Montana's Wind Energy:
An Economic Analysis

A report commissioned by the Montana Chapter of the Sierra Club

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Key Points

1. Wind is cheaper than coal, gas, or oil.

2. Wind potential could meet all Montana's electricity needs.

3. Wind development could provide substantial economic benefits to Montana communities.

4. Storage technology provides consistent supply.

5. With PSC approval, low sale prices to utilities and short contracts stunted Montana wind development.

6. Wind generation may be the least harmful energy source to birds.

Contents

Background of Montana's Wind Industry

As its residents know, Montana offers a unique lifestyle under the Big Sky. The northern state contains more cattle than people[1], towering peaks, nine National Park Service areas[2], plenty of natural resources, and seemingly endless valleys and fields.

This report collects relevant wind industry data from interviews, government websites, news, and other industry reports to compare the costs and benefits.

For decades, Montana has focused on the coal industry and in 2018, the state was the sixth largest coal producer in the nation[3]. In the past, coal boosted the economy, and enticed the state's largest electricity provider, NorthWestern Energy, to further invest. The largest coal power plant in Montana is on its 34th operating year[4] of the industry average lifetime of 46 years.[5] Many people are asking, is coal really the most profitable and cost-effective energy industry for Montana? What about the recent data from International Renewable Energy Agency reports on costs of fuel sources[6], and new reports from Forbes[7] and the New York Times[8], that all point to renewables as the cheapest electricity source?

By the end of 2020, Montana will contain 16 utility-sized, operational wind energy facilities, listed in the table below[9] [10]. Even when all of these facilities are operating, they account for only 0.2% of Montana's total wind generation potential. According to a study by the National Renewable Energy Laboratory, based on data for the kinetic energy per square unit, Montana could develop a total of 679,000 wind energy megawatts[11].

Facility Name	County	Capacity (MW)	Current Project Owner	Operational Date	Facility Type[12]
Big Timer Wind Farm	Sweet Grass	25.1	Con Edison Development	2018	QF
Diamond Willow Wind Facility	Fallon	30	Montana-Dakota Utilities Co	2007	other
Fairfield Wind	Teton	10	Greenbacker Renewable Energy	2014	QF
Gordon Butte Wind	Meagher	9.6	Gordon Butte Wind LLC	2012	QF
Greenfield Wind	Teton	29.9	Greenbacker Renewable Energy	2016	QF
Horseshoe Bend Wind Park	Cascade	9	Cycle Power Partners	2006	QF/export
Judith Gap Wind Energy	Wheatland	135	Invenergy Services LLC	2005	other
Musselshell Wind Project	Wheatland	20	Potentia Renewables Inc	2012	QF
Glacier Wind I	Toole	106.5	NaturEner LLC	2008	export
Glacier Wind II	Toole	103.5	NaturEner LLC	2009	export
Rim Rock Energy	Toole	189	NaturEner LLC	2012	export
Pryor Mountain Wind Farm	Carbon	240	Pacificorp	2020	export
South Peak	Judith Basin	80	ALLETE Clean Energy	2020	QF
Spion Kop Wind Farm	Judith Basin	40	NorthWestern Energy	2012	QF
Stillwater Wind	Stillwater	79.8	Pattern Development LP	2018	QF
Two Dot Project	Wheatland	9.7	NorthWestern Energy	2005	QF

