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Renewable Energy in the Cowboy State

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Introduction

The cowboy state of Wyoming more than lives up to its reputation as a rugged, big, beautiful place. Between Yosemite in the West and vast prairies in the East, stupendous mineral deposits and an undeniable presence of grit as well as independence, Wyoming is truly a unique state where no one size fits all. Wyoming's relationship with renewable energy is complicated, with renewables seen as both a threat to the coal industry upon which Wyoming is heavily reliant, but also as a potential source of future economic growth. As the economic currents change, pushing the state away from coal, Wyoming is beginning to grapple with what its future will look like in a world where the neighboring states are turning to it to fulfill their RPS requirements. The lack of explicit policies and a reluctance to provide incentives for renewables created a challenging environment for wind and solar development. Nevertheless, a number of projects are underway posing a question of how much longer Wyoming can afford to be send mixed signals towards renewables.

Background

Demographic Landscape

Although 10th largest state by area, Wyoming is the least populous and the second most sparsely populated state in the country. Its population has remained relatively steady over the past decade. From 2013-2017, 92.8% of residents older than 25 held a high school diploma and 26.7% held a bachelor's degree or higher.[1] The majority of residents (70% in 2017) reside in rural areas, where the population is less than 2,500 per community.[9] Nearly 61% of residents are between 18 and 65[2], and 87% are Caucasian, which is 14% higher than the US as a whole.[3]

Economic Landscape

The top two economic drivers in the state are mineral extraction and tourism, with the former making up the bulk of the economy.[4] Wyoming is an incredibly resource-rich state. The mineral extraction industry includes mining of energy minerals (coal, oil, uranium, natural gas), industrial minerals (aggregate, trona), metals (copper, gold), and gemstones (diamonds, jade). The state leads the nation in coal production and is the eighth largest producer of oil and natural gas.[5] Although these resources are scattered throughout the state, most of the deposits of coal, oil and gas are in the northeast. This region is known as the Powder River Basin and is home to seven of the ten largest US coal mines. Consequently, it is considered to be the economic engine of the state. The tourist industry is mostly concentrated in the northwestern part of the state, with Yellowstone and Grand Teton National Park being the top two tourist attractions. In 2017, 8.7 million tourists visited Wyoming, spending a total of $3.5 billion and generating $188 million in local and state tax revenues.[6]

In recent decades, Wyoming has had to grapple with and respond to rapid changes in attitudes and policies targeting energy production across the nation. As coal power plants become more expensive to operate and states shift towards gas and other alternative resources for their energy needs, the economic environment for Wyoming as the coal producing state is turning increasingly challenging. The most immediate response to this market volatility is reflected in the sizeable decline of the mineral extraction industry. Since 2007, the industry as a percentage of gross domestic product (GDP) has been steadily decreasing, from approximately 35% in 2007 to a little over 20% in 2016 (Fig. 1).[7]

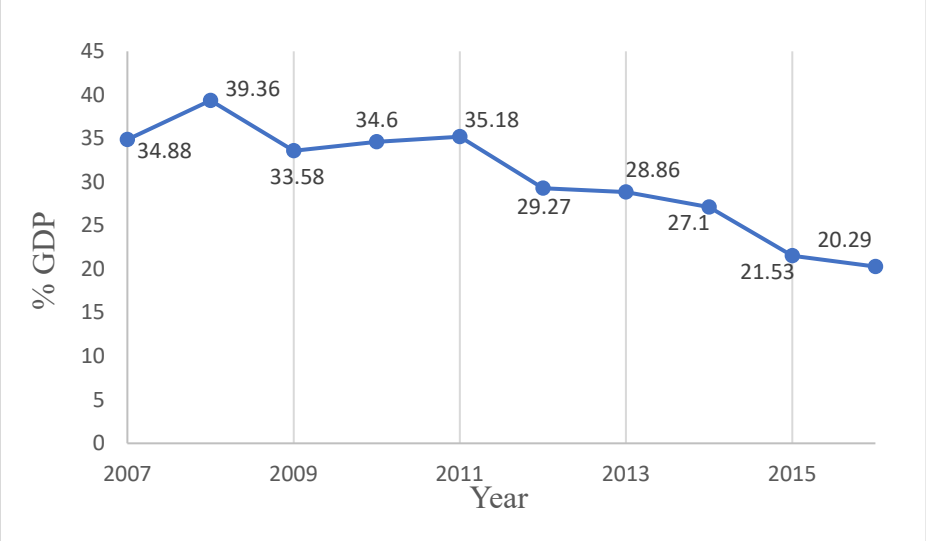

Figure 1 Extraction Industry as a percentage of total Gross Domestic Product of Wyoming from 2007 to 2016 [8]

Not surprisingly, the top economic priority for Wyoming is diversification of its economy, which is playing an increasingly prominent role in its outlook on renewable energy and will continue doing so in the future.

Political Landscape

Wyoming has been politically conservative since the 1950s. A Republican candidate has won the majority in every election except in 1964 when voters supported Democratic nominee Lyndon Johnson. In 2017, 67% of residents identified as Republican while only 18% as Democrat. Teton County has the most Democrats with 37%, followed by Albany County, home to the state's only university (University of Wyoming). Six out of eight counties in the Powder River Basin overwhelmingly identify as Republican (over 80%)[9].

In January 2019, Mark Gordon was sworn in as the 33rd Governor of Wyoming, following Matt Mead (2012–2018). Both are members of the Republican Party. In his first State of the State Address, the current governor emphasized that "energy must continue to be one of the pillars of our economy," remarking that "…coal will remain an essential part of America's energy portfolio for decades to come." His only mention of renewable energy comes as goals to "enhance the State Energy Office, which helps speed up permitting for oil and gas drilling and siting renewable energy".[10]

Energy Overview

Despite being the least populated state in the country, Wyoming ranks at the top of the list for per capita electricity consumption.[11] The biggest driver for this trend is the energy intensive industry, which makes up the core of Wyoming's economy. In 2016, 56% of the total end-user consumption was in the industrial sector, followed by 22.7% in the transportation sector, 12.1% commercial and only 9.2% residential.[12] Still, the state produces 15 times more energy than it consumes, which makes it the largest net energy exporter nationwide.[13] Based on a 2017 Energy Information Administration (EIA) report, the state's net electricity generation was 46,741,846 MWh.[14] The total in-state consumption was 16,778,067 MWh.[18]

Electricity Mix

Wyoming's electric grid mix is dominated by coal, with 85% of the state's net electricity generation produced by coal-fired power plants (Fig. 2).[15] The state has a total of seven operational coal-powered power plants, although many of them have multiple online units in different locations.[16] Since the early 2000s electrical generation from coal has declined slightly from 42,000 MWh in 2001 to roughly 38,000 MWh in 2017, or approximately 8%. The state has been slowly adding renewable power sources, especially wind, to its electricity mix. Approximately 10% of the electricity comes from wind, followed by 2% from conventional hydro dams. Hydropower is supplied by 21 existing dams, many of which were built more than a decade ago and are owned by the federal government.[17] No new hydro dam projects are expected to be built in the near future. The remaining 5% comes from natural gas-fired and petroleum-fueled generating units.[18]

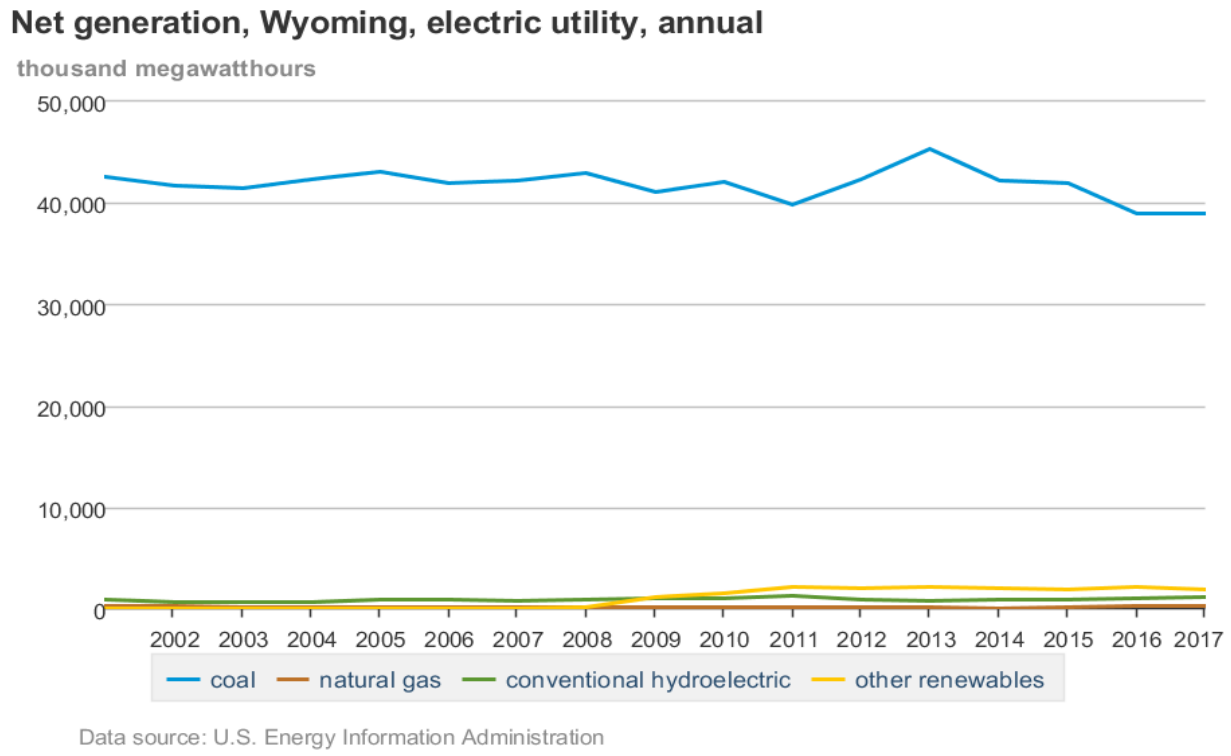

Figure 2 - Net generation for coal, natural gas, conventional hydroelectric, and other renewables in Wyoming from 2002 to 2017

