The Plains & Eastern Clean Line ("Plains & Eastern" or the "Project") will deliver the best renewable resources in the country to the southeastern United States, an area that lacks access to new, low-cost renewable power.

Due to its lower losses and more efficient use of right of way, HVDC is the most economic technology to move large amounts of power over long distances. By selling transmission capacity to renewable generators or the buyers of their power, the Project will avoid difficult cost allocation proceedings. Clean Line's independence from existing or planned generation and from load-serving utilities permits a

[1] For purposes of this document, "southeastern" and the "Southeast" include Arkansas as well as Tennessee, Mississippi, Alabama, Georgia, Kentucky, Florida, Virginia, South Carolina, and North Carolina.

single-minded focus on meeting the needs of the Project's many stakeholders through a transparent development effort.

Plains & Eastern will make possible some $12 billion of renewable energy projects that otherwise cannot be built due to limitations of the existing grid. These projects, together with the Plains & Eastern Clean Line, will create more than 6,000 permanent jobs, reduce carbon pollution by more than 14 million tons annually, and offset the emissions of approximately two million cars each year. During construction, Plains & Eastern will stimulate the economy by creating approximately 70,000 person-years of employment or 360,000 person-years of employment if the renewable energy plants enabled by the Project are considered.[2] The Project will increase competition in wholesale power markets and improve the security and diversity of America's energy supply.

For over 12 months, Clean Line's team has advanced development of the Project on a number of fronts. Clean Line has made significant progress on the interconnection process for the terminals at both ends of the transmission lines. Clean Line and TVA entered into a Memorandum of Understanding ("MOU"), pursuant to which TVA will play an active role in including the Project in transmission planning processes going forward. With respect to interconnection on the western or "windward" side of the Project, Clean Line held extensive discussions with staff and members of Southwest Power Pool ("SPP").

Clean Line is working with 18 wind developers that have projects located in the Oklahoma and Texas Panhandles and southwestern Kansas (the "Resource Area"). Several developers have agreed to share wind data so that Clean Line can optimally design the Project to take advantage of the best wind resources and most efficiently use the line capacity. These developers are potential transmission service customers; alternatively, they may sell power to load-serving entities who purchase capacity on the Plains & Eastern Clean Line.

As part of its efforts to employ best practices in siting the Project, Clean Line has met with hundreds of stakeholders in an extensive outreach effort. In order to understand and avoid sensitive areas, Clean Line entered into a consulting agreement with the Arkansas Field Office of The Nature Conservancy and is working on a similar arrangement with the Oklahoma Field Office. Clean Line presented the Project to local or regional offices of Sierra Club, Canoe Club, Wildlife Federation and Audubon Society and is committed to working with these organizations to find optimal routes for the Project. Clean Line performed a Phase I study to identify potential routes and engaged Ecology and Environment, Inc. ("E&E") to be its lead environmental consultant. Efforts to obtain the necessary permits and authorizations at the state level are already underway; Clean Line recently filed to become a public utility in both Oklahoma and Arkansas.

Clean Line proposes that DOE and Southwestern use their authority under section 1222 of the Energy Policy Act of 2005 to participate in the development, construction and operation of the Plains & Eastern Clean Line. By doing so, DOE and Southwestern would help meet anticipated future electric transmission needs, enable the development of new renewable generation capacity, and provide customers significantly greater access to low-cost renewable energy than they have today – or are likely ever to have in the absence of the Project.

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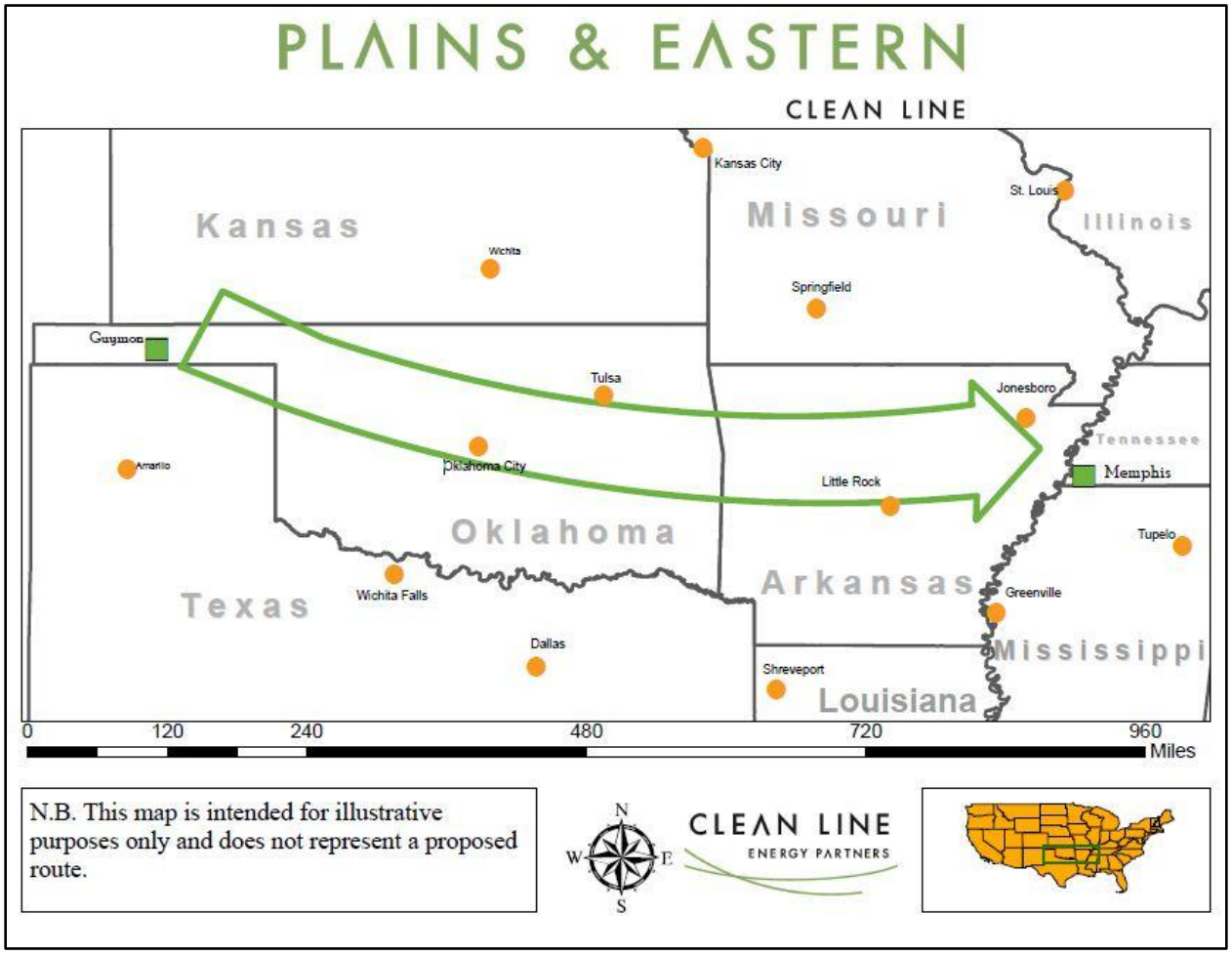
[2] A person-year is a unit of job creation equal to full time employment for one person for one year. Economic benefits are estimated in Dr. Ray Perryman's study, *The Potential Impact of the Proposed Plains & Eastern Clean Line Transmission Project on Business Activity in the US and Affected States*, attached as Appendix 3.

Figure 1
Plains & Eastern Clean Line Project Area Map



Source: Clean Line Energy

SECTION I: STATUTORY CRITERIA

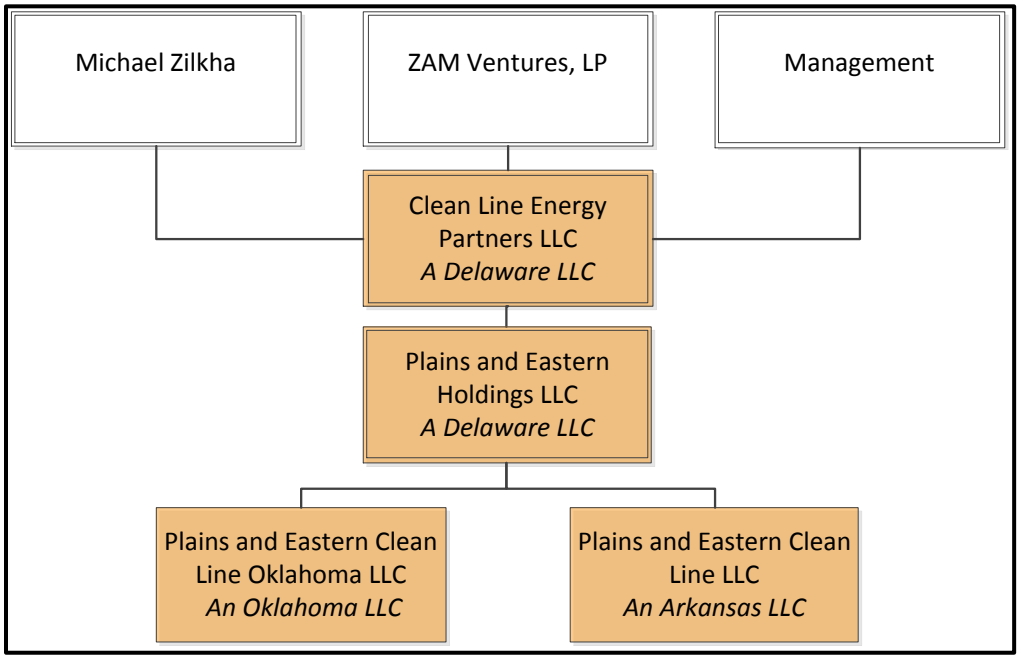
The RFP states that, in order to exercise authority, the Secretary, in consultation with the applicable power marketing administration ("PMA"), must first determine that a proposed Project meets certain statutory criteria. In connection with making this determination, the RFP then asks that any entity interested in providing contributed funds for upgraded or new transmission facilities under section 1222 submit a Project Proposal that contains information responsive to certain requests. Section I lists each of those requests and provides Clean Line's appropriate responsive information.

1. General Description of the Entity

The name and a general description of the entity submitting the Project Proposal;

This proposal is submitted on behalf of Clean Line Energy Partners LLC and its subsidiaries: Plains and Eastern Clean Line Holdings LLC, a Delaware limited liability company; Plains and Eastern Clean Line LLC, an Arkansas limited liability company; and Plains and Eastern Clean Line Oklahoma LLC, an Oklahoma limited liability company (together, "Clean Line"). Clean Line Energy Partners LLC is the sole member and 100% owner of Plains and Eastern Clean Line Holdings LLC, which in turn is the sole member and 100% owner of both Plains and Eastern Clean Line LLC and Plains and Eastern Clean Line Oklahoma LLC. Collectively, these entities are developing and own all of the assets comprising the Plains & Eastern Clean Line. The Project is owned through multiple entities because it is desirable for state regulatory reasons that the applicant for public utility status in Oklahoma and Arkansas be domiciled in the appropriate state.

Figure 2
Clean Line Organizational Structure



Source: Clean Line Energy

2. Project Description

a. Overview

An overview of the proposed Project, including the Project location, proposed routing, and minimum transfer capability;

Clean Line is developing and planning to build and operate the Plains & Eastern Clean Line transmission project. The Project will be developed in two phases, with each phase consisting of one bi-pole HVDC transmission line. Together the two lines will be capable of transmitting up to 7,000 MW of power from renewable projects in western Oklahoma, southwestern Kansas and the Texas Panhandle to TVA and other utilities in the Southeast. Each phase will have two DC converters, one at each end of the line. The preliminary converter locations for the first phase are Texas County, Oklahoma and a substation near Memphis, Tennessee.

b. Eligibility Criteria

(For Proposals for Projects for non-DOE entities to participate with Southwestern or Western in designing, developing, constructing, operating, maintaining, or owning a new electric power transmission facility and related facilities located within any State in which Southwestern or Western operates): A statement, supported by the best available data, demonstrating how the proposed Project meets all of the following five eligibility criteria:

The Plains & Eastern Clean Line meets the five criteria set by the DOE in order to partner with Southwestern pursuant to section 1222 of the Energy Policy Act of 2005.

I. The proposed Project must be either: (A) Located in an area designated under section 216(a) of the Federal Power Act (16 U.S.C. 824p(a)) and will reduce congestion of electric transmission interstate commerce; or (B) Necessary to accommodate an actual or projected increase in demand for electric transmission capacity.

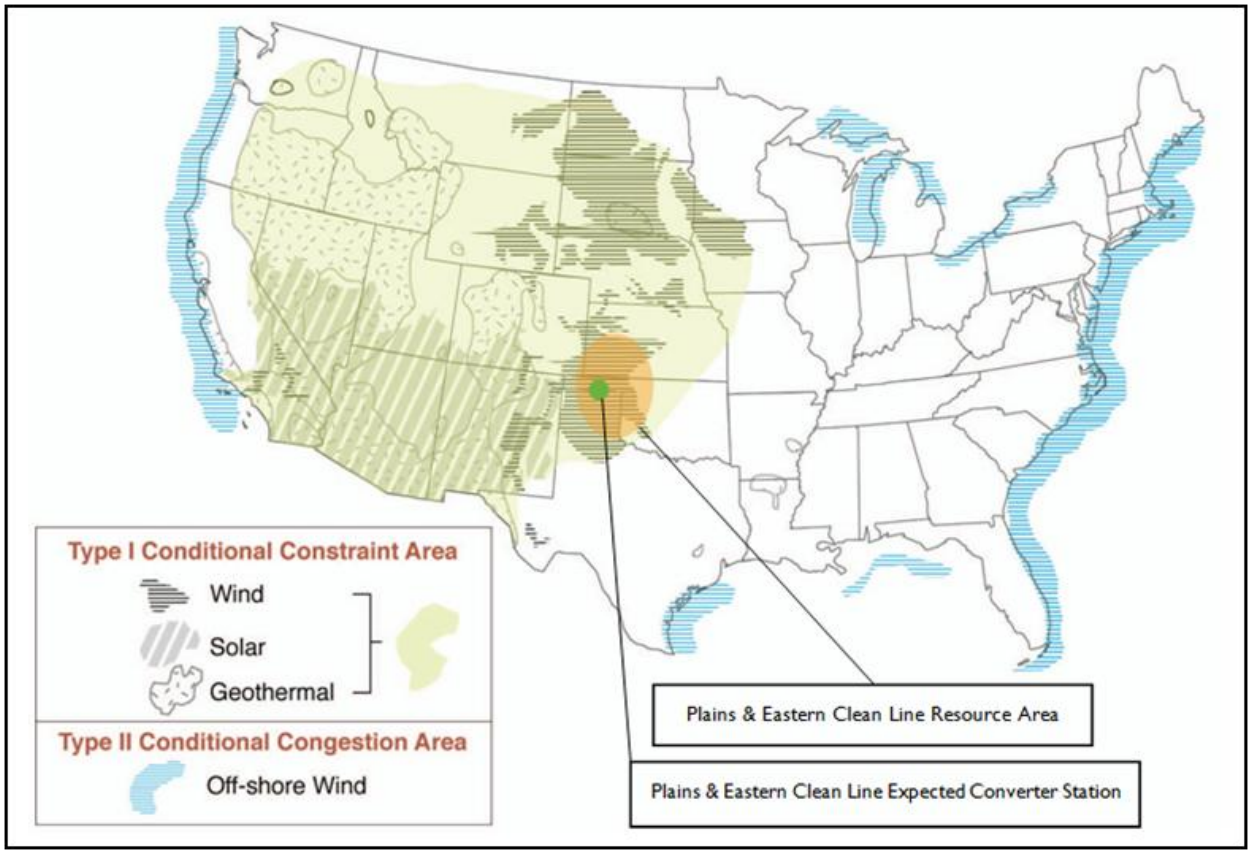
The Plains & Eastern Clean Line is necessary to accommodate the actual and projected increase in demand for electric transmission capacity to deliver renewable energy from western SPP to load centers in the southeastern United States.

While the proposed route of the Plains & Eastern Clean Line is not within an area designated under 216(a) of the Federal Power Act, the DOE has identified the Project's Resource Area as a Conditional Constraint Area ("CCA") in both its 2009 National Electric Transmission Congestion Study and 2006 National Electric Transmission Congestion Study.

As indicated in Figure 3, the Resource Area is a Type I CCA, meaning wind generation can be developed with existing technology. DOE also notes that Kansas and Oklahoma have strong wind generation potential that could significantly improve the economic vitality of the states' rural counties, enhance reliability and potentially reduce consumer electricity costs.[3]

[3] US Department of Energy, *National Electric Transmission Congestion Study*, December 2009, 22.

Figure 3
Type I and Type II Conditional Constraint Areas



Source: US Department of Energy, National Electric Transmission Congestion Study, December 2009, Pg. ix.

The DOE Electricity Advisory Board concluded that increasing transmission capability will help ensure reliable electric supply and provide greater access to economically priced power. It stated, "The possibility of a national renewable portfolio standard will require significant new transmission to bring these resources, which are often remotely located, to consumer load centers."[4]

According to a joint white paper by the Solar Energy Industries Association and the American Wind Energy Association ("AWEA"), "The massive deployment of renewable generation envisioned by President Obama cannot occur without a renewed investment in our country's transmission infrastructure."[5] The North American Electric Reliability Corporation ("NERC") concluded that "Significant transmission expansion will be needed to comply with renewable mandates, even in the absence of a national renewable portfolio standard."[6] NERC found that if a national renewable portfolio standard ("RPS") of 15% were adopted, an additional 40,000 miles of transmission lines would be

[4] Electricity Advisory Committee, *Keeping the Lights On in a New World*, January 2009, 45.
[5] American Wind Energy Association and the Solar Energy Industries Association, *Green Power Superhighways*, February 2009, 3. http://www.awea.org/GreenPowerSuperhighways.pdf.
[6] North American Electric Reliability Corporation, *2009 Long-Term Reliability Assessment:* 2009-2018, October 2009, 29.

needed and "Transmission would be a key component to accommodating new resources, linking geographically remote generation to demand centers."[7]

In addition to the general demand for more transmission oriented to renewables, there is and will be a specific demand for transmission to address the following concerns:

- Additional Transmission is Needed to Develop Wind Resources in the Southwest Power Pool;
- Additional Transmission is Needed to Relieve Congestion in Western SPP;
- Additional Export Capability is Needed from SPP; and
- Additional Transmission is Needed to Import Power in the Southeast.

The Plains & Eastern Clean Line meets each of these needs.

