

Methods appendix:

How renewable energy jobs can uplift fossil fuel communities and remake climate politics

February 2021

Data sources

For fossil fuel employment, this analysis uses data from [Emsi](#), which provides labor market information covering a variety of occupational and industry estimates. We primarily focus on industry-specific employment totals. Employment is from 2019 only.

For levelized cost of electricity (LCOE), this analysis uses data from “A Geographically Resolved Method to Estimate Levelized Power Plant costs with Environmental Externalities” by Rhodes et al.¹ Data was downloaded from the authors’ public GitHub [repository](#). Downloaded data inputs (overnight \$/kWh) were adjusted to match standard assumptions from the authors’ Levelized Cost of Electricity [web map](#) tool. These assumptions were derived from the 2015 National Renewable Energy Laboratory Annual Technology Baseline database. Values for Oglala Lakota County, S.D. were not available in the GitHub repository, and were instead imputed from the web map. All LCOE cost estimates are in 2015 U.S. dollars, per Rhodes et al.

For congressional district election results, this analysis uses the [Directory of Representatives](#) available on the U.S. House of Representatives website. While New York’s 22nd District seat was still technically vacant at the time of analysis, [recent court rulings](#) declared Republican Claudia Tenney the winner, and we proceeded to treat the county as Republican for the purpose of this analysis.

Geographic scope

We analyze fossil fuel employment across all counties nationally. However, due to LCOE data availability, this analysis is geographically limited to the lower 48 states. LCOE analyses were run using both county units and congressional district units.

Key terms and analytical approach

Fossil fuel employment: Based on underlying activities and outputs according to the North American Industry Classification System (NAICS), we have identified a total of 16 fossil fuel industries, ranging from oil and gas extraction to power generation to petrochemical manufacturing. We also examined prior industry analyses, including the [U.S. Energy & Employment Report](#), to determine a range of fossil fuel activities. The table below lists the relevant industries and associated employment totals.

¹ Rhodes, Joshua, Carey King, Gürcan Gulen, Sheila Olmstead, James Dyer, Robert Hebner, Fred Beach, Thomas Edgar, and Michael Webber. “A Geographically Resolved Method to Estimate Levelized Power Plant Costs with Environmental Externalities.” *Energy Policy* 102 (March 2017): 491–99. <https://doi.org/10.1016/j.enpol.2016.12.025>.

Fossil fuel industries and employment, 2019

NAICS Code	Industry Name	Employment
2111	Oil and Gas Extraction	141,654
2121	Coal Mining	50,400
213111	Drilling Oil and Gas Wells	60,562
213112	Support Activities for Oil and Gas Operations	269,556
213113	Support Activities for Coal Mining	4,849
221112	Fossil Fuel Electric Power Generation	82,423
22112	Electric Power Transmission, Control, and Distribution	240,360
2212	Natural Gas Distribution	110,147
23712	Oil and Gas Pipeline and Related Structures Construction	178,024
23713	Power and Communication Line and Related Structures Construction	214,633
3241	Petroleum and Coal Products Manufacturing	113,076
32511	Petrochemical Manufacturing	26,577
3353	Electrical Equipment Manufacturing	145,341
4861	Pipeline Transportation of Crude Oil	12,473
4862	Pipeline Transportation of Natural Gas	29,832
4869	Other Pipeline Transportation	8,396
	Fossil Fuel Total	1,688,303

Source: Brookings analysis of Emsi data.

Fossil fuel employment hubs and fossil-fuel-dependent communities: For this analysis, we defined *fossil fuel employment hubs* as the 622 counties ranking in the top 20% of fossil fuel employment among the lower 48 states, or those with at least 486 fossil fuel workers, ranging up to 122,390 (Harris County, Texas). We also reference the 622 counties ranking in the top 20% for their *share* of fossil fuel employment as *fossil-fuel-dependent communities*. For example, Slope County, N.D. has only 84 fossil fuel workers, but this accounts for half of the county's low total employment, and thus places Slope County as the most fossil-fuel-dependent county in the lower 48 states. Representing the other extreme, Los Angeles County, Calif. has the third-highest level of fossil fuel employment (25,156), yet that number only amounts to 0.5% of total employment in the county. By both count and share, 264 counties fall into the top 20% of fossil fuel employment.

Levelized cost of electricity: The levelized cost of electricity measures how many dollars it would cost to produce a megawatt hour of electricity for a designated energy-generation technology. Rhodes et al. levelized cost of electricity calculations considered a vast array of factors, including plant lifetimes, upfront and operational costs, and resource availability across 12 electricity-generation technologies, although our analysis focused specifically on wind and utility-scale solar photovoltaic. For more details, please see their [full publication](#). The final levelized cost of electricity formula used in our analysis produces these costs without considering externalities or availability zones. We chose not to price externalities in this analysis in order to highlight the more traditional economic costs of generating electricity, and to show that clean energy can present economic opportunity in addition to its well-known environmental and human health benefits.

Energy-generation competitiveness: Like our fossil fuel employment hub definition, we defined energy-generation competitiveness as the 622 counties ranking in the cheapest 20% of levelized cost of electricity for each energy source. For wind, the cost to generate electricity among the most competitive counties ranged from \$46.77/MWh in Floyd County, Texas up to \$74.85 in Cameron County, Texas. For solar photovoltaic (utility-scale), the cost to generate electricity among the most competitive counties ranged from \$62.80 in Luna County, N.M. up to \$79.66 in Washington County, Fla.