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The Energy Transition and Local Government Finance: New Data and Insights from 10 US States

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Working Paper 24-01
January 2024

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Acknowledgements

We thank the Wilderness Society, and Julia Stuble in particular, for their support of this project. Thank you to Sarah Mills at the University of Michigan for coordinating the collaboration among the authors, to Dustin Tingley from Harvard University for comments on preliminary findings from the work, Ben Gilbert from the Colorado School of Mines for comments on a draft of the paper presented at the 2024 Allied Social Science Association annual conference in San Antonio, TX, and to the participants at that session organized by the International Association of Energy Economics. We are grateful to Anthony Lopez and Brian Sergi of the National Renewable Energy Laboratory for sharing data on developable land for wind and solar. Most importantly, we are grateful to the hundreds of state and local government officials who responded to our questions and data requests during the research phase of this project.

About RFF

Resources for the Future (RFF) is an independent, nonprofit research institution in Washington, DC. Its mission is to improve environmental, energy, and natural resource decisions through impartial economic research and policy engagement. RFF is committed to being the most widely trusted source of research insights and policy solutions leading to a healthy environment and a thriving economy.

About RFF’s Equity in the Energy Transition Initiative

RFF’s Equity in the Energy Transition initiative recognizes that the United States and the world need to rapidly reduce greenhouse gas emissions to avoid the worst impacts of climate change. Research carried out by the initiative and its partners seeks to understand how these changes to the energy system will affect communities and what policy tools can effectively deliver solutions to ensure a more equitable energy system.

Sharing Our Work

Abstract

Fossil fuels are the primary contributor to global climate change, and efforts to reach net-zero emissions will require a dramatic curtailment of their extraction and use. However, fossil fuels fund public services at all levels of government, and research has not assessed whether clean energy sources can provide similar scales of revenue. In this paper, we analyze a novel dataset that we have assembled on how fossil fuels and renewable energy contribute to local governments in 79 US counties across 10 states. Revenues from fossil fuels far outweigh renewables in aggregate terms, providing more than $1,000 per capita annually in dozens of counties. However, wind and solar in some states generate more local public revenue than fossil fuels per unit of primary energy production. In most counties that depend heavily on fossil fuels for local revenues, solar—but not wind—has the technical potential to replace existing fossil fuel revenues, but this would require dedicating implausibly large portions of developable land (in some cases, more than half) to solar. For counties with less reliance on fossil fuels, wind and solar can more plausibly replace fossil fuel revenue streams. This finding suggests that while renewable energy will provide new revenue streams for communities, fossil fuel–dependent regions will need to build new tax bases well beyond wind and solar, develop other sources of revenue, or risk a decline in public service provision.

Contents

1. Introduction

Today's energy system plays an important role in funding public services at the local, state, tribal, and federal levels in the United States, supporting transportation infrastructure, public education, social services, and more. As fossil fuel production decreases as a result of increased competition from new sources, natural declines, and public policies that incentivize technologies such as wind and solar, the decline of coal, oil, and natural gas will reduce government revenue, while the rise of clean energy will generate new income streams. In this analysis, we present new data to better understand the current contribution of the energy system to local government budgets and consider how an energy transition may change this.

The importance of energy-related revenues for local governments has been noted by lawmakers in recent years, perhaps most prominently in the Inflation Reduction Act of 2022. In the act, Congress stipulated that certain clean energy projects would be eligible for enhanced tax credits if they were built in areas where 25 percent or more of local tax revenues come from fossil fuels.[1] However, no data currently exist that would allow the federal government or most local governments to calculate whether a community would meet this threshold (IRS 2023). Relatedly, no analysis has assessed whether clean energy technologies such as wind and solar can help replace declining fossil fuel revenues in the communities that rely on them.

To start to fill these information gaps, we gathered and analyze a novel dataset that contains roughly 40,000 observations of local government revenue from the energy system, including the production of coal, oil, and natural gas; the transportation and refining of those fuels; electric generation from coal, natural gas, wind, and solar; and the electricity grid. Our data cover 79 energy-producing counties across 10 leading energy-producing states: Alaska, California, Colorado, Montana, North Dakota, New Mexico, Ohio, Texas, West Virginia, and Wyoming. We develop estimates for county governments, school districts, municipalities, and other local governments (e.g., fire or hospital districts) within each county. To contextualize the importance of these revenue streams, we also compare local government revenues with wages paid to fossil fuel workers in select counties.

The analysis allows us not only to assess the scale of revenues that support essential services but also to make comparisons across energy technologies and fuel sources. Although more data are needed to provide a comprehensive picture, our analysis offers the first view as to whether clean energy technologies such as wind and solar can fill the gap left by declining revenues from fossil fuels.

1 Inflation Reduction Act of 2022, H.R.5376, 117th Cong. (2022). **https://www.congress.gov/bill/117th-congress/house-bill/5376**.

2. Related Research

Despite the importance of the topic to hundreds of communities across the US, little research has quantified the scale of public revenues generated by energy commodities and infrastructure. We are aware of just two national analyses. The first (E. Brunner, Hoen, and Hyman 2022) focuses exclusively on wind energy and finds that the installation of new generation facilities increases local school district revenue by $1,000 or more per pupil, leading to increased expenditures, primarily on infrastructure.

The second nationwide analysis is Raimi et al. (2023), who estimate that the production, processing, transportation, and combustion of fossil fuels generated $138 billion annually for local, state, tribal, and federal governments from 2015 through 2019. However, that analysis did not include estimates at the local (i.e., county) level, nor did it estimate the fiscal contributions of clean energy sources such as wind or solar, neither did it include revenues generated by electric transmission and distribution infrastructure.

A modest body of research has examined the fiscal contributions of specific energy technologies or fuels at different regional scales. This includes national-level analysis from Newell and Raimi (2018), who calculate state and local government revenues from oil and gas production across 16 US states; Prest (2022), who estimates the effects of changes in federal oil and gas leasing policies on the federal budget; and Prest et al. (2023), who estimate changes in local government revenue under alternative decarbonization scenarios in five US oil- and gas-producing regions. Smith et al. (2021) provide a highly localized view by documenting how $2 billion in annual revenues from fossil fuel production on federal lands are distributed to the state and local levels. McBride et al. (2022) assess county-level tax revenues from oil and gas production across the United States but rely on a proprietary analysis carried out by an industry data firm that does not make its methods or data public.

Research reports from the University of Michigan (Uebelhor et al. 2021; Hintz et al. 2021) have documented the policies that dictate how wind and solar are taxed at the local level but do not quantify the resulting revenues. Another research report, from Rhodes (2023), uses tax filings from the state of Texas to estimate that a representative 100 megawatt (MW) wind or solar farm could generate roughly $10–$20 million in local tax revenue over its 30-year lifespan and that existing clean energy projects will generate hundreds of millions of dollars in revenue for dozens of counties in Texas. At the same time, numerous analyses have found that proximity to certain forms of energy infrastructure, including hydraulically fractured natural gas wells, solar installations, and wind farms can reduce property values, at least temporarily, for nearby homeowners (Muehlenbachs, Spiller, and Timmins 2015; Elmallah et al. 2023; E. J. Brunner et al. 2024), which could reduce local property tax bases.

Other work has provided evidence through case studies at local or regional levels. Mayer (2018) finds that local government officials in the Mountain West perceive that fossil fuels provide more fiscal benefits than renewables but does not quantify those contributions. One analysis from the US Department of Energy estimates that new nuclear power stations could more than replace local government revenue losses associated with coal plant closures (Hansen et al. 2022). Other case studies have focused on the potential revenue losses for retiring coal-fired power plants in regions including Iowa, Montana, and Ohio (Jolley et al. 2019; Christianson et al. 2021; Roemer and Haggerty 2022); Appalachian communities that are heavily dependent on coal mining (Morris et al. 2021); and fossil fuel–dependent economies in West Virginia and Wyoming (Gazmararian and Tingley 2023).

3. Data and Methods

Our data were gathered over roughly two years from thousands of federal, state, and local documents, datasets, and other sources (primarily direct communication with local and state government officials).[2] Where available, we obtained data reported in state or local government documents that specified revenues collected from energy sources or infrastructure that flowed to local levels. In many cases, detailed data were not available, requiring us to make estimates. For example, states often distribute energy-related revenues to counties, school districts, municipalities, and other local governments according to formulas specified in statutes but report aggregated data only at the county level. In these cases, we estimate how this revenue is distributed among local governments within a given county based on statutes and complementary data, such as local government financial reporting. Details of our methods for making these estimates are included in the state-by-state appendices.

Because of the time required to gather these data, a comprehensive national analysis was not possible. We therefore sought to include states and counties that represent a wide range of energy activities, including the production of coal, oil, and natural gas; transportation and refining of these fuels; electricity generation infrastructure from coal, natural gas, wind, and solar; and electricity transmission and distribution infrastructure. We include revenues from land leases (e.g., royalties, lease payments, and rents from public lands), severance taxes, property taxes, electric generation taxes, and—where data were available—payments in lieu of taxes. We did not seek to include incomes taxes, sales taxes, or other sources, because our previous work indicated that available data would not provide sufficient granularity to understand the contribution of the energy sector at the local level (Newell and Raimi 2018; Raimi et al. 2023).

Although it is not comprehensive (e.g., we did not gather data on all revenue sources or from nuclear, hydro, or bioenergy), our dataset represents the most extensive effort to document how a wide range of energy technologies contribute to local public services. In total, our dataset includes roughly 40,000 observations across 79 counties (or, in the case of Alaska, boroughs) in 10 states: Alaska, California, Colorado, Montana, North Dakota, New Mexico, Ohio, Texas, West Virginia, and Wyoming (see appendix for full list). We chose these states because they are leading energy producers across a wide

2 We do not include Native Nations in this analysis because detailed revenue data are typically not publicly available.

range of technologies and because our previous work (Newell and Raimi 2018; Raimi et al. 2023) suggested that they would have sufficiently granular data to allow us to produce reliable revenue estimates.

