



CLEAN LINE ENERGY PARTNERS:

Building Transmission To Facilitate Large-Scale Renewable Energy Development

Overview:

- Clean Line Energy Partners is developing four large transmission projects to connect areas of the country that have excellent wind and solar energy resources to load centers several hundred miles away that can use the power.
- The company will use high-voltage direct current (HVDC) technology to minimize energy losses and have a smaller footprint compared to alternating current technology.
- Each project will cost about \$2 billion to build and will help catalyze several times that amount in renewable energy generating capacity investments.

Quick Facts:

Company Name:
Clean Line Energy Partners

Company Website:
www.cleanlineenergy.com

Location: Houston, Tx
(Headquarters)

Year Founded: 2009

Technology / Sector:
Electrical Transmission

2011 Employees: 37

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"We don't build big projects in this country anymore but we need big projects if we are going to break down big barriers."

Jimmy Glotfelty,
Executive Vice President and Co-founder

IN PURSUIT OF MEGA-CAPACITY TRANSMISSION PROJECTS

The wind energy industry in the United States has experienced an astonishing growth rate of nearly 40 percent per year (on average) since the mid-2000s,¹ but lack of access to adequate high-voltage transmission capacity could curtail future expansion and limit the integration of large amounts of renewable energy into the electric grid. Houston-based Clean Line Energy Partners was created in 2009 with the mission to bring thousands of megawatts (MW) of new renewable power to communities across the country. The company's President and co-founder, Michael Skelly, who spent 10 years building Horizon Wind Energy into a successful wind power project developer, knew that developing new transmission lines was the key to connecting the vast untapped wind energy resources in the central United States to markets in more populous load centers located hundreds of miles away.

Although wind farms can be built in most regions of the country, the areas with the most potential (in terms of both quality and quantity) can be found in the Great Plains between the Rocky Mountains and the Mississippi River.² "The strength of the wind in the center of the country is of a different nature compared to other regions," said Mario Hurtado, Executive Vice President and co-founder of Clean Line. With this in mind, Skelly assembled a small team of energy industry veterans and created Clean Line Energy Partners. The company has grown from its three co-founders and an intern to 37 employees in just over two years, and is divided into four teams, one for each of its four transmission line projects.³

One project is the 800-mile *Plains & Eastern Clean Line*, which upon completion will have the capacity to connect approximately 7,000 MW of wind energy generation from western Oklahoma, southwest Kansas, and the Texas Panhandle to utilities and customers in Tennessee, Arkansas, and other nearby markets. Assuming an annual capacity factor of 40 percent for a representative Great Plains wind power project, 7,000 MW is enough wind power to meet the annual electricity needs of about 2.5 million homes.⁴ The other three projects are similar in scope, and aim to deliver wind energy produced in the middle of the country to points East and West.

POWERING LOAD CENTERS WITH DISTANT WIND FARMS

The United States currently receives about 10 percent of its electricity from renewable energy sources, with wind energy comprising 17 percent of that total.⁵ Despite its small share of total installed capacity, wind power has been second only to natural gas in terms of new capacity added in the last several years.⁶ Wind is typically the most economically competitive renewable energy resource for bulk power production, and therefore often the preferred option for meeting state renewable portfolio standard (RPS) mandates. Furthermore, with good wind resources, wind power can compete with fossil fuels even without an RPS. But unlike power plants that burn fossil fuels, which can be built where needed, wind farms can only be sited in locations with suitable wind resources. As more and more wind power capacity has been built, access to transmission has become more of a constraint.⁷ In order to facilitate the continued growth of wind power, as well as utility-scale solar power, to meet expected demand, new transmission lines must be built.

That is easier said than done. Siting and building transmission lines is a slow process. Moreover, today's electric grid was never designed to move large amounts of power from the windy middle of the country to populations centers in the East, West and Midwest. Over more than a century, the electricity grid grew organically, from a collection of many small grids that served local loads to a patchwork of interconnected regional grids, but with limited transfer capacity between each region. The projects that Clean Line is developing would overcome this constraint and directly connect regions with wind resources to major load centers.