Wind

Wind generation has grown substantially in the last twenty years (Fig. 3). As of 2017, Wyoming's installed wind-powered electricity generating capacity was at 1,489 MW,[19,20] ranking 16th in the nation.[21] According to the American Wind Energy Association (AWEA), Wyoming has 22 online wind projects, with 1,005 turbines total, most of which are located in the windiest part of the state – the northeast.[22] Electric utilities are outpaced by independent power producers (IPPs), which in Wyoming are made up of electric cooperatives, in terms of both historic and current net generation as well as installed capacity. There is a sharp increase in wind power generation for both IPPs and utilities in 2008, although this growth peaked in 2011 and fluctuated over the next decade.

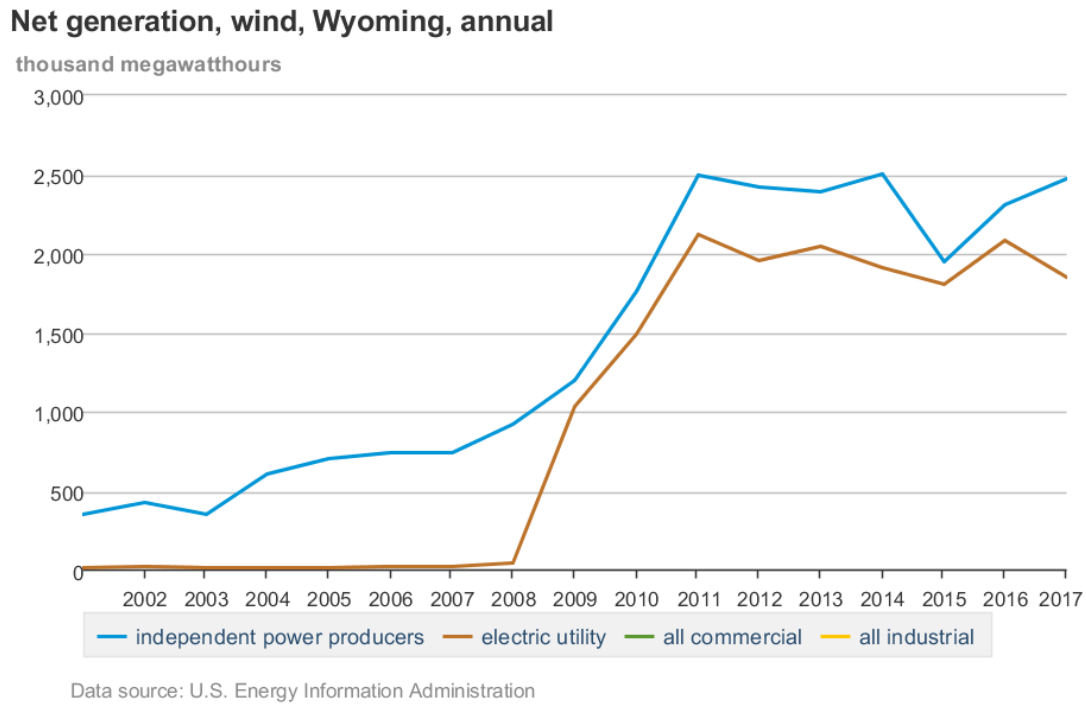

Figure 3 - Net generation of wind in Wyoming from 2002 to 2017

Solar

About 0.01% of Wyoming's electricity comes from solar. Historically, most of the installed solar has been in the distributed generation sector[23], although the first ever utility scale project, Sweetwater, was built in 2018 (see Fig. 4). It covers 700 acres of rangeland in the Green River region close to the border with Nevada. According to the Solar Energy Industries Association (SEIA)[24], as of Q3 2018 a total of 2.61 MW of distributed generation was installed, which is used to power about 381 residential homes and approximately 177 non-residential establishments. Total residential installations tripled in 2018 compared to the previous year and are projected to keep growing based on SEIA's estimates. This growth is largely attributed to utility scale solar.

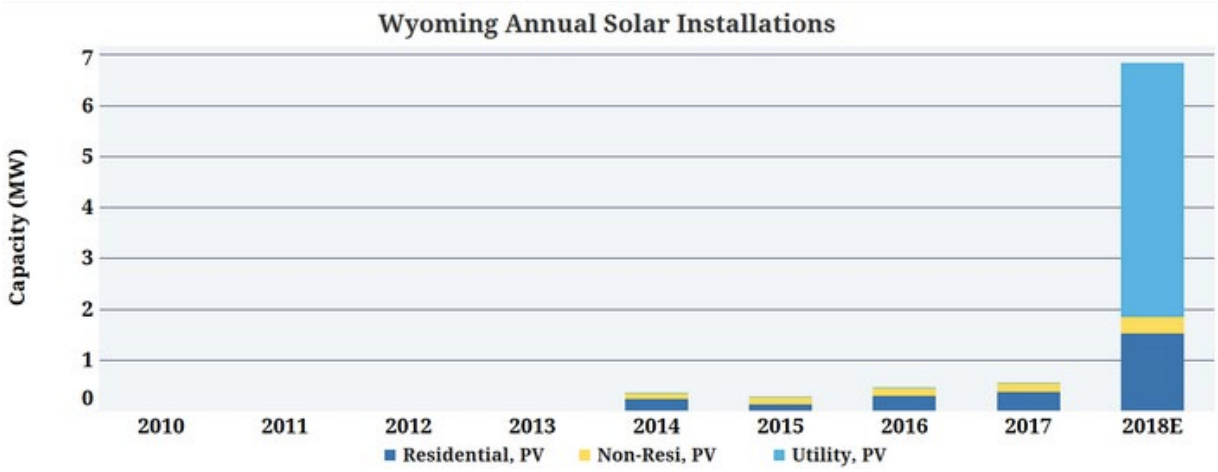

Figure 4 - Annual solar installations in Wyoming from 2010 to 2018

Key players in the electricity market

There are three major electric utility providers in Wyoming: Rocky Mountain Power, Cheyenne Light, Fuel and Power and rural Wyoming Cooperatives. Rocky Mountain Power is a subsidiary of PacifiCorp, an Investor Owned Utility (IOU) that serves five Western states and has the biggest presence in the region serving 140,000 customers throughout the state. Cheyenne Light, Fuel and Power, also an IOU, serves 41,000 electric customers and 40,000 natural gas customers in the greater Cheyenne, Wyoming area.[25] Wyoming Public Service Commission (PSC) is the regulatory agency that has jurisdiction over all of the IOUs as well as some jurisdiction over rural cooperatives. According to PSC, there are some 18 cooperatives in the state. Wyoming has a traditionally regulated electricity market.[26] The PSC does not regulate municipal utilities or interstate utilities.[27] There are eleven municipal utility providers, eight of which receive power from the Wyoming Municipal Power Agency.[28]

In spite of the colossal industrial and commercial activities in the state, Wyoming generates enough electricity to export close to 60% of its generated electricity to other states, with Texas being the biggest customer.[29] [30] Often, transmission lines carrying this electricity operate at maximum capacity, imposing significant constraints on exports.[31] There are no energy imports.

Power Plant Closures

A number of old powerplants are being retired across the state marking a shifting trend away from coal. Wyoming's largest utility Rocky Mountain Power (RMP) documented its commitment to reducing reliance on coal-fired power plants in its latest Integrated Resource Plan.[32] It has already started delivering on this plan. On January 31, 2019, it shut down a 384 MW unit near Kemmerer coal mine that is part of the Naughton Power Plant, which it plans to convert to a gas-fired unit.[33] It stated high costs to upgrade Unit 3 to meet emission limits while burning coal as the primary reason for the shut-down.[34] The utility also plans on retiring the other two coal-fired units with 500 MW nameplate capacity by 2029, at the end of their depreciable life. Two other coal-powered power plants were retired: the 36 MW Osage Plant in 2010 and the 22 MW Neil Simpson plant in 2014.[35]

Renewable Energy Projects

In the next five years, Wyoming is planning on adding 6.25 GW in wind projects. Most of this development is concentrated in counties near the southern border where the state's wind resources are most abundant. Most of the wind projects are built to export power to neighboring states. 143MW of solar is also in the pipeline. For a full list of pending projects and corresponding descriptions see Appendix C.

