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Renewable Energy Policy in Oklahoma

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Table of Contents

Background

Transformations in Oklahoma's Electricity Generation Mix: A 20-Year Review

Over the last two decades, the state of Oklahoma has undergone a significant transition in its electricity generation mix. Notably, wind energy has emerged as a prominent source, contributing 44% of the state's total net generation in 2022.[1] Following a steep increase in wind energy deployment over the last 10 years, Oklahoma is now the third-largest wind power producer in the United States.[2] Natural gas is another major player in Oklahoma's electricity mix and has charted a steady and significant rise since 2022 (Figure 1).[1] By contrast, coal's share of electricity generation followed a sharp decline, dropping from 63% share of net electricity generation in 2001 to 10% in 2022 (Figure 1).[3] Additional renewable resources, including hydropower, biomass, and solar, have made contributions to in-state generation over this period.

Oklahoma has brought several large-scale wind energy projects online in the last two years, reinforcing the state's dependence on wind power generation.[4] The state also has a small but increasing focus on utility-scale solar photovoltaic (PV) installations.[5] Across its portfolio, the state regularly produces more energy than it can consume, which allows for adjacent states to receive excess energy transmission. Within the electricity sector, industrial and transportation uses account for the majority of total energy consumption, while residents consume less than 20% of the electricity pot.[6]

Oklahoma's electricity sector consists of both investor-owned and municipal utilities, as well as several rural electric cooperatives. The Oklahoma Corporation Commission (OCC) holds the primary authority in regulating public utilities in the state, but their jurisdiction does not extend to utilities under municipal or federal authority. The OCC's regulatory domain encompasses three investor-owned utilities and five cooperatives that voluntarily agree to regulatory oversight. Municipal systems and cooperatives can opt out and remain outside the Commission's regulatory scope. This optionality makes Oklahoma's renewable energy policy landscape a bit of a "choose your own adventure."

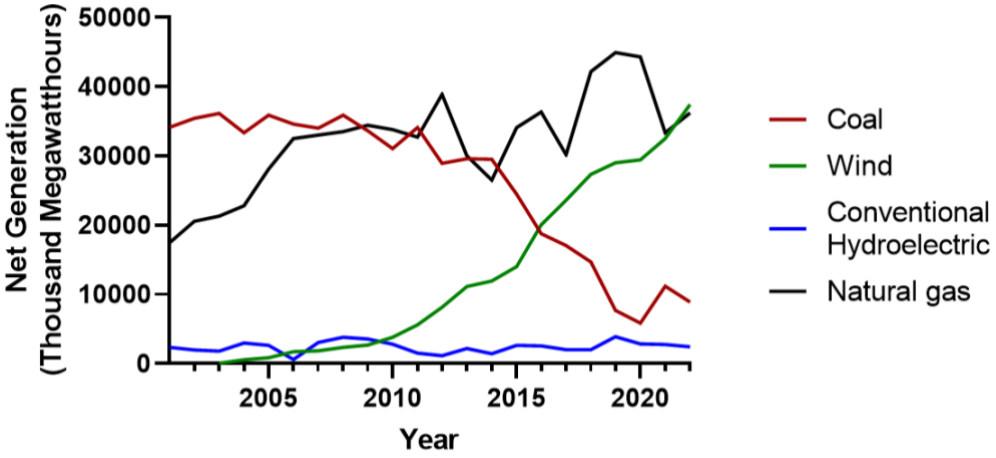

Figure 1 *Analysis of net electricity generation in Oklahoma from 2002 to 2022. (U.S. EIA, Electricity Data Browser)*

Renewable Energy Integration in Oklahoma

Oklahoma has made remarkable progress in integrating renewable energy sources into its energy portfolio. In 2022, renewables accounted for nearly half of the state's electricity generation (Figure 2), compared to less than 10% ten years prior. Situated in the Great Plains, Oklahoma's combination of land and resource availability has allowed wind energy to make its mark as a major player, currently providing 93% of the state's renewable electricity generation (Figure 2).[7,8] Taking advantage of its prime location in the wind belt, Oklahoma has constructed several utility-scale wind energy projects. For example, the 999-megawatt Traverse Wind Project, completed in April 2022, is one of the largest wind farms in North America. It includes 356 wind turbines that are expected to power approximately 300,000 homes annually.[9]

While wind is a standout contributor, hydropower makes a small contribution of around 3% of Oklahoma's total net generation (Figure 2)[7]. The state has ten hydroelectric plants that depend on precipitation levels and drought to generate power.[10] Oklahoma also operates a single hydroelectric pumped storage power plant, which increases reliability by storing electricity during low demand periods and releasing it during peaks.[11]

Biomass resources contribute less than 0.4% of the state's total electricity net generation (Figure 2). Oklahoma has three utility-scale biomass power plants that respectively harness wood and wood waste, municipal solid waste, and landfill gasses.[12]

Solar energy, mainly in the form of solar PV installations, has exhibited growth in recent years starting from a relatively low baseline. In 2022, the combined contribution of utility- and small-scale solar PV amounted to about 0.4% of Oklahoma's renewable net electricity generation (Figure 2).[9] This is notable since Oklahoma ranks as the sixth sunniest state in the U.S,[13] yet the 45th in terms of solar capacity installed (Figure 4).[14] From conversations with Oklahoma-based developers, the main factors explaining the state's slow solar deployment include policy, namely the lack of statewide incentives and solar installers, construction costs, and a backlogged interconnection queue.[15,16] While its contribution to the energy mix remains low compared to other sources, solar installations have doubled since the authorization of power-purchase agreements (PPAs) in 2019. The state's 12 utility-scale solar farms are mainly located in the dry, sunny plains of western Oklahoma. These solar arrays accumulate approximately 298 megawatts of generating capacity. With the cost of solar technologies decreasing and promising solutions

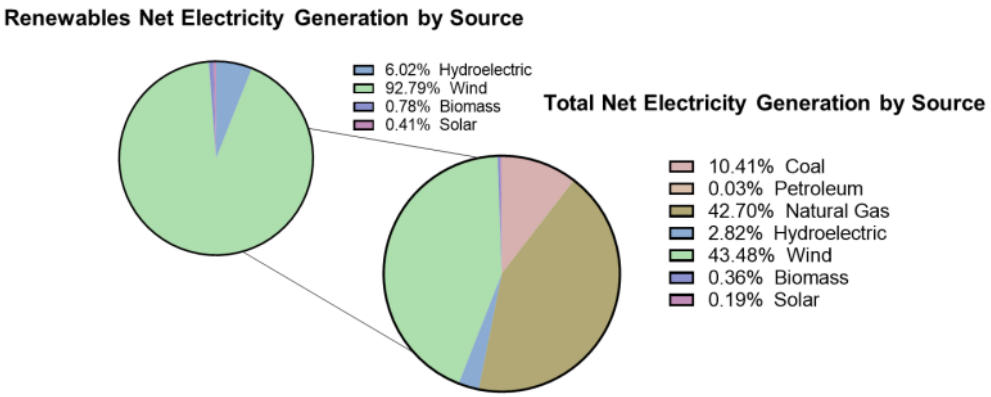

Figure 2 *Proportion of Oklahoma's net electricity generation by source in 2022, where wind and natural gas. (U.S. EIA, Electricity Data Browser)*

for transmission and interconnection backlogs on the horizon, the future is shaping up to be supportive of the expansion of utility-scale solar in Oklahoma.[11]

Although the state has made significant progress in renewable energy adoption, Oklahoma has not achieved its full potential for renewables-based generation. Lands in western Oklahoma have vast solar and wind resources that could fulfill in-state energy consumption (Figures 3, 4)[17,18] and even direct excess generation towards interstate transmission to collectivize the clean energy transition in the U.S.[19]

Local Narratives: Public and Political Discourse on Renewables in Oklahoma

Oklahoma's state officials treat the subject of climate change with sensitivity, subtly acknowledging changing weather patterns without addressing climate change by name or the industries to blame.[20] Despite officials' hesitation to affiliate with a climate action agenda, Oklahoma has made major strides in wind energy. The state song's self-proclamation as "where the wind comes sweepin' down the plain," echoes their position as the third-largest producer of wind power in the country,[21] but some vocal Oklahomans are not ready to give up natural gas and coal just yet. Oklahoma has deep cultural and economic roots in the fossil fuel industry,[22] as symbolized by its capitol being the only one in the country to have active oil rigs on its grounds.[23] Many mainstream media narratives broach the subject of renewables with this history in mind and defend the fossil fuel industry's reputation.