Additional Transmission is Needed to Develop SPP Wind Resources

Encompassing Kansas, Oklahoma and the Texas Panhandle, SPP has some of the best wind resources in the country. According to a white paper presented by SPP in April 2009, "We believe that SPP could absorb only 20%-30% of the wind potential in our region."[8] The potential of these resources is much greater than SPP's demand for renewable energy. Over 32,600 MW of wind projects are in the SPP Generation Interconnection Queue, of which 26,628 MW are located in the tri-state region of Kansas, Oklahoma, and Texas (only the northern part of the Texas Panhandle is located in SPP). According to one estimate by the National Renewable Energy Laboratory ("NREL"), Oklahoma alone could produce in excess of 267,000 MW of high capacity factor wind energy. In comparison, average electricity demand in the entirety of SPP—a Regional Transmission Organization ("RTO") whose members serve consumers in Oklahoma, Kansas and Nebraska, as well as parts of Missouri, Texas and Arkansas—is only about 26,000 MW.[9] Only a portion of this demand can be sourced from renewable energy. For example, the renewable energy goals adopted by Kansas and Oklahoma's legislatures can be met with about 5,000 MW of high capacity factor wind power projects. Thus, additional transmission is needed to export SPP's wind energy out of the region. Wind developers and utilities with renewable energy purchase goals will demand capacity on Plains & Eastern to take advantage of SPP's surplus of renewable resources.

Additional Transmission is Needed to Relieve Congestion in Western SPP

Transmission upgrades are needed to enhance the ability of power to flow from western SPP, where the richest wind resource is located, eastward to locations where electricity demand is higher. In the recent wind integration study commissioned by SPP, Charles River Associates found that as more wind is installed, "Power flows from western SPP to eastern SPP increase significantly…. To accommodate the increased west-to-east flows while meeting the reliability standards of the SPP Criteria, a number of transmission expansions were required."[10]

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[7] North American Electric Reliability Corporation, *2009 Scenario Reliability Assessment*: 2009-2018, October 2009, 9.
[8] Southwest Power Pool, An SPP Perspective, Renewable Energy Conference White Paper, April 14, 2009, 4. http://www.spp.org/publications/Renewable_Energy_Conference_white_paper%20_04%2014%2009.pdf.
[9] Southwest Power Pool, Introduction to SPP, May 13, 2010. http://www.spp.org/publications/Intro_to_SPP_Presentation.pdf.
[10] Charles River Associates, *SPP WITF Wind Integration Study*, January 2010, 1-2.

The expected beginning point of the first phase of the Project, near the Hitchland Substation, is owned by Southwestern Public Service ("SPS"). Due to its high level of wind penetration and limited transfer capability, SPS experiences curtailment of wind farms in some hours and low marginal prices in other hours (see Figure 4). These low prices are evidence of transmission congestion. Both curtailment and congestion are caused by inadequate transmission capacity linking SPS with the broader SPP grid.

Figure 4
SPS Pricing

Price Level ($/MWh)	2009 Hours
<0	26
0 to 10	51
10 to 20	1,649
Total	1,726
Percent of Year	19.7%

Source: SPP EIS Balancing Market

In hours when wind production is high, the constrained links between SPS and the broader grid are likely to become congested. As a result, zero marginal cost wind power may not be able to reach load or displace the most expensive fossil fuel generation. Without new transmission, congestion in SPS is likely to increase as more wind power is added. The desire to relieve potentially costly congestion and to allow wind power to achieve the maximum cost savings for consumers will create a demand for capacity on Plains & Eastern.

Additional Export Capability is Needed from SPP

Since SPP can use only a fraction of its renewable energy potential, the increasing demand for renewable energy will create a demand for additional export capability. SPP borders the Electric Reliability Council of Texas ("ERCOT") to the south, Western Electricity Coordinating Council ("WECC") to the west, Midwest ISO ("MISO") to the north, and Entergy to the east. Because SPP is asynchronous with ERCOT and WECC frequencies, the ability to export to these neighboring regions is constrained by limited DC ties. SPP's *Wind Integration Study* found that "[a] concern is that SPP has limited DC connections with ERCOT (to the south) and WECC (to the west)."[11]

Presently the DC ties between SPP and ERCOT are of limited use for exporting wind power because ERCOT already has more wind generation than can be delivered to its load centers. Export capability into WECC is further restricted by the low electricity demand in eastern New Mexico and Colorado and limited transfer capabilities to locations farther west in the WECC footprint. These states have excellent wind resources within their borders and thus are not likely to be major importers of wind energy. Consequently, exports to the East appear to be the most promising route to realizing SPP's wind potential. In its *EHV Overlay Study*, SPP specifically identified a future demand for additional export capacity to the broader Eastern Interconnection as renewable energy increases its penetration level.[12]

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[11] Charles River Associates, *SPP WITF Wind Integration Study*, January 2010, 2-7.
[12] Southwest Power Pool, *Final Report on the SPP EHV Overlay Project*, June 27, 2007, 7. http://www.spp.org/publications/spp_ehv_study_final_report.pdf.

Additional Transmission is Needed to Import Power in the Southeast

TVA's Board of Directors adopted a goal to derive 50% of its power from low or zero-carbon emitting resources by the year 2020.[13] To meet this goal, TVA issued a Request for Proposal in December 2008 to procure power from renewable energy sources. As a result of the Request for Proposal, TVA entered into power purchase agreements with over 1,380 MW of wind power projects, all located outside of TVA's service territory. Importing wind energy—even with the added cost of transmission—proved to be the most attractive option in TVA's competitive RFP process. Further wind energy imports, however, will require an extensive expansion of TVA's import capabilities.

Building transmission to import renewable energy to the Southeast was examined in a collaborative study between the Electric Power Research Institute and Oak Ridge National Laboratory. The study examined several potential options to connect SPP with the Southeast Reliability Corporation ("SERC") and found that connections delivering power to Entergy and TVA were the most economical. The study identified a projected economic demand for new transmission links between SPP and SERC under a variety of scenarios. It stated that:

> The availability of surplus economic wind resource in SPP, and the relative scarcity of wind and other renewable technologies in the Southeast, creates a significant opportunity for economic transfers under a wide range of assumptions about generation technology cost and performance, regional electric market conditions, and future environmental policies.[14]

Additional transmission capacity is needed to meet the reliability and renewable energy goals that the country has established. The need for additional transmission is particularly acute in the western portion of SPP where the Plains & Eastern Clean Line will originate. This region has an outstanding wind resource whose potential greatly outstrips existing and planned transmission. The Southeast also demands additional transmission to supply it with low-cost renewable power that it cannot obtain within the region.

II. The proposed Project must be consistent with both (i) Transmission needs identified, in a transmission expansion plan or otherwise, by the appropriate Transmission Organization (as defined in the Federal Power Act, 16 U.S.C. 791a et seq.) if any, or approved regional reliability organization; and (ii) Efficient and reliable operation of the transmission grid.

The Plains & Eastern Clean Line is consistent with the transmission needs identified in the plans of appropriate Transmission Organizations and the regional reliability organization. The line is not specifically included within any of those plans, but section 1222 does not require that a proposed line be included in the expansion plans – only that it be consistent with those plans. The Plains & Eastern Clean Line meets that test.

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[13] Tennessee Valley Authority, 2008 Environmental Policy, May 2008, 4. http://www.tva.com/environment/pdf/environmental_policy.pdf.

[14] Hadley, S, Key, T., and Deb, R., *Power Transfer Potential to the Southeast in Response to a Renewable Portfolio Standard: Final Report*, November 2009, 29.

Plains & Eastern is Consistent with Needs Identified by SPP

SPP repeatedly has identified the need to build additional transmission to fully develop wind potential in the region and to export it to neighboring regions. In its 2008 Strategic Plan, SPP declared that "New high voltage transmission expansion will be needed to bring wind energy to consumers."[15] The *SPP Wind Integration Study* concluded: "Major transmission reinforcements are needed to accommodate increased wind penetration levels."[16] SPP's *EHV Overlay Study* projected that SPP's transmission system would need to be expanded to accommodate "extensive demand for renewable energy in the US electric system."[17] The study found a need for additional export capabilities from SPP to its neighboring RTOs and made export capabilities one of the primary metrics by which transmission expansion scenarios were scored.

On April 24, 2009, SPP responded to the Arkansas Public Service Commission in Docket No. 08-144-U, *In the Matter of a Notice of Inquiry Regarding the Expanded Development of Sustainable Energy Resources in Arkansas*. SPP stated: "The potential for development of significant renewable resources in terms of wind and solar resources within SPP is almost unlimited and can be more fully realized only if SPP and its neighbors work together to coordinate bulk power planning and operations to effectively integrate and deliver renewable resources within the SPP footprint and to markets throughout the United States."[18]

Plains & Eastern is Consistent with Needs Identified in Collaborative Studies by Multiple Transmission Organizations

The Plains & Eastern Clean Line is consistent with transmission needs identified in the Joint Coordinated System Plan 2008 ("JCSP"). The JCSP was the first inter-regional transmission planning effort in the Eastern Interconnection. The JCSP was a collaborative effort and involved most of the major transmission operators in the Eastern Interconnection, including, MISO, SPP, PJM Interconnection, TVA, Mid-Continent Area Power Pool and several key members of SERC.

The JCSP report examined two potential scenarios by 2024: (1) the Eastern Interconnection meets 5% of its energy needs from wind ("Reference Scenario") and (2) it meets 20% of its energy needs from wind ("20% Wind Scenario"). The report assumed that the vast majority of the wind generation is sited in areas with the best resources, located in the western part of the Eastern Interconnection. In each scenario, the JCSP report found that HVDC transmission overlays may provide significant value by reducing grid congestion and facilitating new renewable resource development. As noted below in Table 1 and Figure 5, the JCSP included almost 3,000 miles of HVDC transmission lines in the Reference Scenario and over 7,000 miles in the 20% Wind Energy Scenario. Many of these HVDC lines are similar to the Plains & Eastern Clean Line. The lines originate in plains or midwestern states with strong renewable resources and terminate in eastern states with higher demand but more limited renewable resources.

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[15] Southwest Power Pool, *2008 SPP Strategic Plan*, December 12, 2008, 5. http://www.spp.org/publications/2008_SPP_Strategic_Plan.pdf.
[16] Charles River Associates, *SPP WITF Wind Integration Study*, January 2010, 1-3.
[17] Southwest Power Pool, *Final Report on the SPP EHV Overlay Project*, June 27, 2007, 7.
[18] Southwest Power Pool, Response of Southwest Power Pool, Inc. to Order No. 8 Estimate of the Impact of Proposals to Adopt Federal, Renewable Portfolio Standards, Renewable Electricity Standards, and Energy Efficiency Resource Standards, April 24, 2009, 2-3.

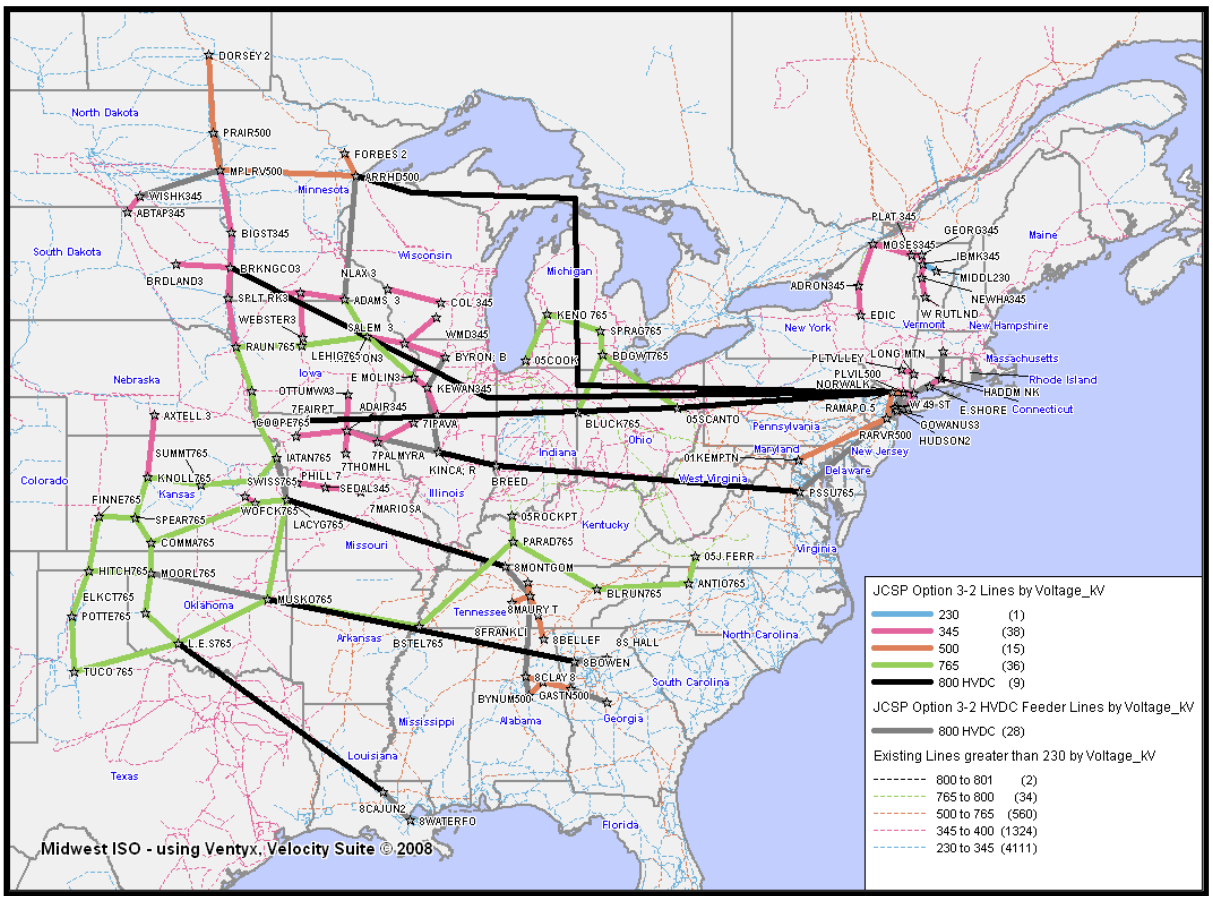
Table 1
Comparison of Reference and 20% Wind Energy Scenarios

		Reference Scenario		Wind Scenario	
		Miles	Percentage	Miles	Percentage
Transmission Overlay (Miles)	EHV AC (>=345kV)	7,109	71%	6,998	48%
	HV AC (<345kV)	-	-	-	-
	HVDC	2,870	29%	7,582	52%
	Total	9,979	100%	14,580	100%

Source: Joint Coordinated System Plan 2008

Figure 5
JCSP Conceptual Transmission Overlay

20% Wind Energy Scenario



Source: Joint Coordinated System Plan 2008

Subsequent to the JCSP report, the NREL performed additional work on specific operational and transmission requirements to integrate wind projects in the Eastern Interconnection. NREL commissioned *The Eastern Wind Integration and Transmission Study* ("EWITS") to determine the

operational impact of meeting 20% of the Eastern Interconnection's demand with wind energy. The study found that HVDC transmission lines were needed to deliver energy from wind-rich states to load centers in the East. Without significant transmission upgrades, curtailment would increase to uneconomic levels and wind development could not grow to the desired level.[19]

Plains & Eastern is Consistent with Reliable and Efficient Operation of the Grid

HVDC provides a number of reliability benefits, including controllable power flows. Compared to an equivalent AC solution, HVDC can link distant parts of the electric grid more reliably. Unlike AC lines, HVDC lines will not become overloaded by unrelated outages since the amount of power delivered is strictly limited by the DC converter. This reduces the likelihood that line outages will propagate from one region to another.

Clean Line will coordinate the controls of its HVDC lines with the system operations groups of the transmission planning organizations (such as SPP and TVA) at each end of the lines to ensure reliability is maintained at both the western and eastern terminals. Clean Line's commitment to reliability is further discussed in items *III* and *IV* below.

Clean Line has engaged Siemens Energy Inc., Power Technologies International ("Siemens PTI") to perform a suite of studies to ensure the Project's design maintains system reliability. Siemens PTI will perform load flow (steady state) analysis, short circuit analysis and dynamic stability analysis. These studies will encompass both terminals of the Project and give detailed insight into possible system concerns and, if needed, appropriate mitigation measures. For the full scope of the Siemens PTI's engagement, please see Appendix 1.

III. The proposed Project will be operated in conformance with prudent utility practice;

Clean Line confirms that the Project will conform to mandatory reliability standards as well as prudent utility practices. Prudent utility practice emphasizes ongoing safety and maintenance requirements concerned with the operation of transmission lines. Clean Line engages only experienced engineering, operations and construction firms to design, construct and maintain the Project. Policies will be developed and implemented in accordance with national, regional and local standards and in such a way as to integrate seamlessly with interconnecting utilities.

Prudent utility practices are summed up in the adherence to the following Federal Energy Regulatory Commission ("FERC") approved NERC standards: Transmission Owner ("TO"); Transmission Operator ("TOP"); Communications; Critical Infrastructure Protection; Emergency Preparedness and Operations; Facilities Design, Connections, and Maintenance; Interconnection Reliability Operations and Coordination; Modeling, Data and Analysis; Personnel Performance, Training and Qualifications; Protection and Control; Transmission Planning; and Voltage and Reactive. Clean Line will work closely with the interconnected utilities and regional entities to develop appropriate operational and seams agreements based upon these standards and prudent utility practices.

[19] US Department of Energy, National Renewable Energy Laboratory, Eastern Wind Integration and Transmission Study, January 2010, 27. http://www.nrel.gov/wind/systemsintegration/pdfs/2010/ewits_final_report.pdf.

IV. The proposed Project will be operated by, or in conformance with the rules of, the appropriate Transmission Organization, if any; or if such an organization does not exist, regional reliability organization;

At the appropriate time, Clean Line will register as a Transmission Owner and Transmission Operator in accordance with mandatory reliability rules approved by FERC. Upon registration as a TO/TOP, Clean Line will meet all applicable NERC, SERC and SPP reliability standards.

Clean Line is actively participating in several SPP working groups to collaborate with SPP members on the Project's interconnection as well as broader transmission issues.

Clean Line is presently working with a third party supplier of control and dispatch services to identify and ultimately design implementation processes for all applicable rules, standards and criteria.

In coordination with the interconnected utilities and regional entities, Clean Line will put in place appropriate operational agreements or seams agreements prior to commercial operation. Clean Line anticipates achieving operational readiness approximately six months prior to the energization of each transmission line.

Clean Line will install synchrophasors at each end of the transmission line to provide real-time data for system operators at locations necessary to promote increased reliability and situational awareness. The inclusion of synchrophasors will ensure that Clean Line participates in the North American Synchro Phasor Initiative ("NASPI") and will support efforts to understand the impact of integrating large amounts of wind into the electric system. NASPI grew out of a DOE-funded effort to improve reliability of the bulk electric system after the 2003 Blackout.

Clean Line will work with NERC, FERC and other authorities to ensure that existing and future physical and cyber security standards are implemented in a manner that improves the reliability of the Project and the bulk electric system.

V. The proposed Project will not duplicate the functions of existing transmission facilities or proposed facilities which are the subject of ongoing or approved siting and related permitting proceedings;

The Plains & Eastern Clean Line is not duplicative of existing facilities or proposed facilities that are currently in the transmission interconnection queue or permitting process. No transmission projects to export power out of SPP into the Southeast are in the TVA or Entergy interconnection queue or are engaged in a public permitting process.