Infrastructure Investment

Wyoming is making some investments in expanding its transmission capacity and is in the process of constructing five new transmission lines. Most of these are being built specifically for exporting wind power to states like California, Utah and Nevada (for a full list of transmission projects, please see Appendix B). The primary financing mechanism for these investments is state-issued bonds: state legislation provided the Wyoming Infrastructure Authority (WIA) with bonding authority of $1 billion to promote transmission development throughout the state.[36] In general, however, the existing transmission infrastructure is inadequate for supporting rapid development of utility-scale solar and wind. Although a big network of powerful transmission lines is present near wind and solar resource-rich parts of the state as well as the Powder River Basin, most of it is utilized by the existing extraction and minerals industries. Based on our interview with Rob Godby, this lack of transmission lines is one of the major culprits for a sharp decline in wind development

that occurred in 2010. And because all current infrastructure investments are aimed at supporting approved renewable energy projects, the overall capacity after these projects come online is not forecasted to grow by much unless the state decides to continue building.

Renewable energy potential

Wyoming's high prairies coupled with tall ridges create some of the richest wind resources in the country. According to National Renewable Energy Lab (NREL), the state has a total wind power potential capacity of 552,072 MW and estimated annual generation of 1,944,340 GWh for land-based turbines at 80-meter hub height and 30% capacity factor.[37] With annual average wind speeds of 8.5 m/s or higher, the southeastern part of the state has the highest concentration of these resources (Fig. 1, Appendix A). This region includes Platte, Converse, Goshen, Laramie (highest), Natrona, Carbon and Fremont counties. With only 1,489 MW installed wind capacity and slightly below 5,000 MW in development, wind is a hugely underutilized resource. Given Wyoming's 2017 annual load of 46 GWh, utilizing a mere 0.00236% of the wind resources would generate enough power to meet such demand.

Wyoming also has sizable solar resources that have not been tapped, particularly in the central and southwest regions of the state (Fig. 2, Appendix A). Based on NREL's analysis, the total solar resources in Wyoming average from 3.7 to 6.2 kWh/m^2/day, which yield a total capacity of 6,879 MW and estimated annual generation of 13,209 GWh.[38] With under 3 MW of installed and in-development solar fleet, Wyoming is utilizing less than 0.0436% of this resource. Again, given the 2017 electrical load, the state could easily meet the demand with solar alone.

Given Wyoming's small and mostly rural developments there are no major urban areas in the southeast and central parts of the state where the wind and solar power potential is the highest. This poses some challenges for renewable energy development as large urban areas often drive the demand for renewables. On the other hand, this lack of densely populated metropolitan areas allows for larger projects to be built. Moreover, with few forests or wetlands, the natural topography is conducive to building wind turbines with 80-meter hubs as well as utility-scale solar. Most of Goshen, Laramie, Albany and Platte counties are composed of privately-owned lands with small pockets of local government lands, state wildlife agency lands and state parks. Fremont, Sublette and Sweetwater counties have a lot of publicly owned lands managed by BLM. There are also some tribal lands, namely the Wind River Indian Reservation in the Fremont county. In terms of transportation, there are two major roads connecting the region - Interstate 80 going east and Interstate 25 going north, as well as a system of railroad tracks.[39] There is sizable industry activity in the area, including natural gas processing plants and power plants (coal, wind, gas and hydro) as well as mineral mining and processing operations.[40] Given the existing infrastructure in terms of access, the region is well suited for renewable energy projects, although additional investments in transmission lines will be necessary to support any substantial development.

Renewable Energy and Local Narratives

Despite substantial growth in the state's wind energy sector in the past two decades, wind development is a divisive issue. In light of the state's overwhelming economic dependence on traditional energy resources, many communities depend on the mining and extraction industry for their livelihoods. It is then not surprising that as wind becomes cost-competitive with fossil fuels it is increasingly seen by many as a direct threat to state's economy and many of its residents' wellbeing. Nothing reflects this attitude more than the state governments' actions. Over the years, a number of state legislators proposed policies to render wind less attractive to investors and to protect existing mining and extraction businesses. The most notable of these laws is the wind generation tax. Lawmakers have argued that every other energy resource in Wyoming is taxed and wind should be

no different.[41] In a survey of 694 residents 40% support and 34% oppose the tax hike.[42] Although small and not entirely representative of all Wyomingites, this survey does demonstrate just how polarizing wind energy is.

On the other hand, the growing awareness of the negative externalities generated by conventional energy sources as well as the economic incentives to lease land for wind and solar projects encourage the development of renewable energy. In Rawlins, near Chokecherry and Sierra Madre wind projects, residents attended a wind energy training in an effort to educate themselves about wind as well as to demonstrate their communities' support of the industry.[43] Across the state, farmers and ranchers have benefitted from supplemental income from leasing their property to wind developers.[44] And in cities, efforts are underway to encourage more renewable energy through community solar projects and "green" tariff programs[45]. Although no municipal goals have been set and only 3% of Rocky Mountain Power customers participate in their "green" programs, these efforts highlight positive attitudes towards wind.[46]

Not all local narratives are rooted in economic arguments, however. Many state residents have expressed concerns over the detrimental impact of wind development on the landscape.[47] Wyomingites pride themselves on having wide open spaces and turbines drastically interfere with these natural features. Considering that most of the wind energy generated in-state is exported to neighboring states, this sentiment is particularly strong amongst state residents who are stuck paying the price for something they do not reap much benefit from.[48] So much so, that a voter group called *Wind Wyoming's Way* out of Cheyenne has announced a ballot initiative for 2020 to increase taxes on wind energy production to specifically pay for the impact on the landscape.[49] Beyond the effects on landscape, there are also concerns that turbines negatively affect wildlife. Since hunting is a very popular pastime in the state, there has been a lot of backlash against wind farms, leading to environmental studies and more arduous siting process for wind projects.[50, 51]

Literature review

There has been comparatively little academic research done on how policy is impacting renewable energy development in Wyoming. Benegal, et al. analyzed the role of economic costs and benefits framework in shaping public perception of renewable energy in Wyoming and addressed the implications of their findings for public policy.[52] There has also been some research done by Godby, et al. analyzing the impact of the Clean Power Plan on Wyoming's economy and labor market.[53] Although this research doesn't address renewable energy policy per se, it does provide an important assessment of the related greenhouse gas reduction policies and the role assumptions play in simulations used to evaluate such policy outcomes. Pocewicz, et al. assessed preferences of Wyoming residents for siting of energy and residential development.[54] Similarly, Peterson, et al. conducted a field study to assess citizen preferences for renewable energy outcomes, and Wyoming was included in the study.[55] The Center for Energy Economics and Public Policy at the University of Wyoming has published a number of papers on energy policy and is involved with a number of research projects in the field.[56] NREL has conducted a study of economic potential for Wyoming wind transmission to California.[57]

Renewable Energy Policies

The state of Wyoming does not have any explicit climate policy in the form of a Renewable Portfolio Standard (RPS) or Energy Efficiency Resource Standard, nor has the state set any goals promoting the development of renewable energy technology.[58] This absence of goals and an overwhelming opposition to renewables from state legislators has had profound implications for all

other policies in the energy landscape, and largely left the development of renewables up to individual industries, utilities, and state/federal agencies.

Public Lands Policies

Public lands, which occupy more than half of Wyoming, can potentially play a major role in supporting the development of renewable energy[59]. Only 44% of land in Wyoming is privately owned, with the state and federal government owning the remaining 56%. Most of the public lands are managed by BLM, whose 18.4 million acres make up the largest contiguous area of accessible public land in central and western Wyoming.[60] Importantly, this land overlaps with the state's wind and solar resources, making it prime for siting renewable energy projects. The eastern third of the state is dominated by private lands; however, smaller tracts of accessible state and federal public lands are also found there, opening up possibilities for smaller wind and solar projects[61].
Energy generation on public lands in not a novel concept. The federal government often leases federally managed land to private individuals and companies for energy development, including crude oil and natural gas drilling, solar energy development, and geothermal energy development[62].

Siting solar on public lands might especially be advantageous given current public land policies. Solar energy development projects on BLM-managed public lands are authorized as rights-of-way (ROWs) under Title V of the Federal Land Policy and Management Act (FLPMA) so long as it is follows the BLM's land-use plan[63]. All solar project proposals to BLM must comply with the National Environmental Policy Act (NEPA)[64], but overall it is relatively straightforward to site a solar project on BLM lands. BLM has also developed The Western Solar Plan which specifically guides development of utility-scale solar energy development on public lands. This plan established 19 Solar Energy Zones (SEZ) with access to transmission corridors and areas with high solar potential in order to prioritize solar energy and associated transmission infrastructure development. Although Wyoming is currently not designated as SEZ, BLM does have a well-documented process and criteria for designating an area as SEZ, which leaves open an opportunity for the state to officially designate areas with highest solar resources as SEZs[65].

Another BLM policy favorable to renewable energy development is the Solar and Wind Energy Rule, went into effect in January 2017[66]. The rule "brings down the near-term rates and fees paid by solar developers on BLM-managed land, ensures transparency and predictability, and allows for competitive bidding processes."[67] This policy directs the agency to work with energy developers and local citizens to identify priority areas for wind and solar development *in advance* of individual project proposals, as a way to help minimize conflict. Both of these policies work to encourage renewable energy development on BLM lands.