The state's leading newspaper mostly reports on the clean energy transition from the perspective of economic development. *The Oklahoman* provides a platform to writers both in favor of and opposed to the expansion of wind and solar in the state. Recent reports highlight Oklahoma as an attractive location for renewable energy manufacturers, due to the state's appealing investment climate and incentives offered through the recent Perform Act. The Perform Fund offers up to $180 million for capital expenditure projects that advance economic development and direct job creation. Rather than affiliate with progressive aims, officials refer to this project as "the largest [economic development project] in state history." Oklahoma officials often claim a commitment to environmental protection, clean air, and public health while simultaneously impeding progress on renewables. Guest-writing for *The Oklahoman,* the Corporate Commissioner demonstrated this dissonance between value and action, calling pro-renewables policies an example of "federal overreach" and warning citizens that the renewables industry would increase utility bills and decrease grid reliability.[24] She accused the Environmental Protection Agency of compromising its responsibility for grid reliability and economic security in exchange for advancing ideological agendas. Similarly, the governor of Oklahoma drew firm boundaries with companies and agencies perceived to be "push[ing] some political agenda", such as the 13 banks banned from doing business with the state after allegedly boycotting oil and gas (O&G).[25] Across these examples, the political discourse on renewables in Oklahoma is notable as much for what is said in the media as what is left unsaid.

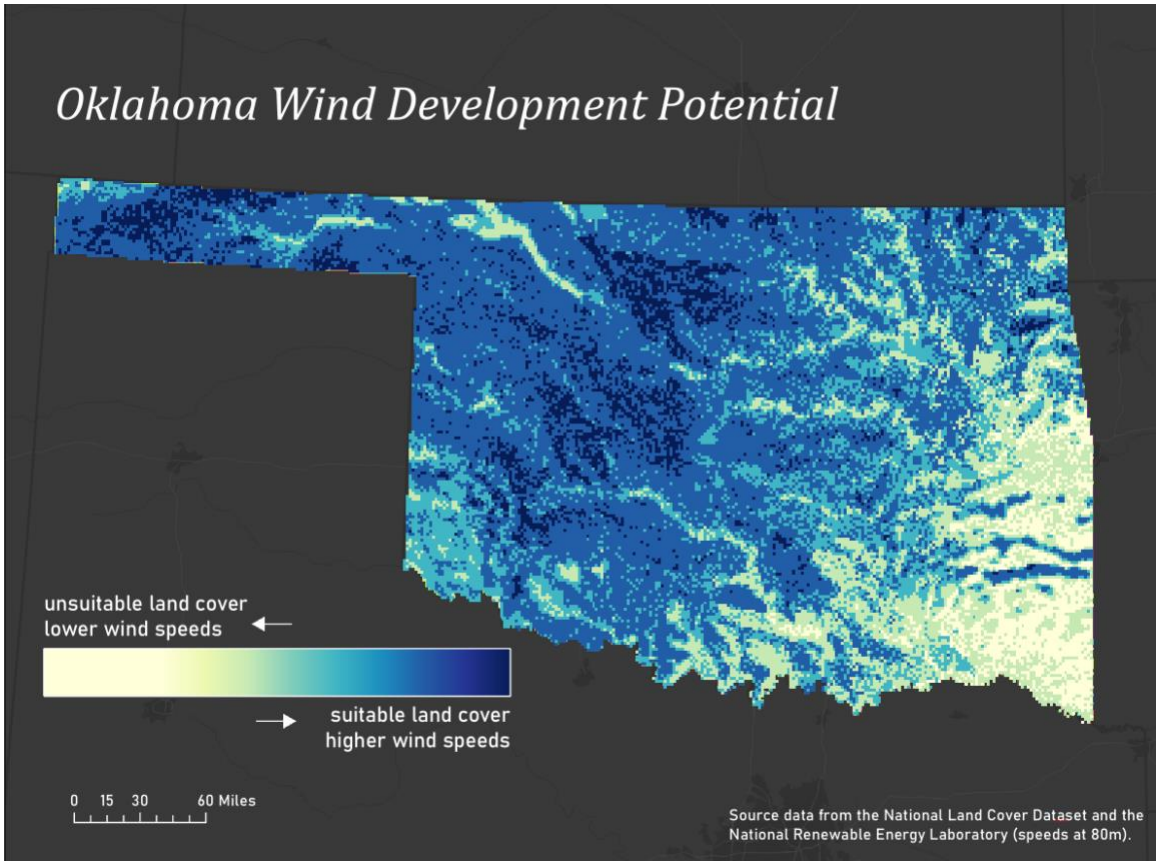

Figure 3 *Raster overlaying land use and wind energy resources, illustrating the potential for an expansion of wind generation sources in western Oklahoma. (Source data from National Land Cover Dataset and NREL).*

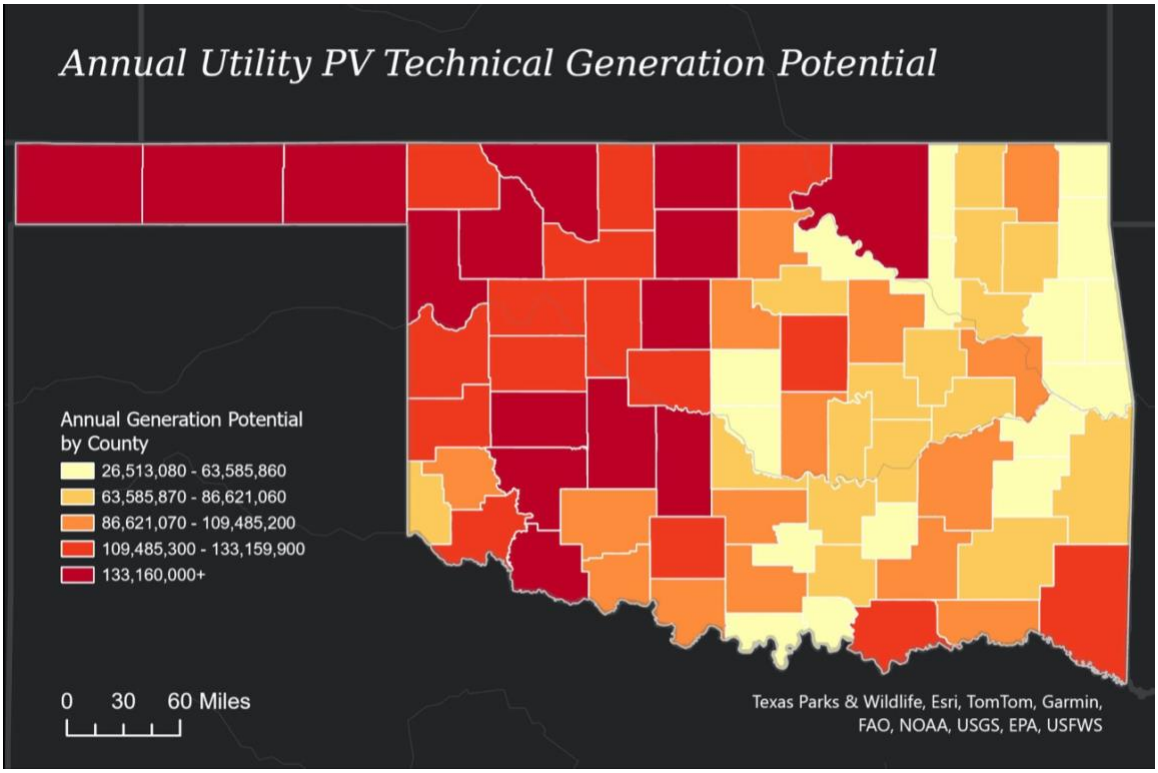

Figure 4 *Annual utility solar PV technical generation potential by county in Oklahoma. (Source data from Texas Parks & Wildlife)*

The non-mention of human-induced climate change obscures the state's responsibility to clean up its grid. The language used to discuss renewable energy sets the tone for its success or failure in a community.

