



Clipper Windpower turbine near Medicine Bow, Wyoming
Photo credit: PIX 14903

Introduction

Wyoming is a significant energy exporter, producing nearly 40% of the nation's coal and 10% of the nation's natural gas. However, opportunities to add new energy exports in the form of power generation are limited by insufficient transmission capacity. This fact sheet summarizes results from a recent analysis conducted by NREL for the Wyoming Infrastructure Authority (WIA) that estimates jobs and economic development activity that could occur in Wyoming should the market support new investments in power generation and transmission in the state.

Modeling Inputs

New infrastructure projects considered in this analysis would be developed for the purpose of exporting Wyoming wind and natural gas generation throughout the West and include four high voltage (HV) transmission lines, a network of transmission lines that collect new power generation for export outside the state, 9 GW of new wind power, and 1.8 GW of new natural-gas-fired power. The estimated capital investment and the Wyoming share of this investment are detailed in Table 1.

Results¹

Given today's economic structure, the investments flowing through the Wyoming economy are estimated to support:

- An average (as opposed to peak) of 4,000–5,900 Wyoming jobs per year for 10 years from construction-related activities; 8,000–

14,000 Wyoming jobs per year during peak construction activity.

- Wages and benefits to Wyoming workers averaging \$200 million–\$330 million per year during the 10-year construction period.
- 2,300–2,600 Wyoming jobs during the operations period of the infrastructure life cycle (at least 20 years, based on typical financing for new wind power projects).
- Wages and benefits ranging from \$100 million–\$120 million per year during operations.
- Economic activity (output) on the order of \$1.2 billion in 2016 and \$1.4 billion in 2019 (during peak construction) and \$380 million per year during operations-only years.
- Total Wyoming economic output on the order of \$12 billion–\$15 billion (construction plus 20 years of operations); this represents approximately 30% of the total potential economic activity associated with these projects.

In this scenario, development of wind energy yields the greatest number of Wyoming jobs and economic development activity, although new transmission and natural-gas-fired projects also produce large numbers of Wyoming jobs. Economic development activity is highest during peak construction periods but remains considerable during operations, both in terms of employment and economic output (Figure 1 and Figure 2).

Table 1. Wyoming Share of Project Spending (For Equipment Installed within Wyoming)

Infrastructure Type	Units Installed	Total Installed Cost	Wyoming Share	Annual Operating Expenditures	Wyoming Share
Wind Generation	9,000 MW	\$18 billion	16%–22%	\$225 million	37%
Natural Gas Generation	1,800 MW	\$2.3 billion	22%–33%	\$42 million*	18%**
500 kV HVDC Transmission	2	\$2.2 billion	21%–32%	\$60 million	25%–37%
500 kV HVAC Transmission	2	\$1.3 billion	32%–49%	\$35 million	26%–32%
230 kV HVAC Transmission	Multiple***	\$660 million	25%–40%	\$17 million	26%–32%
Total		\$25 billion	19%–26%	\$380 million	31%–34%

¹Results are generally reported as a range due to uncertainty in the ability of Wyoming-based business, contractors, and service providers to participate in the development, construction, and operations of these projects. However, Figure 1 and Figure 2 show the results from our base case estimates and are based on the best available information to date.

*Excludes fuel cost as no incremental change in Wyoming-based gas production is expected from these projects.

**Weighted average fixed and variable costs.

***Various lines and substations associated with a basic collector system.

Note: Totals may not add due to rounding.

Figure 1. Base case employment by type of infrastructure
 Note: Data are stacked to show the total jobs resulting from all investments combined