SPP is in the process of implementing significant upgrades to its AC transmission system, but these projects have different objectives than the Plains & Eastern Clean Line. On April 27, 2010, SPP's Board of Directors approved "Priority Projects" totaling $1.14 billion of investment. The stated purpose of these projects is to relieve congestion, improve SPP's generation interconnection queue, and enhance transfer capability from SPP West to SPP East. These projects do not increase SPP's export capabilities to other regions. The Plains & Eastern Clean Line is not duplicative of the Priority Projects; in fact, the two are complementary. The Priority Projects will enhance the ability of wind farms to transmit power within SPP, while the Plains & Eastern Clean Line will increase the ability to export wind power out of SPP. The combination will maximize the SPP region's ability to capitalize on its wind resources.

3. Financing Statement

A financing statement, detailing the amount of funds the submitting entity would contribute to DOE for purposes of carrying out the Project, including the expected Project costs for which those contributed funds would be used, and the fiscal year(s) in which any contributed funds would be provided to DOE.

In response to the request for a "financing statement," Clean Line has set forth below a brief summary of expected project costs, the plans for funding, and an estimate of the amount and schedule of contributed funds that Clean Line will provide to Southwestern for the Project. Upon request, Clean Line will provide to DOE any additional financial information that DOE may require, including information that would be submitted on a confidential basis.

Based on internal estimates and third-party consultation, Clean Line anticipates that the total cost of developing and constructing the Project will be approximately $3.5-4.0 billion. Total development cost is estimated at $100 million, including land acquisition; total cost of DC converters is estimated at $1 billion; and total cost of the lines (including towers and cable) is estimated at about $2.4-2.9 billion (or $1.5-1.8 million per mile).[20] An approximate schedule of costs is shown below:

Table 2
Clean Line Preliminary Cost Schedule

Preliminary Cost Schedule				
Year	**Development**	**Converters**	**Line**	**Total**
2010	$ 4,000,000	$ -	$ -	$ 4,000,000
2011	$ 6,000,000	$ -	$ -	$ 6,000,000
2012	$ 7,000,000	$ -	$ -	$ 7,000,000
2013	$ 20,000,000	$ 50,000,000	$ 100,000,000	$ 170,000,000
2014	$ 50,000,000	$ 250,000,000	$ 700,000,000	$1,000,000,000
2015	$ 13,000,000	$ 250,000,000	$ 700,000,000	$ 963,000,000
2016	$ -	$ 250,000,000	$ 700,000,000	$ 950,000,000
2017	$ -	$ 200,000,000	$ 700,000,000	$ 900,000,000
Total	$100,000,000	$1,000,000,000	$2,900,000,000	$4,000,000,000

Source: Clean Line Energy

This schedule of costs is predicated on a late 2015 online date for the first of the Project's two lines and a 2017 online date for the second line. The total budget and schedule remain fluid at this juncture.

Clean Line anticipates that it will pay directly for the vast majority of Project related costs, including costs incurred for engineering and construction services performed by non-governmental personnel, the procurement of materials, and the acquisition of property rights acquired through negotiated purchase. Therefore, the funds used to pay these costs will not flow through Southwestern and will not count towards the $100 million statutory limitation on contributed funds in section 1222 of the Energy Policy Act of 2005.

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[20] This is consistent with public cost estimates of HVDC lines, for example in SPP's *EHV Overlay Study*, which estimates $1.7 million per mile for 500 kV HVDC lines, 40.

Clean Line proposes to supply contributed funds to Southwestern for those costs that must be incurred by Southwestern and otherwise cannot be paid for directly by Clean Line. As a result, Clean Line proposes to contribute approximately $14.133 million to Southwestern for purposes of advancing the Project. To date, Clean Line has had initial conversations with Southwestern but is pleased to further discuss the requirements for contributed funds.

Clean Line anticipates that these contributed funds will cover two categories of costs: (1) the costs for Southwestern to acquire any necessary property rights that cannot be acquired except through the use of federal eminent domain authority, and (2) Southwestern's administrative and development costs relating to the line, such as NEPA-related costs.

With respect to the first category, Clean Line expects to acquire upwards of 90% of the right of way required for the Project through privately negotiated transactions and will aim for much higher percentages. Consistent with the experience of Clean Line's management on other large transmission projects, Clean Line expects that no more than 10% of the right of way would be acquired through condemnation proceedings. Table 3 shows an estimate of the timing of contributed funds and their purpose.

Table 3
Contributed Funds Estimate

Year	Land Acquisition	Administrative	Contingency	Total
2010	$0	$200,000	$66,667	$266,667
2011	$0	$200,000	$66,667	$266,667
2012	$0	$200,000	$66,667	$266,667
2013	$2,200,000	$400,000	$866,667	$3,466,667
2014	$4,400,000	$400,000	$1,600,000	$6,400,000
2015	$2,200,000	$400,000	$866,667	$3,466,667
Total	$8,800,000	$1,800,000	$3,533,333	$14,133,333

Source: Clean Line Energy

Clean Line's estimate of land acquisition costs is based on work with Universal Field Services, Inc. ("Universal"). Universal estimated that acquiring two, 200 foot right of way along a possible route for the project would cost $80 million at fair market value. Clean Line assumed that land values will appreciate 10% by 2013. This equates to an average dollar per acre cost of about $2,300 per acre. Applying a 10% condemnation rate, total fair market value for acquiring land through the use of eminent domain would be $8.8 million. Clean Line added a one-third contingency due to the high level of cost uncertainty at this stage.

As to the second category of costs noted above, Clean Line recognizes that Southwestern's participation in the development of the Project likely will require significant internal and external resources to assist with the preparation of necessary NEPA analysis, provide legal advice, perform engineering services for Southwestern, and other activities. Clean Line and Southwestern will need to have more detailed discussions as to the scope and breadth of services for which contributed funds will need to be provided. The above estimate assumes that Clean Line will enter into an agreement directly with Southwestern's lead environmental contractor so that these costs would not count against the section 1222 limitation. While Clean Line prefers this solution, it would be willing to discuss an alternative.

Clean Line will cooperate with DOE and Southwestern to ensure that the Project will not adversely affect Southwestern's customers from a cost or reliability perspective.

SECTION II: PROJECT CRITERIA

The RFP states that if a proposed project meets the eligibility criteria discussed above, DOE and the relevant power marketing administration will conduct an initial evaluation of the eligible project, including criteria such as whether the project is in the public interest and whether it will facilitate the reliable delivery of power generated by renewable resources (75 Fed. Reg. at 32941). The RFP then sets forth data and information that project proposals should contain so that DOE and the relevant PMA can conduct this evaluation (75 Fed Reg at 32941-32942). Clean Line has provided this information below, in the order set forth in the RFP.

1. Public Interest

Public interest. A brief description of how the Project is in the public interest, including, but not limited to, advancing the purposes of EPAct.

The development of a robust, domestic clean energy industry is in the critical interest of the United States. When President Barack Obama addressed the nation from the Oval Office on June 16, 2010, he said, "The transition to clean energy has the potential to grow our economy and create millions of jobs – but only if we accelerate that transition. Only if we seize the moment."[21] Due to its strong wind and solar resources and capability for business innovation, America can move away from its dependence on foreign energy and create a sustainable clean energy economy.

The public at large clearly favors improving America's energy infrastructure; in a recent CBS News/New York Times poll, 75% of respondents said they would be willing to pay more for electricity if it were generated by renewable sources like solar or wind energy.[22] Support is strong in states like Oklahoma, which stand to gain economically from the burgeoning renewable energy industry. The Sooner Survey, released in October 2009, revealed that 72% of Oklahomans strongly approve the development of additional wind farms and are in favor of building large transmission lines that will provide for greater ability to sell electricity to other states.[23]

Transmission availability is already limiting the location and pace of wind farm construction as well as the utilization of operating wind farms. In the early 2000s, most projects were installed at the intersection of the best wind resources and existing transmission. Tremendous growth in wind generation has filled almost all of the transmission lines in the windiest parts of the country. Consequently, new construction has shifted from the windy sites in the Midwest to less windy but closer to load sites in the East (see Figure 6). Using data from AWEA, Clean Line calculated the geographical center of wind installations in the Eastern Interconnection. From 2005 to 2009, the epicenter for new construction moved about 220 miles east—from near Kirksville, Iowa to near Ottawa, Illinois. Building projects in less windy sites, however, leads to a higher cost of wind power for consumers.

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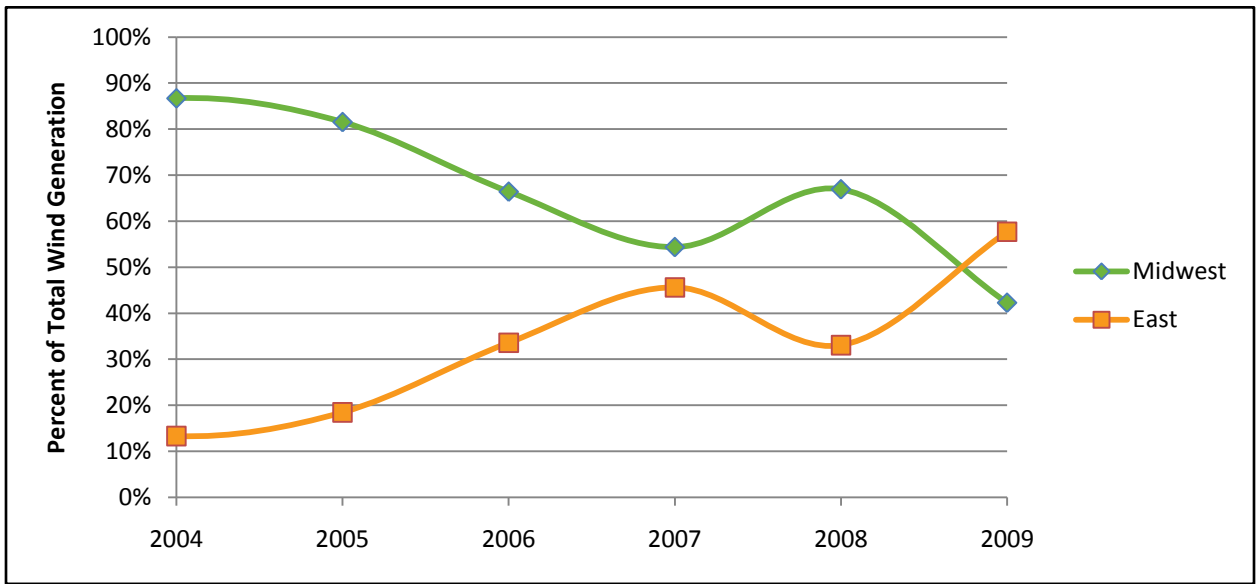
[21] Remarks by President Barack Obama, June 16, 2010. http://www.whitehouse.gov/blog/2010/06/16/president-obamas-oval-office-address-bp-oil-spill-a-faith-future-sustains-us-a-peopl.
[22] New York Times and CBS News, "Americans' Views on the Environment" April 2007. http://www.cbsnews.com/htdocs/pdf/042607environment.pdf.
[23] Cole Hargrave, Sondgrass & Associates, *Sooner Survey*, Vol. 19, No. 3, October 2009, 3.

Figure 6
Shift in Wind Construction



Source: American Wind Energy Association

Note: Midwest: North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Minnesota, Iowa
East: Illinois, Indiana, Ohio, Pennsylvania, New York, Wisconsin, Tennessee, West Virginia, New Jersey, Maine, Massachusetts, and Missouri

Transmission is becoming scarce even in moderately windy areas, limiting the industry's growth. During the first quarter of 2010, new wind installations declined 50% compared to the first quarter of 2009. Wind projects under development vastly outstrip available transmission. Of the 32,600 MW of wind projects in the SPP Generation Interconnection Queue, only a small fraction will be able to reach customers through the existing transmission system. Recognizing that a lack of transmission will prevent the full development of wind resources and the accompanying economic benefits, RTOs such as SPP, through its Priority Projects, and ERCOT, through its Competitive Renewable Energy Zones ("CREZ"), are in the process of upgrading their transmission systems to accommodate the interconnection of new wind power projects. Equally important is finding ways to export rich renewable resources to regions without access to low-cost clean energy. Inter-regional projects like the Plains & Eastern Clean Line help meet this need while complementing regional efforts already underway.

The Plains & Eastern Clean Line will bring a host of economic benefits, not only from the construction of new transmission, but also because it will enable over 7,000 MW of renewable energy projects that would otherwise not occur due to a lack of transmission infrastructure.[24] Oklahoma, as the state where many of these new projects will be located, and Arkansas, as a leading manufacturing state of wind turbine components, will directly benefit from the new renewable energy projects made possible by Plains & Eastern.

[24] 7,000 MW is a conservative estimate of new wind projects enabled by Plains & Eastern. Because wind farms typically do not generate 100% of their nameplate capacity, the Project will likely connect wind farms that collectively have a capacity more than the Project's. Therefore, while the Project is capable of transmitting 7,000 MW, Clean Line estimates that, depending on advances in technology, the Project may draw on 8,000 MW or more of new renewable power projects.

The Plains & Eastern Clean Line will advance the nation's energy security by providing a stable, domestic source of clean energy to the Southeast. The electricity delivered by the Project could be used to power electric vehicles; alternatively, by displacing natural gas generation, the Project will enable domestic natural gas resources to be used for transportation instead of power production. In either case, the Project could reduce reliance on imported oil, a key goal of the Energy Policy Act of 2005 and all energy-related legislative initiatives underway in Washington.

Because of its crucial role in improving energy security, enabling thousands of megawatts of renewable power, creating tens of thousands of jobs, and abating more than 14 million tons of carbon dioxide and other emissions on an annual basis, the Plains & Eastern Clean Line is in the public interest of the United States.

a. Economic Benefits

Construction of the Plains & Eastern Clean Line and the associated renewable power projects will provide a tremendous stimulus to the US economy, while long-term operations will create thousands of permanent jobs. To estimate the total economic benefit of the Plains & Eastern Clean Line and the associated renewable energy projects, Clean Line engaged noted economist Ray Perryman. All estimates in this section come from Dr. Perryman's study, *The Potential Impact of the Proposed Plains & Eastern Clean Line Transmission Project on Business Activity in the US and Affected States*. In addition to the direct expenditures and employment associated with the Project, Dr. Perryman's study estimates other benefits resulting from the multiplication of the Project's direct effects throughout the US economy. The study uses extensive survey data, industry information, and a variety of corroborative source materials to create a matrix describing the various goods and services to produce transmission lines and wind power projects. Once the base information is compiled, it is mathematically simulated to estimate the magnitude of successive rounds of activity involved in the overall production process.

Total economic benefits, including multiplier effects, from building the transmission lines and associated wind farms are shown below in Table 4 and Table 5, respectively.

Table 4
Economic Benefits of Construction and Development of the Plains & Eastern Clean Line

(Monetary Values in Millions of Constant (2010) Dollars)				
	Oklahoma	Arkansas	Tennessee	US
Total Expenditures	$ 2,949	$ 2,249	$ 254	$ 13,289
Gross Product	$ 1,455	$ 1,098	$ 124	$ 6,067
Personal Income	$ 989	$ 747	$ 85	$ 3,925
Person-Years of Employment	18,004	13,601	1,529	70,489

Source: The Potential Impact of the Proposed Plains & Eastern Clean Line Transmission Project on Business Activity in the US and Affected States – The Perryman Group

Table 5
Economic Benefits of Construction and Development of Associated Wind Farms

(Monetary Values in Millions of Constant (2010) Dollars)				
	Oklahoma	Arkansas	Tennessee	US
Total Expenditures	$ 12,696	$ 12,277	$ 7,792	$ 51,057
Gross Product	$ 6,114	$ 6,009	$ 3,777	$ 23,617
Personal Income	$ 4,161	$ 4,099	$ 2,572	$ 15,891
Person-Years of Employment	76,665	75,502	47,615	291,885

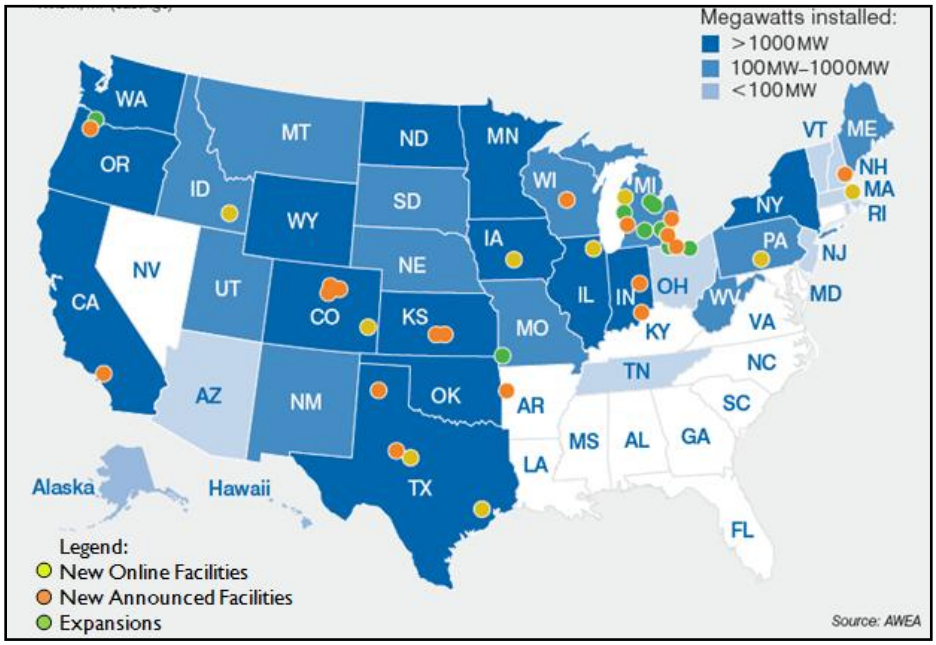
Source: The Potential Impact of the Proposed Plains & Eastern Clean Line Transmission Project on Business Activity in the US and Affected States – The Perryman Group

Total employment effects from the Project and the enabled power plants are over 362,000 person-years.

Economic benefits from the Plains & Eastern Clean Line will continue after its completion. The Project is estimated to create over 6,000 permanent jobs. Based on prevailing rates, construction and operation of the Project and associated wind farms will generate approximately $1.8 billion in state and local taxes during construction and $167 million per year during operation.

The increased development of wind and solar projects will attract additional manufacturing investment. Figure 7 shows the expansion of manufacturing facilities in 2009. Note the trend that manufacturing tends to be located near the sites where wind turbines are installed.