In October 2010, BLM approved its first project to generate solar energy on public lands, and as of March 2018 it had approved 25 solar projects, totaling 6,319 MW of installed capacity, across eleven states. In June of 2018, the BLM Rock Springs Field Office officially approved a first ever solar project to be sited on BLM-managed land in Wyoming - the 80-MW Sweetwater Solar Energy Facility, marking an important milestone for utility-scale solar on Wyoming public lands. With approximately 166 million acres of federal land in the state available to be leased for energy development, there is indeed a big opportunity for these types of renewable energy projects in the future[68].

Checkerboarding

One major obstacle to siting renewables on public lands is the presence of checkerboarding. Checkerboarding refers to land ownership pattern where federal and private lands are intermingled, making access to public lands difficult or even impossible[69]. Checkerboarding is a result of the

federal government incentives given for the establishment of the railroad in the 20th century, where alternating sections on both sides of the tracks would be given to the railroad and the remaining areas remained as federal property. Because of this, most areas affected by checkerboarding are in the southeast part of the state where the railroad system is present. It is also where a lot of Wyoming's wind and solar resources are in abundance.

When public land is completely surrounded by private land, access to this land depends entirely on whether there is a public road present. If there is a public road or a right-of-way (easement) for public access through the checkerboard or intermingled land, then the public has legal access to the public land crossed by the public road[70]. Otherwise, it is illegal to cross private property to access public land without owner's permission, which means that often public lands are landlocked and consequently inaccessible. Sometimes, a checkerboard of land ownership results in public and private parcels meeting corner to corner as opposed to landlocked. However, Wyoming's trespass law prevents 'corner-crossing' from one piece of public land to another.

Over 3.05 million acres of public land in Wyoming is landlocked preventing the public from using it in any way. [71] A number of hunting organizations have filed complaints with the state pertaining the lack of access to wildlife of landlocked public lands as well as arising disputes between its members and private property owners over this access.[72] Energy developers could potentially face similar problems when siting renewables on landlocked public lands. Without public access, energy developers would need to negotiate with private property owners, adding cost and time to projects sited on these lands. To add to the complexity of such arrangement, Wyoming, like many states in the West, does not have a state-level office or program that oversees land-use planning[73], leaving all land-use management to local authorities. Without central management, there is often a lack of information and easily obtainable public records on which lands are privately owned and which ones are not. Energy developers would have to spend considerable amount of time and resources to gather the necessary information on land ownership.

Renewable Energy in National Parks

It is worth mentioning that Wyoming national parks and forests are increasingly embracing renewable energy, although all of the efforts are aimed at offsetting on-site energy needs and will not contribute to the state's electricity mix. For instance, Yellowstone National Park recently approved a plan to improve energy efficiency and renewable energy production systems at Yellowstone's Buffalo Ranch, bringing it closer to being zero-emissions facility[74]. The park also has several other small renewable energy systems in operation[75].

Tax Policies

Energy taxes provide more than half of Wyoming's revenues, with approximately 80% of the state's operating budget coming from the extraction industry taxes.[76] All industrial operations in the state are subject to ad valorem property taxes, where the taxable value is set at 11.5% of the market value.[77] Mineral industries contribute anywhere from 50% to 65% of all property taxes.[78] At this time Wyoming does not offer property tax exemptions for wind developers.[79] Property taxes are collected by counties with revenues used to fund schools, health departments, hospitals, local airports and highway infrastructure. [80]

Since 2012 Wyoming has been levying a $1.00/MWh excise tax on electricity produced from wind resources for trade and sale. Wind power produced for personal consumption and for federal, state, county or municipality use is excluded from this tax. [81] The tax kicks in three years after the generator is placed in service.[82] Of the generated revenue, 60% is distributed to counties where the

generator is located, and 40% goes to the state general fund.[83] Although a sharp decline in wind development starting in 2010 coincided with the production tax introduction, the tax alone did not singlehandedly stall the industry. Based on an interview with Robert Godby, lack of transmission to support further wind development was the biggest playing factor.

Sales and use taxes are the second largest revenue source for the state,[84] with 69% of the statewide sales tax going to the general fund and 31% to local governments.[85] Previously, there was a sales tax exemption enacted by HB0215 for renewable energy generation capital expenditures. However, it expired in 2012 for generators greater than 25 kW.[86] Perhaps not surprisingly, it was never renewed. With revenues from mineral and extraction industries declining over the past decade, many legislators contended that "counties needed revenue to pay for roads and other infrastructure during construction of wind farms".[87] On the other hand, such exemption does exist for sales and purchases of equipment used to construct new coal gasification or coal liquefaction facility, calling into question the reasons given for not renewing it for wind.[88] Given that renewable energy projects are capital intensive, sales tax exemptions offer substantial incentives for developers. Although not likely the sole cause of the decline of wind development in the state, its elimination adds to the hostile to wind development environment.

In recent years, declining oil and gas prices have generated a lot of debate at the state legislature regarding its tax code. The Joint Revenue Committee has been looking into ways to update the state's tax structure and diversify its revenue streams, leading to a number of proposals to modify taxation of renewable energy.[89] In the 2019 legislative session alone, bills were introduced proposing that the wind production tax rate be modified from $1.00/MWh to $5.00/MWh (*HB239*)[90] or that it be repealed (*HB241*).[91] *HB260* proposed an escalating five-year tax schedule with no taxes levied on production during the first year, $0.50/MWh tax on production in the second year, a $1.00/MWh of production in the third year, $3.00/MWh of production in the fourth and $5.00/MWh production for all subsequent years of generation.[92] All three failed due to the opposition citing fears that higher wind taxes would depress wind industry investment in Wyoming.[93]

A 2016 economic analysis of proposals to increase generation taxes on wind supports this thesis.[94] It points out that most of the additional revenue generated from increased wind tax would need to come from new projects, as existing facilities are estimated to only account for 18% of such revenues.[95] With increased taxes, not only is there a chance of deterring new development but there is also a chance that old facilities might choose not to rebuild upon completion of useful life, taking their business to states with more favorable tax incentives. This negative effect would likely be further compounded by the absence of explicit climate policies that could encourage investment in renewables despite lower developer profit margins. Tax increase proposals have also drawn sharp criticisms from wind developers. The CEO of Power Company of Wyoming, which owns the largest proposed project Chokecherry/Sierra Madre, recently stated that with these proposals the state was at risk of "taxing this project out of existence"[8]. Under the $5/MWh proposal, the company's tax burden would increase from $800 million to about $1.8 billion.[96] Deterrence of wind projects would also result in forgone property and sales tax revenue, hurting both the local communities and the state. It's been estimated that at current tax rates, total potential tax revenues for proposed and in-development wind projects are almost $1.9 billion assuming a 20-year life for each project.[97] The state could lose this revenue if all projects cancel and relocate to other states.

Although no wind tax increase proposals have succeeded, it's likely that in the future Wyoming will change its taxation of renewables. But even in absence of a tax increase, the nearly constant efforts of state legislators to implement higher taxes on wind, albeit unsuccessful, signal to potential developers that Wyoming is too volatile of an environment in terms of its tax policy, which might deter wind developers.[98]

In 2017, Wyoming also passed a Joint Resolution requesting Congress to enact legislation requiring revenues received by the federal government from wind and solar energy developments in the state be equally shared with the state, consistent with existing law regarding the disposition of royalties and fees received in connection with the production of certain fossil fuels and geothermal energy on federal land.[99] A number of wind projects are being developed on federal lands, including Chokecherry Sierra Madre. The change would not have any impact on the developer's tax burden. [100] Currently, renewable energy developers have to pay acreage rent and a MW capacity fee to site projects on public lands.[101,102] However, it will change how the revenues generated from renewables sited on federal lands are allocated, with a share going to the state.

Siting Policies

Wyoming relies on both state and local governments for siting wind projects.[103] Depending on the size and location, siting can involve multiple agencies, guidelines and assessments, contributing to a potentially time consuming and complicated process**.** For all projects sited on federal lands or interconnected to federal transmission, the developer must go through lengthy environmental assessments in accordance with the National Environmental Policy Act prior to obtaining a permit.[104] For projects located on U.S. Forest Service Lands, a Special Use Permit must be obtained, whereas for projects on the Bureau of Land Management (BLM) territory, the wind energy lease for a Right-of-Way (ROW) is required.[105] A federal permit is also required if a project is interconnected to a federally owned or operated transmission.