The communities living closest to renewable energy projects portray similarly varied views. Most local narratives focus on wind since it is the preeminent renewable source in Oklahoma. Through various channels, Oklahomans have praised the benefits the renewable energy industry has brought home, including: (1) the higher rate at which the industry hires veterans,[26] (2) the potential income generation for current landowners and economic security for future generations,[27,28] (3) and company contributions to the tax base and investment in public infrastructure.[29] Even residents who do not consider themselves renewable advocates can see the community benefit. Craig Schlichting was won over by the leasing income and the developer's investment in local schools. Though not his ideal scenario, Schlichting voiced his acceptance of wind energy, recognizing "in a poor state, it's good money."[30] Renewable development companies advertise their dedication to "remain[ing] a good neighbor" throughout a project's lifetime, such as how NextEra donated STEM kits to a high school near one of its sites.[31] Companies like NextEra present their community involvement as an intergenerational investment: the company donates STEM kits to local high school science classes to ensure residents receive the educational opportunities that will make them competitive candidates for future jobs in the energy sector.

On the other end of the spectrum, residents and local organizations file the standard petitions to wind energy, often related to prairie fragmentation and habitat degradation.[32] One resident commented on an article from *The Oklahoman* that the Perform Fund was an example of "more socialism for the rich."[33] Tribes living near renewable energy developments cite different oppositions to projects. The Osage Nation has organized against Enel's projects on its ancestral lands, where the horizon is a "sacred meeting place of heaven and earth."[34] The turbines obstruct the vista that is sacred to their morning worship ceremony, effectively compromising the tribe's cultural use of their land for renewable energy development. The conversation around renewables in Oklahoma is mainly driven by these economic and cultural roots.

Geographic understanding

I. Economic base of Oklahoma

The state's economic base is dominated by mining and trade, transportation, and utilities such as electricity generation (Figure 5). The mining sector extracts naturally-occurring mineral solids, such as coal and ores; liquid minerals such as crude petroleum; and gasses, such as natural gas.[35] Oklahoma extracts natural gas and oil throughout the entire state.[36] Major gas fields (defined as recovery of more than 1 trillion cubic feet of gas) are located in the northwest region, major oil (recovery of more than 100 million barrels of oil) and gas fields coexist in the central region, (Figure 6) and coal mining occurs primarily in the eastern region of the state (Figure 7).[37,38] Figure 8 shows the geographical distribution of the various economic sectors in

Oklahoma, excluding mining and extraction. Major cities, such as Oklahoma City and Tulsa, have prominent health care industries, while adjacent counties specialize in retail trade and manufacturing.

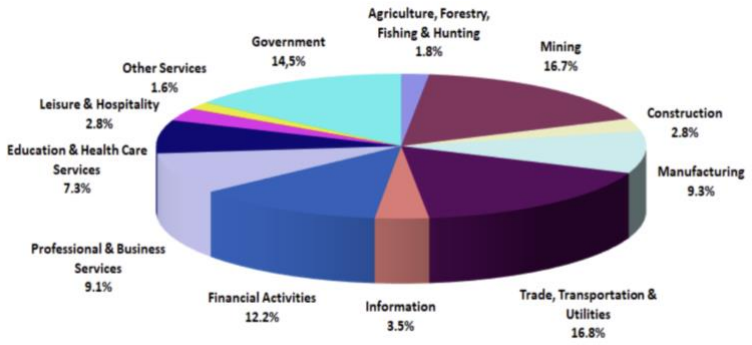

Figure 5 *Oklahoma non-farm industry contribution to earnings, Q1 of 2021. (Oklahoma Employment Security Commission)*

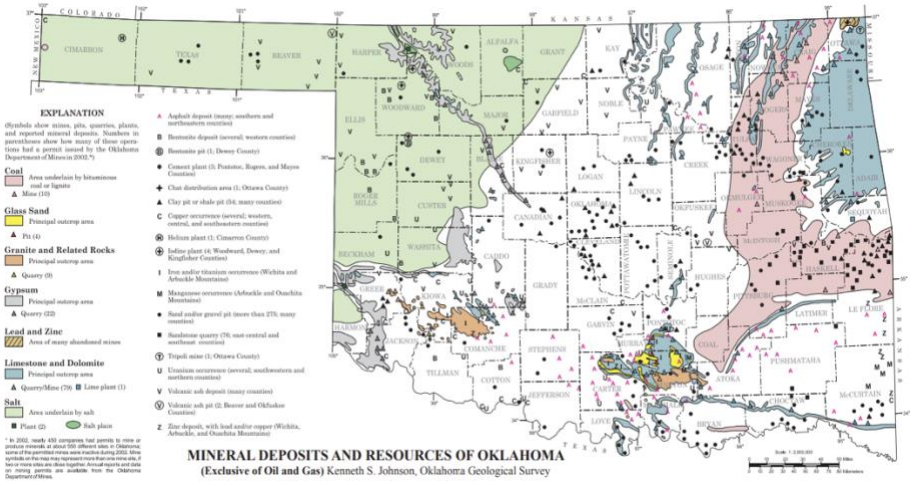

Figure 6 *Oil and gas production and facilities in Oklahoma. (Oklahoma Employment Security Commission)*

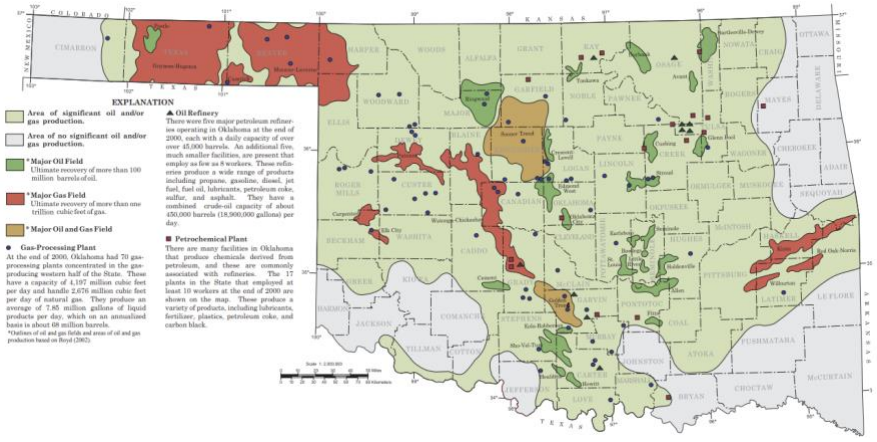

Figure 7 *Mineral deposits and resources in Oklahoma. (Oklahoma Employment Security Commission)*

