

The Economic Impact of the Plains
& Eastern
Clean Line in Oklahoma

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Executive Summary

The Plains & Eastern Clean Line transmission project, approved by the U.S. Department of Energy in March 2016, will include an estimated \$2 billion investment in a 720-mile high voltage direct current transmission line project connecting renewable wind energy produced in the Oklahoma and Texas Panhandles to customers in the Mid-South and Southeast. Completion of the project will require substantial one-time expenditures in the development and construction of the transmission system and complementary wind farms. The wind farms will have an estimated 4,550 megawatts (MW) of installed capacity. For purposes of this study, we have assumed that half of the installed capacity will be in Oklahoma and the other half in Texas. Additionally, maintenance and operation of the transmission system will support recurring economic activity in Oklahoma. The total economic impacts in Oklahoma from both one-time development and construction and recurring

operations are summarized below.

Note that the one-time construction impacts represent impacts both from wind farm and transmission line construction (reported separately in the body of the report), the latter

Summary of Oklahoma Economic Impacts		
One-Time Development and Construction Impacts		
	Direct Effect	Total Effect
Employment - Total	3,326	12,403
Employment – Average Annual	1,330	4,961
Labor Income	\$216,731,357	\$588,606,204
Output	\$1,007,496,579	\$1,982,828,090
Recurring Maintenance Operations Impacts		
	Direct Effect	Total Effect
Employment - Total	43	108
Labor Income	\$3,240,985	\$7,156,246
Output	\$16,772,000	\$34,094,814

includes the supply of steel monopole transmission towers from Pelco Structural, an Oklahoma-based manufacturer. The maintenance and operations impacts refer only to the transmission line and do not reflect estimates of the economic activity necessary to support wind farm operations. The construction phase of the project is expected to begin in the second half of 2017 and last approximately 30 months.

Introduction

The Plains & Eastern Clean Line project, approved by the U.S. Department of Energy in March 2016, will include an estimated \$2 billion investment in a 720-mile high voltage direct current (HVDC) transmission line project connecting renewable wind energy produced in the Oklahoma and Texas Panhandles to customers in the Mid-South and Southeast. The project will enable wind farm projects in Oklahoma and Texas capable of producing an estimated 4,550 MW of electricity to be collected, converted to direct current, and transmitted to markets where it will be sufficient to provide power to more than one million households. For a complete review of the project, including route descriptions and most recent news releases see <http://www.plainsandeasterncleanline.com/site/home>.

The construction, operation, and maintenance of the transmission line will serve as an initial economic catalyst setting in motion secondary layers of economic activity. For simplicity of presentation, the impacts in Oklahoma can be conceptualized as occurring in three phases. First, the Oklahoma portion of the wind farm development (half of an estimated 4,550 megawatt total) will require significant outlays for local construction and installation services consistent with the 2,275 megawatts of installed capacity assumed in Oklahoma.¹ Second, an alternating current (AC) collection system and converter station, that will convert AC to DC, will be developed to gather the produced electricity, convert it from AC to DC, and send it efficiently down nearly 430 miles of newly added HVDC line from the Panhandle to Sequoyah County on the state's eastern border. Third, efficient operation of the entire system will require recurring support in the form of maintenance, repair construction, and operations management. This brief report provides current estimates of both the initial expenditure required for each of the phases outlined above, as well as estimates of the secondary economic impacts

¹ This is a simplifying assumption in order to estimate the magnitude of the expected economic impact in Oklahoma from the newly constructed wind farms. The actual share of wind generation to be built in Texas and Oklahoma will depend on commercial decisions made by the generators connecting with the project.

associated with each. For illustration purposes, the regional importance of the initial economic activity is highlighted by isolating the impacts associated with an estimated \$56 million preferred supplier contract with Pelco Structural, LLC, an Oklahoma based manufacturer.²

The economic impacts experienced by the wind farm and transmission system development and construction as well as operations and maintenance will be manifest across the state. While the economic impact models represent the economy of the state as a whole, a few comments on the regional impacts may be instructive. Some aspects of the economic impacts – both direct and indirect – are inherently local and fully realized in the immediate region. These activities may include local construction, site preparation, legal services, and induced household purchases. Other activities extend to other areas, including purchases from manufacturers and specialized services that may be located in the state’s metropolitan areas or industrial centers.