Figure 7
Expansion of Manufacturing Facilities in 2009



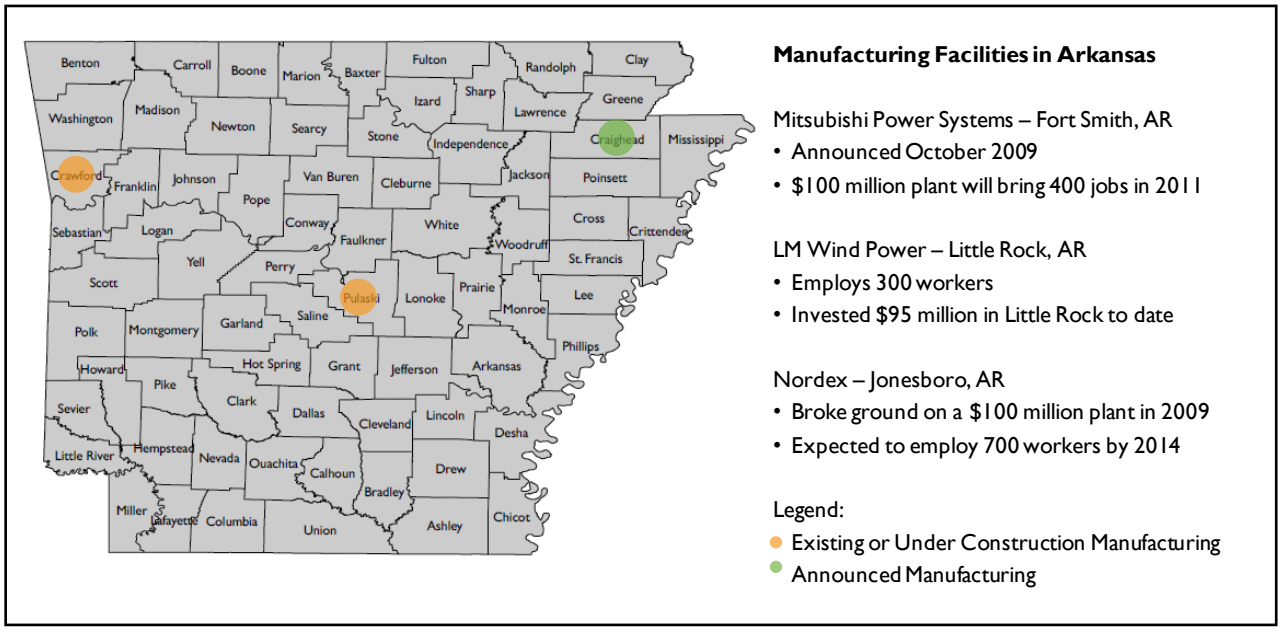
Source: American Wind Energy Association

Also noteworthy is that as the US wind industry is expanding, the domestic content of turbines is increasing. According to AWEA, "With supportive policies in place since 2004 and a rapidly growing market, US domestic manufacturing of wind turbines and their components has increased 12-fold with domestic content increasing from less than 25% to 50% even with a much larger market."[25]

Arkansas is located between some of the windiest states in the country and large electric loads. With its rivers, highways and rail infrastructure, the state is in an ideal position to become the manufacturing hub for the wind industry. Recognizing this, Mitsubishi Power Systems, LM Wind Power and Nordex already have established factories in Arkansas resulting in nearly 2,500 new jobs in the state (see Figure 8).[26] [27] It is possible that benefits in Arkansas will be substantially higher than currently estimated if Clean Line is successful in sourcing towers and cable from that state. The Perryman Group estimated that cable and tower manufacturers in Arkansas could realize $1.5 billion in output (gross product) and 18,391 person-years of employment as a result of the new opportunities provided by the Project. Plains & Eastern's effect of stimulating new wind generation should lead to expansion of the manufacturing facilities or the opening of new facilities in Arkansas and may have similar benefits for Oklahoma and Tennessee.

For more information on the economic benefits of the Plains & Eastern Clean Line, please see the study prepared by The Perryman Group and attached as Appendix 2.

Figure 8
Wind Turbine Component Manufacturing Facilities in Arkansas



Source: Clean Line Energy

[25] American Wind Energy Association, Windpower Outlook 2010. http://www.awea.org/pubs/documents/Outlook_2010.pdf.
[26] Arkansas Economic Development Commission, "Nordex to Build Wind Turbine Plant in Jonesboro, Arkansas," Press Release, October 24, 2008. http://www.mccallumsweeney.com/uploads/NEWS-125-08%2010%2015%20Nordex%20Press%20Release.pdf.
[27] Sedgwick, Reston. "Mitsubishi to Build Arkansas Wind Turbine Plant." Green Technology Daily, April 8, 2010. http://www.greentechnologydaily.com/solar-wind/679-mitsubishi-to-build-arkansas-wind-turbine-plant.

b. Environmental Benefits

Renewable power creates environmental benefits by replacing generation from thermal plants powered by fossil fuels like coal, oil and natural gas. Energy delivered by the Plains & Eastern Clean Line will allow southeastern utilities to achieve significant reductions in pollution. Reduced emissions include greenhouse gases (principally carbon dioxide), particulates (such as SO_X and NO_X) and heavy metals (including mercury). Displacing thermal generation also saves the large amounts of water needed to cool power plants. According to the Institute of Electrical and Electronics Engineers Spectrum, approximately 39% of freshwater withdrawn from rivers, lakes and aquifers in the United States is used to cool thermoelectric power plants.[28] Recently in the southeastern United States, very low river levels prevented numerous thermal plants from running at full capacity due to a lack of cooling water; this created a major reliability problem. The problem could potentially be mitigated in the future if the system were less reliant on thermal generation.

Renewable generation decreases emissions because polluting plants can be run less often and at lower output levels. Estimating the reduction in pollution as a result of the Plains & Eastern Clean Line requires an assessment of how operators would reduce thermal power production and replace it with the renewable power injected via the Project. Clean Line engaged ICF International ("ICF") to create such an estimate using a transmission-constrained model of the entire Eastern Interconnection that incorporated the Plains & Eastern Clean Line. ICF's report is attached as Appendix 3. The model assumes that 7,000 MW of incremental wind generation is built in Oklahoma, Texas and Kansas due to the Project. The additional wind power is then delivered to the southeastern grid in TVA's service territory.

ICF estimated environmental benefits by comparing two cases. Each case was simulated with a year-long, hourly economic, security constrained dispatch of the Eastern Interconnection using GE's MAPS[29] software. MAPS is a leading software product for simulating hourly power production in a transmission system and is used by utilities around the United States. The Reference Case did not include the Plains & Eastern. The Change Case included the Project in the electric transmission system as well as an incremental 7,000 MW of wind generation made possible by the Project. This incremental renewable power is delivered to TVA and the broader southeastern grid. The benefits of the Project are represented by the difference in emissions between the two cases.

[28] The Coming Clash Between Water and Energy. IEEE Spectrum Staff, IEEE Spectrum, June 2010, 26-27.
[29] MAPS is a registered trademark of General Electric.

Table 6 summarizes the pollution avoided by the Project.

Table 6
Annual Emissions Reductions

Pollutant	Reference Case (A)	Change Case Including Plains & Eastern Clean Line and 7,000 MW wind injection in SPP (B)	Net Decrease in Emission (C) = (B) - (A)
Nitrogen Oxides (NO_x) (Tons)	1,584,326	1,575,783	-8,543
Sulfur Dioxide (SO_2) (Tons)	4,133,550	4,095,909	-37,641
Carbon Dioxide (CO_2) (Tons)	1,982,236,231	1,967,974,868	-14,261,363
Mercury (Hg) (Pounds)	24,251	24,161	-90

Source: Analysis of the Benefits of the Proposed Plains and Eastern Clean Line, ICF International

The Project will make meaningful reductions in NO_x, SO_2 and mercury pollution. By abating over 14 million tons of annual carbon dioxide emissions, the Project will achieve the equivalent savings of taking two million cars off the road each year. The estimate of carbon dioxide emissions reductions may be conservative because ICF's model includes a price of carbon dioxide of $24 per ton. A price on carbon would further reduce carbon intensity from today's levels. Without a cost to emissions, baseline carbon dioxide levels would be higher, and reductions from the Project therefore could be greater. The Brattle Group ("Brattle") performed an independent evaluation of avoided carbon dioxide emissions due to the Project. Brattle's analysis did not include a carbon dioxide price and estimated a total emissions reduction of 19 million tons annually (see Appendix 4).

c. Cost Competitiveness

The Project will offer a cost effective source of renewable energy deliverable into the Southeast and will provide for increased competition in renewable power supply. As further detailed in *Resource Description*, the Project will draw low cost wind power from some of the windiest sites in the country. Even when the cost of transmission is included, these sites can deliver power for significantly lower cost than wind farms constructed in the Southeast, both onshore or offshore. Due to the better wind resource farther west, wind projects in the Resource Area will produce 1.5 to 2.0 times more power per installed MW than projects in the Southeast. The result is dramatically more affordable renewable power. Beginning in late 2015, Clean Line believes that the Plains & Eastern will be able to deliver power to the Southeast for under $80 per MWh. Of this delivered price, about $30/MWh will cover transmission, while about $50/MWh[30] is needed to cover the capital and operating costs of the wind farms providing energy. While these figures may change with commodity and turbine prices, Clean Line is confident that renewable power delivered through the Project will be cost competitive with gas-fired generation and significantly cheaper than new nuclear power, local wind and biomass projects, and offshore wind.

Because renewable power projects have zero marginal cost, the Plains & Eastern Clean Line will also decrease wholesale electricity prices in the Southeast. Wind turbines and solar panels never have to pay for fuel; therefore, their operational costs do not increase with greater use. As more renewable power

[30] Lower levelized costs may be achievable. For example, Oklahoma Gas & Electric reported a levelized cost of $37.57/MWh in a June 2010 filing to the Oklahoma Corporation Commission. http://imaging.occeweb.com/AP/CaseFiles/02FC906F.pdf.

reaches the southeastern market, the market-clearing price of electricity will decline, thus providing benefits to all consumers.

To estimate the Project's price reduction impact, ICF ran an economic dispatch model using GE's MAPS and PSLF[31] software, more fully described in Appendix 3. Together, MAPS and PSLF simulated the entire Eastern Interconnection on an hourly basis for one year. The model took account of the hourly profile of wind generation using simulated production data from NREL's *Eastern Wind Integration and Transmission Study*. It simulated the hourly marginal cost of each generator using an estimated unit heat rate and a set of assumptions about fuel prices and environmental allowances, which are set forth on page 28 of Appendix 3. Notable assumptions include a $7.15/mmBtu Henry Hub natural gas price and a $24/ton carbon dioxide price. While the magnitude of price decreases may change with assumptions about fuel and emissions prices, the basic conclusion that wind significantly reduces prices remains true over a wide variety of assumptions.

ICF estimated that prices in TVA will decline by $4/MWh. Even though ICF's model assumes delivery is exclusively to western Tennessee, wholesale power prices in Entergy Arkansas decline as a result of the Project.

Table 7
Wholesale Power Prices

Wholesale Power Prices – 2016 ($/MWh)			
Scenario	**Period***	**TVA**	**Entergy-Arkansas**
Reference Case	Off-Peak	57.9	59.4
	Peak	83	86.3
	All Hours	74.7	77.3
Change Case – Includes Clean Line Project and 7,000 MW Wind Injection in SPP	Off-Peak	54.9	59.4
	Peak	78.4	84.6
	All Hours	70.5	76.2

*On-peak is defined as 7 x 16

Source: Analysis of the Benefits of the Proposed Plains and Eastern Clean Line, ICF International

[31] PSLF (Positive Sequence Load Flow) software is a suite of analytical software tools developed by GE to simulate large-scale power systems.

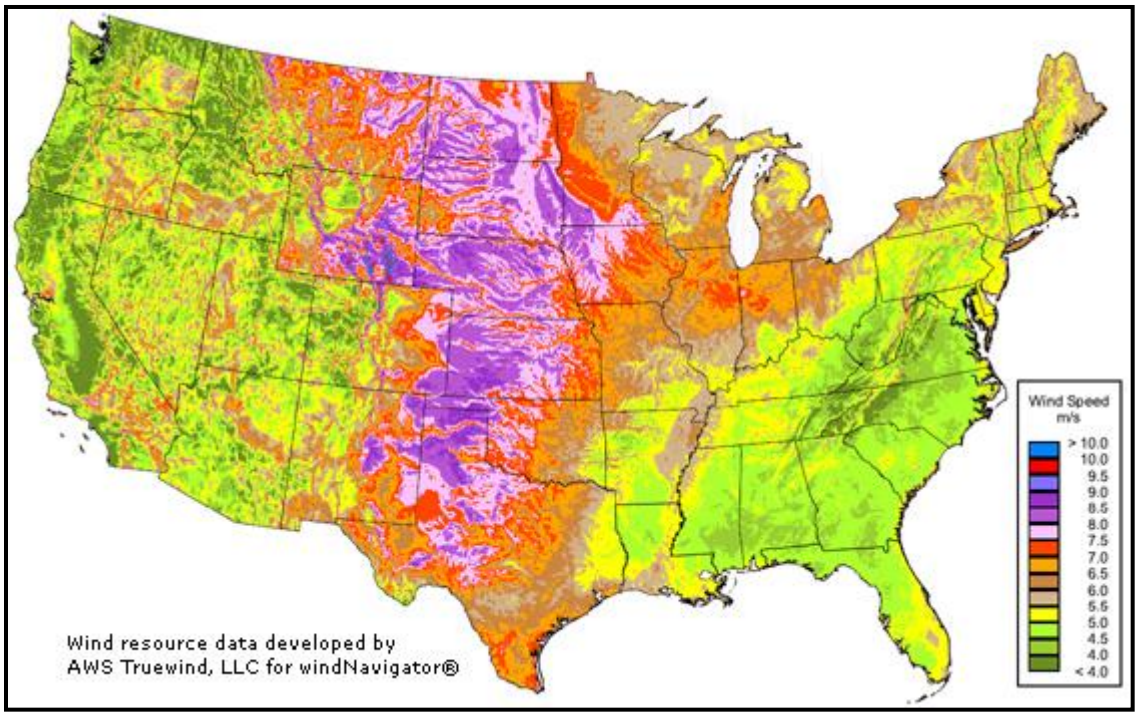
2. Resource Description

Resource description. A description of the energy resources (wind, solar, hydro, coal, natural gas, nuclear, etc.) for which the proposed Project would facilitate delivery; the size and location of the resources; schedule for resource development; specific location of load or markets; availability of generation-related ancillary services, including regulation and frequency response and operating reserves; a description of the entity's involvement in the development of the energy resources to be delivered; and/or any commitments to purchase the resulting energy and capacity from the proposed resource.

a. Size and Location of Resource

The Plains & Eastern Clean Line will draw from the best wind resources in the country. Working with the meteorology firm AWS Truepower ("AWS"), NREL published the map in Figure 9 of average wind speeds at 80 meters, the hub height of a modern wind turbine.

Figure 9
USA Wind Speeds at 80 M Hub Height



Source: US Department of Energy, National Renewable Energy Laboratory

Large areas near the origin of the Plains & Eastern Clean Line have average 80-meter wind speeds of 9.0 meters per second (about 20 miles per hour) or greater. In contrast, states in the Southeast, the Project's target delivery market, do not have average wind speeds above 6.0 meters per second (about 13 miles per hour). At such speeds, utility-scale wind projects are rarely economical.

NREL and AWS also published a ranking of wind capacity potential by state at a 40% gross capacity factor, as referenced in Table 8.

Table 8
Wind Capacity Potential by State

Windy Land Area >= 40% Gross Capacity							
		Factor at 80m				Wind Energy Potential	
Ranking (by Capacity Potential)	State	Total (km^2)	Excluded (km^2)	Available (km^2)	Available % of State	Installed Capacity (MW)	Annual Generation (GWh)
1	**Texas**	**180,822**	**15,426**	**165,397**	**24%**	**826,983**	**3,240,930**
2	Nebraska	165,445	10,012	155,433	78%	777,165	3,084,090
3	South Dakota	163,281	10,004	153,277	77%	766,383	3,039,460
4	**Kansas**	**163,170**	**11,105**	**152,065**	**71%**	**760,324**	**3,024,280**
5	North Dakota	160,497	21,932	138,564	76%	692,821	2,728,620
6	Montana	98,309	18,737	79,571	21%	397,857	1,529,560
7	Iowa	72,119	8,400	63,719	44%	318,595	1,232,860
8	Wyoming	70,268	17,787	52,482	21%	262,410	1,043,890
9	**Oklahoma**	**55,593**	**6,038**	**49,555**	**27%**	**247,773**	**952,678**
10	New Mexico	39,573.80	2,424.70	37,149.10	11.80%	185,745.30	712,877

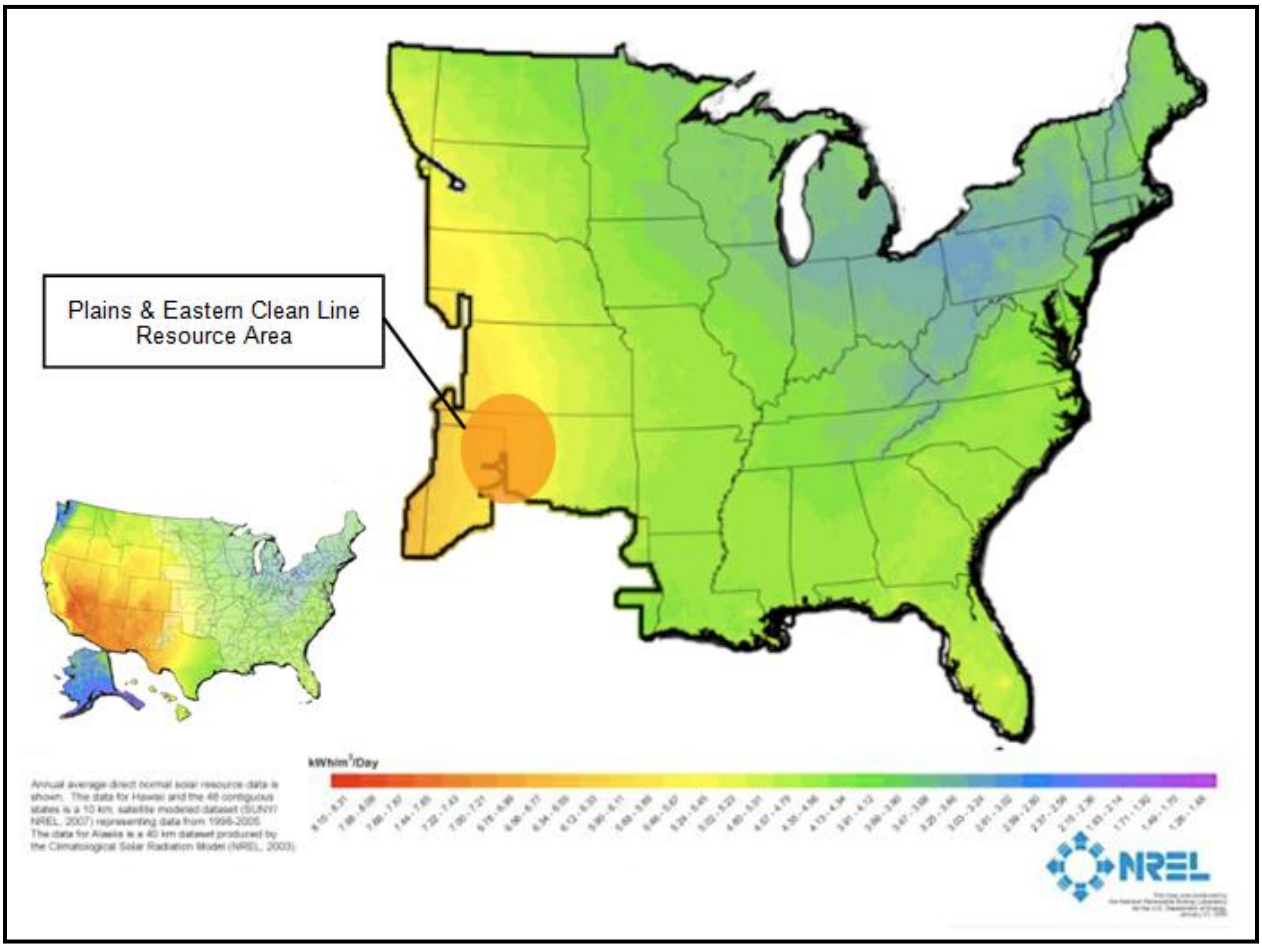
Source: US Department of Energy, National Renewable Energy Laboratory

Each of the three states from which the Plains & Eastern Clean Line is likely to draw wind power—Oklahoma, Kansas and Texas—is ranked in the top ten in wind potential. Each state has significantly more potential than the capacity of the Project. This suggests that it is feasible to fill the Plains & Eastern with some of the highest capacity factor wind energy in the country.