State permitting and siting rules and regulations are set by the Wyoming Industrial Siting Council (ISC)[106], a division of the Department of Environmental Quality (DEQ). Commercial wind projects consisting of 30 or more wind turbines must go through a permitting process with ISC. The agency determines social, economic and environmental impacts of the project and has the authority to mandate the developer to make impact assistance payments to counties where the project is cited.[107] To date, it seems that only one such series of payments has been authorized—namely, for the Ekola Flats Wind Energy project.[108]

All projects with nameplate capacity exceeding 0.5 MW and with fewer than 30 turbines are under the permitting jurisdiction of local counties and as such are required to obtain a permit from the board of county commissioners.[109] If a project is sited in multiple counties, the developer is required to obtain a permit from each county. Counties must adopt siting regulations that are at least as stringent as the those spelled out in W.S. 18-5-504[110], which spells out the minimum standards for wind facilities and enforce the following setbacks:

- The base of towers must be at least one hundred ten percent (110%) of the maximum height from any property line contiguous or adjacent to the facility (unless waived in writing by the owner of every property which would be located closer than the minimum distance) or any public road right-of-way.
- The base of any tower must be at least 1,000 feet from a residential dwelling or occupied structure (unless waived in writing by the person holding title to the residential dwelling or occupied structure) and ½ miles from the limits of any city or town.

Importantly, in setting these minimum requirements, the state legislators were careful to reserve the landowners' right to waive the minimum setbacks, which is in line with Wyoming's strong commitment to safeguarding individual property rights held holy by both politicians and private

citizens. These siting rules also allow counties to set more stringent requirements and effectively deter wind development.

Siting Policy Developments

Since the explosion of wind development in the early 2000s, Wyoming policymakers have implemented a handful of acts most of which placed restrictions on wind developers while seemingly creating more protections for landowners. The 2010 *Wind Energy Facilities Act*[111] established a uniform framework for siting and permitting wind projects larger than 0.5 MW at the county level. It also granted counties authority to adopt more stringent requirements than the statutory minimum. As of 2012, 16 counties out of 23 implemented their own wind permitting requirements, and only one county, Sublette, banned all wind development.[112] This act also put in place transparency measures by requiring wind developers to demonstrate reasonable efforts in notifying landowners and neighboring cities (within 20 miles) of the proposed development, as well as publishing a notice of the proposed wind facility in a newspaper of general circulation in all counties in which the facility will be located at least 20 days prior to the public hearing required by W.S. 18-5-506.

In 2010 the legislature enacted the 2010 State Eminent Domain Act[113] placing a moratorium on private wind companies condemning land for collector systems (lines that bring generation to transmission)[114]. The moratorium, however, expired in 2013. A successor moratorium was unsuccessfully proposed in both 2018 (HB0070)[115] and 2019 (HB0285)[116]. Given that other energy industries exercise eminent domain to site collector systems, it is possible that the failure to renew the moratorium was due to the wind industry's lobbying efforts.[117]

The 2011 Wind Energy Rights Act (WERA)[118] set up a framework to help landowners negotiate land use contracts with wind developers by specifying that all wind energy agreements must meet a set of statutory requirements. This empowered landowners to negotiate better development options, including granting an easement or entering into a lease to develop wind energy, while reserving a royalty interest from wind energy production.[119] In addition, WERA clarified the dominance of mineral rights over wind energy rights, thus sending a strong signal that mineral and extraction industries maintain their priority in the state economy. Furthermore, many Wyomingites took matters a step further by forming Landowner Wind Associations (LWA)[120] that pool neighboring properties into big blocks of developable land and rely on collective bargaining to secure more equitable contracts with higher lease prices, although the precise number of LWAs formed in the state is unknown.

Public Service Commission Policies

While legislators in Wyoming are reluctant to introduce and unable to pass legislation encouraging renewable energy development in the state, the Wyoming Public Service Commission (WPSC) has shown some support in recent cases pertaining to renewables. The WPSCs limited jurisdiction focuses on the availability of safe, adequate, and reliable electric service to Wyoming residents, which translates to no control over exported electricity.[121] The WPSC only issues Certificates of Public Convenience and Necessity (CPCNs) to developers and provides comments to the primary siting authority, the Industrial Siting Council of the Department of Environmental Quality (DEQ). Although the WPSC is not the ultimate siting authority, they are still part of the siting process for projects where part of the power remains in the state, and they enforce regulations and perform safety inspections for all utilities in Wyoming.[122]

In spring of 2017, Rocky Mountain Power (RMP) filed an extensive 87-page case asking the WPSC to severely slash the reimbursement rates it is required to pay to qualifying facilities from $52/MWh to $31.48/MWh under the Public Utility Regulatory Policies Act of 1978 (PURPA).[123] This request most likely came in anticipation of construction approval for the first utility-scale solar project in the state, Sweetwater Solar. RMP argues that plummeting prices for wind, solar and natural gas make the current prices they are required to pay independent power producers far too high and unsustainable in the long-term.[124] The WPSC approved this reimbursement rate decrease on February 1, 2018[125]. Following this petition, a bill was introduced to Congress in 2018 to modernize PURPA, claiming that PURPA no longer drives renewable energy development and subjects consumers to unnecessarily high rates.[126] As of April 6, 2019, the bill was referred to the Subcommittee on Energy and had six new co-sponsors.[127]

On June 30, 2017, RMP submitted an application to the WPSC requesting Certificates of Public Convenience and Necessity (CPCNs) to construct or acquire four new Wyoming wind resources with a total capacity of 860 MW (later updated to 1,171 MW), along with four transmission resources necessary to interconnect the wind projects.[128] The Wyoming Office of Consumer Advocate approved this agreement[129], and the WPSC has granted RMP seven conditional CPCNs contingent on RMP securing all rights-of-way/easements (ROWs) before starting construction (as of March 24, 2019, RMP had obtained all ROW for the TB Flats I and II wind projects and the WPSC had approved construction to begin on April 1, 2019).[130]

Net metering

In 2001 Wyoming established statewide net metering (NEM) program that requires electric utilities to offer eligible customers an energy meter capable of registering electricity flow in two directions and compensate customers for any generated unused electricity.[131] The bill specified that solar, wind, biomass and hydroelectric up to 25 kW capacity are eligible technologies and that the law applies to investor-owned utilities, electric cooperatives and irrigation districts.[132] As residential-scale solar rarely exceeds 25 kW generation capacity, virtually all residential systems qualify for net metering, allowing system owners to receive credits for any generated power that is sent back to the grid.[133] Arguably, NEM is by far the most important mechanism for incentivizing residential solar.

While Wyoming's net metering program is beneficial for residential solar installations, it is seen as a hindrance to industrial- and commercial-scale solar.[134] Proponents of larger-scale solar development argue that the current limit of 25 kW discourages commercial and industrial solar projects, citing utilities as the major opponent of raising the generation capacity limit because they see it as a threat.[135] In recent years there have been multiple attempts in the Wyoming Senate to increase the maximum generation capacity allowed, but all have failed so far. In 2016 it was proposed to add geothermal energy to the list of eligible technologies and to increase the max generation capacity limit for a nonresidential facility to 1 MW, but the amendments were withdrawn by the bill's sponsor before it was brought to the floor.[136] In 2017 another amendment was proposed to increase the maximum generation capacity to 50 kW that failed in the senate.[137] In the current legislative session, another amendment to raise the maximum generation capacity has been introduced in the Senate.[138] This time around, it is proposed that the generating capacity can exceed 25 kW if an electric utility authorizes it.

As many legislators perceive solar to be in direct competition with coal[139], the battle to raise the generating capacity limit is certain to continue to be contentious, affecting viability of large renewable projects and creating market volatility. But the fact that RPM is actively expanding its

renewable energy portfolio suggests that perhaps the demand for renewable energy will get an upper hand after all.

Energy resource and conservation policies

Wyoming has a long history of being a leader in the energy industry, and many in the state want to see that continue. Since 2011, Wyoming has been a member of the Energy Producing States Coalition, a group of fossil fuel-producing states whose goals are to develop domestic energy and coordinate state energy policy related to fossil fuels to increase efficiency of federal energy regulatory processes.[140] There has been legislation in recent decades that has sought to expand and diversify Wyoming's energy resources, but only in regards to clean coal[141,142], enhanced recovery of oil and gas[143], pipeline and infrastructure[144], and nuclear (although no nuclear reactors or fuel cycle facilities exist in Wyoming).[145] These policies prove that it is much more feasible to pass legislation related to oil and gas and coal than anything explicitly related to renewable energy technology or development.

An energy efficiency and conservation bill passed in 2011 called the *Energy improvement program* permits local governments to designate energy improvement areas and establish an energy improvements program, including renewable options, for cost-effective improvements to existing buildings.[146] The State Energy Office is charged with promoting energy efficiency and conservation throughout Wyoming and provides programs and loans that businesses and municipalities can apply for.[147] Figure 8 shows project locations throughout the state that have received funding for energy improvements from the Wyoming Business Council.

In both 2017 and 2018 the *Energy strategic plan* bill failed that would have created a biennial energy strategy and committee to promote excellence in energy development, production, technology, and regulation of natural resources for highest benefit for Wyoming citizens.[148] The failure of this bill in both 2017 and 2018 seems counterintuitive to the state's energy goals of diversification by increasing economic competitiveness and expansion of energy development in the state while also including a strong natural resource conservation provision. There is no specific information about why the bill failed, only a note in the bill digest that states no report was filed prior to the cutoff date.[149] As funding was not part of this bill, it could be argued that the reason for failure was related to a lack of urgency to enact a strategic energy plan without an RPS in place.