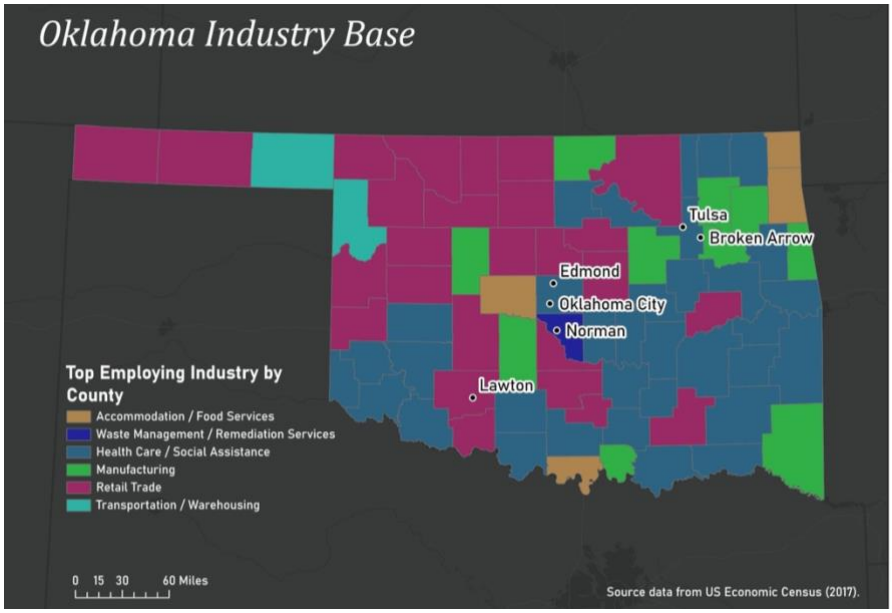

Figure 8 *Top employing industries across Oklahoma counties. (Source data from 2017 US Economic Census)*

II. Demographic trends and Political Distribution

As of the 2010 census, 34% of Oklahoma's population lived in rural areas with the urban population concentrated in Oklahoma City and Tulsa (Figure 11).[39] Of the state's 77 counties, only seven have more than 5% of their land base classified as urban use.[40] Oklahoma is a thoroughly red state and has voted republican for the past several decades during the presidential election.[41] (Figure 11) As for the OCC, it is guided by three elected commissioners, all currently affiliated with the Republican Party.

Policy Landscape

Explicit Climate Policy

Media narratives often paint renewable energy development as an institution of climate action. Yet, Oklahoma has become the third-largest generator of renewable energy without the regulatory muscle of a statewide climate action plan. The value proposition in Oklahoma focuses on economic rather than environmental sustainability, as the state builds an energy future that creates jobs, diversifies income streams, and improves intergenerational wealth. Oklahoma has proven that it can contribute to the clean energy transition without aggressive or explicit climate policy in the driver's seat. Even so, it is helpful to analyze how the state's policy landscape might moderate its progress towards carbon neutrality in the future.

Without a statewide climate agenda, Oklahoma's efforts to help its communities prepare for climate change are diluted by inexplicit state environmental and energy plans and dispersed across a patchwork of municipal climate action plans. The Oklahoma Governor's Office released its first Energy Plan in 2011 in collaboration with the Secretary of Energy to establish a detailed

baseline from which the state could grow and innovate its energy portfolio.[42] The administration retooled its approach for the plan's second iteration in 2021 to respond to the intersectionality of energy and environment, still without crossing into explicit climate policymaking. A keyword search of the 2021 Energy & Environment Plan returns one match for "climate change": an acknowledgment of environmental changes and a stated commitment to lowering carbon emissions in the power sector. This plan is predominantly qualitative, describing the state's current energy portfolio and setting vague intentions rather than tractable goals for future development. This conservatism is a symptom of the plan's stated goal to avoid "picking winners and losers" among the energy mix.[43] It attempts to distance the state from "unnecessary regulation and mandates [that serve] only to penalize the consumer." In the 2021 Energy & Environment Plan, the government highlights its dual leadership in both fossil fuel and renewable energy sectors.

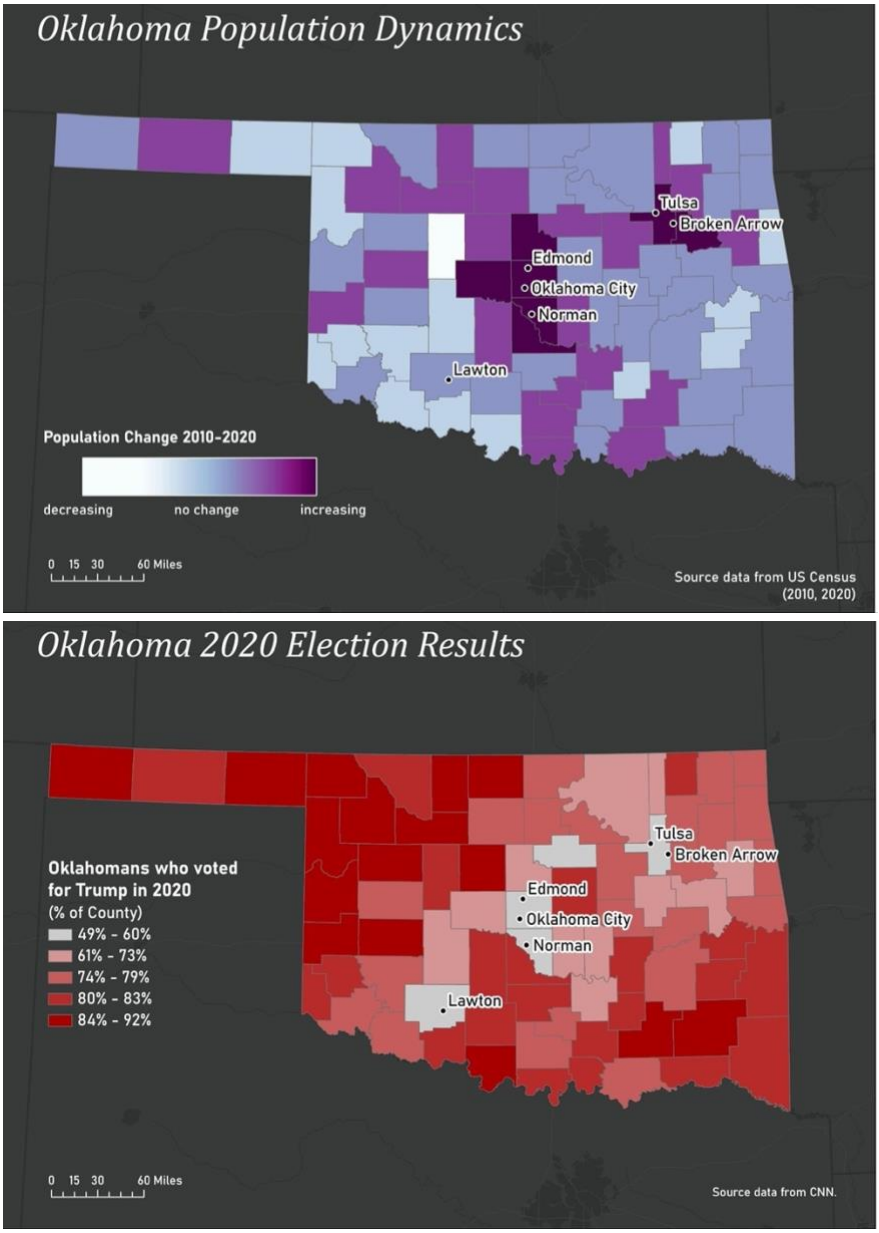

Figure 9. *Oklahoma maps demonstrating (above) population changes from 2010 to 2020 by county[44] and (right) 2020 presidential election results by county.[45]*

The plan's authors attempt to stabilize this precarious position by building flexibility into its roadmap for energy development, hoping to continue to excel in both industries for the foreseeable future. This balancing act has powered innovation without forfeiting loyalties up to this point, but it remains to be seen for how long Oklahoma can continue to burn the candle at both ends.