² This is a simplifying assumption in this study. The actual contract amount will depend on the results of commercial decisions made by Pelco Structural and other parties involved in the construction of the project.

Economic Impacts: Transmission Line, Converter Station, and Collection System

Delivering newly generated wind energy to markets in the Mid-South and Southeast will require capital investment in an AC collection system and converter station to gather the generated power and convert it to direct current for efficient transfer across the transmission line. The estimated capital outlay in Oklahoma to fully realize this development is \$491 million. This direct capital outlay is estimated to support 2,592 direct full-time equivalent jobs over the three-year construction. The impacts reported below represent all impacts resulting from the nearly three-year development and construction period.³

	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment - Total	2,592	932	1,084	4,610
Employment – Average Annual	1,037	373	434	1,844
Labor Income	\$171,154,758	\$54,679,344	\$51,208,876	\$277,042,978
Output	\$491,000,013	\$180,025,608	\$163,816,911	\$834,842,532

The initial capital outlay will trigger indirect and induced economic activity culminating in \$835 million in Oklahoma production requiring 4,610 jobs supporting labor income of \$277 million. The labor impacts represent compensation of \$60,096 per full-time equivalent job, more than seven percent higher than the State's average compensation per job.

³ Indirect impacts refer to secondary impacts generated from business to business spending as firms involved in the initial catalyst (direct impact) increase purchases from their suppliers who must in turn increase purchases from their suppliers and so forth as the initial expenditure ripples through interconnected industries. Induced impacts refer to secondary impacts generated from household to business spending as labor income gains from both direct and indirect activity pass through local consumption markets.

Economic Impacts: Operations and Maintenance

The AC collection system, converter station, and transmission line will require some level of annual maintenance. Maintenance is expected to include electrical services, construction repairs and maintenance, equipment purchases, and other activities consistent with maintaining efficient operations of the system. In contrast to the previously reported impacts which represent the long run impacts of one-time capital outlays, these impacts represent the long run impacts of outlays expected to recur annually. Direct maintenance expenditures in the State are estimated to be \$16.8 million dollars and requiring 43 jobs.

Table 2: Plains & Eastern Clean Line Operations and Maintenance				
	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment - Total	43	36	29	108
Labor Income	\$3,240,985	\$2,595,826	\$1,319,435	\$7,156,246
Output	\$16,772,000	\$13,102,187	\$4,220,627	\$34,094,814

The maintenance expenditures serve as recurring state economic activity, with each successive year of expenditures setting in motion long run economic impacts supporting 108 jobs, \$7.1 million in labor income, and \$34 million in in-state production. The economic impacts will recur annually with each year of maintenance operations.

Economic Impacts: Preferred Supplier Case Study

Included in the \$491 million capital outlay in Oklahoma required to bring the project online is an estimated \$56 million preferred supplier contract with Pelco Structural, L.L.C. Pelco Structural is a Claremore, OK based manufacturer of utility, lighting, communication, and traffic poles. With an expertise in steel-tapered transmission poles, Pelco Structural serves as an example of an Oklahoma company that will face an increase in the final demand for their product as a result of the transmission line construction. In response to the \$56 million increase in demand for their product, Pelco Structural will respond by extending the working hours of current employees and hiring new ones. They will also increase their internal demand from suppliers of materials and services so that they can successfully complete the contract. Both at Pelco Structural and with their suppliers, new wages will be generated by workers. The combination of economic impacts through increased supplier reliance and through increased household expenditures represent the indirect and induced impacts attributable to this contract specifically. All economic impacts are reported in table 3 below.

Table 3: Pelco Structural Impacts				
	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment – Total	173	94	83	350
Employment – Average Annual	69	38	33	140
Labor Income	\$12,304,885	\$5,038,779	\$3,943,181	\$21,286,845
Output	\$55,999,998	\$15,855,035	\$12,614,688	\$84,469,721

The total economic impact from the preferred supplier contract is estimated to support 350 jobs, generating \$21 million in labor income and supporting \$84.5 million in regional economic impact.