Analysis and Conclusions

A decade ago, Wyoming outlined the state's energy vision at the Western States Energy and Environment Symposium: "To provide reliable, affordable, and secure energy to other western states while protecting the state's unique wildlife and natural resources through best practices and innovation."[150] This vision sums up well Wyoming's sentiments of continuing to be an energy state and providing cheap, reliable energy to their residents while maintaining the wild landscape and preserving the spirit of the west. Wyoming does not have an RPS or any explicit renewable energy goals or policy, which is in line with state politics of giving priority to the industries which have been the economic drivers of the state for many decades: the mineral and extractive industries. This lack of a state vision and goals regarding renewable energy development has implications for all other policy areas. Without doubt, Wyoming is sending a strong message that renewable energy is not on its priority list and will likely not get any favorable treatment in the near future, wind and solar resources notwithstanding.

Over the past 10 years there has been very little explicit policy enacted with respect to renewable energy development. And of the few policies that have been implemented, most made

renewables less attractive from a developers' standpoint. Policies related to wind energy production taxes, net metering, and other special tax treatments for renewables have gotten the most attention in the capitol. While the Wyoming Public Service Commission and the Bureau of Land Management are relatively open to renewable development in the state for economic reasons, legislators hesitate to create favorable incentives for renewables because of the state's loyalties to the mineral and extraction industries. And yet, there is no denying that Wyoming is not entirely ignoring the natural advantage it has in virtue of its wind and solar resources as well as ample land for developing large utility-scale projects. Nearly all the large-scale wind projects and new transmission lines are being developed specifically for exporting wind energy to other states—notably to California and Nevada to help meet their respective RPSs, while the relatively modest amount of renewable energy development for in-state use is pursued by IOUs in an attempt to lower electric rates. As the only state that taxes wind production, it is truly impressive that there is still demand for Wyoming-based wind projects, and it speaks to the state's superiority when it comes to wind resources.

The production tax is arguably the most salient disincentive for wind development going forward. Increasing it to $5.00/MWh, as a number of state policymakers attempted to do in 2019, is estimated to double development costs, which is almost certainly guaranteed to make Wyoming highly uncompetitive. But even in absence of such increases, developers are given few incentives to aggressively develop in the state. Lack of sales and use tax exemptions, which traditionally provide significant savings during the construction stage, directly lower developers' bottom line. In light of Wyoming's current struggle with restructuring its revenue stream and diversifying the economy that largely relies on coal and natural gas, raising tax revenues from renewables is an appealing option. It's also politically popular as it promises to bring renewables on par with oil and gas industries in terms of how much they contribute to state coffers. But it's one that's not likely to encourage renewable energy development long-term, especially in combination with Wyoming's complicated siting rules and regulations.

Although policies play a significant role in driving the development of renewable energy industry, there are other factors that are at play. The historic lack of transmission capacity has been one of the biggest deterrents to wind development and it is imperative that the state keeps investing in expanding its infrastructure to accommodate large utility-scale projects. Although Wyoming is building new transmission lines, it remains to be seen if enough construction happens to support the projects in the pipeline and attract new projects. Without transmission infrastructure, which is by far more expensive and difficult to develop than wind or solar, there can be no talks of wind and solar developments. This is the greatest bottleneck. In Wyoming, there is also an added challenge of checkerboarding which makes it difficult to develop new energy infrastructure and install transmission lines, as well as distinguish between private and public lands. And, because the state's greatest wind and solar resources are primarily located on public lands, developing renewables can become time-consuming and expensive even if there is requisite transmission capacity. The permitting process is one of the biggest hurdles in most states. But the intermingling of multiple landowners in Wyoming's checkerboard land ownership takes this challenge to another level. Checkerboarding of public lands is ubiquitous throughout Wyoming, and siting a project often involves multiple agencies—DEQ Industrial Siting Commission, federal government, county boards, the Wyoming Public Service Commission—as well as private property owners, many of whom form LWAs and demand higher lease payments. Moreover, with many private property rights safeguards in place than a lot of other states, landowners, who are quite savvy when it comes to leasing land, generally have the upper hand in negotiations with developers. That in itself can be a deterrent to developers. Last but not least, interconnecting to existing transmission lines, if the developer can find one, might also involve state and federal authorities. This complexity and

ambiguity of siting and permitting in Wyoming does not bode well for the renewable industry, especially in light of all the other disadvantages of developing renewables in the state.

Wyoming is truly standing at a crossroads. With rapidly declining revenues from mineral and extraction industries and growing out-of-state demand for wind, the state has a real opportunity to pivot itself in a new direction. But with the legislature insisting on sticking with the old tradition of propping oil and gas, and curbing wind development through elimination of incentives, it is difficult to say whether it will be able to attract wind developers for much longer. The window of opportunity is not likely to remain open forever. Even though Wyoming has some of the finest wind and solar resources, new technology innovations in wind turbines will eventually open up less windy states for development. It is also important to note renewables is not a panacea for Wyoming, which places high value on its traditions, its history and its natural environment. But for a state that is surely going to experience economic troubles in the next decade, it will have to chart its course with respect to renewables once and for all and stick to it.

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Appendix A – Renewable Energy Resources