Despite lacking explicit climate policy or exclusive industry allegiances, Oklahoma has previously set clean energy goals through a Renewable Portfolio Standard (RPS). In 2010, the state codified an RPS goal for electric utilities. The Oklahoma Energy Security (OES) Act, H.B. 3028, required that 15% of all installed generation capacity come from renewable sources by 2015,[46] with qualifying technologies including geothermal, solar, wind, biomass, hydroelectric, among others. The act also established a standard for natural gas, declaring it the preferred choice of fossil fuel generating facilities when additional capacity is needed to round out generation by renewables. In 2015, the total capacity of electricity from renewables reached 25.9% within the state. Uniquely, Oklahoma's RPS does not require electric companies to buy and maintain renewable energy credits that prove their compliance. Instead, electric companies are required to send an annual report to the OCC outlining their facilities' potential generation capacity, actual production, and energy source. The RPS did not extend beyond its initial goal and the state still abstains from requiring utilities to buy a certain percentage of electricity from renewable sources.

With or without a new benchmark, the percent of total electricity generated from renewable sources has steadily increased since the OES was enacted.[47] Utilities are taking initiative on their own to establish greenhouse gas reduction objectives, such as Oklahoma Gas and Electric, which is on track to reduce emissions by 50% by 2030.[48] Oklahoma continues to outperform comparable states in other ways, which could be a result of the state's incentive programs, including: a quality jobs program, a manufacturer investment/new jobs tax credit package, and a five-year ad valorem exemption for new or expanded facilities.[49] These programs will be discussed in future sections, but they enact Oklahoma's value proposition with host communities: that as a leader in the power sector Oklahoma supports renewables as an agent of economic development, rather than on account of environmentalist claims. In 2019, the OCC reinforced this value proposition when it adopted new net metering rules for solar, which raised the system limit to 300 kW, removed the 25,000-kWh annual generation limit, and required utilities to compensate net excess generation at their avoided cost rate. The policy was anticipated to increase rooftop solar, but these outcomes have not yet been realized in the state's energy portfolio. Such an increase might have been fortified by policies advancing the climate benefits of renewables, but the state will not know until it tries.

Oklahoma has deep ties to the fossil fuel industry, as demonstrated by entrenched political and fiscal loyalty, so it is no surprise that it has yet to enact a carbon tax.[50] Even so, deemphasizing the relationship between renewables and climate action has proven to be advantageous for the state's clean energy transition. Advocacy for renewables may be more successful when the message emphasizes the young industry's economic benefits rather than

vilifying the legacy, albeit dirty, industry. Local narratives show that public acceptance of renewables is positively associated with economic development claims and is facilitated most effectively by developers that speak the pro-development, pro-energy language. Residents praise the industry for the diversified agricultural income, growth of the tax base, and investment in public infrastructure; less so for its contribution to cleaning up the grid.[51] The economic development messaging and incentive programs have certainly propelled Oklahoma far through its clean energy transition, but the future of its policy landscape will determine the final degree to which it makes progress. Will Oklahoma maintain its leadership position in renewables deployment going forward, or will the state be anchored to its current stance straddling fossil-based and renewable energy systems?

Taxation of Renewables

As noted above, Oklahoma has made a name for itself as a state at the forefront of renewables development, due in part to tax incentives and policies. In 2001, Oklahoma introduced a Zero-Emission Tax credit, which provided a 10-year refund of $0.005 per kilowatt-hour of energy generated for qualifying wind, hydroelectric, solar, or geothermal facilities.[52] In simpler terms, this incentive offered a tax credit to those who produce and sell electricity from clean, zero-emission facilities, which helped the developer reduce their state income tax burden. Within a few years of the tax credit being passed, the first utility-scale wind energy projects were developed in Oklahoma. The first developments, spurred by state incentives and expedited by a wide-open interconnection queue, were not the last; many more wind projects came online in the following decade. In 2015, Oklahoma Governor Mary Fallin signed legislation both introducing stricter rules for wind turbine siting and ending a popular five-year property tax exemption for the industry. This policy change was estimated to save taxpayers up to $50 million annually but was also one of the first casualties of the political battles being fought in the energy sector. The decision followed extensive negotiations, with Republican Rep. Earl Sears stating that the agreement marked the end of ad-valorem reimbursement for the wind power industry.[53]

This left the Zero-Emission Tax credit as one of the last surviving credits for renewable developers. In 2016, Oklahoma's oil and gas industry campaigned to sunset all financial incentives for wind energy projects. They argued that wind energy, already established and commercially viable, no longer depended on taxpayer incentives. With the end of state incentives for wind, lobbyists called for tougher siting rules and a new state tax on wind production to bring renewables to "full parity" with oil and gas. Proponents of wind energy appealed that the industries should be seen as complementary and work together for a diverse energy mix.[55] In response to these debates and the sizable budget line item going to tax credits, wind facilities that began services after July 2017 were removed as eligible credit recipients of the Zero-Emissions credit. The state later introduced a $500,000 refund cap on non-wind facilities in 2019, and officially ended the Zero-Emissions program on December 31st, 2021.[54]

The repeal of these tax credits was poorly timed for the emergence of solar markets. In 2015, the costs of utility-scale solar installations were just beginning to make sense for Oklahoma

developers. For a state with such low electricity prices, solar had previously been a non-competitive technology. With construction costs coming down and more examples of successful utility-scale solar coming online, solar became ripe for deployment just as the state government was putting the brakes on its clean energy incentive programs. Conversations with developers painted a picture of the perfect storm for wind's explosive development in the early 2000s, as compared to a more inert environment by the time solar came around in 2015.

A 2020 evaluation of the Zero-Emission Tax credit program reported credit use skyrocketing from $2.3 million in 2012 to $88 million in 2019. Despite the large increase in state expenditures, lawmakers followed recommendations to maintain the program through the end of 2021. It has been viewed as an overall success due to: (1) renewable energy electricity generation increasing from 3.1% of electricity generated in 2002 to 43.5% by 2022, (2) the high volume of wind facilities that opened operations during the program's lifetime,[54] and (3) the consistent drop in electricity prices below the national average since the program's commencement. Critics of the Zero-Emission Tax credit remark on the outsized state investment compared to little return on job growth: the wind power industry employed a mere 178 people in Oklahoma in 2018.[55] Although this program has run its course, several wind facilities will continue to receive credits through 2026 because of the 10-year credit schedule. The lesson learned is that, despite being effective in growing the renewables industry, ambitious credits and exemptions may not be sustainable in the long run.

With several state tax incentives nearing the end of their lifetime, today's renewable energy developers rely on federal tax incentives like the renewable electricity production tax credit (PTC) and the Investment Tax Credit (ITC), which have been subject to their own scrutiny in Oklahoma. In Kingfisher Wind LLC v. Wehmuller, Oklahoma set a precedent for the taxation of PTCs.[56] When assessing Kingfisher wind farms, the county valued the facilities at $458 million, while Kingfisher calculated the value much lower at $169 million. This discrepancy was traced to the county's inclusion of Kingfisher's PTCs in their assessment calculations. The county assessor argued that PTCs are subject to property taxation because they "are of such an economic benefit to owning, operating, and determining the full fair cash value of the wind farm and its real property." The Oklahoma Supreme Court ruled in favor of Kingfisher due to a 2013 state constitution referendum and PTCs were officially intangible property not subject to ad valorem taxation. In response to this ruling, school districts across the state grew concerned for the anticipated impact to their budgets and capital plans. The Chairman of the Kingfisher County Board of Commissioners claimed that the ruling, "will negatively impact counties where wind energy systems are located," calling it "a serious blow to state aid." Despite the ruling being accepted as lawful, communities remain upset with the substantial decrease in projected revenue.[57] Oklahoma's taxation on renewables reflects the intricate dance between facilitating renewable energy deployment and maintaining fiscal responsibility. As the state grapples with these challenges, it stands at a crossroads, prompting deeper questions about its long-range energy strategy and the interplay between various stakeholders in shaping policy.

Siting Authority

Siting authority in Oklahoma is described in the next two sections as it pertains to wind and solar power.