Economic Impacts: Wind Farm Development

The transmission system will connect customers in the Mid-South and Southeast with wind energy generated in the Oklahoma and Texas panhandles. The wind energy will be produced from wind farms straddling state lines with a nameplate installed capacity of an estimated 4,550 MW developed evenly between the states. The Oklahoma portion (2,275 MW) of the development is estimated to require initial expenditures of \$4 billion to \$4.5 billion. The largest share of the expenditures will be required for equipment manufacture and procurement including towers, blades, and turbines. The outlays are assumed to occur largely with manufacturers outside the state and therefore are not included in the impact estimates presented below. A significant share of the remaining costs, including site construction, engineering services, legal services, electrical materials and installation services, and labor services are assumed to occur locally, providing initial economic activity in the State generally and northwestern Oklahoma specifically. This subset of Oklahoma specific expenditures are estimated to be nearly \$700 million, providing employment opportunities throughout development and construction of the 2,275 MW wind farm to 4,505 Oklahomans. The secondary impacts presented in Table 4 include both indirect and induced effects referred to simply as the multiplier effect. All impacts reported in Table 4 represent the total estimated impacts from the two-year development and construction period for the wind farms in Oklahoma.

	Direct	Multiplier Effect	Total Impact
Employment - Total	734	7,059	7,793
Employment – Average Annual	294	2,824	3,117
Labor Income	\$45,576,599	\$265,986,627	\$311,563,226
Output	\$516,496,565	\$631,488,992	\$1,147,985,557

Including indirect and induced impacts, the wind farm development is estimated to generate 7,793 jobs with \$311 million in local labor income gains stemming from a total change in regionally produced goods and services (output) of \$1.15 billion. The

reported economic impacts are estimated in an Oklahoma customization of the National Renewable Energy Laboratory (NREL) Jobs and Economic Development Impact (JEDI) model. The customization includes modest modifications to the State's underlying industry structure and estimated local activity shares derived in close consultation with Oklahoma wind industry experts. Wind farm operations will require annual support and maintenance, generating an additional stream of recurring economic impacts. While not formally estimated and reported in this report, these impacts are important in considering the totality of economic impacts associated with the transmission line project.

It is worth noting that the wind generation industry is rapidly developing in Oklahoma. The state currently ranks fourth in the nation in installed wind capacity. As the industry matures, it is expected that a concentration of industrial support activity will develop regionally to support the development, maintenance, and operations of wind generation facilities. As these support and supply chain clusters develop, new industry linkages appear in the economy. As a result, the multiplier, or spillover effect, increases as a greater share of the initial capital outlays and secondary impacts are captured in the local economy rather than "leaking" into other economies. The impacts just presented assumed that a large portion of the initial capital outlays leaked out of the Oklahoma economy. If this assumption is relaxed as the industry matures and captures more of the direct and support economic activity, the reported impacts will understate the true economic contribution of the project. The impacts reported, therefore, reflect the conservative nature of the model assumptions and should be interpreted accordingly.

Methodology

Economic impact studies are designed to estimate the economic benefits to a region from new activity. While they are not cost-benefit studies – as they do not explicitly estimate all of the costs or benefits of the new activity – they are an essential step in understanding more completely the avenues by which local regions benefit from new economic activity.

Economic impact models begin with a static delineation of payments between a regional economy's primary institutions (firms, households, and governments). The system of payments links the dollar output from a given industry (e.g. construction) to the dollar inputs required from supporting industries (e.g. wholesale lumber purchases, land title services, etc.) and the dollar inputs required from households (e.g. labor services). In this way, every dollar of new output from an industry can be shown to require a given level of new support from related industries and regional households.

Economic impacts are estimated as responses to an external economic stimulus. The change in final demand for regional production triggered by the stimulus is referred to as the direct economic impact. In order to accommodate the newly demanded output, the producer in turn requires additional support from their suppliers, and in order for these suppliers to accommodate the new demand, they in turn increase purchases according to the relationships in the economic model from their supporting industries, and so on. The aggregate process of economic increase is referred to as the indirect economic impacts of the initial stimulus.

In addition to indirect economic impacts, an additional layer of economic impacts are realized as workers from all levels of the process spend a portion of their additional labor income (and non-labor income). This household spending creates new demand (a second stimulus) from household supporting industries (e.g. health services, retail purchases, dining, etc.) which sets in motion successive economic activity as described previously. The aggregate process of economic activity from

household spending is referred to as the induced economic impacts of the initial stimulus. Economic impact models as described above that estimate new economic activity based on current linkages between the inputs required from supporting industries and the output they support are known as Input-Output (IO) models.