One challenge with quantifying revenue flows to local governments is determining whether and how to include revenue that is collected by states or the federal government and then distributed to local government entities. For example, most states collect severance taxes when fossil fuels are extracted, the proceeds of which often flow into general funds that are distributed based on each state's unique budgeting process and may ultimately be used to fund K–12 education and local governments. In these cases, we cannot directly observe energy-related revenues that may flow to local governments, because we do not know which dollars are "energy" dollars and which come from other revenue sources. Because of this complexity, we include revenues only where state- or local-level reporting allows us to directly observe flows of energy-related revenues to local governments (see state-by-state appendices for details). This means that our estimates are a lower bound of the true level of energy revenues that flow to the local level.

Another challenge comes from gathering data on property tax revenue from wind and solar facilities. In some locations, state or local authorities publish data that allow us to determine or estimate property taxes paid by these facilities. In other states and for certain energy sources, particularly solar, these more comprehensive data are not available. In such cases, we first contacted local assessors. If unsuccessful, we next attempted to carry out manual searches of assessment data through county government websites. Wherever possible, we aggregated property values or taxes paid for parcels that host wind and solar facilities. This task was feasible for most but not all counties, particularly in cases where large-footprint energy facilities stretch across thousands of individual parcels (e.g., large wind farms). Where we present data on wind and solar revenues, those data represent comprehensive analysis of our counties of interest unless otherwise noted.

Yet another limitation is that in some states, the available data do not allow us to compare across different energy types. For example, Wyoming's state government assesses the value of most power generation, transmission, and distribution property but does not make detailed data publicly available. Instead, it aggregates the data into three categories that include all electric utility assets by county—major electrics, municipal electrics, and rural electrics—and does not distinguish among different types of infrastructure (e.g., generation, transmission, distribution) or energy sources (e.g., coal, natural gas, or wind) (Wyoming Department of Revenue 2021). Colorado, Montana, and West Virginia take a similar approach, limiting our ability to analyze data, particularly in the electricity sector.

Despite these limitations, our dataset allows us to draw novel policy relevant insights. In the following section, we present our analysis of the data from 2021, the most recent available year.[3]

3 In cases where 2021 data were not available but data from the previous or subsequent year were, we use the 2020 or 2022 data.

4. Results

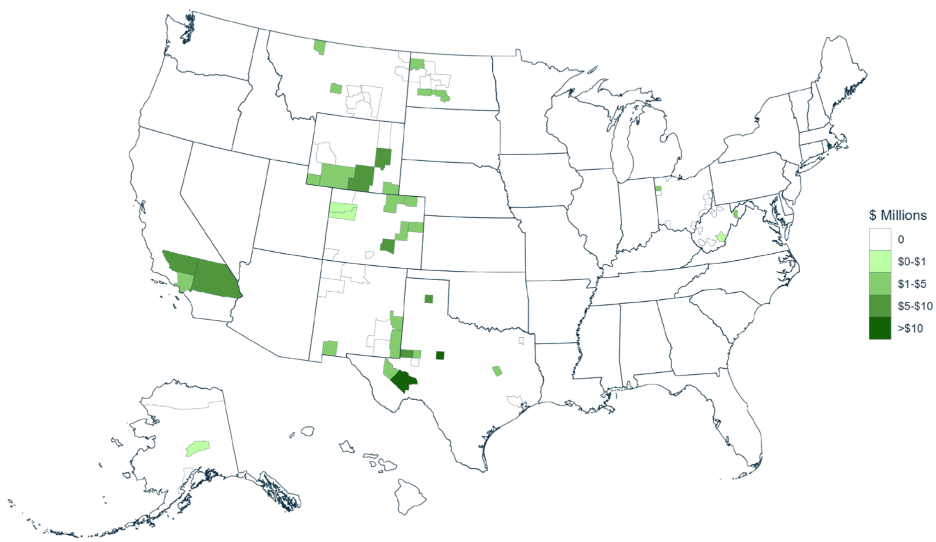
Because our focus is on local government revenues from the energy system, we present results from the perspective of the government and not the energy industry. This differs from other analyses, which often seek to measure the effective tax rate that companies face in a given state (e.g., Headwaters Economics 2012; Colorado Legislative Council Staff 2014; Pennsylvania Independent Fiscal Office 2014). Therefore, these results should not be interpreted as the level of tax (or other payments) paid by companies operating in each county or state.

4.1. National Results

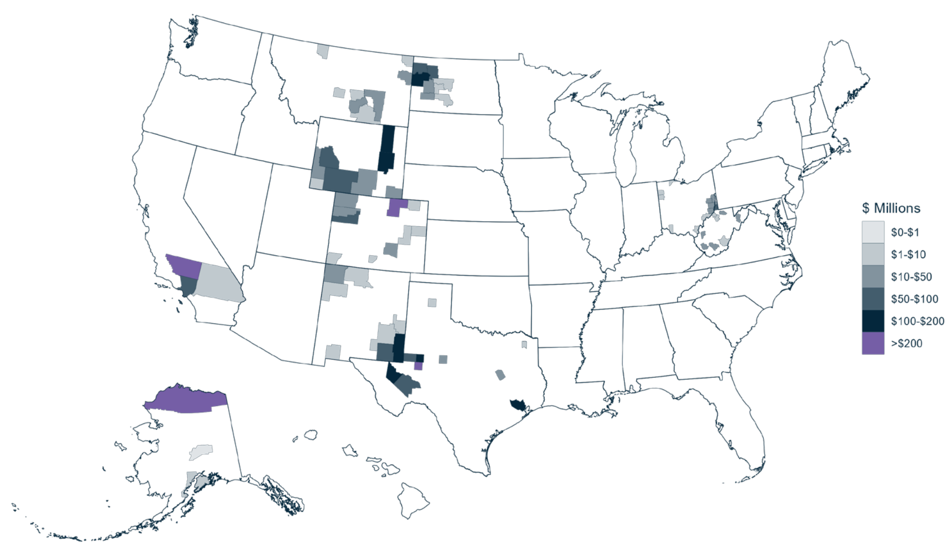
Our analysis reveals three main insights. First, although we include counties with extensive wind and solar development, local revenues from fossil fuels dominate those from renewables in our sample counties. This result is unsurprising because 79 percent of US primary energy production came from fossil fuels in 2021 (EIA 2023b), but the magnitude of the difference is revealing. Figure 1 illustrates that although wind and solar generated more than $1 million for 20 of our 79 sample counties in 2021, fossil fuels generated orders of magnitude more in the counties where production occurs at large scale, such as Weld County, Colorado ($527 million); North Slope Borough, Alaska ($395 million); Kern County, California ($238 million); and Midland County, Texas ($209 million). Local governments receive more than $100 million annually from fossil fuels in 11 of our 79 sample counties (see appendix for full results).

Figure 1. Direct Local Government Revenue from (A) Wind and Solar and (B) Fossil Fuels in 2021

A. Wind and Solar



B. Fossil Fuels



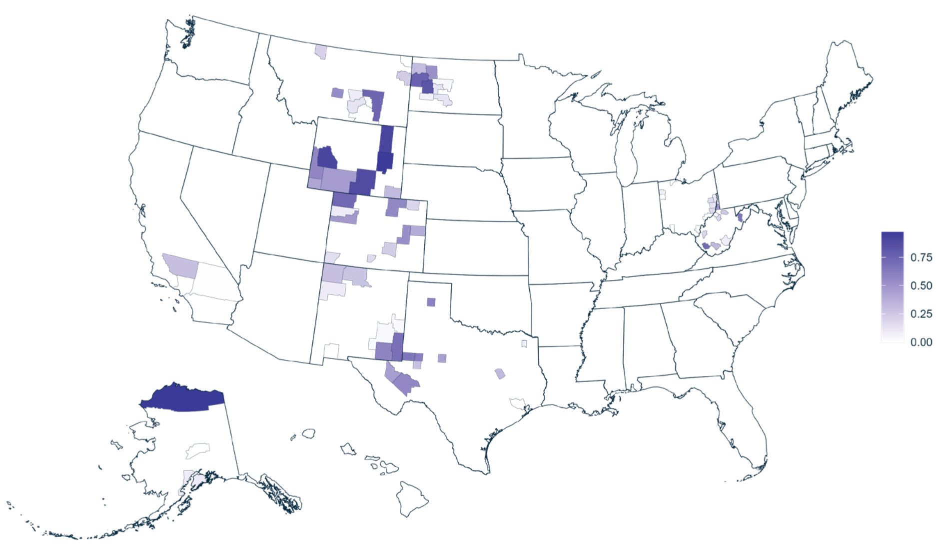
Note: Counties with outlines were included in our sample. We gathered sufficient fossil fuel data for 77 counties and sufficient wind and solar data for 32 counties. In 2021, no utility-scale solar farms were operating in any of our sample counties in AK, ND, or WV. Solar data were unavailable in CA (except Kern County), NM, and MT.

To put these figures in perspective, fossil fuels generated more than $10,000 per capita in government revenue for 5 of our sample counties and more than $1,000 per capita for 28 counties. The highest level of per capita revenue from wind and solar was roughly $1,000, and only 11 counties exceeded $100 per capita.

Another useful metric is the share of local government revenue that comes from the energy sector. Unfortunately, a comprehensive analysis is not possible because there is no database that tracks local government revenues and expenditures across all taxing entities (this is especially true for the thousands of taxing entities such as fire districts and hospital districts). In the absence of comprehensive data, we turn to property tax revenue information, which is systematically reported by most state governments in annual reports that aggregate total property tax revenues at the county level for all taxing entities within that county.