I. Wind Power

In Oklahoma, siting authority for wind power is split between local and state governments. Prior to constructing a wind facility, a wind developer must submit Notice of Intent to the OCC, provide copies of the notice to local jurisdictions overseeing land use decisions in the project area (17 OK Stat § 160.11, 2022), and convene a local public hearing. State law requires that any wind turbine be 1.5 nautical miles (approximately 9,110 feet) from the centerline of any runway, public school, or hospital.[58,59,60] Additional siting requirements for wind power are at the discretion of local governments.

Across the 77 counties, 164 cities, and 433 towns in Oklahoma, there exist sparse patches of wind siting ordinances.[61] Local wind siting requirements are in place in El Reno, Midwest City, Owasso, Yukon, Moore, Muskogee, Oklahoma City, Tulsa, and Ponca City.[62,63,64,65,66,67] It should be noted that the lack of information accessible at the municipal level may have skewed data reporting, highlighting a need for a consistent, centralized database of local zoning and siting requirements. The nine cities with siting requirements for wind, summarized in Table 1, are limited to setback distances, noise restrictions and total turbine height limits. The full list of siting requirements for each city can be found in the citations for Table 1. Tulsa's ordinance explicitly names a requirement for 'Small Wind Energy Conversion Systems (WECS)', which is demonstrated by the significantly smaller height limits than what is typical in other cities. Owasso and Yukon have the most restrictive siting ordinances, limiting turbine heights to less than 100 feet. In addition, Ponca City explicitly bans the use of wind farms (i.e., multiple wind turbines); however, one WECS is permitted on any individual property for the sole purpose of satisfying the energy needs of that parcel. At the time of this report, no explicit local-level siting requirements exist for large, utility-scale wind farms in rural areas of Oklahoma.

The National Renewable Energy Laboratory developed a state-by-state interactive map that integrates local siting requirements and zoning ordinances with installed wind projects (Figure 12).[68] However, the siting ordinances available for Oklahoma only include data from El Reno, Yukon, and Ponca City. The only city that has wind ordinances in place and houses a wind farm is in the city of El Reno, which has relatively relaxed wind siting requirements compared to the other cities named above.

In Oklahoma, there is no explicit limit on capacity, freeing developers to build extremely large wind farms. Oklahoma's minimal state- and local-level siting requirements make it an attractive location for both local and out-of-state wind developers. For example, American Electric Power, based in Ohio, built a 1 GW wind farm in Blaine and Custer counties that came online in 2021.[69] Public sentiment toward wind farms has varied over the years, as previously described in the *Local Narratives* section. Several news articles throughout the mid-2010s (when some local ordinances were enacted) document residents' aversion to incoming wind developers.

Most notable is the 2014 class-action lawsuit brought by residents of Kingfisher and Canadian counties against various wind developers with the goal of blocking development.[70] The residents claimed wind farm project(s) would decrease property values, create nuisance, and adversely affect their health. Ultimately, the judge dismissed the claims and the wind farms were built.[71] In 2022, one resident sued the state for *limiting* wind farms on his property, due to the previously mentioned 1.5 nautical mile setback requirement.[72] The resident's 750-acre plot of land is within this radius of the nearest public school, disqualifying it for wind farm development. As a result, this resident and others claim they are missing out on thousands of dollars in increased royalties, plus additional tax revenue streams for local school districts.[73] While nuanced cases of policy obstacles to deployment exist, the split siting requirement system has not completely obstructed wind development in Oklahoma, since it is the third-largest wind power producer in the U.S. Even so, this ranking only speaks to what is, not what could be.

Table 1. Summary of some cities in Oklahoma with defined wind siting ordinances.

City	County	Total Turbine Height Limits	Setbacks	Noise	Code/Year
El Reno	Canadian	600 feet	1.1x total turbine height	55 dBA	361-30[74] / 2011
Midwest City	Oklahoma	NA	1.5x total turbine height	NA	5.7.5[75] / 2010
Owasso	Rogers and Tulsa	For properties < 1 acre, height < 15 ft. Properties 1- 2 acres, height < 60 ft. Properties 2- 5 acres, height < 80 ft. Properties > 5 acres, height < 100 ft.	1.5x total turbine height from nearest property line	50 dBA	17.2[76] / 2012
Yukon	Canadian	100 feet	1.0x total turbine height	55 dBA	204-173[77] / 2014
Moore	Cleveland	NA	1.0x total turbine height	NA	12-125[78] / NA
Muskogee	Muskogee	< 10 feet above the max permitted height of the zoning district	1.1x total turbine height	75 dBA	90-12-04[79] / NA
Oklahoma City	Oklahoma	Towers in the AA district not limited by height	1.0x total turbine height from all property lines	Defer to City Code	59-12200[80] / NA
Tulsa	Tulsa	For properties < 1 acre, height < 30 ft. Properties 1-2 acres, total height < 65 ft. Properties 2- 5 acres, total height < 85 ft. Properties > 5 acres, total height < 100 ft.	1.1x total turbine height	60 dBA	45.200[81] / 2016
Ponca City	Kay	Ban	Ban	Ban	11-5-1(14)(a)[82]

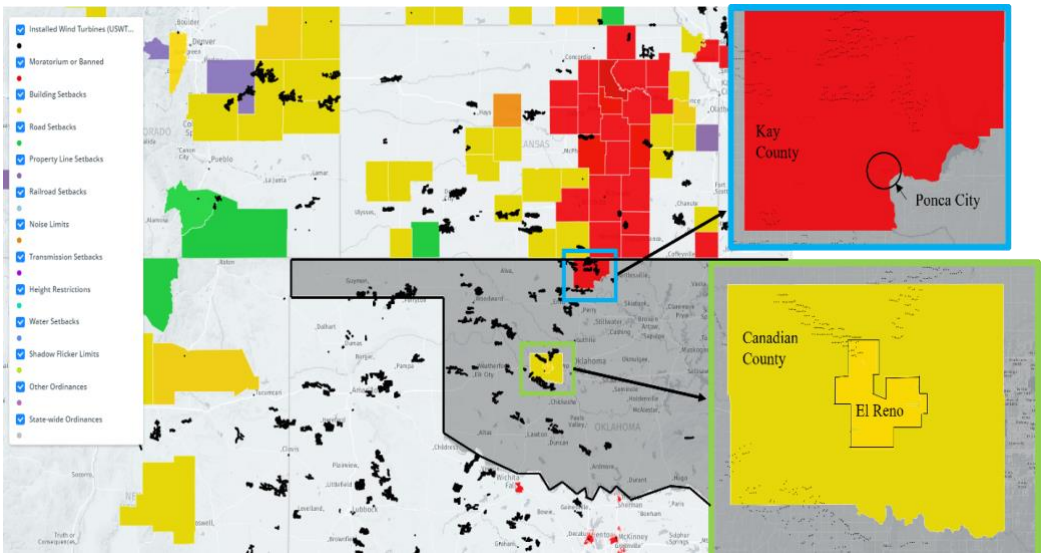

Figure 12. Wind energy siting requirements and zoning ordinances in Oklahoma. Black dots represent wind turbines. The various colors represent different siting requirements.[83]

II. Solar Power

Where siting requirements for wind are few and far between, solar siting is practically free reign. There is no clear authority on solar siting in Oklahoma and there are no statewide zoning or siting restrictions.[84] The only state regulations for solar concern the process of connecting it to the grid for compensation in the form of net metering.[85] Similar to wind, some cities and towns have created their own ordinances for solar siting, including Oklahoma City, Chickasaw, Lawton, Del City, and Miami.[86] Most of these municipal ordinances regulate the placement of panels to protect aesthetics, but are not as comprehensive as those regulating wind siting. In February 2023, Senate Bill (SB) 558 was introduced to prevent restrictions, covenants, bylaws, or other regulatory documents of the owners' association that would have the effect of "prohibiting…the installation of solar panels…on the rooftop of any property or structure."[87] The bill has yet to pass the state senate.