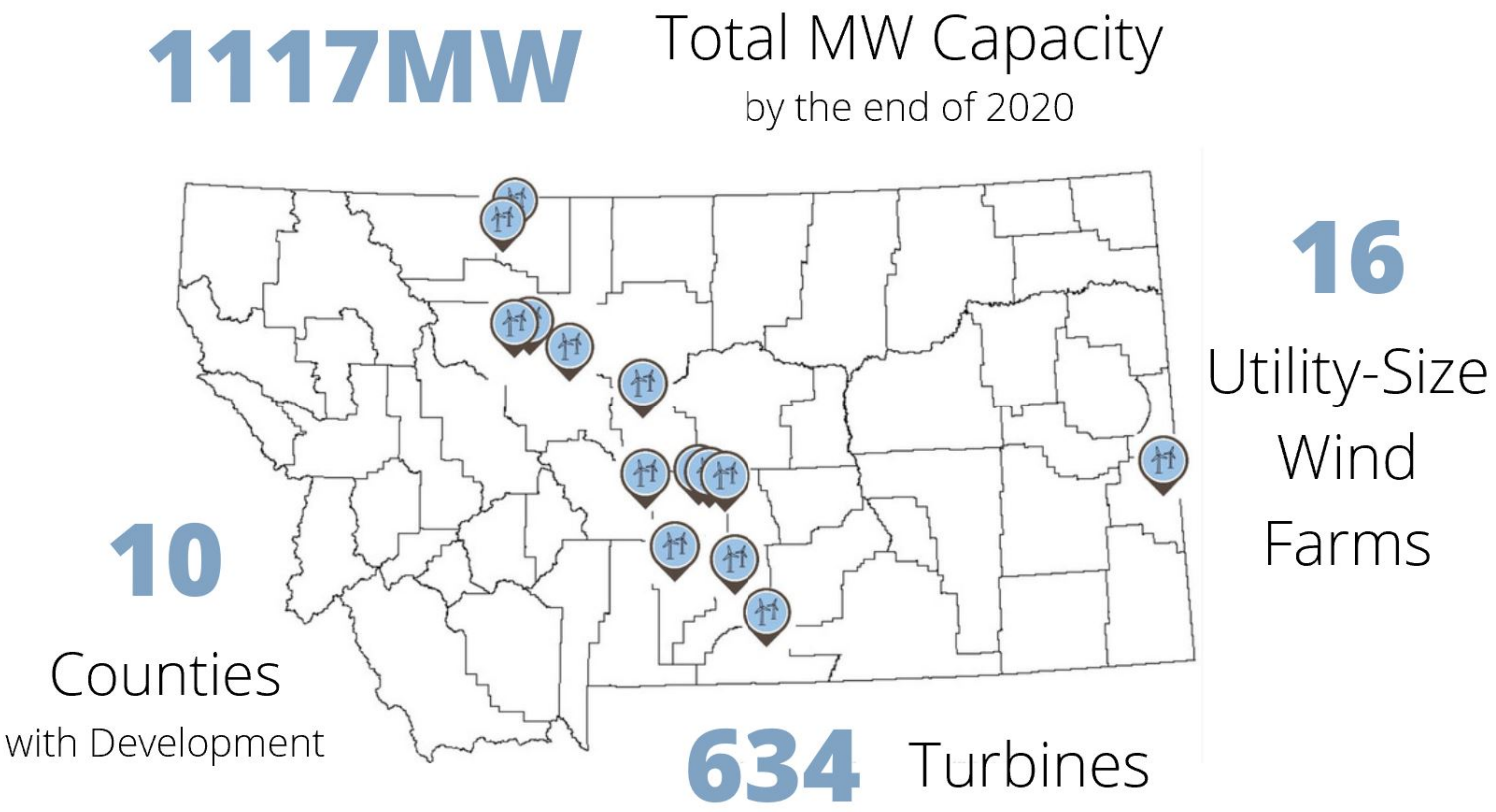
The above chart lists "Qualifying Facilities" (QF's) which are renewable electricity sources counted as part of the state's requirement under the federal Public Utility Regulatory Policies Act (PURPA). This act from 1978 aims to promote the "conservation of energy," "efficiency," "equitable retail rates," hydroelectric development, and "conservation of natural gas.[13]" The Federal Energy Regulatory Commission explains that "one of the ways PURPA set out to accomplish its goals was through the establishment of a new class of generating facilities that would receive special rate and regulatory treatment. Generating facilities in this group are known as qualifying facilities.[13]" Qualifying Facilities are noteworthy because they operate under a different set of rules. In particular, consumers only pay for QFs when they operate, unlike utility-owned electricity plants which consumers pay for whether they produce or not (B. Fadie, personal communication, August 17,2020).

The table below explains the differences in regulation between three major categories of wind generation. Keep these in mind as a context for the rest of the report's findings.