Using these data, we can assess the share of total property taxes derived from the energy system. Among our 79 sample counties, the energy system contributes more than half of total property taxes in 22 counties, with 4 exceeding 90 percent (North Slope Borough, Alaska, and Campbell, Converse, and Sublette Counties, Wyoming) (Figure 2). Fossil fuels are the dominant contributor and account for more than half of property tax revenues in 15 counties and more than 10 percent in 47 counties. Wind and solar contribute more than half of property tax revenues in just one county (Roosevelt County, New Mexico) and more than 10 percent in 8 counties (see appendix for full results).

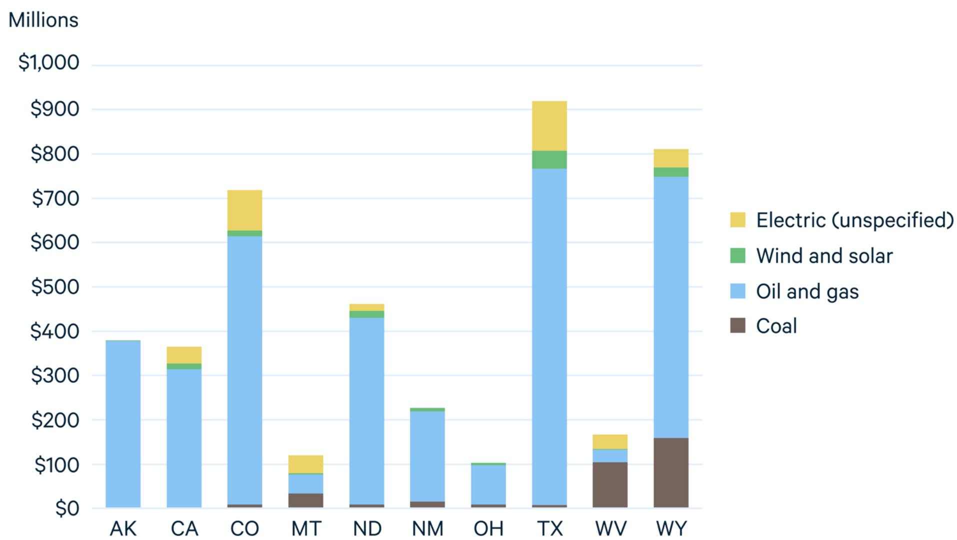
Figure 2. Share of Local Property Tax Revenues from the Energy System in 2021



Note: Includes property tax revenue for counties, school districts, municipalities, and other taxing entities within each county. West Virginia data exclude local property taxes from oil and gas production properties. Montana data exclude local property taxes from pipeline infrastructure.

Across our sample counties, oil and gas accounted for 82 percent of energy-related local government revenue, compared with 8 percent for coal and 2 percent for wind and solar. In some states, electricity system revenues were reported in an aggregate generation, transmission, and distribution category, which accounts for the final 8 percent (Figure 3). The true share of revenue from fossil fuels is likely higher, as our estimates exclude indirect revenues from sources such as permanent funds that are endowed exclusively by fossil fuels, along with other sources such as sales and income taxes, which also are likely dominated by fossil fuels.

Figure 3. Direct Local Government Revenue in 79 Counties by Energy Type in 2021

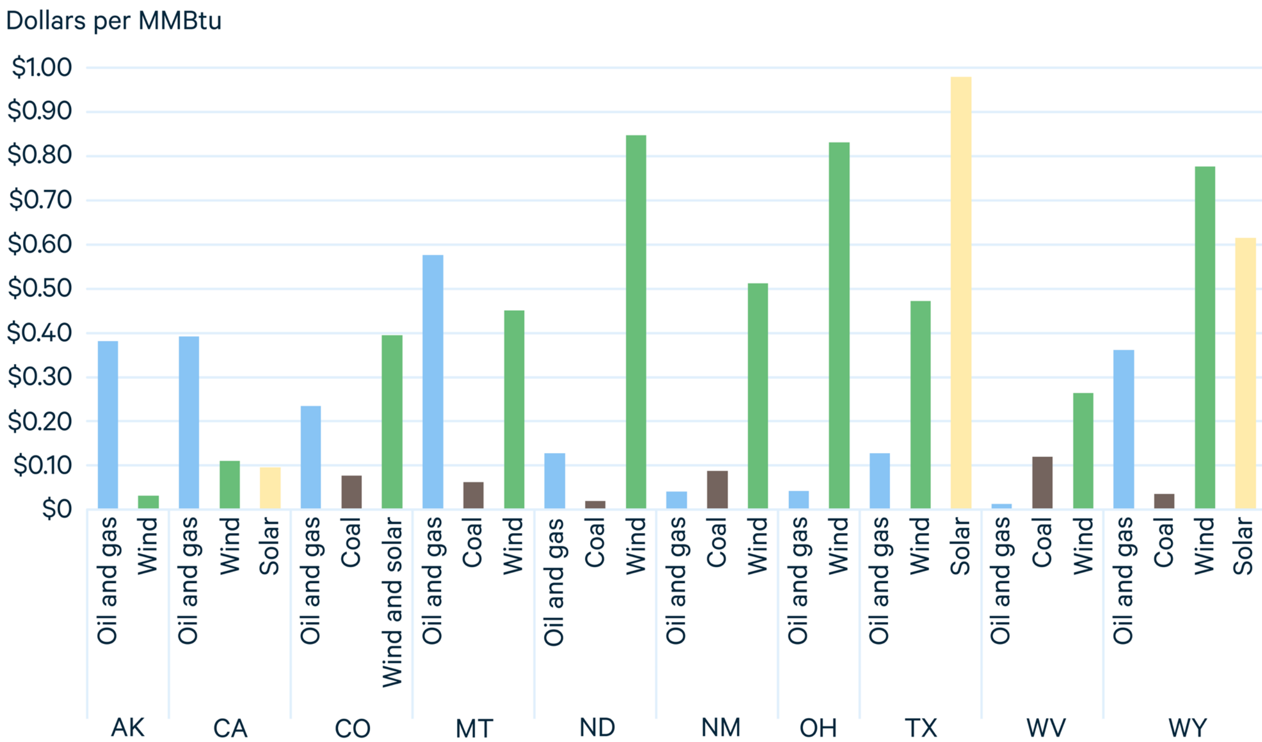


Note: Excludes local property tax revenue for oil and gas production in West Virginia and pipelines in Montana.

Our second main finding is that on an energy-equivalent basis, local revenues from wind and solar in some cases exceed those from fossil fuels.[4] In Colorado, Montana, North Dakota, Ohio, Texas, and West Virginia, renewables often produce similar, if not higher, levels of local revenue as fossil fuels per unit of primary energy production. Indeed, the highest levels of local revenue per unit of primary energy production are from wind and solar in New Mexico, Ohio, and Texas. But there is wide variation across and even within states: in Alaska, California, and Wyoming, oil and gas generate substantially more revenue than wind or solar on an energy-equivalent basis (Figure 4). What's more, local revenues vary widely because of local revenue policies, which in some cases fully or partially exempts certain power producers from property tax liability, which we discuss further in Section 4.2.

4 "Energy-equivalent basis" refers to the total primary energy production from each energy source in each county in 2021. To estimate primary energy production from wind and solar, we use EIA's "fossil fuel equivalency" approach, which assumes that wind and solar plants generate electricity with a conversion efficiency equal to the average US fossil-fired power generation fleet (EIA 2023a).

Figure 4. Direct Local Government Revenue per MMBtu of Primary Energy Production in 2021

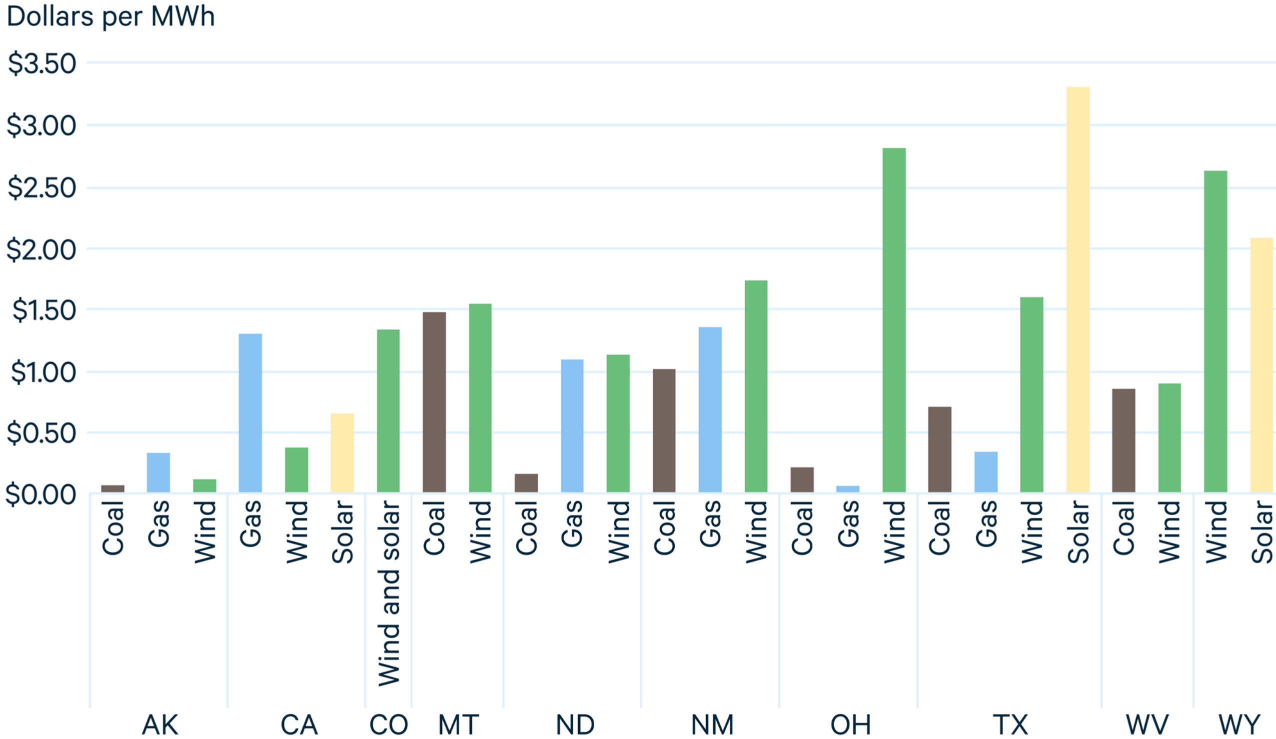


Note: Revenue and energy data are from 2021. MMBtu = million British thermal units. Includes energy production and revenue data from 79 counties across 10 states. Energy production data are from EIA for coal, wind, and solar and from various state agencies for oil and gas. Excludes local property tax revenue for oil and gas production in West Virginia and pipelines in Montana.