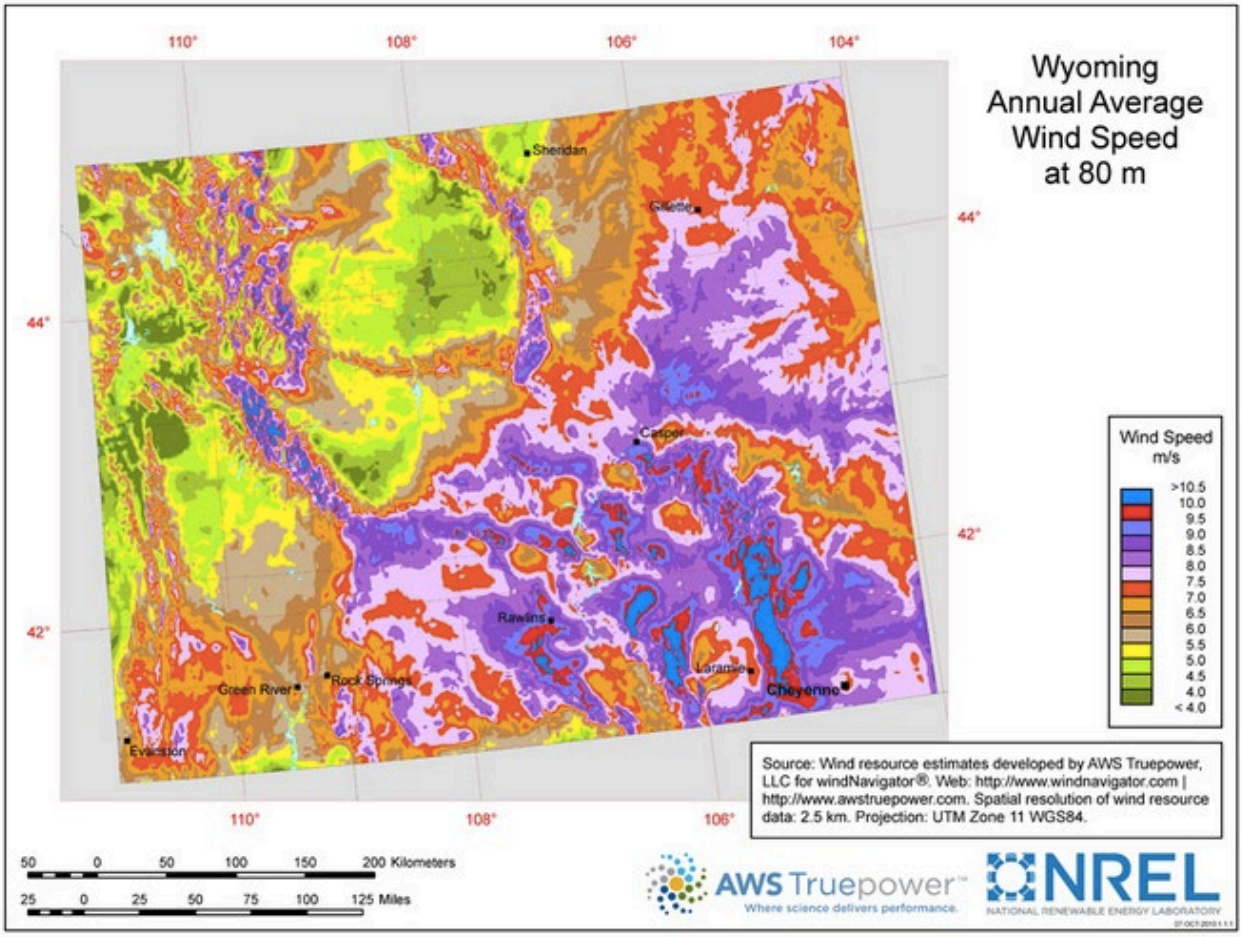


Figure 1 - Annual average wind speed at 80 meters in Wyoming

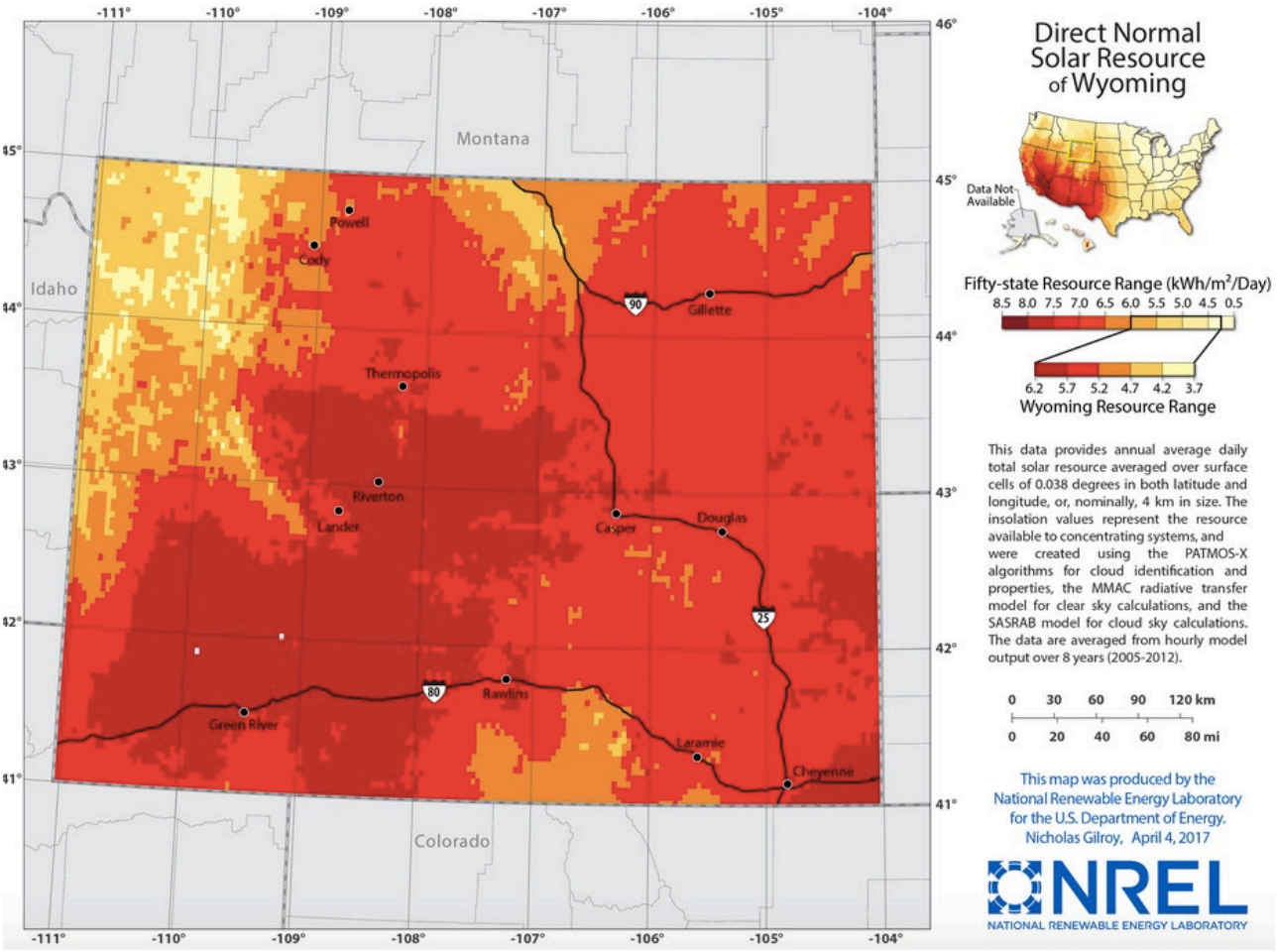
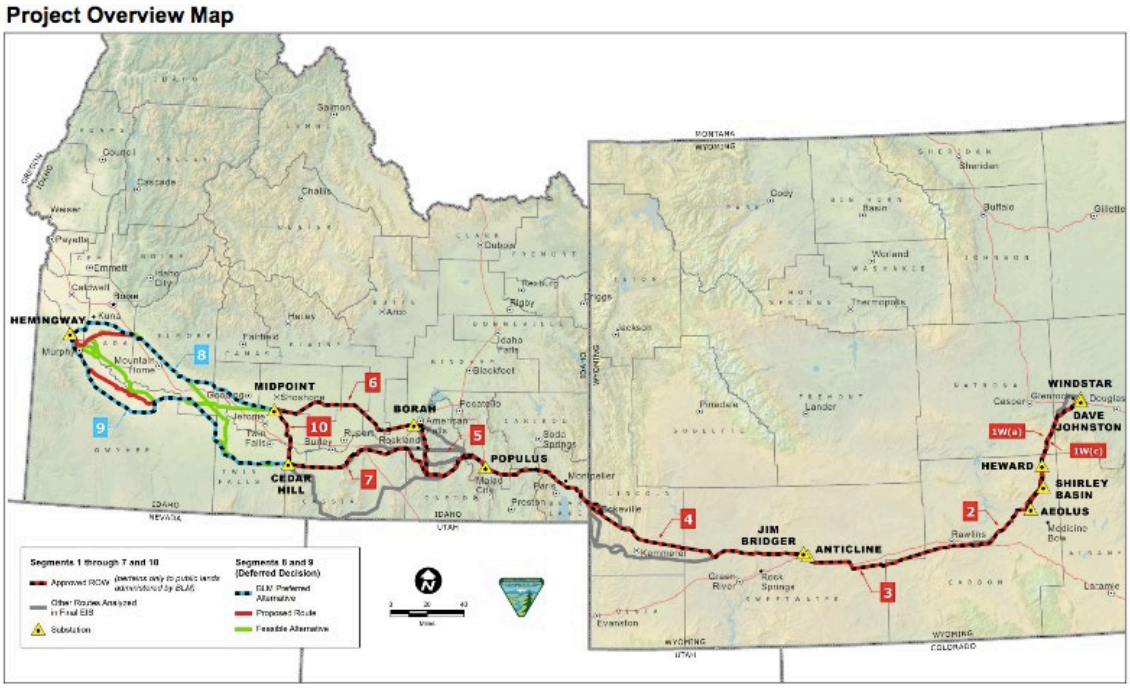


Figure 2 - Annual average daily solar resource of Wyoming

Appendix B – Transmission projects



Appendix Figure 1 - Rocky Mountain Power's Energy Gateway Transmission Expansion: South.

Energy Gateway Transmission Expansion

West

RMP is in the process of developing Segment D of the Gateway West Project – a collaboration with Idaho Power to build 1,000 miles of high-voltage transmission lines running from Wyoming to Idaho and connecting to existing and new generators, including wind and solar units (Appendix Fig. 1).[150] The new transmission lines are expected to be placed in service in 2024.[150]

South

The Gateway South project[150] is a 500-kilovolt transmission line, approximately 400 miles in length (depending on the route that is selected), beginning at the planned Aeolus substation near Medicine Bow, Wyoming, and terminating at the Clover substation near Mona, Utah.[150]

TransWest Express Transmission (TWE) [150]

TWE, developed by Denver-based Anschutz Corporation, is a 730-mile high-voltage transmission infrastructure project that is designed to deliver renewable energy generated in Wyoming to the Desert Southwest region (California, Nevada, Arizona; Appendix Fig. 2).[150] It is slated to start in 2020.[150]

Wyoming to Rapid City Transmission Line

Developed by Black Hills Energy, the new transmission line will be approximately 144 miles long, beginning at the Teckla Substation, about 30 miles south of Wright, Wyoming, and ending in Rapid City, South Dakota (Appendix Fig. 3).[150]

Wyoming - Colorado Intertie Transmission (3,000 MW) [150]

The proposed transmission line will connect the Pathfinder Renewable Wind Project in eastern Wyoming to the Southwestern region (Appendix Fig. 4).[150]

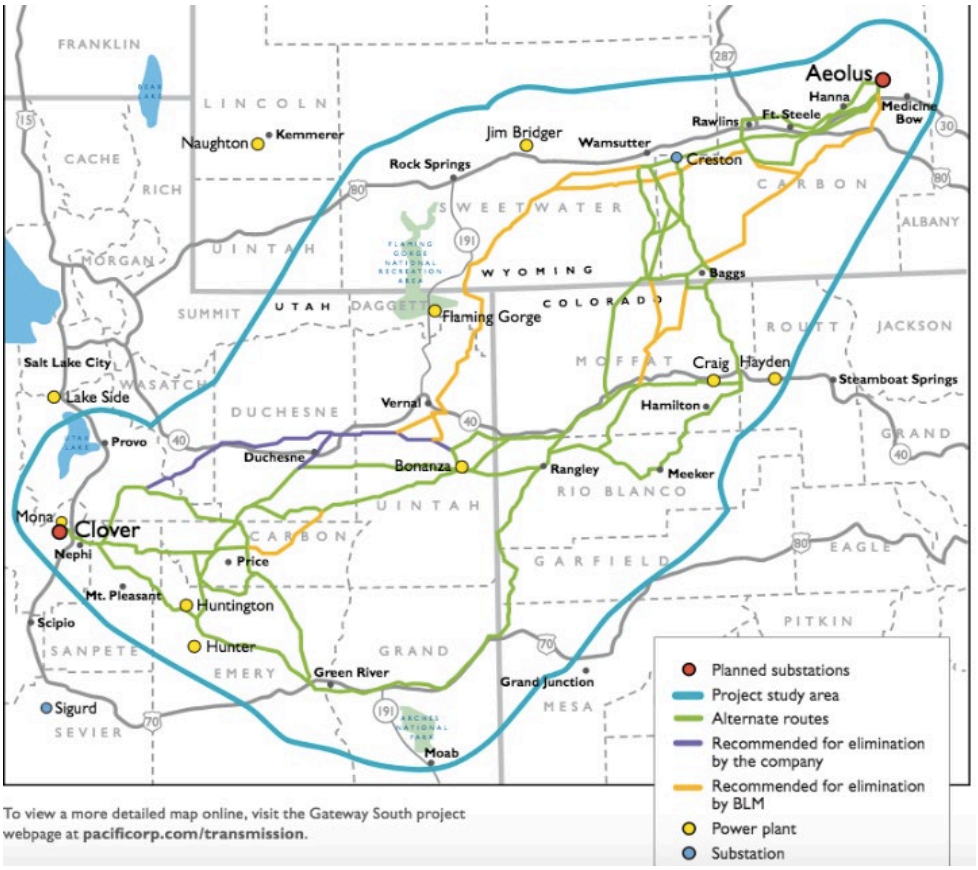


Figure 1 - Rocky Mountain Power's Energy Gateway Transmission Expansion: West.