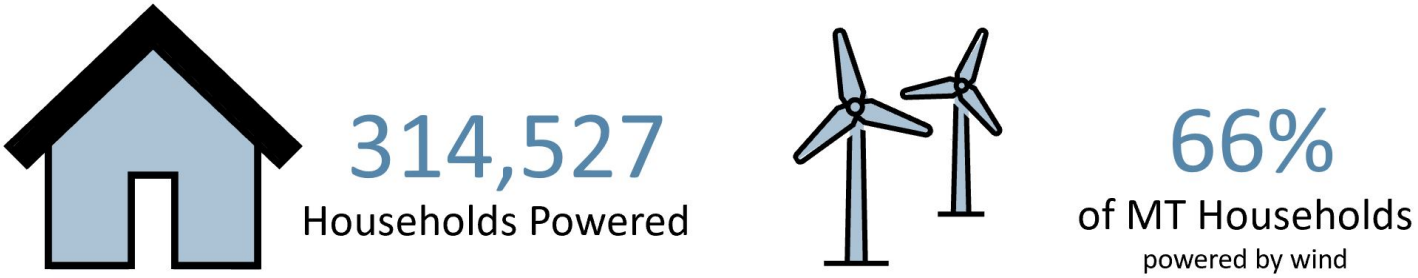
Qualifying Facilities	Wind Farms for Export (can also be QF's)	Other Wind Farms for In-State Consumption
In compliance with federal PURPA requirement	Do not count for renewable requirements	Fulfill state RPS requirement if (see paragraph below)
Sale price to utility and contract lengths set by Public Service Commission (PSC)	Contract privately negotiated by wind developer and out-of-state utility, approved by PSC of state where electricity is consumed	Contract privately negotiated by wind developer and utility, approved by PSC
10 facilities within MT	5 facilities within MT	2 facilities within MT

To promote the growth of the wind industry and subsequently "economic development[14]," Montana enacted a Renewable Portfolio Standard (RPS) in 2005. It lawfully requires all investor-owned utility companies (not co-ops) to collect 15% of their energy from renewable sources[11]. This ensured a space for renewables in the energy market in 2005, and even 15 years later, most of Montana's renewable resources remain untapped.

This graphic depicts Montana's utility-sized wind industry by the end of 2020:



Even a small percentage of Montana's potential provides a significant impact. The graphic below represents the capability of the existing wind farms if the generated power was only used for Montana residents. For an accurate metric, the figures use 11MW per year as the average household consumption[15] and take into account the net capacity factor of the construction year [16].



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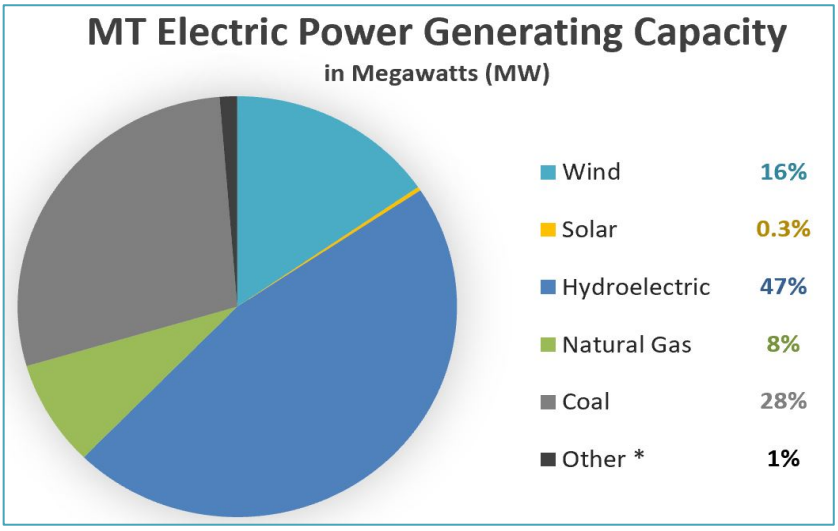
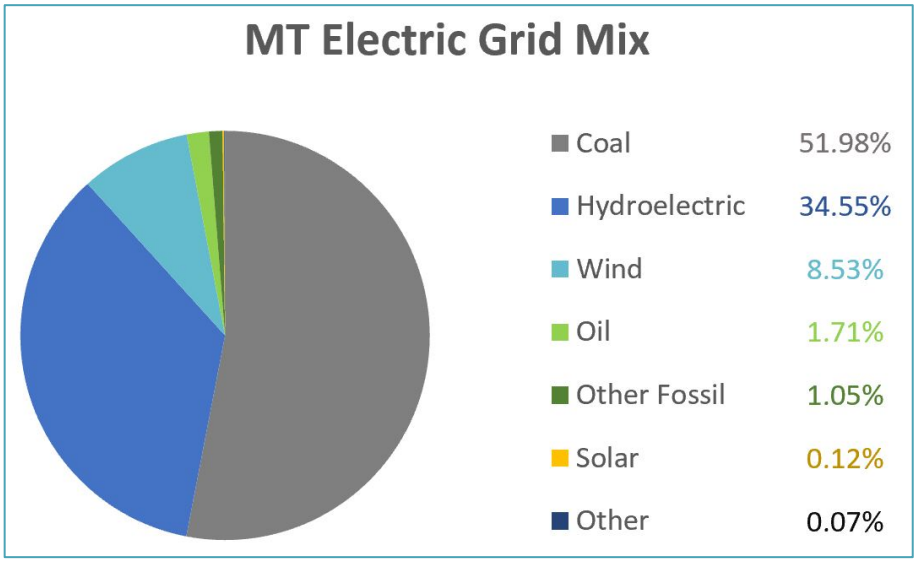
Even though households are a good metric to understand the scope of wind energy, the charts shown below represent Montana's entire electric capacity and the percentages of consumption.