Another complicating factor is that the electricity sector is regulated primarily at the state level. In order for Clean Line to begin construction on any of its projects, each of which passes through multiple states, the company must obtain regulatory approval from each jurisdiction (i.e., the individual state public utility commissions), in addition to the required federal permits. However, state regulators have rarely contemplated the types of projects being proposed by Clean Line, and the company is developing four of them at once. This requires Clean Line to engage and build consensus with thousands of citizens in dozens of communities across the states involved in their projects. "Open dialogue, two-way communication, transparency and distributing good information to the stakeholders are absolutely critical to getting these projects built," says Hurtado.

One of the strengths of their projects, according to Hurtado, is that the transmission lines will not just pass through states, but bring other benefits along the way. For example, the *Centennial West Clean Line*, which would deliver to Southern California wind and solar power from New Mexico, might include a mid-point converter station to bring in solar generation from Arizona as well.

Given the complexity of the development process, Clean Line does not expect to complete any of their projects until 2017 at the earliest. The goal right now is to finalize all siting and permitting and obtain regulatory approval. After that, the business model is actually pretty straightforward. Clean Line will sell the transmission capacity to renewable energy producers and buyers, and use those financial commitments to raise the funds to finance and build the projects.

HVDC TRANSMISSION REDUCES ENERGY LOSSES

As it sets about obtaining regulatory approval and raising the billions of dollars in private capital necessary to build its projects, Clean Line is betting on the quality of its solution. High-voltage direct current (HVDC) technology has been used in its modern form in the United States since the mid-1940s, when HVDC transmission lines connected large hydroelectric power stations to far-away cities. Thanks to improvements in the technology over the last decade, the company says HVDC offers the most economical and energy-efficient solution for long-distance bulk power transmission, and is a better technical solution than the high-voltage alternate current (HVAC) technology that makes up the majority of the existing transmission network.

HVDC has lower energy losses over long distances due to reduced resistance in the wires. For every 1,000 kilometers, line losses are typically less than 3 percent.⁸ The losses for Clean Line's projects, including all necessary power conversions, will be about 4-5 percent, whereas, in the "AC world," said Hurtado, "losses could be from 9 to 15 percent" for a comparable line. Adding new dedicated HVDC lines, with AC-DC converters on each end, also provides for better control over power flow in terms of both quantity and quality, which benefits grid operators.

Compared to HVAC, long-haul HVDC lines also require a narrower right of way⁹ and can move the same amount of power without the need for intermediate substations to maintain voltage and power flow. This smaller footprint will prove important in cases where the company must route its lines through environmentally sensitive areas.

IF YOU BUILD IT, THEY WILL COME

In October and then again in December of 2011, the company made headway when it received approval from state regulators in Oklahoma and Kansas respectively. The regulatory approval in Kansas received bipartisan support and prompted Governor Sam Brownback to announce, "[The project] will provide a vital boost in Kansas's efforts to lead the nation in renewable energy production and bring well-paying jobs, generate revenue for landowners and local communities, and open Kansas's abundant wind resource to new markets."¹⁰

Clean Line President Skelly is convinced that once state and federal regulatory agencies allow the company to move forward with its projects, "billions of dollars of new investment in renewable energy sources" will occur. Each transmission project will cost roughly \$2 billion, and is expected to help catalyze several times that amount in wind and solar power development. The first phase of the *Plains & Eastern Clean Line* project, for example, is projected to support about \$7 billion in new wind power projects (3,500 MW), with much of that investment staying in the local or regional economy.