Two key dynamics that drive these differences are wide variation in tax mechanisms and revenue allocation policies across states. In most states, a large share of revenue generated by fossil fuels flows to the state government through severance taxes and leasing royalties, with a relatively small portion allocated to the local level (Newell and Raimi 2018). For wind and solar, the dominant revenue mechanisms in most states are local property taxes, which directly fund counties, school districts, municipalities, and other local taxing entities.

Because the electricity sector will play a key role in efforts to reach net-zero emissions, it is also instructive to compare revenues within that sector (Figure 5). This also provides more of an apples-to-apples comparison, since wind and solar are primarily used for electricity generation, whereas fossil fuels are used for a broader set of applications (e.g., direct end uses in transportation, buildings, and industry).

Figure 5. Direct Local Government Revenues per MWh of Electricity Generation in 2021



Note: Includes revenue only from electric-generating assets. Revenue and electricity data are from 2021. MWh = megawatt hour. Electricity generation data from EIA.

Our third main finding is that in most counties, solar—but not wind—could technically replace fossil fuel revenues but would require a large share of available land, particularly in counties that depend heavily on fossil fuels. For example, in Weld County, Colorado, solar energy facilities could generate a level of revenue equivalent to that of fossil fuels ($527 million in 2021) but would need to occupy roughly 4,800 square kilometers, more than half of the developable land in the county. In counties where fossil fuels contribute little local revenue, wind and solar development can more easily replace them. In Carson County, Texas, for example, where fossil fuels generated $1.7 million in 2021, wind could match these revenues with 12 percent of developable land, while solar could provide the same amount using just 0.5 percent of this land.[5] (Results for all counties are provided in the appendix.)

The scale of deployment needed to replace fossil fuel revenues with renewables in the most fossil fuel–dependent counties would almost certainly cause land use conflict (Sward et al. 2021; Moore et al. 2022). For counties where fossil fuel revenues exceed $100 million per year, generating an equivalent amount from wind is not physically

5 These calculations assume that future wind and solar energy development pays the same level of property taxes or payments in lieu of taxes per MW as facilities did in 2021. They use developable land, wind, and solar capacity potential estimates from Lopez et al. (2023) and assume that development is subject to the average local setback requirements. For details on these calculations and assumptions, see the appendix.

possible, given existing tax rates, and doing so with solar would require between 14 and 66 percent of developable land, a scale that dwarfs existing land uses for energy production.[6] For context, biofuels production, the United States' most land-intensive energy source by a wide margin (Lovering et al. 2022), occupies roughly 5 to 10 percent of agricultural land in Iowa, the nation's leading biofuels producer.[7]

4.2. Understanding State-Level Variation

Our results show wide variation across states and energy types. Although we are not able to explain all this variation quantitatively, we can identify some major contributing factors. As mentioned in Section 4.1, the most important factor is likely the wide variation in state policy and how funds are shared between state and local governments. In the context of oil and gas, state and local revenue collections range from roughly 1 to 40 percent of the value of oil and gas produced. The share of this revenue that is collected by, or allocated to, local governments also varies widely, ranging from 0.5 to 9 percent of the value of oil and gas produced (Newell and Raimi 2018).

The distinction between direct and indirect revenues also affects results. For example, local governments in New Mexico receive the lowest amount of direct revenue per unit of energy production from oil and gas among our sample counties (see Figure 3). However, local governments within these counties do collect substantial oil and gas revenues indirectly through state permanent funds and other mechanisms that we do not quantify in this analysis (Prest et al. 2023).

State policies toward renewable energy explain additional variation. In California, local revenues per unit of solar generation are far below those of Texas and Wyoming, the other states for which we have solar-specific data. This is primarily because in California, state policy dictates that local governments cannot tax new solar generation infrastructure (California State Board of Equalization 2021). As a result, property owners pay taxes on the assessed value of the land but not on the value of newly installed solar equipment. But solar revenues in California are not zero, because some older solar facilities, such as the large concentrated solar power stations in San Bernardino County, contribute meaningfully to the local tax base.

Revenues from wind also vary widely across jurisdictions and are likely explained by several factors. First, older properties are consistently assessed at lower valuations than newer properties. For example, wind farms in Wyoming that began operating between 2000 and 2005 were valued at $35,000/MW, whereas those that began

6 This calculation excludes Alaska, New Mexico, and North Dakota, where we do not have data on solar revenues.

7 This calculation assumes 0.38 to 0.66 million acres of land per billion gallons of biofuels produced (Austin et al. 2022). In Iowa, which produced 4.4 billion gallons of biofuels in 2021 (Urbanchuk 2022), this implies land use of 1.6–2.9 million acres, roughly 5–10 percent of the state's 30.6 million acres of farmland (USDA 2021).

operating between 2015 and 2021 were valued at $101,000/MW.[8] In some counties, such as Paulding County, Ohio, wind farms do not pay property taxes but instead make a payment in lieu of taxes, which in 2021 equaled roughly $8,000/MW. Finally, some states apply taxes to wind farms in addition to local property taxes, such as Wyoming's wind generation tax, which allocates 60 percent of revenues collected from the tax to local governments where the infrastructure is located.[9]

Revenue from coal- and natural gas–fired power plants also show a wide range. One major contributor to this variation is the different business models for electric power generation, transmission, and distribution across states. As with solar in California, Alaska exhibits much lower-than-average revenue generation from electric generation property. A major cause is that in Alaska, 90 percent of state residents are served by not-for-profit municipal utilities or community-owned cooperatives (Alaska Power Association 2023). Electric cooperatives pay a small tax imposed by the state (totaling $2 million in 2021), with all revenue returned to the borough in which the co-op is located (Alaska Department of Revenue 2022).

5. Discussion and Conclusion

When considering the implications of an energy transition, most analysts and public figures focus on potential employment impacts. For example, President Joe Biden regularly states, "When I think climate, I think jobs," and former president Donald Trump vowed, "We're going to put our miners back to work" (Lebowitz 2023; Trump 2017). Similarly, a growing body of scholarly work and analysis from major energy institutions highlights the effects of an energy transition on jobs (Pai et al. 2021; Finkelstein Shapiro and Metcalf 2021; Mayfield et al. 2023; IEA 2023). This focus on employment is appropriate, given the importance of wages and benefits that support families and communities, along with the crucial role that work has in shaping individuals' identities (e.g., Timma 2007).

In raw financial terms, however, the issue of public revenues may be just as important as jobs in fossil fuel–dependent communities, if not more. For example, total wages paid to fossil fuel workers in Alaska's North Slope Borough in 2021 were $328 million, compared with local government revenue of $396 million that same year.[10] In Weld County, Colorado, total fossil fuel wages were $338 million, compared with $565 million in local revenue. In some cases, local revenue far exceeds local wages, such as in

8 Authors' analysis based on revenue data provided by the office of the Wyoming State Tax Commissioner and electricity data from the EIA.

9 "Tax upon Production of Electricity from Wind Resources," Wyoming Statutes §39-22.

10 This includes wages paid to employees in the following sectors, as defined by the North American Industrial Classification System (NAICS): 211, oil and gas extraction; 213, support activities for mining; 2121, coal mining; 221112, fossil fuel electric power generation; 221210, natural gas distribution; 23712, oil and gas pipeline and related structures construction; 324, petroleum and coal products manufacturing; and 486, pipeline transportation.

Carbon County, Wyoming, where revenues outweigh wages by more than four to one. Among our 79 sample counties, local government revenue from fossil fuels exceeded local wages from those same sectors in 33 counties.[11]

These figures, while instructive, are also incomplete for at least three reasons. First, nonwage benefits (e.g., health insurance, retirement savings) for fossil fuel workers can be substantial and are not accounted for here. Second, the wage data we use from the US Census Bureau (2023) base the location of wages paid on the location of the business establishment, not that of the worker, who could live and work in a different county. This is particularly the case for companies whose physical establishments are in different locations from the energy assets they operate. On the other hand, the revenue figures we report here are lower bounds and do not account for the dollars that flow to federal, tribal, or state governments, which likely far exceed revenues flowing to the local level.

Regardless of the details of the calculations, it is clear that the energy sector plays a major role in supporting government services across the United States, and efforts to dramatically reduce greenhouse gas emissions will have major consequences for these revenue streams and the services they support. Although local, state, and federal policymakers have recognized the importance of this issue, little data is available to guide decisionmaking.

This analysis provides a novel dataset of local government revenue from the extraction, processing, transportation, and use of fossil fuels, as well as wind and solar energy across 79 counties in 10 US states. The data are far from comprehensive, suggesting the need for more research to better characterize the scale of local revenues from the energy system.

Our results demonstrate that fossil fuels, particularly oil and gas, play a dominant role in generating revenue for local governments, providing more than half of all local property tax revenues in 15 of our 79 sample counties and more than 10 percent in 47 counties. Although wind and solar in some states generate more revenue per unit of primary energy production than fossil fuels, the scale and energy density of fossil fuel production, compared with the geographically dispersed nature of wind and solar means that these alternatives would need to cover implausibly large portions of fossil fuel–dependent counties to replace the revenues they currently generate.