In 2019, according to data collected from 39 energy production sites by the US Energy Information Administration (EIA), wind energy accounted for 16% of the total generating capacity for electricity in Montana [18].



*Other: Petroleum Coke, Biomass, Recovered Heat, Landfill Methane

But, according to the government site WINDExchange, also sourced from the EIA, around half of wind generation is consumed within the state. This chart is adopted from their data [19].



Stages of Wind Development

Interest

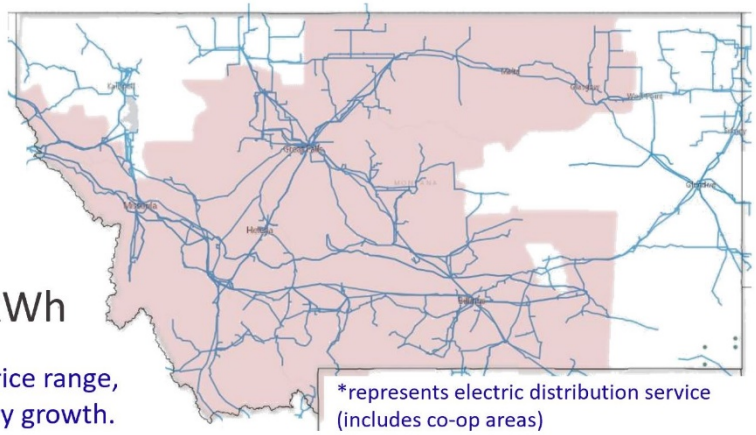
Before development begins, these are the conditions to encourage investment and community support:

Development

The ideal renewable energy project would receive support from three major contributors: Utility companies (NorthWestern Energy or Montana-Dakota Utilities), County and Public Service Commissioners, and the communities within the county. They aid the development in these ways:

NorthWestern™ Energy

1. Allow access to transmission lines (blue) within their region of service* (red)



*represents electric distribution service (includes co-op areas)

2. Purchase electricity from facilities at a price that sustains production

$0.035 /kWh → **$0.05** /kWh

While facilities can operate at the lower end of the price range, prices around $0.05 / kWh ensure profits and industry growth.