Clean Line has also entered into strategic partnerships with companies along the supply chain. They have an alliance with the technology-giant and HVDC provider Siemens to address wind integration issues where the existing grid may be weaker. Clean Line has also put in place a Memorandum of Understanding with the construction and engineering firm

Fluor. For the *Plains & Eastern Clean Line* project, Clean Line has formed an alliance with General Cable, whose facility in Malvern, Arkansas, has been tapped to manufacture the 25 million feet of wire necessary to build the *Plains & Eastern Clean Line*, an order estimated to be worth more than \$100 million at today's commodity prices. For that same project, Clean Line also has an agreement in place with Pelco Structural, under which Pelco will be a preferred supplier for the tubular steel transmission structures, which Pelco will supply from its facility in Claremore, Oklahoma. Pelco will also make engineering resources available to aid in design and costing of structures, and support ongoing development and construction efforts for the project. The agreement also provides that the transmission structures for the *Plains & Eastern Clean Line* will be manufactured within the states that the project crosses and raw materials will be sourced from local companies as much as possible.

By building thousands of miles of transmission lines across the country, Clean Line is hoping to help the wind industry continue its growth and deliver lasting returns for multiple stakeholders in many states, from landowners to companies in the electric power supply chain, to future producers and users of renewable energy. Jimmy Glotfelty, Executive Vice President and co-founder, stressed that each of their projects is being designed to be additive to the growth already anticipated for the wind and solar industries. He also recognized that Clean Line is taking on a daunting challenge, reminiscent of the construction of the U.S. Interstate Highway System, which took over 35 years to complete. "We don't build big projects in this country anymore," Glotfelty said, "but we need big projects if we are going to break down big barriers."

ENDNOTES

1. Growth rate applies to total installed capacity. From 1999-2009, cumulative U.S. installed wind power capacity jumped from about 2,500 MW to over 35,000 MW, an increase of 1,300 percent. Growth from 2004-2009 averaged 39 percent annually, and growth from 2009-2010 was 15 percent. See the American Wind Energy Association's U.S. Wind Industry Annual Market Report Year Ending 2009, <http://www2.grist.org/pdf/AWEA.pdf> and U.S. Wind Industry Annual Market Report Year Ending 2010, http://www.awea.org/learnabout/publications/upload/4Q10_market_outlook_public.pdf (February 9, 2012).
2. Utility-Scale Land-Based 80-Meter Wind Maps, Department of Energy, http://www.windpoweringamerica.gov/wind_maps.asp (February 14, 2012).
3. The company's four projects are: The Grain Belt Express Clean Line; The Centennial West Clean Line; The Rock Island Clean Line; and The Plains & Eastern Clean Line. Read more about the projects at <http://www.cleanlineenergy.com/projects>
4. Capacity factor is the ratio of the actual energy produced in a given period to the hypothetical maximum possible, i.e. running full time at rated power. Typical wind power capacity factors are 20–40 percent. According to Clean Line, wind projects in the Great Plains have capacity factors exceeding 40 percent. For more information, see "Wind Power: Capacity Factor, Intermittency, and what happens when the wind doesn't blow?" Renewable Energy Research Laboratory, University of Massachusetts at Amherst, http://www.umass.edu/windenergy/publications/published/communityWindFactSheets/RERL_Fact_Sheet_2a_Capacity_Factor.pdf (February 16, 2012).
5. "How much of our electricity comes from renewable energy?" U.S. Energy Information Administration, September 2010, http://www.eia.gov/energy_in_brief/slideshows/renewable_energy.html (February 9, 2012).
6. American Wind Energy Association, "Industry Statistics," http://www.awea.org/learnabout/industry_stats/index.cfm (February 11, 2012).
7. "Wind Energy Transmission," State Energy Conservation Office, http://www.seco.cpa.state.tx.us/re_wind-transmission.htm (February 16, 2012).
8. "Ultra HVDC Transmission System," Siemens Energy, <http://www.energy.siemens.com/hq/en/power-transmission/hvdc/hvdc-ultra/#content=Benefits> (February 12, 2012).
9. According to Clean Line, high voltage alternating current lines require two to three times the right-of-way width to move an equivalent amount of power compared to HVDC lines.
10. Draper, Bill, "Kansas regulators approve power line application," Business Week, December 9, 2011, <http://www.businessweek.com/ap/financialnews/D9RH4LDO0.htm> (February 12, 2012).