For locations with little reliance on fossil fuels, however, wind and solar offer a new opportunity to grow local tax bases and support public services. Clearly, communities stand to benefit when new wind and solar development support local public services. But for those communities that are heavily dependent on fossil fuels, our results strongly suggest that state or federal financial support will be needed to ensure delivery of essential services under any deep decarbonization scenario. Over the longer term, these locations will need additional support to develop new economic drivers and diversify the local tax base away from its current dependence on fossil fuels.

11 Local revenue data from authors; county-level wage data from the US Census Bureau (2023).

References

Alaska Department of Revenue. 2022. *Shared Tax Report 2022*. Anchorage, AK: Tax Division. December 28, 2022. **http://tax.alaska.gov/programs/documentviewer/viewer.aspx?1752r**.

Alaska Power Association. 2023. "Welcome to Alaska Power Association." **https://alaskapower.org/**.

Austin, K. G., J. P. H. Jones, and C. M. Clark. 2022. "A Review of Domestic Land Use Change Attributable to U.S. Biofuel Policy." *Renewable and Sustainable Energy Reviews* 159 (May): 112181. **https://doi.org/10.1016/j.rser.2022.112181**.

California State Board of Equalization. 2021. "Active Solar Energy System Exclusion." **https://www.boe.ca.gov/proptaxes/active-solar-energy-system.htm**.

Christianson, Eric, Nora Ladjahasan, Amy Logan, Olivia Behn, and Peter F. Orazem. 2021. *The Economic, Fiscal, and Social Impacts of Utility-Owned Coal-Fired Power Plants in Iowa*. Ames: Iowa State University Extension and Outreach. **https://www.iaenvironment.org/webres/File/Power%20Plant%20Economic%20Impact%20-%20Final.pdf**.

Colorado Legislative Council Staff. 2014. "Effective Severance Tax Rates." Denver: Colorado General Assembly.

EIA (U.S. Energy Information Administration). 2023a. "Monthly Energy Review, Appendix E: Alternative Approaches for Deriving Energy Contents of Noncombustible Renewables." Washington, DC: US Department of Energy. **https://www.eia.gov/totalenergy/data/monthly/**.

———. 2023b. "Monthly Energy Review: August 2023, Table 1.2." Washington, DC: US Department of Energy. **https://www.eia.gov/totalenergy/data/monthly/**.

Finkelstein Shapiro, Alan, and Gilbert E. Metcalf. 2021. *The Macroeconomic Effects of a Carbon Tax to Meet the US Paris Agreement Target: The Role of Firm Creation and Technology Adoption*. Working Paper 21-14. Washington, DC: Resources for the Future. **https://www.rff.org/publications/working-papers/the-macroeconomic-effects-of-a-carbon-tax-to-meet-the-us-paris-agreement-target/**.

Gazmararian, Alexander F., and Dustin Tingley. 2023. *Uncertain Futures: How to Unlock the Climate Impasse*. Cambridge: Cambridge University Press.

Hansen, J., W. Jenson, A. Wrobel, N. Stauff, K. Biegel, T. Kim, R. Belles, and F. Omitaomu. 2022. *Investigating Benefits and Challenges of Converting Retiring Coal Plants into Nuclear Plants*. INL/RPT-22-67964. **https://fuelcycleoptions.inl.gov/SiteAssets/SitePages/Home/C2N2022Report.pdf**.

Headwaters Economics. 2012. *Oil and Natural Gas Fiscal Best Practices: Lessons for State and Local Governments*. **http://headwaterseconomics.org/wp-content/uploads/Energy_Fiscal_Best_Practices.pdf**.

Hintz, Olivia, Emma Uebelhor, and Eli Gold. 2021. *Inventory of State Solar Property Tax Treatments*. CLOSUP Working Paper 54. Ann Arbor: Center for Local, State, and Urban Policy, University of Michigan. **https://closup.umich.edu/research/working-papers/inventory-state-solar-property-tax-treatments**.

IEA (International Energy Agency). 2023. *Net Zero Roadmap: A Global Pathway to Keep the 1.5°C Goal in Reach*. Paris: IEA. **https://www.iea.org/reports/net-zero-roadmap-a-global-pathway-to-keep-the-15-0c-goal-in-reach**.

IRS (Internal Revenue Service). 2023. *Notice 2023-29*. Washington, DC: US Department of the Treasury. **https://www.irs.gov/pub/irs-drop/n-23-29.pdf**.

Jolley, G. Jason, Christelle Khalaf, Gilbert Michaud, and Austin M. Sandler. 2019. "The Economic, Fiscal, and Workforce Impacts of Coal-Fired Power Plant Closures in Appalachian Ohio." *Regional Science Policy & Practice* 11 (2): 403–22. **https://doi.org/10.1111/rsp3.12191**.

Lebowitz, Megan. 2023. "Biden Touts Clean Energy Manufacturing and Union Jobs in Visit to Philadelphia." NBC News. July 20, 2023. **https://www.nbcnews.com/politics/joe-biden/biden-tout-clean-energy-manufacturing-union-jobs-philadelphia-rcna95306**.

Lopez, Anthony, Wesley Cole, Brian Sergi, Aaron Levine, Jesse Carey, Cailee Mangan, Trieu Mai, Travis Williams, Pavlo Pinchuk, and Jianyu Gu. 2023. "Impact of Siting Ordinances on Land Availability for Wind and Solar Development." *Nature Energy* (August): 1–10. **https://doi.org/10.1038/s41560-023-01319-3**.

Lovering, Jessica, Marian Swain, Linus Blomqvist, and Rebecca R. Hernandez. 2022. "Land-Use Intensity of Electricity Production and Tomorrow's Energy Landscape." *PLOS ONE* 17 (7): e0270155. **https://doi.org/10.1371/journal.pone.0270155**.

Mayer, Adam. 2018. "The Fiscal Impacts of Energy: Perspectives from Local Governments in the Mountain West, USA." *Energy Policy* 122 (November): 186–93. **https://doi.org/10.1016/j.enpol.2018.07.043**.

Mayfield, Erin, Jesse Jenkins, Eric Larson, and Chris Greig. 2023. "Labor Pathways to Achieve Net-Zero Emissions in the United States by Mid-Century." *Energy Policy* 177 (June): 113516. **https://doi.org/10.1016/j.enpol.2023.113516**.

McBride, Jameson, Juzel Lloyd, and Seaver Wang. 2022. "Oil and Gas Assets at Risk: How Will Clean Energy's Rise Impact Oil and Gas Communities in the United States amidst Shrinking Fossil Fuel Demand?" The Breakthrough Institute. **https://thebreakthrough.org/articles/oil-and-gas-assets-at-risk-impacts-of-declining-fossil-production-in-climate-scenarios-in-the-us**.

Moore, Sharlissa, Hannah Graff, Carolyn Ouellet, Skyler Leslie, and Danny Olweean. 2022. "Can We Have Clean Energy and Grow Our Crops Too? Solar Siting on Agricultural Land in the United States." *Energy Research & Social Science* 91 (September): 102731. **https://doi.org/10.1016/j.erss.2022.102731**.

Morris, Adele C., Noah Kaufman, and Siddhi Doshi. 2021. "Revenue at Risk in Coal-Reliant Counties." *Environmental and Energy Policy and the Economy* 2 (January): 83–116. **https://doi.org/10.1086/711307**.

Newell, Richard G., and Daniel Raimi. 2018. "US State and Local Oil and Gas Revenue Sources and Uses." *Energy Policy* 112 (Supplement C): 12–18. **https://doi.org/10.1016/j.enpol.2017.10.002**.

Pai, Sandeep, Johannes Emmerling, Laurent Drouet, Hisham Zerriffi, and Jessica Jewell. 2021. "Meeting Well-below 2°C Target Would Increase Energy Sector Jobs Globally." *One Earth* 4 (7): 1026–36. **https://doi.org/10.1016/j.oneear.2021.06.005**.

Pennsylvania Independent Fiscal Office. 2014. *Natural Gas Extraction: An Interstate Tax Comparison*. Special Report 2014-2. **http://www.ifo.state.pa.us/releases.cfm?id=77**.

Prest, Brian C. 2022. "Supply-Side Reforms to Oil and Gas Production on Federal Lands: Modeling the Implications for CO_2 Emissions, Federal Revenues, and Leakage." *Journal of the Association of Environmental and Resource Economists* 9 (4): 681–720. **https://doi.org/10.1086/718963**.

Prest, Brian C., Daniel Raimi, and Zachary Whitlock. 2023. *Assessing the Future of Oil and Gas Production and Local Government Revenue in Five Western US Basins*. Working Paper 23-28. Washington, DC: Resources for the Future. **https://www.rff.org/publications/working-papers/assessing-the-future-of-oil-and-gas-production-and-local-government-revenue-in-five-western-us-basins/**.

Raimi, Daniel, Jake Higdon, Devyani Singh, and Gilbert Metcalf. 2023. “The Fiscal Implications of Energy Transition.” *Review of Environmental Economics and Policy* 17 (2): 217–50. **https://doi.org/10.1086/725051**.

Rhodes, Joshua D. 2023. *The Economic Impact of Renewable Energy and Energy Storage in Rural Texas*. Austin, TX: IdeaSmiths. **https://www.ideasmiths.net/wp-content/uploads/2023/01/Economic-Impact-of-Renewable-Energy_JAN2023.pdf**.

Roemer, Kelli F., and Julia H. Haggerty. 2022. “The Energy Transition as Fiscal Rupture: Public Services and Resilience Pathways in a Coal Company Town.” *Energy Research & Social Science* 91 (September): 102752. **https://doi.org/10.1016/j.erss.2022.102752**.