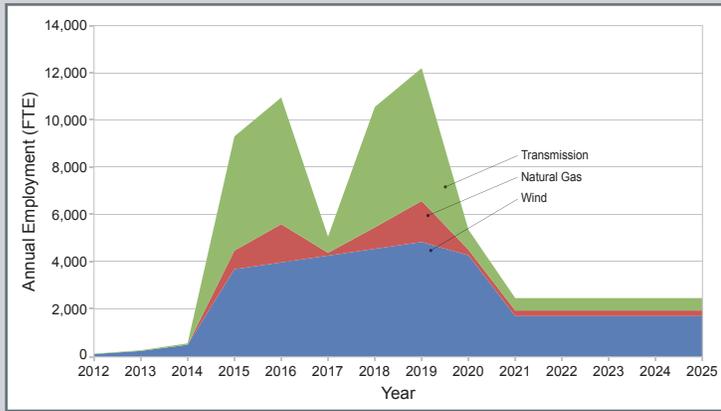
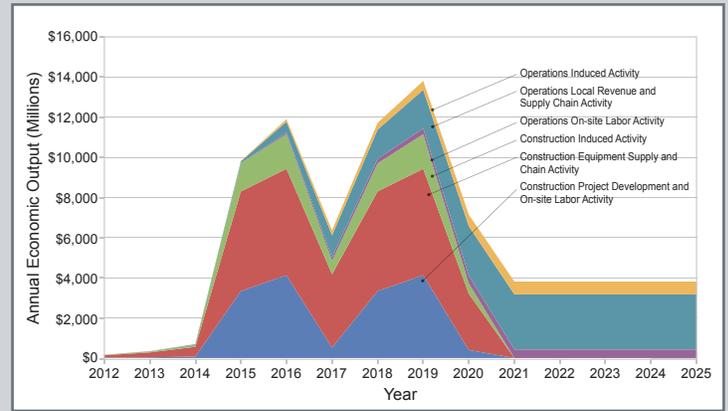


Figure 2. Base case economic output over time
 Note: Data are stacked to show the total output resulting from all investments combined



Discussion

The heavy construction sector is expected to see a significant boost in activity from this development; however, the economic activity resulting from these projects is not limited to this sector. Other Wyoming businesses and industry would see significant economic activity. Wyoming businesses that supply the construction sector, including quarries, cement producers, and hardware suppliers, would see increased activity. Metal fabricators, equipment sales firms, legal and financial services personnel, engineers, and even Wyoming banks may likewise see increased demand for services. To the extent that existing or new Wyoming manufacturers could supply these projects, a whole array of potential manufacturers could see business growth. Finally, service providers, including restaurants, retailers, childcare providers, and grocery stores, among many others, would see increased demand as construction workers and other project beneficiaries spend their paychecks in Wyoming.

The distribution of economic activity by infrastructure type and over time is primarily a function of the level of deployment (for each infrastructure type) and the timing in which projects begin construction and are placed in service. These results are based on hypothetical deployment of new transmission and generation capacity between 2012 and 2021. The hypothetical deployment scenario used in this analysis was developed by the WIA in conjunction with industry stakeholders. The scenario is grounded in the array of proposed HV transmission projects,

which, if built, could result in significant new wind and natural-gas-fired generation. Natural-gas-fired generation is expected to be used to mitigate the variability of wind and take advantage of excess transmission capacity, when available. While this scenario is intended to represent real market potential, it is not intended to forecast transmission and power generation development in Wyoming. Whether this specific scenario is achieved will depend on an array of market, state and federal policy, and other variables.

Ultimately, to realize this potential, demand for Wyoming wind energy is critical. In addition, the development of the new transmission infrastructure to export the Wyoming wind and natural-gas-fired generation across the West is important. Should infrastructure development on the level of that envisioned here become a reality, an array of factors will also influence whether Wyoming will capture this level of economic activity. Parallel deployment of wind, transmission, and natural-gas-fired generation could limit Wyoming's ability to contribute local goods and services to these projects at the level they have been able to for individual projects in the past and reduce the Wyoming-specific economic activity estimated here. Alternatively, the development of a Wyoming labor force that can support this type of infrastructure development, along with a modest amount of Wyoming manufacturing capacity to support these types of projects, could greatly increase the economic activity occurring in Wyoming from these projects.

Methodology

Economic development estimates were generated by NREL's Jobs and Economic Development Impacts (JEDI) models: JEDI Wind, JEDI Natural Gas, and JEDI Transmission models were used in this analysis. JEDI model inputs, including project costs and Wyoming local share values, were determined by research, interviews, and conversations with various Wyoming wind, transmission, and natural gas developers and industry stakeholders as well as companies that conduct energy sector and other business (e.g., legal services) in Wyoming. Detailed interviews with leading engineering, design, and construction firms working in the Rocky Mountain region and publicly available data sources were also utilized.



Photo credit: PIX 06589