Developers are advancing projects totaling tens of thousands of MW in the Resource Area. Over 32,600 MW of wind projects are in the SPP Generation Interconnection Queue, of which 26,628 MW are located in the tri-state region of Kansas, Oklahoma, and Texas (only the northern part of the Texas Panhandle is located in SPP). Clean Line estimates that over 10,000 MW of interconnection requests are located within 120 miles of the Project's terminus in the Oklahoma Panhandle. In addition to those projects in the interconnection queue, there are many wind projects with meteorological data and land options that have not yet submitted a queue request due to a backlog of similar requests and inadequate transmission infrastructure.

In addition to high wind speeds, the Resource Area has the best solar resource in the Eastern Interconnection, as is seen in Figure 10.

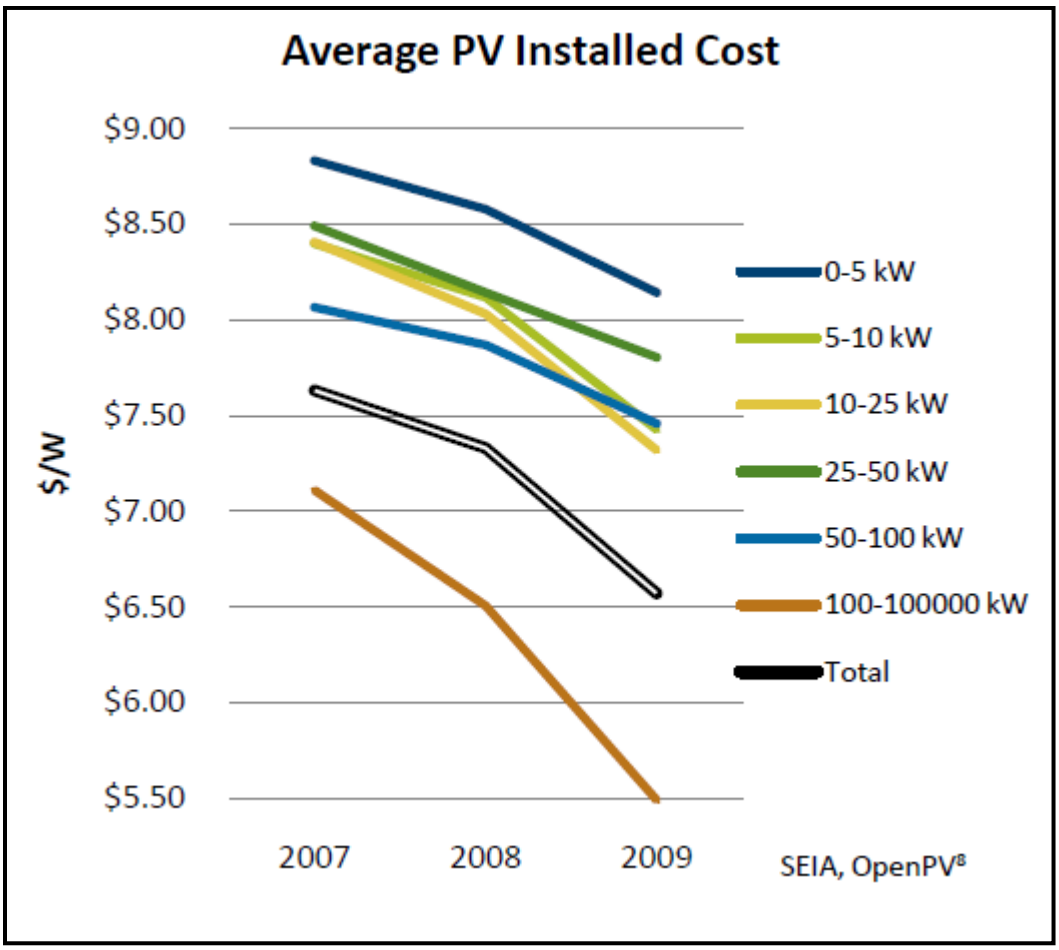
Figure 10
Solar Resource Map: United States and the Eastern Interconnection



Source: US Department of Energy, National Renewable Energy Laboratory

Though wind currently offers the lowest cost renewable energy, solar costs have been declining dramatically. If costs continue to fall, solar is likely to become an important part of the Plains & Eastern Project.

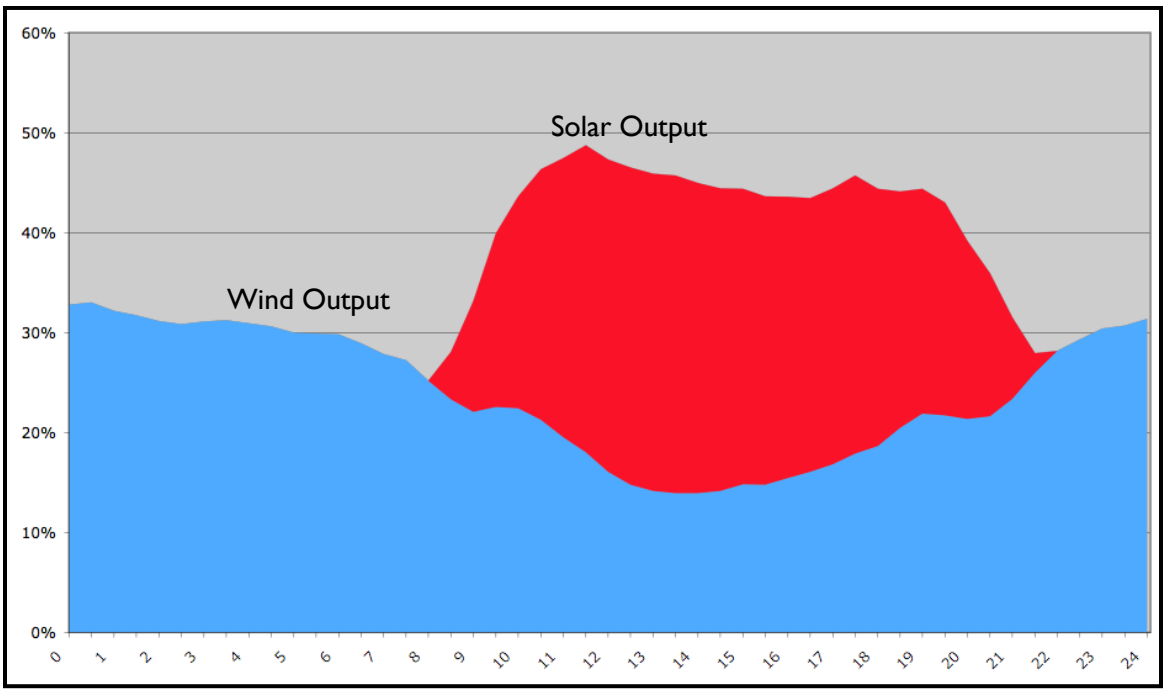
Figure 11
Average PV Installed Cost



Source: Solar Energy Industries Association, US Solar Industry Year in Review, 2009

The production profile of solar fits well with wind energy – the sun shines brightest when winds tend to die down. The combined output of wind and solar roughly mimics the summer load shape of most electric utilities. The figure below shows the combined average output during August of solar (red) and wind power (blue) assuming there are 2 MW of wind power for each 1 MW of solar power (as shown, the solar output is expressed as additive to wind with percentages based on the nameplate of wind resources only). While discussion of solar has thus far been focused on photovoltaic technology, thermal concentrating solar power is also viable in the Resource Area and is capable of having much higher capacity factors when equipped with thermal storage. The combination of wind and solar power can boost the utilization rate of the Plains & Eastern Clean Line. A higher utilization rate results in a lower cost of delivered energy because the total fixed cost of the transmission lines is spread over a larger amount of energy.

Figure 12
Combined Solar and Wind Output for Typical August Day
(Hour of Day vs. % of Nameplate)



Source: US Department of Energy, National Renewable Energy Laboratory, PVWatts tool (for solar) and ERCOT (aggregate wind production for August 2009).

b. Schedule of Resource Development

Wind development projects sufficient to fill the Plains & Eastern Clean Line can be completed on a schedule consistent with a transmission line online date of 2015. All of the 26,628 MW in the SPP Queue that are located in Texas, Oklahoma and Kansas have scheduled commercial online dates on or before 2015. A study by NREL and AWS Truepower found that Oklahoma has the potential to install 267,000 MW of high capacity factor wind power. In general, the development and construction timeframe for wind farms in the Resource Area is approximately three to five years—considerably shorter than the timeframe for a transmission line. The wind industry has already demonstrated that it can install thousands of MW of new projects in a short timeframe. From 2008 to 2009, over 6,000 MW of new wind projects were installed in Texas, Kansas and Oklahoma.[32]

Clean Line is working with 18 wind developers that are advancing projects located in the Resource Area. These developers include large, multinational, multi-billion dollar companies as well as more local development firms. Many developers have agreed to share wind data so that Clean Line can optimally

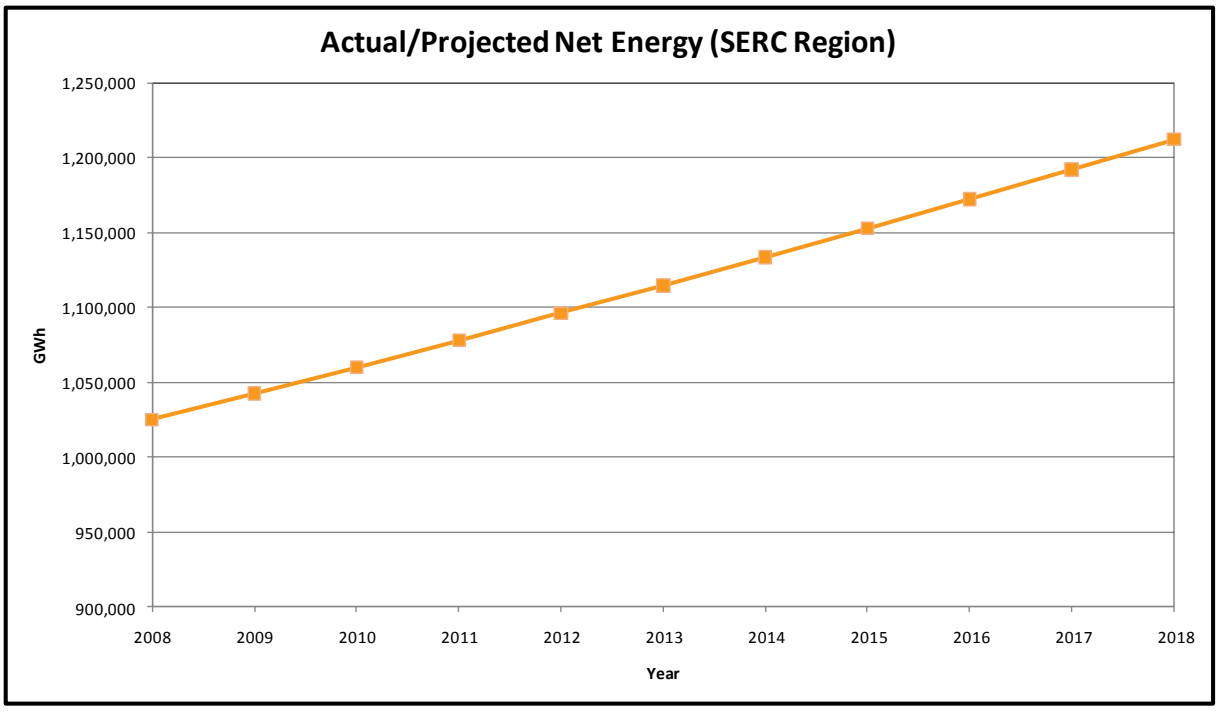
[32]American Wind Energy Association, *AWEA Year End 2009 Market Report*, January 2010. http://www.awea.org/publications/reports/4Q09.pdf; American Wind Energy Association, *American Wind Energy Association Annual Wind Industry Report*, 2008. http://www.awea.org/publications/reports/AWEA-Annual-Wind-Report-2009.pdf; US Department of Energy—Wind Powering America, "U.S. Installed Wind Capacity and Wind Project Locations," Updated: March 2010. http://www.windpoweringamerica.gov/wind_installed_capacity.asp.

design the Project to take advantage of the best wind resources and most efficiently use the line capacity.

c. Location of Load and Market

The Plains & Eastern Clean Line will allow wind farms in the Resource Area to access a new market in the southeastern United States. The Southeast is a desirable market because the region has an increasing demand for electricity. In part because its region continues to grow in population, SERC expects its load to grow by approximately 1.69% annually over the next ten years (see Figure 13).[33]

Figure 13
SERC Region Forecasted Growth of Annual Load



Source: SERC Reliability Corporation, Information Summary, July 2009.

Of the projected total ten-year load increase of 190,000 GWh per year, the Plains & Eastern Clean Line could deliver about 30,000 GWh per year, helping to maintain and increase the percentage of clean energy that the region uses. If projects like Plains & Eastern are not built, more new thermal plants will be required to meet demand, which would further increase carbon emissions and water consumption in the region.

TVA has set aggressive targets for clean power even in the absence of a federal RES. TVA's Board of Directors set a goal of obtaining 50% of its electricity from carbon-free sources. In 2009 and 2010, TVA entered into power purchase agreements with wind farms outside of its service territory totaling 1,380

[33] SERC Reliability Corporation, *Information* Summary, July 2009, 4. http://www.serc1.org/documents/SERC/SERC%20Publications/Information%20Summary/2009%20SERC%20Information%20Summary_Final%2007-28-09.pdf.

MW. To meet its 50% goal, TVA will have to source clean power from thousands more MW of renewable energy projects. As such, TVA is likely to maintain a strong demand for affordable renewable energy.

The Southeast is heavily dependent on coal for its current electricity supply; in 2009 46% of the SERC's energy was coal-fired generation.[34] Nevertheless, several regional utilities, including TVA, Progress Energy and Georgia Power, have indicated that they are likely to retire coal plants. These utilities are finding that the costs of complying with environmental regulations render coal uneconomical. A federal judge ordered TVA to install more than $1 billion in pollution controls and North Carolina's attorney general filed a nuisance suit against TVA's coal operations. Progress Energy has announced it will shut down 11 coal plants totaling 1,500 MW, citing high environmental compliance costs. These and other retirements will create a demand for replacement energy from cleaner sources.

Beyond the need to procure energy to meet load growth or replace retired units, SERC needs renewable energy to meet regulatory goals and requirements for clean power. North Carolina has passed a RPS requiring investor-owned utilities in the state to displace 12.5% of 2020 electricity sales with renewable purchases or energy efficiency measures. Other states may pass renewable legislation in the future, and southeastern states would also be required to purchase renewable power if a federal RES becomes law. The Plains & Eastern Clean Line can provide the southeastern utilities with the lowest cost compliance option and decrease the effects on ratepayers from the federal RES.

Due to the long lead times to permit and construct transmission lines, development must begin now if transmission is expected to be a part of the solution to deliver renewable power to the Southeast.

d. Generation Reliability and Related Ancillary Services

The southeastern United States in general—and TVA in particular—should be able to integrate the renewable power delivered by the Plains & Eastern Clean Line at relatively low cost. TVA has the largest pumped storage hydro facility in the country, which can help manage the variability associated with wind power. Unlike SPP, TVA has a low percentage of wind energy on its system. Consequently, TVA will experience a lower impact from wind power on its system load variability, likely leading to lower costs for its reliable integration.

The variability of wind power can create greater costs for a system operator in the form of increased reserves to run if wind plants ramp down their output; alternatively, fossil fuel plants must be ramped down if wind output ramps up. Added costs of dispatching traditional generation around intermittent renewable resources are broadly termed "integration costs." Clean Line has launched an effort to understand the effect of its Project on the Southeast's transmission system to assure it can be integrated reliably and at the lowest possible cost.

Clean Line commissioned a report from AWS Truepower, attached as Appendix 5, to examine how renewable power from the Project affects southeastern utilities' net load variability. Net load is defined as electric load minus wind power at a given point in time. Net load is a useful measure of wind's impact on a system because the variability of wind and the previously existing load variability should be considered together. A utility must have sufficient up-ramp capabilities (meaning output can be

[34] US Energy Information Administration, Supplemental Tables to the Annual Energy Outlook 2010, Table 80, December 14, 2009. http://www.eia.doe.gov/oiaf/aeo/supplement/supref.html.

increased) and down-ramp capabilities (meaning output can be decreased) to deal with changes in load. Intermittent renewable generation is not dispatchable and therefore behaves more like a change in load on the system. Like load, wind is not easily controllable and traditional generation must be dispatched around its variability. Nevertheless, variability of wind only adds integration costs (such as additional reserve requirements) insofar as it exacerbates the previously existing variability in load. If the variability of wind output is small relative to or uncorrelated with previously existing variability in load, then wind is not likely to have a significant impact on overall system variability and therefore will have minimal integration costs.

Below is a summary of the report's findings:

1. Variability in wind output is uncorrelated with previously existing variability in load. Consequently, wind power delivered by the Plains & Eastern Clean Line will tend not to dramatically increase the hourly changes in TVA's net load.

2. The study examined extreme events in hourly net load changes with and without the Project. Any increase in the magnitude of these extreme events approximates the additional flexibility required of a system, whether through reserves, storage, demand response, or otherwise. The study examined hourly changes in net load at the "three sigma level," meaning the hourly change in net load will be less than a given amount in 99.73% of hours. As Table 9 shows, at this confidence level, TVA's hourly change in load decreased by less than 1,000 MW even with the importation of over 8,000 MW of wind. In the case where TVA only buys half of the 8,000 MW, with the balance exported to neighboring utilities, the incremental hourly load change at the three-sigma level increased by less than 400 MW.

3. While there are modest increases in extreme events, the variability introduced by the additional wind power appears to be manageable.

Table 9
Three-Sigma Variation of Hourly Net Load Variability

3 Standard Deviation	7,000 MW All TVA	50% of 7,000 MW (3,500-TVA, 3,500 split to Neighbors)	7,000 MW All TVA Incremental Variation	50% of 7,000 MW (3,500 - TVA, 3,500 split to Neighbors)
TVA	3,267	2,643	941	317
Southern	-	2,605	-	98
Duke	-	1,587	-	20
Entergy	-	1,699	-	69

Source: AWS Truepower, Load Coincidence Study for the Integration of Wind into Tennessee Valley Authority via the Plains & Eastern Clean Line.