Smith, Kristin, Mark Haggerty, and Jackson Rose. 2021. *Federal Fossil Fuel Disbursements to States: State Policy and Practice in Allocating Federal Revenue*. Bozeman, MT: Headwaters Economics. **https://headwaterseconomics.org/tax-policy/federal-fossil-fuel-disbursements-to-states**.

Sward, Jeffrey A., Roberta S. Nilson, Venktesh V. Katkar, Richard C. Stedman, David L. Kay, Jennifer E. Ifft, and K. Max Zhang. 2021. “Integrating Social Considerations in Multicriteria Decision Analysis for Utility-Scale Solar Photovoltaic Siting.” *Applied Energy* 288 (April): 116543. **https://doi.org/10.1016/j.apenergy.2021.116543**.

Timma, Hilary. 2007. “Experiencing the Workplace: Shaping Worker Identities through Assessment, Work and Learning.” Studies in Continuing Education 29 (2): 163–79. **https://doi.org/10.1080/01580370701403282**.

Trump, Donald J. 2017. “Remarks at the Conservative Political Action Conference in National Harbor, Maryland.” American Presidency Project. February 24, 2017. **https://www.presidency.ucsb.edu/documents/remarks-the-conservative-political-action-conference-national-harbor-maryland**.

Uebelhor, Emma, Olivia Hintz, and Eli Gold. 2021. “Inventory of State Wind Property Tax Treatments.” CLOSUP Working Paper 55. Ann Arbor: Center for Local, State, and Urban Policy, University of Michigan. **https://closup.umich.edu/research/working-papers/inventory-state-wind-property-tax-treatments**.

Urbanchuk, John M. 2022. *Contribution of the Renewable Fuels Industry to the Economy of Iowa*. ABF Economics. **https://iowarfa.org/wp-content/uploads/2022/02/2021-Iowa-Biofuels-Impact-Draft.FINAL_.pdf**.

US Census Bureau. 2023. “County Business Patterns: 2021.” Last updated November 9, 2023. **https://www.census.gov/programs-surveys/cbp/data/datasets.html**.

USDA (US Department of Agriculture). 2021. Iowa Ag News: Farms and Land in Farms. USDA National Agricultural Statistics Service. **https://www.nass.usda.gov/Statistics_by_State/Iowa/Publications/Other_Surveys/2021/IA-Farms-02-21.pdf**.

Wyoming Department of Revenue. 2021. 2020 Annual Report. **https://revenue.wyo.gov/about-us/dor-annual-reports**.

Appendix

A.1. Counties and Energy Sources

Table A.1 lists all counties included in this analysis and indicates the relevant energy source or infrastructure where revenue data were collected.

Table A.1. Counties and Energy Sources Included in This Analysis

State	County/ borough	Oil and gas	Coal	Processing/ refining	Pipelines	Power: oil or gas	Power: coal	Power: solar	Power: wind	Power: various
AK	Denali	—	—	—	—	X	X	—	X	—
AK	Kenai Peninsula	X	—	X	X	X	—	—	—	—
AK	North Slope	X	—	X	X	X	—	—	—	—
CA	Kern	X	—	X	X	X	—	X	X	X
CA	Los Angeles	X	—	X	—	X	—	X	—	—
CA	San Bernardino	X	—	—	—	X	—	X	—	X
CO	Alamosa	X	X	—	—	—	—	—	—	—
CO	Garfield	X	X	X	X	—	—	X	—	X
CO	Kit Carson	X	X	—	X	—	—	X	—	X
CO	Lincoln	X	X	—	X	—	—	X	—	X
CO	Logan	X	X	—	X	—	—	X	X	X
CO	Moffat	X	X	X	X	—	—	—	—	X
CO	Montezuma	X	X	X	X	—	—	—	—	X
CO	Pueblo	X	X	—	X	—	—	X	X	X
CO	Rio Blanco	X	X	X	X	—	—	X	—	X

State	County/ borough	Oil and gas	Coal	Processing/ refining	Pipelines	Power: oil or gas	Power: coal	Power: solar	Power: wind	Power: various
CO	Weld	X	X	X	X	X	—	X	X	X
MT	Big Horn	X	X	—	—	—	X	—	—	—
MT	Musselshell	X	X	—	—	—	—	—	—	X
MT	Richland	X	X	—	—	X	—	—	—	X
MT	Rosebud	X	X	—	—	—	X	—	—	X
MT	Sheridan	X	X	—	—	—	—	—	—	—
MT	Toole	X	X	—	—	—	—	—	X	X
MT	Wheatland	X	X	—	—	—	—	—	X	X
MT	Yellowstone	X	X	X	—	—	—	—	X	X
ND	Dunn	X	—	—	X	—	—	—	—	X
ND	McKenzie	X	X	—	X	X	—	—	—	X
ND	McLean	X	X	—	X	—	X	—	—	X
ND	Mercer	X	X	—	X	—	X	—	—	X
ND	Morton	—	—	—	X	—	X	—	X	X
ND	Mountrail	X	X	—	X	—	—	—	—	X
ND	Stark	X	X	—	X	—	—	—	X	X
ND	Williams	X	X	—	X	—	—	—	X	X
NM	Chaves	X	—	—	—	—	—	—	—	—
NM	Eddy	X	—	—	—	X	—	—	—	—
NM	Lea	X	—	—	—	X	—	—	X	—
NM	Luna	X	—	—	—	—	—	—	X	—
NM	McKinley	X	—	—	—	—	X	—	—	—

State	County/ borough	Oil and gas	Coal	Processing/ refining	Pipelines	Power: oil or gas	Power: coal	Power: solar	Power: wind	Power: various
NM	Rio Arriba	X	—	—	—	—	—	—	—	—
NM	Roosevelt	X	—	—	—	—	—	—	X	—
NM	San Juan	X	—	—	—	X	X	—	—	—
OH	Belmont	X	X	—	—	—	—	—	—	—
OH	Clermont	—	—	—	—	—	X	—	—	—
OH	Gallia	X	—	—	—	—	X	—	—	—
OH	Harrison	X	X	X	—	—	—	—	—	—
OH	Jefferson	X	X	—	—	X	X	—	—	—
OH	Lucas	—	—	X	—	X	—	—	—	—
OH	Monroe	X	—	X	—	X	—	—	—	—
OH	Paulding	—	—	—	—	—	—	X	X	—
OH	Van Wert	—	—	—	—	X	—	—	—	—
OH	Washington	X	—	—	—	X	—	—	—	—
TX	Andrews	X	—	X	X	—	—	X	X	X
TX	Carson	X	—	—	X	—	—	—	X	X
TX	Harris	X	—	X	X	X	—	—	—	X
TX	Limestone	X	—	X	X	—	X	X	X	X
TX	Martin	X	—	X	X	—	—	—	X	X
TX	Midland	X	—	X	X	—	—	—	—	X
TX	Nolan	X	—	—	X	—	—	X	X	X
TX	Pecos	X	—	—	X	—	—	X	X	X
TX	Reeves	X	—	X	X	—	—	X	—	X

State	County/ borough	Oil and gas	Coal	Processing/ refining	Pipelines	Power: oil or gas	Power: coal	Power: solar	Power: wind	Power: various
TX	Titus	X	—	—	X	—	X	—	—	X
WV	Doddridge	X	X	—	X	—	—	—	—	X
WV	Grant	X	X	—	X	—	X	—	X	X
WV	Greenbrier	X	X	—	X	—	—	—	—	X
WV	Logan	X	X	—	X	—	—	—	—	X
WV	Marion	X	X	—	X	—	X	—	—	X
WV	Marshall	X	X	—	X	—	—	—	—	X
WV	Ohio	X	X	—	X	—	—	—	—	X
WV	Putnam	X	X	—	X	—	X	—	—	X
WV	Raleigh	X	X	—	X	—	—	—	—	X
WV	Tyler	X	X	—	X	—	—	—	—	X
WY	Albany	—	—	—	—	—	—	—	X	—
WY	Campbell	X	X	X	X	—	—	—	—	X
WY	Carbon	X	X	X	X	—	X	—	X	X
WY	Converse	X	X	X	X	—	—	—	X	X
WY	Laramie	X	X	X	X	—	—	—	X	X
WY	Lincoln	X	X	X	X	—	—	—	—	X
WY	Natrona	—	—	—	—	—	—	—	X	—
WY	Sublette	X	X	X	X	—	—	—	—	X
WY	Sweetwater	X	X	X	X	—	—	X	—	X
WY	Uinta	X	X	X	X	—	—	—	X	X

A.2. County-Level Revenues

Table A.2 shows the level of revenue for each county from fossil fuels, wind and solar, and our unspecified-electric category. Note that this category generally contains electric generation, transmission, and distribution infrastructure in states where these data were not available as distinct categories or by fuel type.