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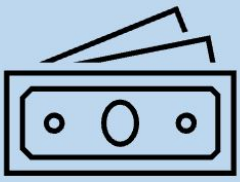
Montana Commissioners

County



Provide tax benefits for renewable energy farms

while still collecting significant tax revenue

Public Service

Assure a long-term contract for at least

20 years

or for the life of the equipment (25 years)

County Citizens

Offer land for lease

with average wind speeds of 11mph or faster at 50m

Engage in Discussion

with County and Public Service Commissioners to request development and transparency

Operation

Once a proposed site reaches the development and then operation stages, it impacts the groups involved in these ways:

	Costs / Investments	Benefits
Landowner	- Property tax (only on the land) - Opportunity cost	+ Steady revenue flow
County	- Construction Noise, Traffic, Inconvenience (fully compensated with impact fee) - "Viewshed" impact	+ Tax revenue + Community projects - schools
Site Owner / Developer	- Development costs - Operations and Management costs - Property tax (Class 14: Commercial Wind Facilities) - Producer's tax - Wholesale Energy Transaction tax	+ Tax cuts (state and federal) + Revenue from utility company
Utility Company	- Transmission lines - Purchase of electricity	+ Movement towards Renewable Portfolio Standard requirement from state + Stable cost of energy

Economic Analysis

To compare the costs and benefits of wind energy, the data was separated into the effects on each party involved, according to the above section. The economic impacts of wind farms are complex and far reaching. To best depict the numerous effects, the data collected includes the installation cost, taxes and fees, operations and maintenance costs, sale price to utility, and consumer price.

According to news releases and multiple interviews, the low sale prices to utilities seem to discourage developers from looking for Montana locations. Wind facility owners are currently receiving $0.03 - $0.04 per kWh for their electricity generation[22] [23], whereas according to a landowner of the Musselshell site, the minimum rate for economic stability for the Musselshell settles around $0.05 /kWh. Even with these remarkably low sale prices, NorthWestern Energy (NWE) continues to increase their consumer rates to $0.11 kWh for residential consumers in 2020[24]. The consumer rates are set not only based on NWE's company costs, but also heavily on return on equity agreements. The agreements vary between facilities but average around 10%[25]. This means that NWE rate calculations factor in a goal to make a profit that equals 10% of the valuation of their investments in Montana. Even if a developer decides to accept the low sale price to NWE, contracts of fifteen years make the development investment even riskier[26]. Developers prefer a 20 to 25 year contract that insures they can sell electricity throughout the lifetime of the turbines.

Taxes[27]

One of the most tangible benefits of wind farm installations to the surrounding county is the increase in tax revenue. Both the electricity producer (often the developer) and the utility company pay the county to generate, transmit, and sell electricity in their county, always. From the county's perspective, wind farm installations are almost always financially productive.

Name	Amount	Payer	Recipient
Wholesale Energy Transaction (WET) Tax	$0.00015 /kWh	Producer/Site Owner	State
On "all electricity transmitted by a transmission service provider in the state"			
Electrical Energy Producer's License Tax	$0.0002 /kWh	Producer/Site Owner	County
On "electrical energy generated, manufactured or produced in the state for barter, sale or exchange, other than plant use."			
Property Tax (by Class)		Producer/Site Owner	County
Class 14: Commercial Wind Generation Facilities			
Public Service Regulation Fee	Current Rate: 0.439% of regulated revenue	Utility applies to consumer rates	State
A "quarterly fee on gross revenue excluding sales to other regulated companies for resale" that pays for the operation of the Public Service Commission.			

On the other side of the taxes, credits and cuts incentivize developers to invest in Montana without the county losing much of their new revenue

CREDITS

Name	Benefit
Renewable Electricity Production Tax Credit (federal credit, being phased out)	2.3¢/kWh benefit for the first ten years
"for projects started by the end of 2014. In 2015, the Consolidated Appropriations Act retroactively reinstated the tax credit for projects started by December 31, 2019."	

Even though the federal Production Tax Credit no longer applies to projects started in 2020, the American Wind Energy Association still anticipates more industry growth. Their website page on the effect of the PTC explains, "because the PTC has been successful in helping establish a reliable, competitive domestic wind industry, wind will continue to expand capacity and deliver economic benefits for Americans and their communities[28]."