Further study is needed to assess any integration costs that TVA or other utilities may experience as a result of added renewable generation. These further studies will examine wind integration with the specific details of the Southeast's generation supply, storage capabilities, and ability to forecast wind output. TVA's storage system and the ability to forecast wind generation are both valuable tools to manage swings in net load. For example, the pumped hydro system can begin producing—rather than

consuming—power if wind output decreases. In addition, an accurate forecast of wind's output decline can ensure that traditional generation capacity is ready to replace the wind.

The development of a large HVDC line between the SPP and TVA systems creates an opportunity for the two systems to more easily share frequency response, regulation and operating reserves. This would require an agreement between SPP and TVA as well as very close collaboration between their respective operations teams. This increased cooperation would enhance overall system reliability and could help to reduce any additional ancillary services needed to integrate the renewable power delivered by the Plains & Eastern Clean Line.

e. Involvement in Development of Generation

Clean Line has no competitive interest in existing generation or retail operations and therefore is well-suited to facilitate transmission solutions that provide wholesale customers with affordable access to clean energy. Maintaining exclusive focus on the development and operation of transmission lines enhances Clean Line's ability to execute projects that best serve the need for increased access to renewable energy. Clean Line does not and will not own any of the generation that will deliver power via the Plains & Eastern. Clean Line's independence will allow competition among renewable generators if TVA or other utilities issue an RFP for renewable resources.

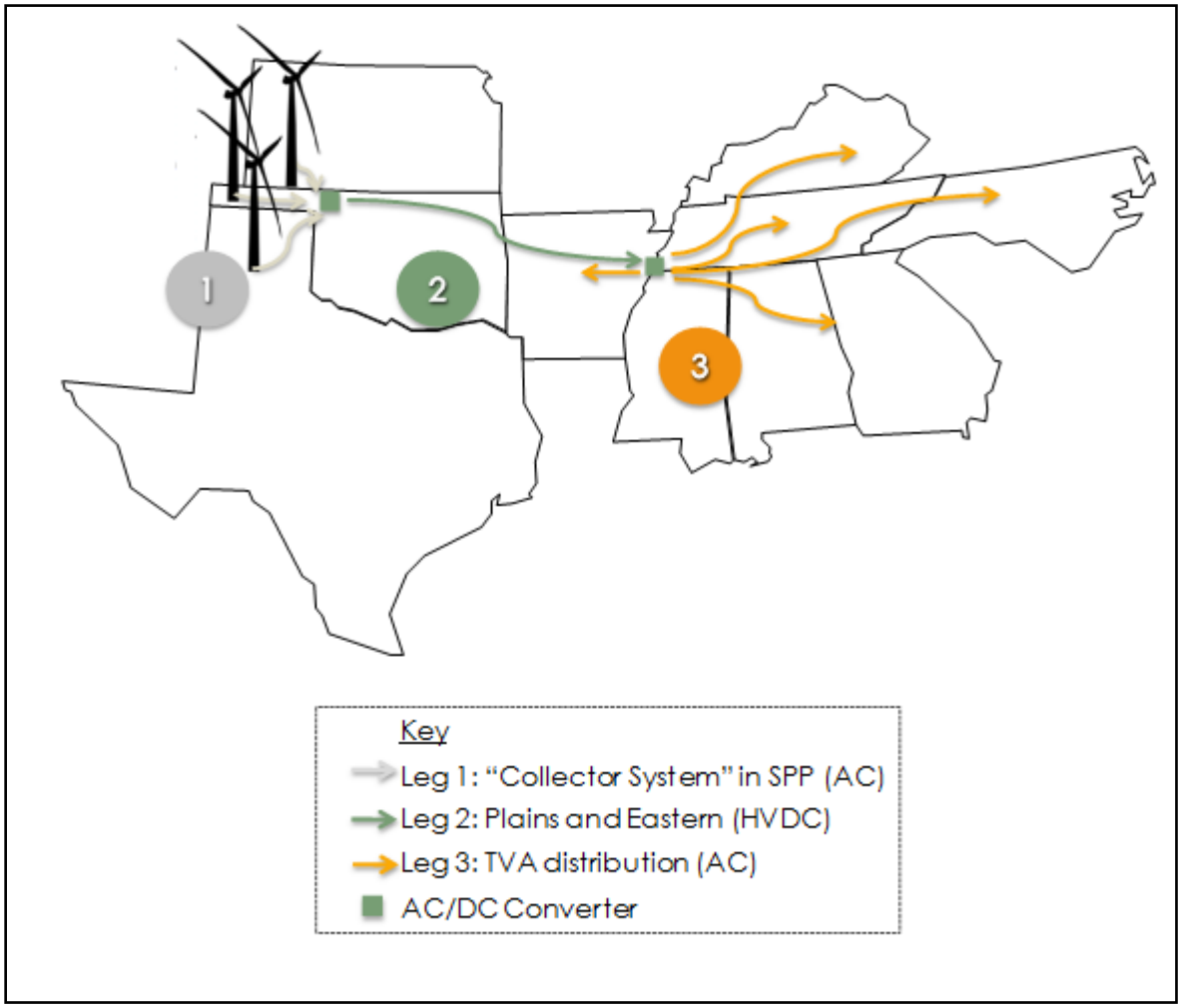
f. Purchase Commitments

Though Clean Line will not enter into transmission service agreements until it reaches a more advanced stage of development, many parties have demonstrated their interest in the Project. As previously described, in October 2009, Clean Line Energy Partners executed a MOU with TVA. Pursuant to the MOU, TVA agreed to cooperate with Clean Line in evaluating the technical aspects of delivering up to 7,000 MW of renewable power to TVA's service territory. Clean Line continues to discuss Plains & Eastern with other southeastern utilities, several of which have signaled their interest in buying capacity on the line, particularly if they need to meet a state or federal RES. Clean Line is also working with most of the major developers in the US who could potentially provide wind power to the project or buy capacity on the lines.

Clean Line believes that the appropriate time to enter into transmission service agreements is once the initial development of the Project is complete: namely, permits have been obtained; an interconnection agreement has been signed; and a clear path to right of way acquisition has been established. At that point in time, transmission customers will be able to make long-term commitments to buy capacity on the Plains & Eastern Clean Line with the confidence that the Project will proceed.

As Figure 14 shows, the Project will collect the wind power from the Resource Area in one of two ways: (i) generators will build AC lines to the Project substation; or (ii) depending on the level of transmission upgrades completed by SPP, they will buy point to point transmission on the SPP system (Leg 1). Through long-term capacity contracts awarded from an open-season or anchor tenant process (described further in *Transmission Rights)*, the Plains & Eastern Clean Line will then deliver the energy to a substation on the TVA system or elsewhere in the Southeast (Leg 2). The utility that owns the substation can use the delivered energy either to meet its own internal needs or it could charge transmission fees and wheel the energy to other end users (Leg 3).

Figure 14
Plains & Eastern Clean Line: Moving Power East



Source: Clean Line Energy

3. Interconnection

Interconnection request. If the proposed Project involves an interconnection request, a description of the interconnection request, including, but not limited to, the names of the entities involved in the request, such as transmission facility owners, Regional Transmission Organizations, Independent System Operators, or any other relevant entities, and the status of that request, including queue position and estimated date the transmission facility owner(s) expect to be ready to provide transmission service.

Clean Line is working with the interconnecting utilities and RTOs at each end of the Project to perform the necessary studies to guarantee system reliability, ensure that relevant system interconnection protocols are met, and determine any necessary system upgrades. With respect to the eastern end of the line, Clean Line submitted six interconnection requests with TVA and Entergy, each for injecting up to 3,500 MW of power and with an estimated online date of 2015.

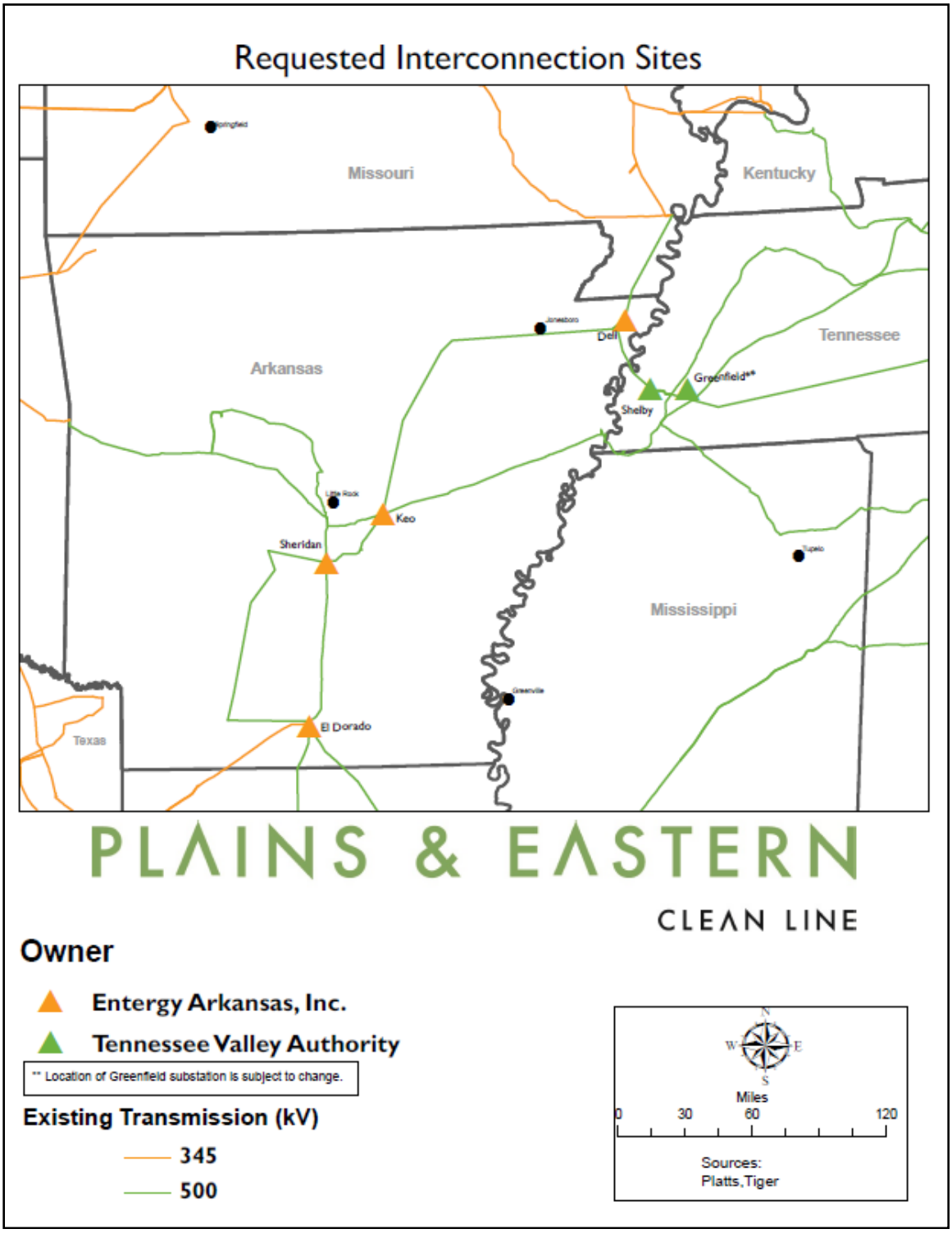
Clean Line submitted two 3,500 MW interconnection requests with TVA and entered the TVA Generation Interconnection Queue. TVA performed initial feasibility studies to determine the viability of the Project at the Shelby, Cordova and Weakley 500 kV Substations and at a greenfield 500 kV substation to be located east of Shelby. The feasibility studies indicated that Shelby and the greenfield site were viable points to pursue at the 3,500 MW level. Therefore, Clean Line entered into two system impact study agreements with TVA. The first one will analyze 3,500 MW of injection at the Shelby Substation, and the second will analyze 3,500 MW of injection at the greenfield site.

Clean Line also examined possible points of interconnection on the Entergy 500 kV system in Arkansas through a set of feasibility studies performed by Entergy's Transmission Technical System Planning group and coordinated through the SPP Independent Coordinator of Transmission for Entergy. Clean Line requested that the following 500 kV substations be evaluated for an injection of 3,500 MW of power from an HVDC link: Sheridan, Dell, Keo and Eldorado. The Eldorado Substation was also tested under a 1,750 MW scenario. Figure 15 shows the geographical location of these interconnection points. The stated purpose of the studies was "to assess the reliability impact of the new facility on the Entergy transmission system with respect to the steady state. It is also intended to determine whether the transmission system meets standards established by NERC Reliability Standards and Entergy's planning guidelines when the 500kV DC line is connected to Entergy's transmission system. If not, transmission improvements will be identified."[35]

Six transfer scenarios were run in which First Contingency Incremental Transfer Capability tests were performed. The results of these studies indicate that for certain scenarios, transfer capability did exist and additional transfer capability could be obtained with system upgrades. In some instances, the upgrades for the Entergy system were significant; however, there were also scenarios in which significant amounts of transfer capability were available. Depending upon the point of injection, the receiving Balancing Authority and the assumed system upgrades, transfer capabilities ranged from 600 MW to nearly 2,000 MW.

[35] Entergy Services, Inc., *Feasibility Study Report, 1,750 MW Interconnection*, February 22, 2010, 2.

Figure 15
Plains & Eastern Clean Line Requested Interconnection Sites



Source: Clean Line Energy

With respect to the western end of the Project, Clean Line is working in accordance with SPP Criteria 3.5 and Appendix 11 to the SPP Criteria. For a description of these protocols, please see Appendix 6. Clean Line has presented the project and proposed study scope to SPP stakeholders at the SPP Transmission Working Group meeting and to Xcel Energy transmission planning staff.

To perform the required interconnection studies, Clean Line hired Siemens PTI, a leader in power systems consulting with extensive knowledge and expertise in all areas of power system planning, analysis and modeling and simulation of HVDC integration. Siemens PTI is performing a suite of studies to ensure that the Project will be implemented in a manner that will not adversely impact the reliability of the bulk electric grid. The starting point of these studies will be models developed by the SPP stakeholders and TVA. Various input assumptions and model parameters will be obtained through collaboration with affected utilities and SPP staff. Siemens PTI will then perform load flow (steady state) analysis, short circuit analysis and dynamic stability analysis. These studies will encompass both terminals of the Project and will give detailed insight into possible system concerns and, if needed, appropriate mitigation measures. For more information on the scope, please see Appendix 1.

Appendix 7 contains several preliminary drawings that have been assembled to assist in the aforementioned studies as well as to give a general idea of the layout of the converter stations. The single line diagrams indicate the general electrical configuration of the project, whereas the plan and isometric drawings show the layouts and configurations of the DC switchyards and the valve halls.

When detailed design on the converter stations begins, further studies may also be required. These studies include, but are not limited to, the following:

- *Determination of AC temporary over voltages ("TOVs") and whether the applied compensation methods and short circuit capacity are adequate.* A temporary or permanent bipolar failure is usually the cause of the most severe TOVs. Another potential cause is frequent switching of too large a shunt capacitor bank. However, studies can determine the maximum appropriate size of the shunt capacitor bank. There are grid requirements to ensure AC transient voltage deviations do not adversely impact nearby communities connected to the AC system and that AC substation equipment remains safe. If additional facilities are needed to restrain AC TOVs, these will be investigated and a solution determined. This work can be addressed with Transient Stability and Electromagnetic Transient Studies.

- *Improvement of AC system performance.* The fast power response of HVDC transmission allows it to provide support to the interconnected AC system as needed. For example, there is a 500 kV AC transmission line between Winnipeg (in Manitoba) and Minneapolis / St. Paul, Minnesota. If one of the AC line sections trips out, the signal to the circuit breakers that clear the AC line section is also sent to the Nelson River HVDC transmission line, which quickly adjusts its power schedule to keep the AC system functioning. In addition, there is the possibility of adding damping controls on the HVDC transmission line that respond to measured AC frequency at each end and modulate DC power to dampen system oscillations should they occur. This is done on the Square Butte and CU DC projects from North Dakota into Minnesota and also on the Nelson River DC transmission. As a result, the power transfer capability on the underlying and parallel AC system is increased. This work can be addressed with Transient Stability Studies.

- *Impact of 60Hz coupling onto the HVDC line*. If the HVDC transmission line is to share right-of-way with AC circuits, there will be 60 Hz coupling onto the DC line. If this coupling is severe enough, it can lead to saturation in the converter transformers. The solution

applied to the Hydro Quebec to New England (Sandy Pond) DC line is to use 60 Hz blocking filters in each pole in series with the valve groups. A control solution is possible but, to Clean Line's knowledge, has not been applied. This work can be addressed with Electromagnetic Transient Studies.

- *Harmonic studies*. It is useful to obtain measured power quality data at the terminating AC busbars (or as close as possible to them) that include, over a given time period, the voltage Total Harmonic Distortion, voltage harmonics of individual harmonics at least up to the 40th harmonic, and negative sequence unbalance levels. This is necessary information for a technical specification to help with AC filter design. In addition, the AC system harmonic impedance over the same range as the measurements will need to be determined for the technical specification. This work can be addressed with several different software packages including Electromagnetic Transient Studies.

- *Switching surge studies*. These studies are needed to determine how converter transformers, filter banks, shunt capacitors and reactors can be energized. The DC controls may respond to the switching action and subsequently worsen the response. This work can be addressed with Electromagnetic Transient Studies.

- *Commutation Failures*. A commutation failure screening study can be undertaken. If the AC system fault instigates a commutation failure in too large an area, the Owner may request additional facilities in the converter technical specification to reduce the effect. For example, voltage sourced converters are not prone to fail commutation. Other equipment such as controlled series capacitor converter ("CSCC") or capacitive commutated converter ("CCC") may be applied to line commutated converters to reduce sensitivity to AC system faults and commutation failures. The initial screening study can be addressed with Electromagnetic Transient Studies.

4. Transmission Rights

Transmission Rights and/or Service. Description of transmission rights or long-term service the entity may desire when the Project is completed.

Clean Line anticipates that it will sell most or all of the transmission rights on the Plains & Eastern Clean Line through long-term agreements with either load serving entities or renewable power developers. Clean Line also anticipates that a secondary market for transmission rights will be created to allow other entities access to the line and to optimize the use of transmission capacity.

Recently FERC signaled its openness to innovative capacity ownership models for transmission projects. In particular, FERC has demonstrated its understanding that the traditional rate-based transmission model for incumbent utilities is not sufficient to bring about the interstate and inter-regional projects needed to integrate more renewable energy into the nation's supply mix.

In February 2009, FERC authorized a negotiated rate proposal for the Zephyr and Chinook projects under development by TransCanada. In lieu of the conventional open season process, FERC authorized TransCanada to pre-subscribe transmission capacity to customers willing to make an early commitment ("anchors"). This "anchor-tenant" model helps solve the "chicken and egg" problem that troubles many transmission projects: namely, transmission customers do not want to commit to transmission capacity

before they know a project will be built, but transmission developers do not want to commit to building a project before they know customers will purchase the capacity.