Table A.2. Direct Local Government Energy Revenue by County

State	County/borough	Year	Total	All fossil fuels	Wind and solar	Other or unspecified
AK	Denali	2021	$31,487	$24,889	$6,598	—
AK	Kenai Peninsula	2021	$9,140,294	$9,140,294	—	—
AK	North Slope	2021	$395,539,447	$395,539,447	—	—
CA	Kern	2021	$282,197,074	$238,327,784	$6,731,003	$37,138,287
CA	Los Angeles	2021–2022	$75,616,324	$74,590,934	$1,025,389	—
CA	San Bernardino	2021	$7,093,332	$1,363,987	$5,160,652	$568,692
CO	Alamosa	2021	$3,459,926	$3,459,926	—	—
CO	Garfield	2021	$78,730,794	$74,215,563	$33,867	$4,481,364
CO	Kit Carson	2021	$7,309,758	$4,896,761	$1,500,603	$912,395
CO	Lincoln	2021	$6,804,211	$2,108,350	$2,798,621	$1,897,240
CO	Logan	2021	$9,268,671	$6,843,969	$1,838,842	$585,860
CO	Moffat	2021	$25,303,850	$12,923,236	—	$12,380,614
CO	Montezuma	2021	$6,005,340	$4,994,570	—	$1,010,770
CO	Pueblo	2021	$47,955,012	$1,824,798	$5,236,172	$40,894,043
CO	Rio Blanco	2021	$19,199,335	$18,491,653	$14,249	$693,433
CO	Weld	2021	$565,266,755	$526,896,983	$2,454,434	$35,915,337
MT	Big Horn	2020	$9,351,677	$9,351,677	—	—
MT	Musselshell	2020	$4,545,849	$3,535,751	—	$1,010,099

State	County/borough	Year	Total	All fossil fuels	Wind and solar	Other or unspecified
MT	Richland	2020	$35,811,030	$28,439,688	—	$7,371,341
MT	Rosebud	2020	$20,835,962	$20,835,962	—	—
MT	Sheridan	2020	$2,090,871	$2,090,871	—	—
MT	Toole	2020	$4,005,796	$747,044	$1,770,390	$1,488,362
MT	Wheatland	2020	$4,198,057	$110	$914,534	$3,283,414
MT	Yellowstone	2020	$38,237,813	$11,708,125	—	$26,529,688
ND	Dunn	2021	$47,905,807	$46,895,488	—	$1,010,319
ND	McKenzie	2021	$129,647,925	$125,665,101	—	$3,982,824
ND	McLean	2021	$3,578,357	$3,248,976	—	$329,380
ND	Mercer	2021	$7,472,949	$7,046,328	—	$426,621
ND	Morton	2021	$9,206,665	$2,105,441	$3,794,050	$3,307,174
ND	Mountrail	2021	$57,811,270	$56,370,103	—	$1,441,167
ND	Stark	2021	$27,394,271	$24,301,541	$1,529,226	$1,563,504
ND	Williams	2021	$65,514,016	$61,151,916	$734,602	$3,627,499
NM	Chaves	2021	$578,923	$578,923	—	—
NM	Eddy	2021	$71,322,696	$71,322,696	—	—
NM	Lea	2021	$123,327,423	$121,634,620	$1,692,803	—
NM	Luna	2021	$150,002	—	$150,002	—
NM	McKinley	2021	$2,563,439	$2,563,439	—	—
NM	Rio Arriba	2021	$4,932,887	$4,932,887	—	—
NM	Roosevelt	2021	$5,638,667	$5,467,958	$170,709	—
NM	San Juan	2021	$23,629,293	$23,629,293	—	—
OH	Belmont	2021	$26,569,360	$26,569,360	—	—

State	County/borough	Year	Total	All fossil fuels	Wind and solar	Other or unspecified
OH	Clermont	2022	$2,784,996	$2,784,996	—	—
OH	Gallia	2022	$1,957,215	$1,957,215	—	—
OH	Harrison	2021	$17,886,364	$17,886,364	—	—
OH	Jefferson	2021	$22,257,048	$22,257,048	—	—
OH	Lucas	2021	$939,326	$939,326	—	—
OH	Monroe	2021	$21,270,051	$21,270,051	—	—
OH	Paulding	2021	$3,615,474	—	$3,615,474	—
OH	Van Wert	2021	$450,730	$450,730	—	—
OH	Washington	2021	$399,224	$399,224	—	—
TX	Andrews	2021	$80,960,413	$67,711,115	$8,855,526	$4,393,771
TX	Carson	2021	$9,712,215	$1,669,037	$5,842,843	$2,200,335
TX	Harris	2021	$166,204,142	$88,573,935	—	$77,630,206
TX	Limestone	2021	$16,416,731	$14,387,169	$574,008	$1,455,554
TX	Martin	2021	$150,269,312	$146,681,091	$202,452	$3,385,769
TX	Midland	2021	$215,922,040	$208,665,392	—	$7,256,649
TX	Nolan	2021	$21,351,238	$7,304,312	$11,739,852	$2,307,074
TX	Pecos	2021	$61,354,327	$44,495,389	$12,616,002	$4,242,936
TX	Reeves	2021	$193,342,482	$185,324,046	$948,941	$7,069,496
TX	Titus	2021	$4,193,717	$1,481,790	—	$2,711,927
WV	Doddridge	2021	$9,693,996	$8,203,856	—	$1,490,139
WV	Grant	2021	$10,593,745	$8,015,099	$1,055,852	$1,522,794
WV	Greenbrier	2021	$2,803,149	$454,104	$98,779	$2,250,267
WV	Logan	2021	$22,494,566	$19,812,760	—	$2,681,807

State	County/borough	Year	Total	All fossil fuels	Wind and solar	Other or unspecified
WV	Marion	2021	$14,038,351	$10,658,454	—	$3,379,896
WV	Marshall	2021	$52,948,163	$41,269,963	—	$11,678,200
WV	Ohio	2021	$13,834,352	$11,800,233	—	$2,034,119
WV	Putnam	2021	$12,841,129	$11,467,741	—	$1,373,388
WV	Raleigh	2021	$22,810,657	$17,722,379	—	$5,088,278
WV	Tyler	2021	$4,596,555	$4,085,495	—	$511,060
WY	Campbell	2021	$192,328,030	$182,302,764	—	$10,025,267
WY	Carbon	2021	$32,132,740	$23,596,373	$7,692,425	$843,942
WY	Converse	2021	$100,271,909	$87,884,040	$9,176,010	$3,211,859
WY	Laramie	2021	$47,949,083	$42,452,617	$2,361,814	$3,134,652
WY	Lincoln	2021	$28,283,188	$26,244,759	—	$2,038,428
WY	Sublette	2021	$89,957,928	$89,585,468	—	$372,459
WY	Sweetwater	2021	$66,209,915	$59,697,365	$376,226	$6,136,324
WY	Uinta	2021	$9,937,631	$8,204,161	$1,290,482	$442,988

Note: Excludes property tax revenue from oil and gas extraction in West Virginia and pipelines in Montana.

Table A.3 reports the share of local property taxes generated by the energy system in the most recent available year. Local property tax revenues include those flowing to counties, school districts, municipalities, and other taxing entities such as hospital or fire districts.

Table A.3. Share of Local Property Tax Revenues from the Energy System

State	County/borough	Year	Energy share	Fossil fuel share	Wind and solar share
AK	Denali	2021	0.0%	0%	0%
AK	Kenai Peninsula	2021	9%	9%	0%
AK	North Slope	2021	98%	98%	0%
CA	Kern	2021	29%	25%	1%
CA	Los Angeles	2021	0.4%	0%	0%
CA	San Bernardino	2021	0.3%	0%	0%
CO	Alamosa	2021	17%	17%	0%
CO	Garfield	2021	48%	45%	0%
CO	Kit Carson	2021	39%	24%	9%
CO	Lincoln	2021	54%	16%	22%
CO	Logan	2021	19%	10%	7%
CO	Moffat	2021	72%	29%	0%
CO	Montezuma	2021	15%	12%	0%
CO	Pueblo	2021	23%	1%	3%
CO	Rio Blanco	2021	9%	8%	0%
CO	Weld	2021	57%	53%	0%
MT	Big Horn	2020	1%	1%	0%
MT	Musselshell	2020	9%	0%	0%
MT	Richland	2020	24%	0%	0%

State	County/borough	Year	Energy share	Fossil fuel share	Wind and solar share
MT	Rosebud	2020	74%	74%	0%
MT	Sheridan	2020	0.0%	0%	0%
MT	Toole	2020	21%	0%	12%
MT	Wheatland	2020	55%	0%	12%
MT	Yellowstone	2020	12%	3%	0%
NM	Chaves	2020	4%	4%	0%
NM	Eddy	2020	58%	58%	0%
NM	Lea	2020	68%	68%	1%
NM	Luna	2020	0.1%	0%	1%
NM	McKinley	2020	9%	9%	0%
NM	Rio Arriba	2020	28%	28%	0%
NM	Roosevelt	2020	3%	3%	53%
NM	San Juan	2020	30%	30%	0%
ND	Dunn	2020	83%	70%	0%
ND	McKenzie	2020	76%	63%	0%
ND	McLean	2020	4%	2%	0%
ND	Mercer	2020	12%	9%	0%
ND	Morton	2020	13%	5%	0%
ND	Mountrail	2020	52%	44%	0%
ND	Stark	2020	6%	3%	0%
ND	Williams	2020	31%	25%	0%
OH	Belmont	2021	12%	12%	0%
OH	Clermont	2021–2022	0.4%	0%	0%

State	County/borough	Year	Energy share	Fossil fuel share	Wind and solar share
OH	Gallia	2021–2022	3%	3%	0%
OH	Harrison	2021	16%	16%	0%
OH	Jefferson	2021	12%	12%	0%
OH	Lucas	2021–2022	0.1%	0%	0%
OH	Monroe	2021	17%	17%	0%
OH	Paulding	2021	8%	0%	8%
OH	Van Wert	2021–2022	1%	1%	0%
OH	Washington	2021–2022	0.3%	0%	0%
TX	Andrews	2021	66%	55%	7%
TX	Carson	2021	59%	10%	35%
TX	Harris	2021	1%	1%	0%
TX	Limestone	2021	33%	29%	1%
TX	Martin	2021	61%	60%	0%
TX	Midland	2021	29%	28%	0%
TX	Nolan	2021	44%	15%	24%
TX	Pecos	2021	56%	41%	12%
TX	Reeves	2021	46%	44%	0%
TX	Titus	2021	8%	3%	0%
WV	Doddridge	2021	18%	15%	0%
WV	Grant	2021	66%	49%	7%
WV	Greenbrier	2021	8%	1%	0%
WV	Logan	2021	71%	62%	0%
WV	Marion	2021	25%	19%	0%

State	County/borough	Year	Energy share	Fossil fuel share	Wind and solar share
WV	Marshall	2021	49%	37%	0%
WV	Ohio	2021	19%	16%	0%
WV	Putnam	2021	19%	17%	0%
WV	Raleigh	2021	32%	24%	0%
WV	Tyler	2021	4%	3%	0%
WY	Campbell	2021	91%	86%	0%
WY	Carbon	2021	88%	54%	16%
WY	Converse	2021	97%	81%	6%
WY	Laramie	2021	32%	26%	2%
WY	Lincoln	2021	57%	53%	0%
WY	Sublette	2021	91%	91%	0%
WY	Sweetwater	2021	47%	42%	0%
WY	Uinta	2021	42%	31%	4%

Note: Total revenue data from assorted state sources. Energy data from authors. Excludes property tax revenue from oil and gas extraction in West Virginia and pipelines in Montana.