CUTS

New or Expanding Industry (State)	Year	Option 1 Taxable Value	Option 2 Taxable Value
"NEI allows for wind farms to be taxed at either 25% or 50% of their taxable value in the first 5 years after construction" because renewable energy is considered a new and expanding industry. "Following the 5 year period, this percentage increases an equal amount (15% or 10%) each year until the 10th year when the full taxable value is attained. In theory, the NEI property tax application and the depreciation of market value will result in a relatively consistent tax levy for an individual wind farm with NEI status[24]."	1st - 5th	25%	50%
	6th	40%	60%
	7th	55%	70%
	8th	70%	80%
	9th	85%	90%
	10th	100%	100%

Case Studies

Due to the complex nature of the wind industry, case studies offer an in-depth look at Montana's wind industry. A focused view lends itself to detailed data and accurate conclusions. For this report, two sites, Judith Gap and Musselshell, were chosen due to their different sizes, availability of information, and shared county. Then, to form conclusions about the scope of the wind industry in Wheatland county, the impacts of the county's three wind energy sites, Judith Gap, Musselshell, and Two Dot, were combined. The capacity factor used to calculate costs and benefits for Judith Gap is based on a national average for the type of turbine used at that site and is reportedly much lower than the actual capacity factor for Judith Gap, **resulting in very conservative estimates of the economic benefits**. As of the publishing of this report, we were unable to obtain actual capacity factor data for Judith Gap.

Sale Price to Utility[29]	Project Investment[6]	Capacity Factor* [8]	Yearly Production[6]	Households Powered[7, 9]	Jobs[30]
$0.03 kWh	$203,000,000	30.8%	364,241 MWh	33,203	100 construction 12 O&M

*Capacity factor – average percentage of absolute production capacity being generated (varies based on wind speeds). Note again that the capacity factor used for Judith Gap is based on a national average and the actual capacity factor is likely much higher due to consistent winds, resulting in lower estimates of impacts particularly taxes paid and households powered.

Operational in 2005, the Judith Gap Wind Farm remains one of the most renowned sites in the state. Invenergy Services LLC runs the site in Wheatland county right outside of the town Harlowton.

Costs & Benefits (for Tax Year 2018)

SITE DEVELOPER/OWNER

Development Costs		Operating Costs	
Development Investment	$203,000,000	Land Lease	> $116,000
Land Lease[31]	> $116,000	Employee Salaries[32]	$652,440
Employee Salaries[33]	$3,540,000	WET Tax	$54,636
Impact Fee	$3,200,000	Property Tax	$1,263,384
Property Tax	$1,263,384	Producer's Tax	$72,848
TOTAL	**$211,119,384**		**$2,103,308**

The above development costs vary based on the length of construction. "Development Investment" accounts for the equipment cost and its transportation. "Land Lease" refers to the annual cost to the site owner and is greater than or equal to the listed amount and can increase by a 3% royalty payment after the production exceeds the contracted amount. "Employee salaries" are construction workers during development and operations and maintenance workers during operation. The figures above are calculated as the national average of an annual salary for the number of workers needed. The "Impact Fee" is paid once to the county, usually at the end of the development stage.

Annual Revenue		Annual Profit	
Revenue from Sales to Utility	$10,927,230	Operating Profit	$8,823,922

LANDOWNER

Costs		Annual Revenue		Annual Economic Profit
Opportunity Cost*	$5,323	Lease Payments	$116,000 with 2.5-3% royalty	**> $110,677**