Yet, developers have not taken advantage of the relatively open policy landscape for solar. Oklahoma has high solar resource potential yet underperforms compared to states with fewer "sun-peak" hours per day. Certain policy barriers may be responsible for this untapped potential. For example, states with more aggressive tax incentives and environmental mandates than Oklahoma tend to be more supportive of the emergence and growth of solar markets. [88] As mentioned in the *Taxation of Renewables* section, the tax incentives that allowed wind to take off in Oklahoma were sunsetted by the time solar arrived on the scene. Additionally, Oklahoma did not allow PPAs until 2018, which tend to drive the economics of renewables development. PPAs allow wind and solar developers to raise funds, purchase equipment, and construct the projects without incurring direct costs to local energy users.[89] When first allowing the use of PPAs in Oklahoma, the attorney general issued an opinion that established their legal use to pay for distributed generation projects, including rooftop solar.[90] Since allowing PPAs the state has seen

a steady rise in annual residential solar installations, with the estimated residential solar capacity at 20 MW in 2022.[91]

However, this pales in comparison to the estimated 11,714 MW of wind capacity in Oklahoma in 2022.[92] This might be expected if Oklahoma did not have the abundant solar viability that it does, yet it ranks as the sixth sunniest state in the U.S.[93] This disparity comes down to the distinction between residential and utility-scale solar; residential solar has risen in recent years in Oklahoma, but contributes significantly fewer MW per project than utility-scale deployment. It may take time for utility-scale deployment to grow solar's portion of the state's energy mix, but policy intervention can expedite the expansion of this technology. Since economic prosperity drives the state's value proposition for energy development, Oklahoma could facilitate the emergence of solar markets by subsidizing the cost of construction and closing the, albeit relatively small, gap between wind ($1,498 per kW in 2020) and solar ($1,655 per kW in 2020).[94] With the end of the zero-emissions tax credit and recent increases in the construction costs of wind evening the clean energy playing field, solar may soon find its time to shine in Oklahoma.

However, costs do not take the sole blame for the technology's lag. In regional transmission organizations (RTOs) with more streamlined interconnection processes (e.g., ERCOT), new projects can be pass through development phases and commence operations much quicker. However, the Southwest Power Pool (SPP) interconnection queue is fielding a much higher volume of proposed projects. In the early 2000s, the SPP queue was relatively open and wind projects were able to launch rather efficiently. With more developers are eager to take advantage of today's federal incentives like the PTC and ITC trickling down to states, the queue has become backlogged just before solar could take off. In fact, solar installation projects make up 34% of the total queue for Oklahoma. In future sections, we will discuss the policy implications of this backlog and what industry actors are doing to bring more projects online.

Use of Public Lands

While zoning applies to private lands, Oklahoma has a significant proportion of public land area that may also host renewables. In several western states, the Bureau of Land Management (BLM) has instituted competitive leasing provisions to support renewable energy deployment on public lands.[95] In June 2023, the BLM reduced fees for wind and solar development on public lands by 80%.[96] The costs of developing on public lands are high due to a lengthy bureaucratic review and permitting process, and often exceed the benefit of installing renewables on otherwise viable lands. Even so, public lands leasing programs can streamline the development process by maximizing generation potential and minimizing resource conflicts. The BLM is taking steps to expand federal incentives for renewable development on public land to additional states. The agency manages 7.4 million acres of federally-owned land between Oklahoma, Kansas, and Texas where it administers the extraction, use, and sale of fossil fuels, but it has not yet released plans for the region's renewable energy industry.[97] With active oil rigs on the state capitol's grounds, offering up public lands up to renewable energy may be a tough sell in

Oklahoma. On top of cultural considerations, the fiscal reality is that fossil fuel developers typically pay lower fees for public lands than do wind and solar developers.[98] This national trend is reinforced by Oklahoma statutes that prioritize public land leases for coal, oil, and gas extraction (64 OK Stat § 1049, 1055, 1064, 1066, 1081, 1083). For a state that supports clean energy on the basis of economic development, Oklahoma's policy landscape does not make a compelling case for developers to make the switch to renewables. For as long as the mineral owner's rights are made more valuable by law (52 OK Stat § 803), energy developers may hesitate to step away from oil and gas and invest in the clean energy transition. If renewable energy infrastructure was given equal or greater legal standing, the policy landscape may open more opportunities for deployment.

The Department of Energy (DOE) Office of Indian Energy has facilitated successful wind energy projects with Oklahoma tribes. Projects conducted in 2010 assessed the feasibility and viability of installing renewable energy systems on tribal lands.[99] The study's findings highlight how intergovernmental relations between state and tribal governments add nuance to renewable energy policymaking. Tribal energy projects are predicated on the tribe's goals to "promot[e] confidence, tribal culture and an effective, sovereign government."[100] Advances in renewable energy can be advances in energy democracy; a decentralized grid can help tribes regain independence over their energy needs.[101] Even so, some tribes have raised concerns that renewable energy infrastructure directly interferes with traditional ceremonies, burial grounds, and hunting activities due to spatial and visual disruptions to the landscape.[102]

Incentive programs will have to address these fundamental disputes in order to advance successful projects going forward. Since the initial DOE studies, the Cherokee Nation has become a leader in renewable energy development. In 2013, it joined forces with four other tribes to develop what was at the time the largest wind farm on tribal land. The Chilocco Wind Farm is currently in construction with half of its footprint on lands owned by the Cherokee Nation and the other half on lands owned by the Kaw Nation, Otoe-Missouria Tribe, Pawnee Nation, and Ponca Nation. This partnership marked a turning point in the history of tribal energy; conventionally, tribes have been the sole private owners of their projects, so convening this partnership was no simple feat.[103] In a 10-6 vote, the tribal council granted a limited waiver of sovereign immunity to obtain debt financing and equity investments to fund the wind resource infrastructure project.[104] The dissenting council members claimed that this concession is fundamentally opposed to the tribe's principles of self-governance and would destroy Cherokee trust property. Other council members who hesitated initially were persuaded by the potential of clean energy to be the lesser of two evils for their landscape when standing next to fossil fuels.

These narrow margins of success identify a leverage point for policy more supportive of renewable energy development on tribal lands. Any attempts to expand siting possibilities into public lands must be enacted with cultural sensitivity, or risk polluting clean energy futures with intergovernmental disputes. As seen in other states, it is difficult to strike a balance between accelerating the clean energy transition while maintaining democratic decision-making.[105] The dislocation of the decision-making process from host communities and their local representatives

has the potential to burn bridges between system stakeholders, importantly at a time when building bridges could take progress farther than ever before. Existing tensions over competing theories of tribal sovereign immunity could become the substrate on which development disputes are negotiated. For example, if energy policymakers back "quasi-sovereignty" arguments to disempower opposition and streamline siting on tribal lands, the clean energy transition will reinvoke the exploitative narratives of colonialism, moving backward rather than forward on energy democracy. There may not be a simple solution to the structural disruption, but amendments to federal loan requirements and investment programs could protect sovereign immunity while bolstering tribal confidence in and contribution to more equitable energy futures.

Infrastructure Investment

Oklahoma has made significant investments in transmission lines, specifically in the form of expanding transmission between counties and states. To accommodate the increase in wind farms, the state needed new transmission lines to transport the energy to users. In 2010, the Oklahoma Legislature tasked the OCC to develop a plan with SPP that would expand transmission capacity, improve reliability, and promote wind energy development. Since 2010, SPP has approved approximately $10 billion in transmission upgrades; of this amount, $2.3 billion was distributed to projects in Oklahoma. This included over 386 miles of new regional and interstate transmission.[106] In February 2023, the Public Service Company (PSC) announced two projects to improve 160 miles of transmission lines over the next three years, which will impact eight counties within the state.[107] President Biden's 2023 infrastructure law also includes $85.3 million allocated to Oklahoma for clean energy, energy efficiency, and power.[108] About half of the funds will go towards weatherization and over a quarter will go towards preventing outages and making the grid more resilient.