Clean Line anticipates that the Project will include a mix of anchor-tenant and open season transmission customers. It is likely that both generators and power purchasers will own capacity on the Plains & Eastern Clean Line. The creditworthiness of capacity customers is a key consideration and is essential to successful financing of the Project. Clean Line expects to sign capacity contracts leading up to the completion of the development phase of the project. Because Plains & Eastern is an interstate line, the process and terms under which capacity is sold will be subject to regulation by the FERC. In the Zephyr and Chinook ruling, FERC set forth four criteria for evaluating requests for negotiated rate authority. One of those criteria is "the potential for undue preference, including affiliate preference."[36] In light of this statement and subsequent FERC decisions, Clean Line believes it is more likely to reach a rate structure that is acceptable to FERC because of its independence from wind developers.

5. Participant Roles

Participant roles. Description of the proposed role that the submitting entity, the relevant PMA, the Secretary, and any other Project participants might play in the development, ownership, operation, and maintenance of the Project.

As the RFP recognizes, section 1222 authorizes DOE to "participate with other entities in designing, developing, constructing, operating, maintaining or owning, a new electric power transmission facility and related facilities"[37] that are located in states in which Southwestern operates. Congress gave DOE, Southwestern and the Western Area Power Administration ("Western") this authority after the successful efforts by DOE, Western and private parties to provide much-needed transmission capacity through the development of the Path 15 transmission facilities in California. Western participated in the planning and development of those facilities and, in certain limited cases, exercised its condemnation authority under federal law to acquire needed property rights. Western's use of eminent domain authority to enable development of the Path 15 facilities was upheld by the U.S. Court of Appeals for the Ninth Circuit. *United States v. 14.02 Acres of Land More or Less in Fresno County*, 547 F.3d 943 (9th Cir. 2008). DOE, Southwestern and Western will have the same authority in carrying out section 1222 projects.

DOE and Southwestern are authorized to "accept and use funds contributed by another entity for the purpose of carrying out"[38] a section 1222 project, although there is no requirement that a private party contribute funds or that DOE accept such funds in carrying out a section 1222 project. Because DOE and Southwestern already are authorized to accept and use private funds to defray costs in connection with their participation in a section 1222 project, they do not need any further Congressional authorization or appropriation before doing so.

Clean Line has done a substantial amount of work to advance the development of the Plains & Eastern Clean Line. The use of section 1222 is both desirable and necessary because the Project crosses multiple states, involves areas served by more than one Transmission Organization, and has national

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[36] Federal Energy Regulatory Commission, February 19, 2009, 12. http://www.ferc.gov/whats-new/comm-meet/2009/021909/E-15.pdf.
[37] US Department of Energy, Request for Proposals for New or Upgraded Transmission Line Projects under section 1222 of the Energy Policy Act of 2005, Southwestern Power Administration and Western Area Power Administration, June 10, 2010.
[38] US Department of Energy, Request for Proposals for New or Upgraded Transmission Line Projects under section 1222 of the Energy Policy Act of 2005, Southwestern Power Administration and Western Area Power Administration, June 10, 2010.

significance and impact. For these reasons, the Project requires Federal participation for the development and permitting process.

Clean Line does not currently foresee the need for significant financial investment by DOE or Southwestern in the Plains & Eastern Clean Line. Rather, Clean Line will pay for all or virtually all of the costs of developing these facilities, including (through the use of the section 1222 contributed funds authority) DOE's and Southwestern's costs of participating in the Project. Therefore, Clean Line is not seeking Federal financial support under this proposal.

Clean Line foresees the involvement of DOE and Southwestern in the development of these lines in three critically important areas: public outreach, siting and permitting. Of course, the precise roles and responsibilities of DOE, Southwestern and Clean Line would be specified in development agreements and other arrangements to be negotiated among the parties.

First, the participation of DOE and Southwestern in the Project will be critically important in defining the exact parameters of the route and gaining public acceptance and support. Southwestern has a long history of working cooperatively with utilities, communities, landowners, state officials and others in helping meet their needs and at the same time serving national interests. By working together, Clean Line and Southwestern can help ensure that the Project is developed so that stakeholder interests are preserved and that its national significance and importance are understood by all interested parties.

Second, because Southwestern can acquire property through the use of eminent domain, all Project participants can be assured that if necessary state and federal permits are obtained and there is customer demand for the transmission capacity, then the Project will be built. This regulatory and legal certainty allows developers of renewable projects, buyers of renewable energy, and the investment community to commit billions of dollars to fund the construction of both this Project and the accompanying renewable generation facilities. States typically have laws allowing utilities to use eminent domain for siting transmission lines because the development of lines that serve the overall public interest cannot rely on 100% of private landowners voluntarily selling needed property rights. Without the certainty provided by section 1222 or a similar statute with respect to right of way acquisition, there is significant doubt that the cost-effective renewable energy from the Resource Area can be made available to the Southeast United States.

Clean Line is seeking authority from the states of Arkansas and Oklahoma to use eminent domain to acquire right of way for the Project if certain private negotiations prove unsuccessful. If it obtains this authority from the states, Clean Line anticipates that it will use state law and processes to exercise eminent domain authority when necessary to acquire property rights, rather than call upon Southwestern to exercise its federal right of eminent domain.

Clean Line hopes and believes that eminent domain will be used very rarely in connection with the Project's development. Clean Line is committed to treating all landowners with respect and expects to acquire at least 90% of the necessary rights of way through private transactions. To achieve these goals Clean Line will pay fair market value for all necessary property rights and will obligate its representatives and land agents to abide by a code of conduct. Landowners will be contacted as early as possible, and sufficient time will be allocated for negotiations. The significant legal and administrative expenses of condemning land will be avoided if reasonably possible.

Third, obtaining the necessary governmental permits and approvals is a major challenge for the development of any large-scale energy project. As part of their permitting processes, federal agencies conduct necessary analyses and reviews under the National Environmental Policy Act of 1969. In the

case of the Plains & Eastern Clean Line, even in the absence of section 1222, the Project will need federal permits and approvals.

Through the section 1222 process, the Project will benefit from DOE and Southwestern taking a leading role in coordinating federal permitting actions and overseeing necessary NEPA analyses. Coordinating federal authorizations for transmission facilities is consistent with DOE's authority under Federal Power Act section 216(h). Such action will ensure that the energy security policies and interests of the Administration and DOE, as set forth in section 1222 itself, are taken into account in the Project's planning, development and construction.

Clean Line believes that the best way for DOE to carry out these functions will be to delegate authority to FERC to act as lead agency in preparing the Environmental Impact Statement. DOE will continue to have final decision-making authority over its participation in the Project and its development. Delegating to FERC will take advantage of FERC's considerable experience in performing NEPA analyses for long-distance linear infrastructure projects that it has developed through its work on siting natural gas pipelines. Many of the issues in siting pipelines – for example, wildlife, plant and archaeological issues – are relevant to siting long-distance transmission lines. Through the contributed funds authority of section 1222, Clean Line is prepared to pay the NEPA-related expenses of DOE, Southwestern and FERC in carrying out appropriate NEPA analysis for the Project.

Clean Line plans to continue to be the entity with primary responsibility for the Project's permitting, land acquisition, interconnection studies and construction. Because it is funding all or virtually all of the cost of the Project, Clean Line anticipates that it will own all or virtually all of the Project's transmission capacity, which Clean Line will sell to load serving entities or generators.

6. Prior Experience

Prior experience. A brief description of the submitting entity's prior experience related to constructing, financing, facilitating, or studying construction of upgraded and/or new electric power transmission lines and related facilities for the primary purpose of delivering or facilitating the delivery of power generated by resources constructed or reasonably expected to be constructed.

Clean Line is an independent developer of high voltage, long-haul transmission lines. The company focuses exclusively on connecting the best renewable resources in North America with large population centers. In addition to the Plains & Eastern, Clean Line is developing three other projects in the United States that have similar, compelling rationales – facilitating the movement of thousands of megawatts of renewable energy from resource-rich areas to major load centers via HVDC transmission lines.

Figure 16
Clean Line Energy Partners: Projects Map

Source: Clean Line Energy

Clean Line was founded by Michael Skelly, who led the development efforts at Horizon Wind Energy. The rest of the management team is comprised of highly regarded professionals in the electric energy industry, including individuals who have designed, studied, developed and secured the financing for multiple new transmission lines. The team also includes executives who have managed, built and financed ambitious projects in the renewable and traditional energy sectors around the world, as well as senior policy professionals who have shaped energy policy and advanced the renewable energy agenda at the local, state and national levels. In aggregate, the Clean Line team has financed billions of dollars of projects and managed the development and construction of thousands of megawatts of power plants and transmission lines. Biographies of key Clean Line employees are below.

Michael Skelly – Chief Executive Officer

Mr. Skelly has been in the energy business for more than 15 years, and he led the development efforts of Horizon Wind Energy. During Mr. Skelly's tenure at Horizon, the company grew from a two-person operation to one of the largest renewable energy companies in the country. Under his leadership,

Horizon developed and constructed nearly 2,000 MW of wind energy projects and amassed a development portfolio of almost 10,000 MW in over a dozen states. Before Horizon, Mr. Skelly developed thermal, hydroelectric, biomass and wind energy projects in Central America with Energia Global. In 2008 Mr. Skelly ran for the US Congress as the Democratic nominee in the 7th Congressional District of Texas.

Mr. Skelly has a Bachelor of Arts degree in Economics from the University of Notre Dame and a Master of Business Administration from Harvard Business School.

Kathryn Patton – General Counsel

Ms. Patton previously served as Deputy General Counsel for Allegheny Energy, Inc., where she oversaw legal matters for Allegheny's regulated electric utilities and transmission companies and served as the company's Chief Compliance Officer. She led the effort to obtain regulatory approval for construction of the TrAIL transmission project and provided legal advice for the construction and financing of the project. The TrAIL project consists of a 500-kV transmission line extending from southwestern Pennsylvania, through West Virginia and into northern Virginia.

Prior to Allegheny, Ms. Patton worked at Dynegy, serving as Senior Vice President, General Counsel and Secretary for Dynegy subsidiaries Illinois Power Company and Northern Natural Gas Company, and she also served as Vice President and Assistant General Counsel for Dynegy Inc. While at Illinois Power, she was responsible for the legal and regulatory affairs of the company, as well as advising on corporate strategy. She is a Certified Public Accountant and is a member of the State Bar of Texas, the District of Columbia Bar and the Commonwealth of Pennsylvania Bar.

Wayne Galli – Vice President of Transmission and Technical Services

Dr. Galli's background in electric power systems includes more than 12 years of experience in technical and managerial roles. Dr. Galli's experience runs the gamut from system studies and operations to regulatory matters to project development. Most recently, he served as Director of Transmission Development for NextEra Energy Resources where he was instrumental in developing transmission projects under the CREZ initiative in Texas. In this capacity, Dr. Galli championed HVDC solutions for the CREZ and was an instrumental part of the team that obtained a successful award of over $500 million in transmission assets (approximately 300 miles of the most critical CREZ transmission lines) under the CREZ Transmission Service Provider docket. He then led all efforts in routing, siting and engineering of the transmission lines. At SPP, Dr. Galli led the implementation of several components of the SPP market and grew the Operations Engineering group over fourfold to ensure reliable operations of the SPP grid under the new market paradigm. His duties at SPP primarily included overseeing all real-time and short-term operational engineering aspects of the SPP transmission system to ensure system reliability. Dr. Galli's background also includes long-term system planning experience with Southern Company Services, where he analyzed 500 kV expansion plans primarily focused on planning and strengthening Southern Company's 500 kV backbone system from its southwestern quadrant to the major load centers within Southern. Additionally, he gained commercial power systems experience from Siemens Westinghouse Technical Services, taught at the university level, and helped design shipboard power systems for the Department of Defense.

Dr. Galli holds Bachelor and Master of Science degrees from Louisiana Tech University and a Doctor of Philosophy degree from Purdue University, all in electrical engineering. He is a Senior Member of the

Institute of Electrical and Electronics Engineers and is a registered Professional Engineer in the Commonwealth of Virginia.

Jimmy Glotfelty – Executive Vice President

Mr. Glotfelty brings a wealth of public and private sector transmission experience to Clean Line. He is a well-known expert in electric transmission and distribution, generation, energy policy and energy security. He most recently held the position of Vice President, Energy Markets, for ICF Consulting. Mr. Glotfelty served in the US Department of Energy where he was the Founder and Director of the Office of Electric Transmission and Distribution, a $100 million per year electricity transmission and distribution research and development program. Mr. Glotfelty also was the lead US representative to the joint US-Canadian Power System Outage Task Force investigating the Blackout of August 2003. While at the Department of Energy, Mr. Glotfelty worked extensively with utility chief executive officers and senior management in the electric power and energy sectors. He led teams that focused on researching transmission and distribution technologies, gaining Presidential permits for cross-border transmission lines, studying the impacts of Regional Transmission Organizations, identifying major transmission bottlenecks, and securing the critical energy infrastructure of the United States.

Jayshree Desai – Executive Vice President

Prior to joining Clean Line, Ms. Desai was Chief Financial Officer of Horizon Wind Energy, where she was responsible for corporate and project finance, accounting, tax and IT. As CFO, she oversaw the company's balance sheet as it grew from $8 million to more than $5 billion and was a key member of the deal teams responsible for the sale of Horizon Wind Energy to Goldman Sachs in 2005, the subsequent sale to EDP in mid-2007, and the initial public offering of the EDP renewable energy subsidiary in 2008. Before joining Horizon, Ms. Desai was a director at Enron responsible for mergers and acquisitions.

Ms. Desai earned a Bachelor's degree from the University of Texas at Austin and a Master of Business Administration from Wharton Business School at the University of Pennsylvania.

Mario Hurtado – Executive Vice President and Lead Developer of the Plains & Eastern Clean Line

Mr. Hurtado developed and managed power and other energy infrastructure with large corporate and start-up venture companies in the electric power and natural gas industries for over 15 years. Mr. Hurtado headed development and operations in Central America and the Caribbean at Globeleq, a power developer and operator focused on the emerging markets. While at Globeleq, Mr. Hurtado acquired, built and managed a portfolio of traditional and renewable electric generating plants. As an executive at Reliant Energy and Duke Energy, he led corporate transactions and managed the commercial issues involving large utilities and generating plants throughout Latin and North America.

Mr. Hurtado holds a Bachelor of Arts degree in political science from Columbia University.

Max Shilstone – Development Director for the Plains & Eastern Clean Line

Max Shilstone began his energy development career with PanEnergy, which later turned into Duke Energy North America. During this period, Mr. Shilstone successfully developed a greenfield 570 MW

gas-fired combined-cycle project that interconnected to the Palo Verde Nuclear Generating Station, which served the western grid. This project became commercial in 2002. In addition, Shilstone developed a similar project in Clovis, New Mexico. Mr. Shilstone also worked for Stewart & Stevenson Services, a diesel/gas turbine manufacturer, where he successfully managed and marketed large generation projects both in the US and overseas.

Mr. Shilstone received his undergraduate degree in management from The University of Texas in Austin, and his MBA in Finance from St. Thomas University in Houston.

7. Participation of Other Entities

Participation of other entities. A brief description of any steps the entity has taken to seek interest from other entities in participating in developing the proposed Project or in seeking interest in subscribers for the additional transmission capacity resulting from the proposed Project.

Plains & Eastern's successful development requires substantial and widespread participation from a diverse group of other entities and stakeholders. It is Clean Line's responsibility to work collaboratively with landowners, towns, counties, factories and businesses most affected by the Plains & Eastern Clean Line. To garner support for the Project, Clean Line launched an outreach campaign, expending considerable time and money to ensure that the states of Arkansas and Oklahoma view the Project as a source of jobs, security and opportunity.

The company has engaged in dialogue with and solicited input from organizations and individuals concerned about how new infrastructure may affect land use. In order to understand and avoid sensitive areas, Clean Line entered into a consulting agreement with the Arkansas Field Office of The Nature Conservancy and hopes to enter into a similar arrangement with the Oklahoma Field Office. Clean Line has presented the Project to local or regional offices of Sierra Club, Canoe Club, Wildlife Federation and Audubon Society and is committed to working with these agencies to find the optimal route for the Project.

To ensure that qualified local suppliers and contractors can participate in the construction and operation of the Project, Clean Line has had discussions with the Economic Development offices and state Chambers of Commerce in both Arkansas and Oklahoma. With the help of these offices, Clean Line is working to maximize the involvement of local businesses in the Project area.

Clean Line launched its efforts to determine the route of the Plains & Eastern Clean Line by engaging CH2M Hill to perform a Phase I Corridor Identification study. CH2M Hill identified potential corridors within which one or more rights of way could be located. In preparation for state permitting and NEPA processes, Clean Line engaged E&E to be its lead environmental consultant. E&E will assist Clean Line in routing the Project so as to minimize land use and environmental impacts. The E&E Scope is attached as Appendix 8.

To support the routing process, Clean Line engaged Power Engineers, Inc. to perform preliminary transmission line engineering for the Plains & Eastern. The analysis will determine conductor sizing, design criteria, right of way requirements and the family of structures to be used in constructing the line. The scope of their analysis is attached as Appendix 9.

Clean Line is working with leading HVDC equipment manufacturers to present the benefits of the technology to planning engineers, operators and others active in the Project area's transmission sector.

In June 2010, Clean Line hosted personnel from SPP, TVA and other utilities at a seminar where Siemens engineers explained the technical, planning and operational aspects of HVDC.

Clean Line has made significant progress on the interconnection process for the terminals at both ends of the transmission lines. As previously described, Clean Line and TVA entered into an MOU, pursuant to which TVA will play an active role in including the Project in transmission planning processes going forward. With respect to interconnection on the western or "windward" side of the Project, Clean Line has held extensive discussions with staff and members of SPP.

Though Clean Line will not enter into transmission service agreements until the Project reaches a more advanced stage of development, many parties have demonstrated their interest in the Project. In addition to TVA, Clean Line continues to discuss the Plains & Eastern Clean Line with other southeastern utilities, several of which have stated their interest in buying capacity on the line, particularly if they need to meet a state or federal RES. Clean Line is also working with most of the major wind developers in the US. These developers are potential capacity customers on the line. Alternatively, the same developers can sell renewable power to load serving entities that purchase transmission capacity on the Plains & Eastern Clean Line.

8. Financial Viability

Financial viability. Verifiable information demonstrating that the entity is in sound financial condition and has the ability to secure the necessary financing to meet the Project's requirements at all relevant phases of the Project.

Clean Line has secured the ideal investor group for the development of an interstate transmission project – investors focused on long-term results with a shared vision of the need for dramatic investments to integrate renewable energy across the US electric transmission system. As the Project progresses, Clean Line and its investors, independently, or along with other financial sponsors, will raise the additional capital needed to construct and operate the Project.

The majority owner of Clean Line Energy Partners LLC is ZAM Ventures, L.P. ("ZAM Ventures"), the principal investment vehicle for ZBI Ventures, L.L.C. ZBI Ventures, L.L.C., which focuses on long term investments in the energy sector, is a subsidiary of Ziff Brothers Investments, L.L.C. ZAM Ventures' investments include several clean energy companies, such as biotechnology companies in the United States and a sugar-based ethanol business in Brazil.