A.3. Calculating Replacement Revenue

To estimate the amount of wind or solar energy development needed to replace fossil fuel revenues in each county, we rely on recently published estimates of county-level wind and solar potential from Lopez et al. (2023), who gathered more than 2,000 local ordinances related to wind and solar siting. Based on these data, they estimate the amount of developable land available to wind and solar in each county under different setbacks specified in the ordinances. The authors focus on three scenarios: a “no setbacks” scenario, in which there are no restrictions on the siting of wind or solar facilities with respect to distance from structures or other infrastructure such as roads; a “50th percentile” scenario, which assumes county-level setbacks are as stringent as the average national setback distance across all ordinances; and a “90th percentile” scenario, which assumes setbacks are as stringent as the 90th percentile of all ordinances. They then estimate the maximum potential wind and solar development under each policy scenario within each county.[1]

For this analysis, we chose to use the 50th percentile scenario, because a no setbacks scenario is inconsistent with existing local land use policies, and the 90th percentile scenario would tend to overstate the land use restrictions for wind and solar development. To estimate the amount of land needed to match county-level fossil fuel revenues, we first use state-level average revenues for wind and solar to estimate the amount of wind or solar deployment needed to match fossil fuel revenues. We then use the Lopez et al. (2023) estimates to assess the land use requirements of that scale of wind or solar deployment. In many cases for wind, the amount of land needed to match fossil fuel revenues exceeds the available land. For solar, where our revenue data are more limited, land requirements exceed available area for only one county, Harris County, Texas, which is heavily urbanized and has relatively little available land. Table A.4 presents a complete list of developable land, the land needed to match existing fossil fuel revenues, and the proportion of developable land that would be required to do so. Lopez et al. do not provide estimates for Alaska, so we do not present results for this state here.

1 The authors provided us with county-level results for both developable land area and maximum potential wind and solar deployment (in MW) via email.

Table A.4. Wind and Solar Land Needs to Replace Fossil Fuel Revenues

State	County	Fossil fuel revenue	Developable land (km^2)		Land needed to match fossil fuel revenue (km^2)		Share of land to match fossil fuel revenue	
			Wind	Solar	Wind	Solar	Wind	Solar
CA	Kern	$238,327,784	1,449	11,654	91,720	4,866	Not possible	42%
CA	Los Angeles	$74,590,934	477	2,525	28,706	1,523	Not possible	60%
CA	San Bernardino	$1,363,987	6,735	24,599	525	28	8%	0%
CO	Alamosa	$3,459,926	141	596	339	32	Not possible	5%
CO	Garfield	$74,215,563	785	1,748	7,273	682	Not possible	39%
CO	Kit Carson	$4,896,761	2,222	4,674	480	45	22%	1%
CO	Lincoln	$2,108,350	3,960	5,181	207	19	5%	0%
CO	Logan	$6,843,969	1,866	3,875	671	63	36%	2%
CO	Moffat	$12,923,236	5,009	8,940	1,267	119	25%	1%
CO	Montezuma	$4,994,570	1,429	2,385	489	46	34%	2%
CO	Pueblo	$1,824,798	1,692	4,029	179	17	11%	0%
CO	Rio Blanco	$18,491,653	2,751	4,478	1,812	170	66%	4%
CO	Weld	$526,896,983	2,944	8,414	51,638	4,841	Not possible	58%
MT	Big Horn	$9,351,677	3,693	8,186	648	No data	18%	No data
MT	Musselshell	$3,535,751	1,702	3,813	245	No data	14%	No data
MT	Richland	$28,439,688	1,341	3,305	1,970	No data	Not possible	No data
MT	Rosebud	$20,835,962	5,091	9,755	1,443	No data	28%	No data
MT	Sheridan	$2,090,871	905	2,942	145	No data	16%	No data
MT	Toole	$747,044	1,448	3,840	52	No data	4%	No data

State	County	Fossil fuel revenue	Developable land (km²)		Land needed to match fossil fuel revenue (km²)		Share of land to match fossil fuel revenue	
			Wind	Solar	Wind	Solar	Wind	Solar
MT	Wheatland	$110	1,228	2,480	0	No data	0%	No data
MT	Yellowstone	$11,708,125	2,263	5,336	811	No data	36%	No data
NM	Chaves	$578,923	8,556	13,877	34	No data	0%	No data
NM	Eddy	$71,322,696	3,677	8,624	4,226	No data	Not possible	No data
NM	Lea	$121,634,620	3,962	9,959	7,206	No data	Not possible	No data
NM	Luna	$0	4,552	6,587	0	No data	0%	No data
NM	McKinley	$2,563,439	8,375	12,448	152	No data	2%	No data
NM	Rio Arriba	$4,932,887	4,861	8,483	292	No data	6%	No data
NM	Roosevelt	$5,467,958	2,737	5,430	324	No data	12%	No data
NM	San Juan	$23,629,293	6,449	11,030	1,400	No data	22%	No data
ND	Dunn	$46,895,488	626	3,808	4,014	No data	Not possible	No data
ND	McKenzie	$125,665,101	1,105	4,593	10,756	No data	Not possible	No data
ND	McLean	$3,248,976	27	1,721	278	No data	Not possible	No data
ND	Mercer	$7,046,328	196	1,114	603	No data	Not possible	No data
ND	Morton	$2,105,441	523	2,752	180	No data	34%	No data
ND	Mountrail	$56,370,103	278	2,425	4,825	No data	Not possible	No data
ND	Stark	$24,301,541	288	2,311	2,080	No data	Not possible	No data
ND	San Juan	$61,151,916	144	3,073	5,234	No data	Not possible	No data
OH	Belmont	$26,569,360	17	657	1,077	No data	Not possible	No data
OH	Clermont	$2,784,996	1	563	113	No data	Not possible	No data
OH	Gallia	$1,957,215	10	838	79	No data	Not possible	No data

State	County	Fossil fuel revenue	Developable land (km^2)		Land needed to match fossil fuel revenue (km^2)		Share of land to match fossil fuel revenue	
			Wind	Solar	Wind	Solar	Wind	Solar
OH	Harrison	$17,886,364	18	483	725	No data	Not possible	No data
OH	Jefferson	$22,257,048	13	531	902	No data	Not possible	No data
OH	Lucas	$939,326	0	238	38	No data	Not possible	No data
OH	Monroe	$21,270,051	8	797	862	No data	Not possible	No data
OH	Paulding	$0	261	559	0	No data	0%	No data
OH	Van Wert	$450,730	194	876	18	No data	9%	No data
OH	Washington	$399,224	4	1,156	16	No data	Not possible	No data
TX	Andrews	$67,711,115	1,035	3,165	5,159	343	Not possible	11%
TX	Carson	$1,669,037	1,032	1,804	127	8	12%	0%
TX	Harris	$88,573,935	22	224	6,749	449	Not possible	Not possible
TX	Limestone	$14,387,169	292	1,362	1,096	73	Not possible	5%
TX	Martin	$146,681,091	452	1,752	11,177	744	Not possible	42%
TX	Midland	$208,665,392	344	1,594	15,900	1,058	Not possible	66%
TX	Nolan	$7,304,312	1,285	1,968	557	37	43%	2%
TX	Pecos	$44,495,389	5,549	10,769	3,390	226	61%	2%
TX	Reeves	$185,324,046	2,393	5,567	14,121	940	Not possible	17%
TX	Titus	$1,481,790	17	157	113	8	Not possible	5%
WV	Doddridge	$8,203,856	32	407	385	No data	Not possible	No data
WV	Grant	$8,015,099	111	483	376	No data	Not possible	No data
WV	Greenbrier	$454,104	372	1,309	21	No data	6%	No data
WV	Logan	$19,812,760	67	110	931	No data	Not possible	No data

State	County	Fossil fuel revenue	Developable land (km²)		Land needed to match fossil fuel revenue (km²)		Share of land to match fossil fuel revenue	
			Wind	Solar	Wind	Solar	Wind	Solar
WV	Marion	$10,658,454	1	389	501	No data	Not possible	No data
WV	Marshall	$41,269,963	4	334	1,938	No data	Not possible	No data
WV	Ohio	$11,800,233	0	61	0	No data	Not possible	No data
WV	Putnam	$11,467,741	17	431	539	No data	Not possible	No data
WV	Raleigh	$17,722,379	76	509	832	No data	Not possible	No data
WV	Tyler	$4,085,495	11	315	192	No data	Not possible	No data
WY	Campbell	$182,302,764	4,997	10,004	5,930	1,393	Not possible	14%
WY	Carbon	$23,596,373	7,700	13,469	768	180	10%	1%
WY	Converse	$87,884,040	4,326	7,875	2,859	672	66%	9%
WY	Laramie	$42,452,617	2,221	5,339	1,381	324	62%	6%
WY	Lincoln	$26,244,759	594	4,704	854	201	Not possible	4%
WY	Sublette	$89,585,468	3,755	5,374	2,914	685	78%	13%
WY	Sweetwater	$59,697,365	5,846	22,432	1,942	456	33%	2%
WY	Uinta	$8,204,161	1,530	3,496	267	63	17%	2%

Note: Alaska boroughs not included because the Lopez et al. (2023) data did not provide wind and solar potential.