In addition to government funding, private entities are also building transmission lines in the state. In 2016, Clean Line Energy Partners provided $2.5 billion in funding to build 720 miles of transmission lines from a wind farm in the Oklahoma panhandle to Memphis, Tennessee.[109] NextEra Energy Resources took over the project in 2018 and, as of 2023, the project is ongoing.[110] This project is significant because the panhandle has ideal conditions for wind farms but is in a remote location far from preexisting transmission lines.

The lack of recent policy changes relevant to grid and transmission expansions has not stopped Oklahoma from investing a large amount of money in grid and transmission infrastructure.[111] Recent studies foreshadow exciting changes on the horizon. As described in an earlier section, renewable energy projects sit at the mercy of backlogged interconnection queues. Across the country, some projects have been waiting years to be evaluated and given the green light for construction. Policymakers have been thinking creatively about how to streamline the evaluation process and break through holdups. One proposed solution is the Joint Targeted Interconnection Queue (JTIQ), a collaboration between Midcontinent Independent System Operator (MISO) and SPP to relieve project bottlenecks. Projects at the 'seams' of two regions face additional obstacles to development due to the need to determine cross-region impacts,

including double study costs, unclear timelines, and cost uncertainties.[112] In an attempt to provide developers more certainty, MISO and SPP conducted an initial study to explore options for more cost-effective interconnection through greater economies of scale, replacing the bifurcated process with one JTIQ.[113] Two projects have already been approved through this pathway, promising benefits to both regions. In addition to increasing cost and time certainty, the JTIQ portfolio would also increase interregional transfer capacity for both regions, a significant benefit in the face of increasingly frequent and damaging weather events. Following the promising findings of the pilot study, the two RTOs are finalizing their proposal for formal tariff changes to the Federal Energy Regulatory Commission. This collaboration could be transformative for Oklahoma's grid, bringing more clean energy online faster and potentially shrinking the gap between solar and wind.

Net Metering

Some Oklahomans have shown interest in making energy investments at home in the form of small solar and wind. In 1988, the OCC implemented terms and conditions governing the supply and delivery of electric power by small power producers, defined as those with a generating capacity of 100 kW or less. These regulations established the feasibility of net energy metering (NEM) for all customer classifications without capacity limitations and prohibited utilities from mandating that customers acquire new liability insurance to connect to the grid. In April 2014, Oklahoma's governor signed SB 1456, which granted utilities and regulated cooperatives the authority to add a fixed charge to customers who enrolled in net-metered distributed generation after November 1, 2014.[114] In a rare move, Governor Fallin issued an executive order together with her bill signature that underscored the significance of renewable energy in the state. Liberal and democratic stakeholders heavily criticized this bill, referring to it colloquially as the 'Sun Tax.' While SB 1456 at first seemed to discourage private investment in renewables, research shows that states encouraging NEM could achieve a net benefit for all electric customers.[115]

In response to criticism, the OCC enacted revised net metering rules in 2019, raising the system size limit to 300 kW, removing the 25,000-kWh annual generation cap, and making it compulsory for utilities to compensate excess generation at a rate matching the avoided cost. Under the provisions of SB 1456, utilities could request the OCC's permission to institute a fixed charge for customer-generators who installed net-metered distributed generation systems after November 1, 2014.[116] Together the bill and executive order encouraged the OCC to consider alternative pricing approaches, such as time-of-use rates, minimum bills, and demand charges, before authorizing fixed charges for net-metered systems. Despite enacting detailed net metering regulations, the OCC has adopted no standardized interconnection procedures.[117]

By exploring alternative pricing approaches to replace fixed charges, the OCC demonstrated an understanding of the need for innovative strategies in a rapidly evolving energy landscape. This approach suggests a willingness to experiment with different economic models to ensure fairness and sustainability in the renewable energy sector.

Conclusions

Oklahoma's journey through renewable energy policy tells a dynamic story of economic development and consumer preferences. While the state initially provided generous tax incentives to stimulate renewable energy development, these incentives eventually ran into budgetary constraints and were curtailed. The 2010 RPS surpassed its targets, with renewables accounting for a significant portion of the state's electricity generation. The 2021 Energy and Environment Plan details the baseline, progress, and aspirations for future energy development, without prioritizing one generation source over another. As wind development progresses, solar energy continues to face hurdles due to limited incentives, construction costs, and a backlogged interconnection queue. This contrast underscores the intricacies of policy frameworks, prompting questions about coherence in steering the state toward a sustainable energy future. Oklahoma finds itself at a crossroads, with abundant wind and solar resources up against divergent forces either propelling or impeding the realization of its renewable energy potential.

Siting authority is a pivotal factor shaping the development of utility-scale wind farms. Oklahoma, known for its robust wind energy sector, employs a split system between local and state entities to govern the siting of wind projects. The patchwork of local siting ordinances complicates the path to deployment, with only a few cities having established setback distances, noise restrictions, and turbine height limits. Even so, the absence of explicit local-level siting guidance in rural areas seems to give developers of utility-scale wind some flexibility. This opportunity is reinforced by substantial investments in grid and transmission infrastructure. Ongoing transmission projects, such as the lines from the panhandle to Memphis, underscore the state's resolve to overcome geographical challenges for wind farm development. However, the absence of standardized interconnection procedures raises concerns about the consistency and efficiency of renewables development projects. The state's commitment to enhancing transmission capacity, as outlined in the SPP Integrated Transmission Planning report, is commendable, and its innovation with projects like the JTIQ shows promise for an even more diverse energy portfolio in the future. Still, questions linger about how these plans will be executed and the potential challenges associated with such ambitious transmission projects.

The OCC plays a central role in regulating public utilities, and its adaptability is evident in response to criticism of net metering policies. Despite initial challenges, ongoing revisions keep pace with the evolving energy landscape. By raising system size limits and removing generation caps, the OCC signaled a commitment to fostering a supportive framework for a variety of renewable energy solutions. However, challenges arise from the levels of regulatory oversight, with municipal and cooperative utilities operating outside OCC jurisdiction. These regulatory silos may cause disparities in development standards and hinder a cohesive energy transition.

To build on the valuable lessons learned in the last two decades, the state must continue to exercise self-awareness in the way it crafts its policy landscape and responds to community narratives, culture, politics, and development objectives. As a state without explicit climate policy enforcing rapid renewables deployment, Oklahoma has shown that there are recipes for success beyond decarbonization agendas. The state emphasizes the importance of consumer

preferences and market forces, separating itself from the ‘like it or not’ approach that exchanges community buy-in for efficient deployment. Oklahoma makes its lands available to both fossil fuels and renewable energy sources and makes no promises to one over the other. While this delicate balance of decarbonization progress and historical loyalties has succeeded up to this point, it is scientifically certain that the effects of climate change will worsen without significant and widespread commitments to clean energy. To make its policy landscape more hospitable to the clean energy transition, the state may do well to shape market forces to be more supportive of a cleaner, more resilient grid, perhaps with the institution of climate legislation and goals. The case of solar development provides an example of fizzling market forces. Up until recently, residential solar power for electricity generation has seen insignificant growth, primarily stalled by a lack of incentives and high upfront costs. Similarly, utility-scale solar has taken the backseat when compared to utility-scale wind. This is mostly traceable to development economics, where the prospect of solar expansion is dulled by the absence of credits and incentives, whereas wind has seen its heyday of state incentives. To facilitate widespread solar deployment, incentives that level the playing field, policy that streamlines interconnection, and/or environmental mandates that lift all forms of renewable energy may do the trick.

As shown by the Cherokee Nation’s example, the allure of a cleaner grid can tip the balance with potential host communities. Such a shift in the state’s value proposition would likely destabilize the ‘friendly fields’ approach in some areas, due to the tendency of climate agendas to trigger the pressure points of polarization, while making progress in others, due to the urgency of action. Whatever the state decides its next steps to be, Oklahoma must carefully consider both the resource viability and politics of its lands.

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