The most common IO model application is Implan, a data and modeling service commonly used in universities, governments, and economic development agencies to assess the economic impacts of new and existing industry activity.⁴ The Implan model application provides a baseline model of state and regional economies.

Impacts can be estimated either within the software or in a custom spreadsheet application using multipliers derived within and downloaded from the Implan application. The National Renewable Energy Laboratory (NREL) Jobs and Economic Development Impact (JEDI) model is an example of the latter. All impacts provided in this report are estimated either in the Implan software directly or in a custom spreadsheet application using Implan reported multipliers. For consistency and ease of comparison to current economic activity, all dollar values are reported in 2016 values.

⁴ See www.implan.com/company for a complete company review and product description. Other sources of IO model derived multipliers include the Bureau of Economic Analysis RIMS II database found at www.bea.gov/regional/rims/rimsii/.

Study Limitations

Economic impact estimates are derived in an input-output framework. This framework uses the existing structure of the economy to estimate the economic response of existing producers (inputs) to a new demand for regional production (outputs). Input-output models provide a low-cost but informative look at the interplay of new economic activity and the existing economy. Input-output models are subject to limitations, a few of which merit specific mention.

- Input-output models assume slack resources in the existing economy at the time of the new economic activity. The implication is that prices are fixed and therefore only quantities respond to the stimulus. In the case of regional economies at or near full employment, the actual impact may be more inflationary and less stimulative than predicted by the model.
- All impact estimates are long run responses. While much of the impact is likely exerted closely in time to the initial stimulus, economic ripple effects may occur slowly through time. It is incorrect to think of the total impact as occurring in the same year as the direct impact.
- Direct impacts serve as the economic stimulus in input-output models. All direct impacts were provided by Clean Line and are believed to represent a good faith description of the transmission project as currently proposed. Simplifying assumptions concerning the share of the wind farm development in Oklahoma and the size of the preferred supplier contract with Pelco Structural are likewise consistent with a good faith description of what is to be expected.
- This study does not include either an environmental or fiscal assessment – both are beyond the scope of the economic impact report. Nor does the report estimate the economic impacts from changes in electricity power markets. Taxes are levies against economic activity, so fiscal impacts follow economic impacts. Fiscal impacts, however, are not reliably estimated in an input-output framework and are generally estimated outside the model as the

project progresses and additional information on local spending, tax rates and tax policy are known.

- Finally, it is assumed in this study that all construction occurs over a 30-month timeline, beginning in the second half of 2017 and finishing in 2020. Impacts from longer lead-time items that are typically manufactured before the expected start of construction are spread across the 30-month timeframe. Variation in the project start date will not change the impact results in a material way.

About Us

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Dr. Kyle Dean is an experienced professional economist, providing economic analysis for governments, businesses, tribes, and non-profit leaders. Dr. Dean is experienced in regional and urban analysis, tax policy, optimization, and impact analysis for Tribal governments and businesses, trade associations, municipalities, and national and state business entities. Dr. Dean received his PhD in Economics from Oklahoma State University and his Bachelors of Business Administration (MIS) from the University of Oklahoma. He is a member of the American Economic Association and the National Association of Business Economists. Dr. Dean currently serves as Assistant Professor of Economics and Associate Director of the Steven C. Agee Economic Research and Policy Institute in the Meinders School of Business at Oklahoma City University.

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Holding undergraduate and graduate degrees in Economics from the Oklahoma State University, Dr. Evans specializes in regional economic forecasting, local tax incidence analysis, and forensic economics. Dr. Evans co-founded EIG with Kyle Dean in 2005 having since worked with local and national clients including the Oklahoma Bankers Association, Oklahoma state insurance carriers, the U.S. Consumer Healthcare Products Association, Clean Line Energy Partners, and many others. Additionally, Dr. Evans has served as an expert witness in personal injury, asset valuation, and regulatory cases. Dr. Evans currently serves as Assistant Professor of Economics and Executive Director of the Steven C. Agee Economic Research and Policy Institute in the Meinders School of Business at Oklahoma City University.

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