Additional owners of Clean Line Energy Partners include the Houston-based Zilkha family. The Zilkha family has a proven track record of making successful investments in the energy industry, including investing 100% of the equity in Horizon Wind Energy during its initial growth stage.

Upon request from DOE, Clean Line can provide additional information about its equity backing on a confidential basis.

One of the keys to a project's success is to have the proper financial backing for the applicable phase of the project's development. In considering its financing needs, Clean Line views the Plains & Eastern Clean Line as consisting of three phases.

Table 10
Finance Plan

Phase	Key Milestones	Approximate Percentage of Project Cost
Development	Siting authority Interconnection studies Routing Permitting Public outreach	1-2%
Pre-construction	Order DC converters Acquire right of way	10%
Construction	Install and commission converters Procure and install towers, cable	88-89%

Source: Clean Line Energy

Though there is substantial interest in transmission, most investors want to fund projects that are construction ready. Consequently, it is much harder to locate capital with the patience and risk appetite to fund early development. Clean Line has secured the funding it needs to advance the development of Plains & Eastern to a stage where transmission service agreements can be signed and more traditional sources of financing can be secured.

Clean Line's management team has the requisite experience in raising the capital for large-scale energy projects. Executive Vice President Jayshree Desai was formerly Chief Financial Officer of Horizon Wind Energy, where she led the company through several billion dollars of financings and acquisitions including the 2005 company sale to Goldman Sachs and the 2007 sale to Energias de Portugal ("EDP"). She was a key part the management team responsible for raising over $2.4 billion in the initial public offering of EDP's renewable subsidiary. Vice President of Finance and Strategy, David Berry, has led over $2 billion of project finance transactions, including non-recourse debt deals and structured equity transactions.

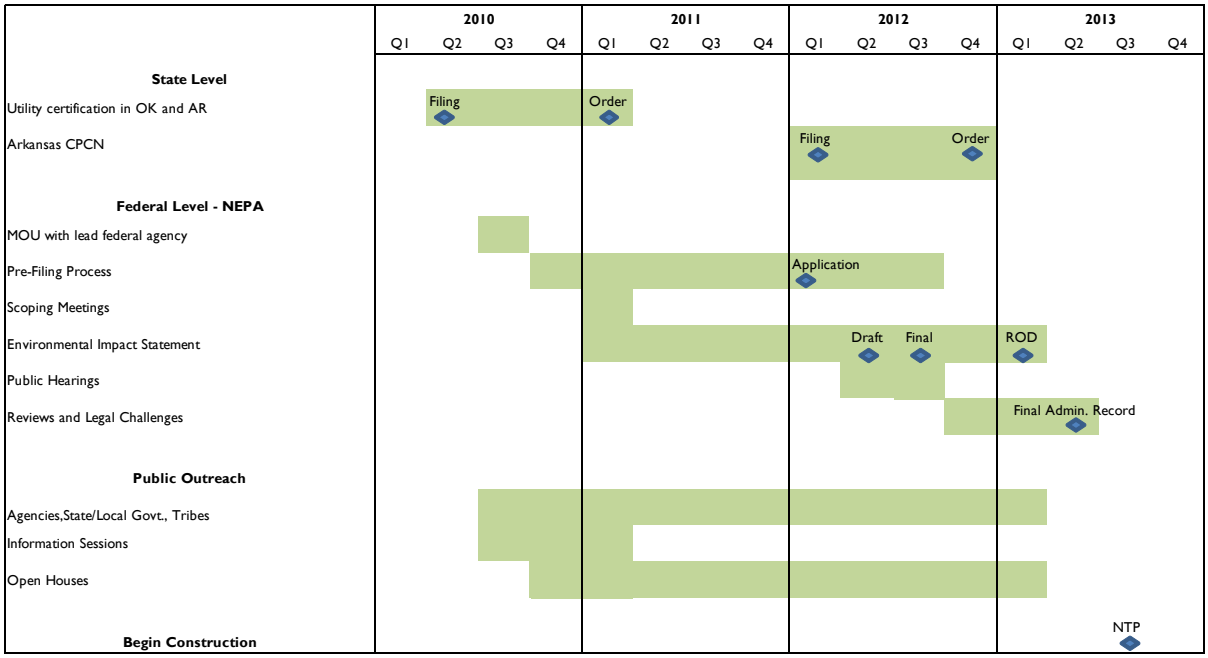
Large amounts of liquidity exist in the capital markets for transmission projects that have reached an advanced stage of development. The debt markets have a substantial history of supporting transmission, including merchant and HVDC lines. In 2003, the Path 15 project, an 83 mile stretch of 500 kV lines in Southern California, closed $209 million in debt financing spread across the bank and bond markets. In 2005, the Neptune Project, a 500 kV HVDC submarine line connecting New Jersey to Long Island, raised $600 million in a private placement at a competitive spread of 125 basis points over LIBOR. In early 2008, Trans Bay Cable LLC successfully closed an approximately $500 million transaction in the project finance market to fund a 53-mile underwater HVDC project across the San Francisco Bay. In September 2008, the Trans-Allegheny Interstate Line ("TrAIL") project closed a $550 million senior secured loan. In January 2010, TrAIL closed an additional $800 million of financing, consisting of $350 million in floating bank debt and $450 million in fixed coupon bonds.

ZAM Ventures is committed to funding the development of the Plains & Eastern Clean Line and expects to have a continued interest in the project. Other equity investors will be brought in to raise the funds necessary to construct a project of this size. Similar to lenders, equity investors have shown considerable enthusiasm for transmission. Private equity funds like ArcLight Capital Partners, EIF Group, Energy Capital Partners and Starwood Energy all have made substantial transmission investments

and have raised funds specifically devoted to transmission and other electricity infrastructure investments. Several large utilities such as Exelon and Duke have established divisions in their unregulated businesses to pursue transmission investments.

9. Additional Information

a. Project Schedule



b. Benefits of High Voltage Direct Current

The Plains & Eastern Clean Line will utilize DC technology, which is as old as the electric utility industry. HVDC technology has been implemented consistently over many years as an effective supplement to the main AC transmission systems. Large-scale HVDC has been successfully deployed in the United States and throughout the world. In North America alone there are more than 30 HVDC installations dating back to 1968.[39]

As demand to move large amounts of renewable energy to distant load centers has increased, HVDC solutions have shifted to the forefront as the most efficient option. Until recently, the notion of using HVDC to move renewable energy was not feasible because utilities, transmission planners and developers were not concerned with developing inter-regional transmission lines for movement of remote resources to load. HVDC technology is primarily cost effective when constructed over long distances.

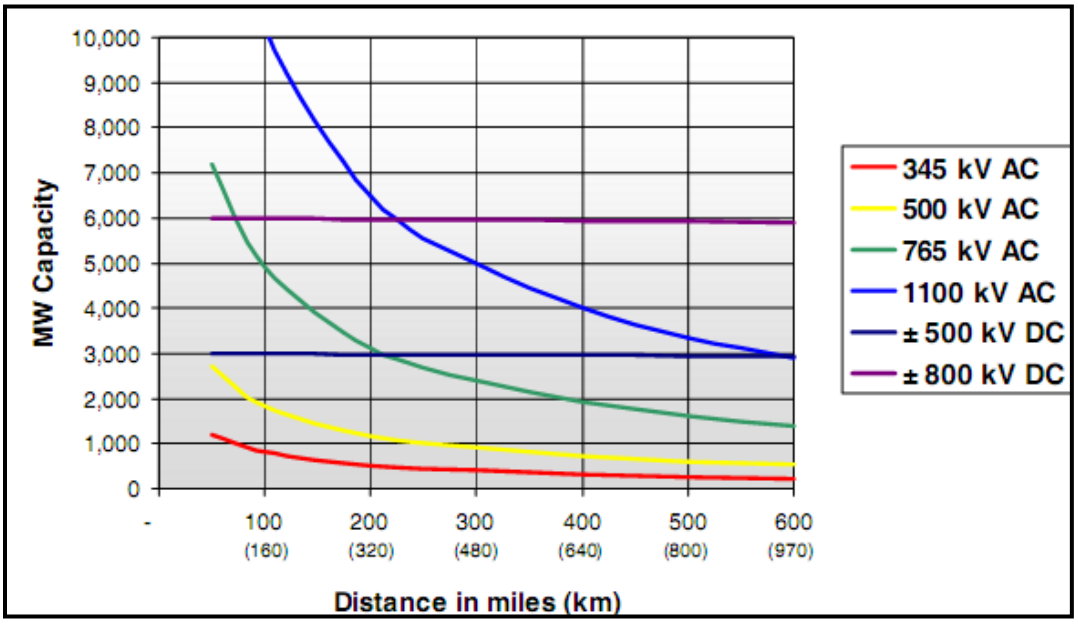
[39] DC and Flexible AC Transmission Subcommittee of the IEEE Transmission and Distribution Committee by the Working Group on HVDC and FACTS, HVDC Projects Listing, July 2009. http://www.ece.uidaho.edu/hvdcfacts/Projects/HVDCProjectsListingJuly2009-existing.pdf.

Proper deployment of an HVDC solution can:

- Result in lower line losses over long distances than comparable AC lines;
- Complement AC networks without contribution to short circuit power or reactive power requirements;
- Dampen power oscillations in an AC grid through fast modulation of DC transmission power and thus improve system stability;
- Give the operator complete control of energy flow, making it particularly well-suited to managing the injection of variable wind generation; and
- Allow the operator to control reactive power loading.

There are many factors that limit extra high voltage ("EHV") AC transmission capacity including: thermal considerations, steady-state stability, transient stability and voltage concerns. For EHV AC transmission lines, the maximum load capability of the line decreases as the length of the line increases. Figure 17 shows that at increasing distances, the ability to load the line, or "loadability" of EHV AC transmission lines diminishes, while the loadability of HVDC diminishes only slightly with distance.

Figure 17
Line Loadability vs. Distance Without Series Compensation



Source: Fleeman, J.A.; Gutman, R.; Heyeck, M.; Bahrman, M.; Normark, B.; , "EHV AC and HVDC transmission working together to integrate renewable power," *Integration of Wide-Scale Renewable Resources Into the Power Delivery System, 2009 CIGRE/IEEE PES Joint Symposium* , vol., no., pp.1-1, July 2009, 29-31..

Figure 18 shows a comparison of losses for various configurations that could be applied to move 3,000 MW of power over 250, 500 and 750 miles. The 345 kV and 500 kV lines in this analysis were assumed to be series compensated in order to load them to twice their surge impedance loading ("SIL") levels.[40]

Table 11 provides the assumptions used in the analysis to develop Figure 18. In this table, the first column indicates the operating voltage of the line in thousands of volts (kilovolts). The second column is the number of lines that are required (i.e., how many rights of way would be required). The third column indicates the number of circuits per structure (e.g., in the first row, for the 345 kV option, there would be two sets of structures (lines), each with two circuits). This is equivalent to having four physical transmission lines. The fourth column indicates the estimated right of way width for the assumed configuration. The fifth, sixth and seventh columns indicate the requirements for reactive support needed to achieve appropriate loading of the line. The last three columns indicate the type, configuration and bundling of the assumed conductors. In this case, all conductors are assumed to be Aluminum Conductor Steel Reinforced, which is an industry standard. Bundling refers to how many conductors are needed for each phase (for AC) or each bi-pole (for DC). Conductor sizes are measured in thousands of circular mils (kcmil). In the cases below, a 1590 kcmil conductor has a diameter of 1.545 inches, a 2312 kcmil conductor has a diameter of 1.802 inches, and a 795 kcmil conductor has a diameter of 1.108 inches.

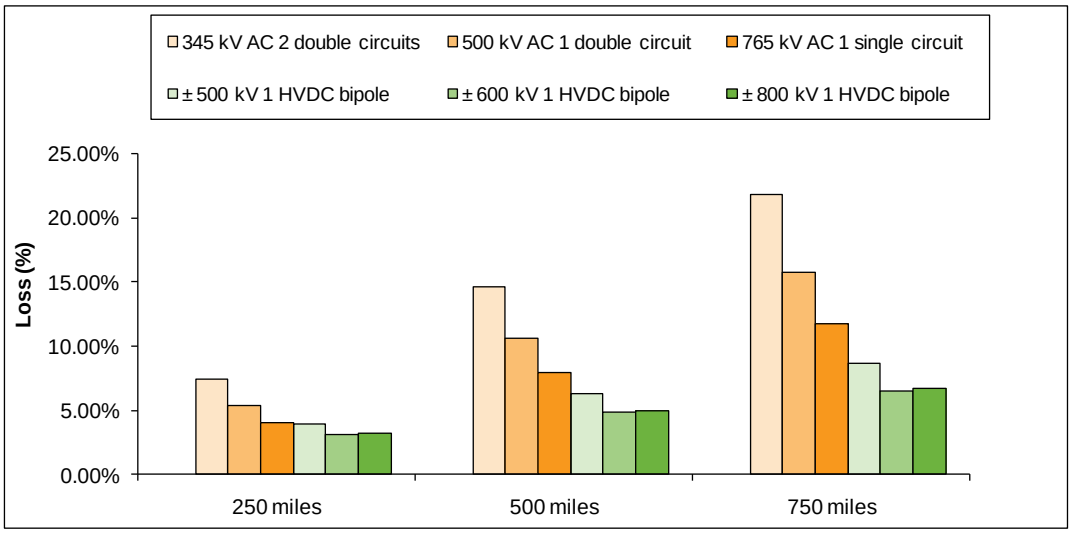
Table 11
Assumptions in Loss Comparison

Voltage (kV)	Configuration			Reactive Support			Conductor		
	Lines	Circuits per Tower	Est. ROW (ft)	Series Compensation	Shunt Reactors	Shunt Capacitors	Type	Bundle	Size (kcmil)
345 AC	2	2	300	Yes	No	Yes	ACSR	2	1590
500 AC	1	2	200	Yes	Yes	Yes	ACSR	2	2312
765 AC	1	1	200	No	Yes	Yes	ACSR	6	795
±500 DC	1	2	150	N/A (terminal reactive support designed as part of filter bank and system requirements)			ACSR	3	2515
±600 DC	1	2	150				ACSR	3	2515
±800 DC	1	2	250				ACSR	5	795

Source: Clean Line Energy

[40] The SIL of a transmission line is the megawatt loading level of a line at which a natural reactive power balance occurs; that is, the line neither produces nor consumes reactive power. For a 345 kV line, the typical SIL is around 450 MW.

Figure 18
Loss Comparison for 3,500 MW



Source: Clean Line Energy

Figure 18 demonstrates that though DC always results in lower losses than AC, the relative advantage of DC in terms of lower losses increases at longer distances. The efficiencies of the AC options could be increased if the series compensation were removed from this analysis; however, this would be at the expense of additional circuits, thus increasing costs, right of way requirements and overall environmental impact.

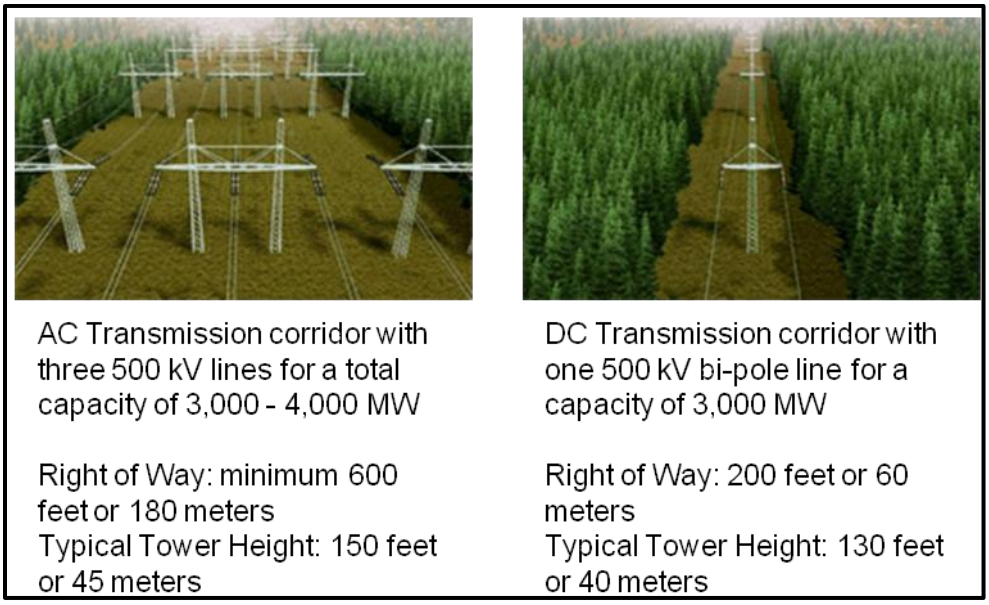
In general, when considering distance effects, long-haul EHV AC transmission lines:

- Require intermediate switching stations approximately every 200 – 250 miles (i.e., segmenting the lines) in order to handle issues associated with voltage profile, transient overvoltages and transient recovery voltages;
- Exhibit lower angular and voltage stability limitations;
- Have a higher requirement of reactive power dependent upon loading and higher charging currents at light load; and
- Present more parallel flow issues.

The analysis presented above, and in the relevant academic and industry literature, dictate that HVDC quickly becomes the most economic, efficient and environmentally friendly option for transmission of greater than 2,000 MW over distances greater than 250 miles.

As indicated in Figure 19, HVDC lines utilize less right of way, transfer approximately twice the power, and accommodate narrower structures than comparable EHV AC lines. By making more efficient use of transmission corridors and reducing land impact, public acceptance of the Project will be greater and total land acquisition costs will be lower.

Figure 19
Typical Transmission Line Structures for 3,000-4,000 MW



Source: Siemens

10. Conclusion

The Plains & Eastern Clean Line meets the demand for new electric transmission infrastructure to connect the best renewable energy resources to load centers. The Project and the renewable energy generation it will stimulate will create jobs, reduce pollution and improve the country's energy security. By supporting the Project's public outreach, permitting and siting efforts, DOE and SWPA can play a critical role in the Project's success – a partnership between Clean Line and SWPA could make these benefits a reality.

For further information about Clean Line Energy Partners and the Plains & Eastern Clean Line, please contact:

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APPENDICES

1. **Plains and Eastern Clean Line (Phase I) Interconnection Review Study**
2. **The Potential Impact of the Proposed Plains & Eastern Clean Line Transmission Project on Business Activity in the US and Affected States – The Perryman Group**
3. **Analysis of the Benefits of the Proposed Plains and Eastern Clean Line – ICF International**
4. **Potential Carbon Emission Reductions and Costs of Delivering Wind Energy from the Plains & Eastern Clean Line Transmission Project – The Brattle Group**
5. **Load Coincidence Study for the Integration of Wind into TVA via the Plains and Eastern Clean Line – AWS Truepower**
6. **SPP Criteria 3.5 and Appendix 11**
7. **Preliminary Converter Drawings**
8. **Proposal to Perform Routing and NEPA Compliance Activities for the Plains and Eastern Clean Line Project**
9. **Power Engineers, Inc. Scope of Work**