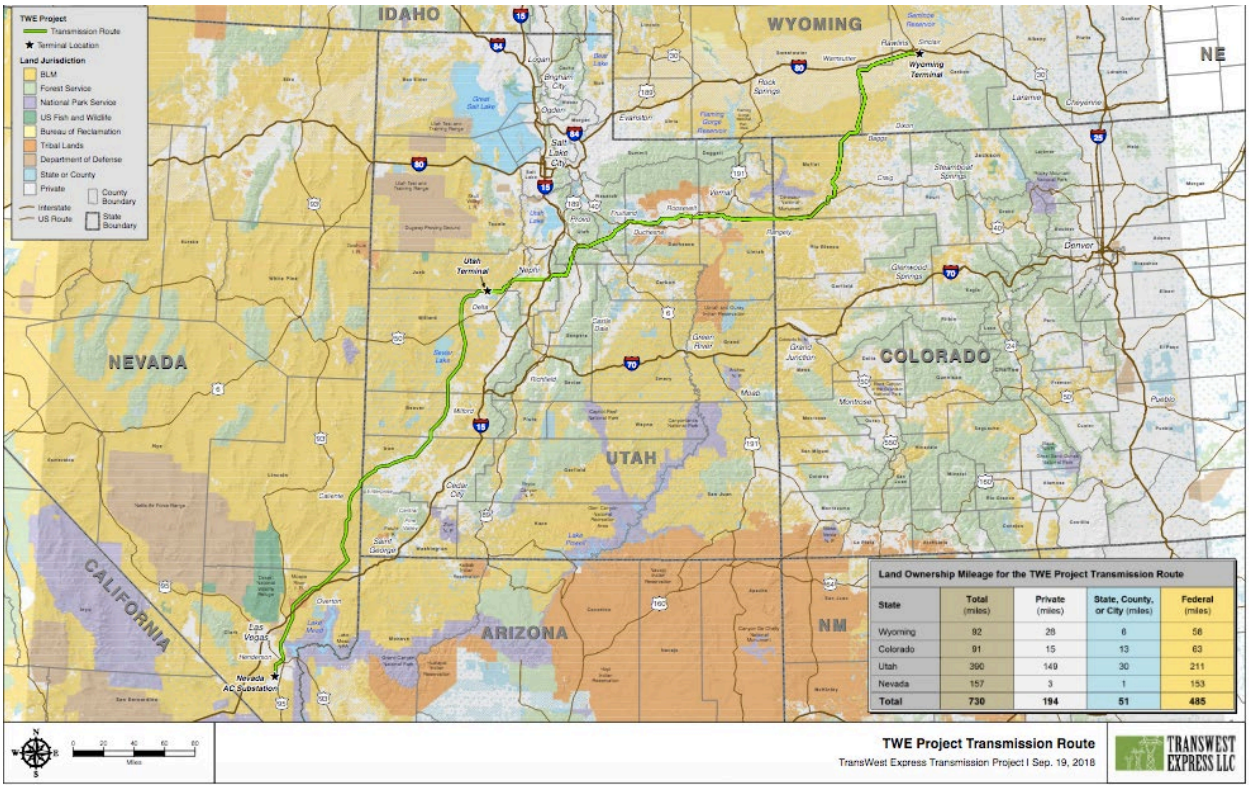


Figure 2 - Anschutz Corporation's TransWest Express Transmission

Figure 3 - Black Hills Energy's Wyoming to Rapid City Transmission Line.

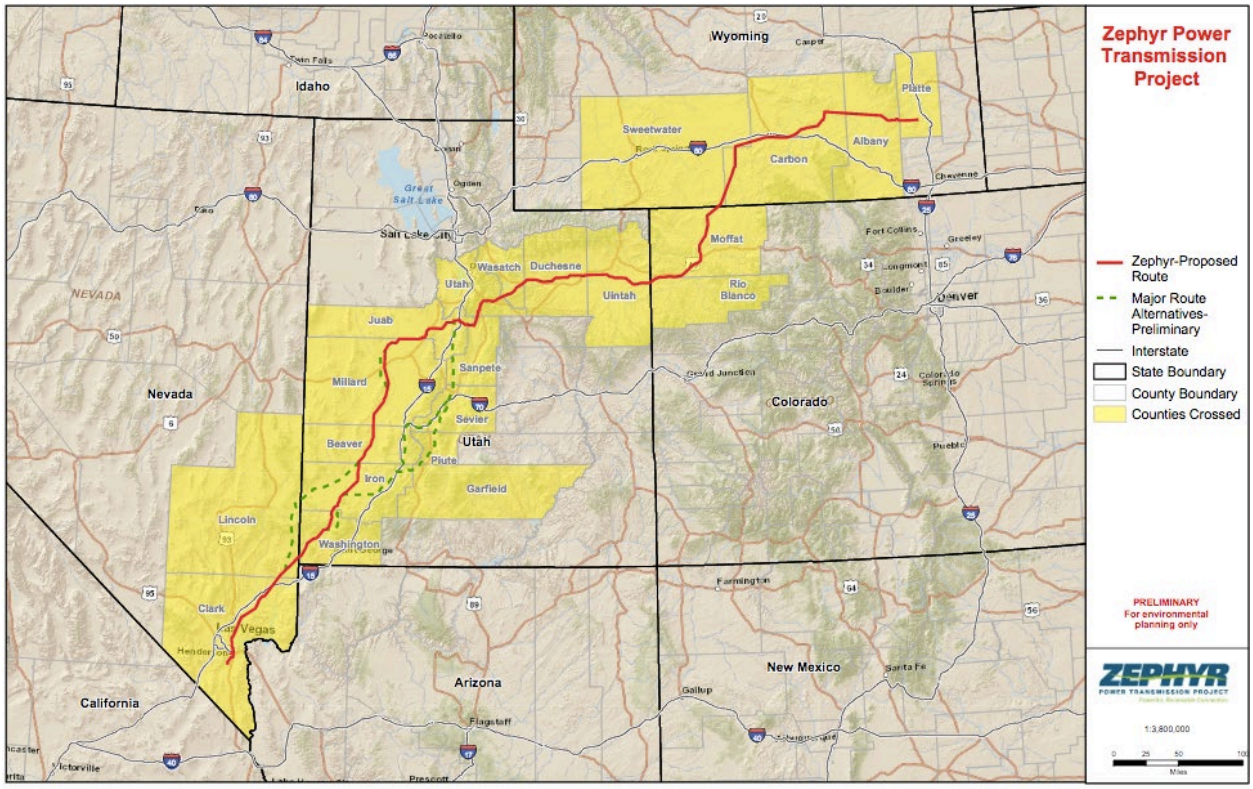


Figure 4 - Wyoming - Colorado Intertie Transmission Line.

Appendix C – Wind and Solar Projects

Chokecherry and Sierra Madre Wind Energy Project (3 GW)
Developed by Power Company of Wyoming LLC, this is a 1,000-turbine wind farm sited in Carbon County, Wyoming. According to the Natural Resources Defense Council (NRDC), the first 500 turbines will be online by the end of 2020, with the remainder scheduled for 2023.[150]

Rocky Mountain Power, Energy Vision 2020 (1.15 GW)
The utility plans on bringing online 3 new wind projects by 2020 - Ekola Flats, a 250-MW proposal in Carbon County; TB Flats I and II, a 500-MW farm in Carbon County and potentially Albany County; and Cedar Springs, a 400-MW farm proposed in Converse County.

Pathfinder Renewable Wind Project (2.1 GW)
Wind farm sited for development near Chugwater in Platte County. It is designed to provide clean energy to California.

Sweetwater Energy (80 MW)
The first-ever utility scale solar farm of 80 MW was built in 2018 in southwestern Wyoming.

Fossil Solar LLC Farm (63 MW)
This solar farm will be developed outside the town of Kemmerer, with plans to connect that power to the network of transmission serving PacifiCorp's coal-fired power plant Naughton.