*loss of some land that cannot be used for agricultural production

WHEATLAND COUNTY

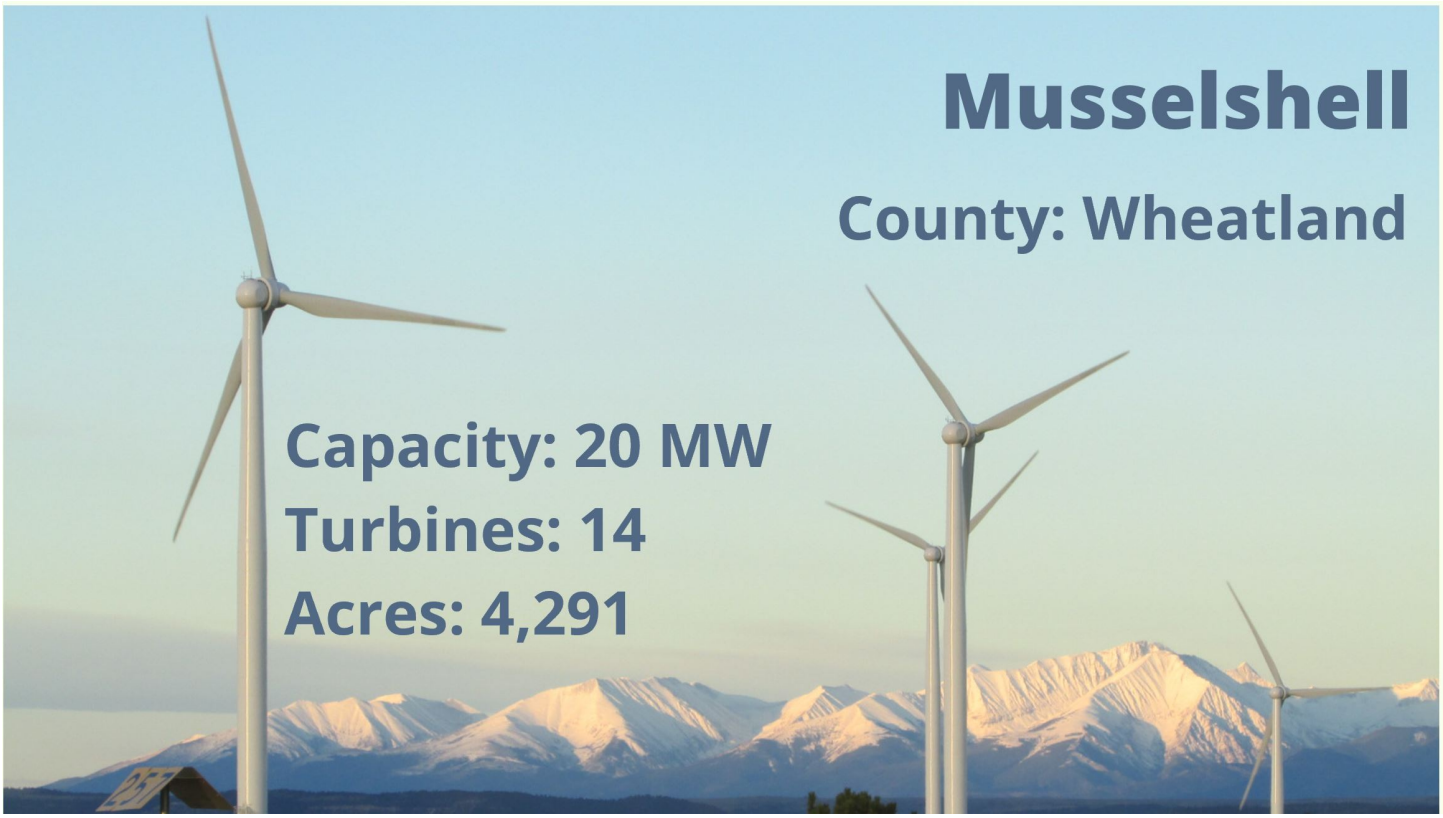
Costs		Revenue		Annual Profit from Taxes
Viewshed, traffic, noise	$ 3,200,000	Impact Fee	$3,200,000	**$1,390,868**
		Annual Tax Revenue	$1,390,868	

Community Impacts

Various Montana news sources explain the benefit of the extra tax revenue for Harlowton. The Prairie Populist outlines how "almost half" of the extra tax revenue was spent, "towards benefiting Judith Gap Schools and Harlowton Schools. Other projects have included the Harlowton Kiwanis Club and the 'Save the Engine' Committee which worked to restore an old Milwaukee Railroad Car."

Land Lease payments are also cited as impactful towards the county's income. The landowner receives much more income, at a steadier rate, than if he farmed all of his land. But, even better, landowners can effectively collect two sources of revenue from their land because the crops grow or livestock graze in the same field as the turbines. The Prairie Populist paints the scene of "wind turbines sprouting out of wheat

fields and sheep grazing up to the doorstep." Mary-Beth Bennett, land owner of the Judith Gap wind site, summarized her feelings in an interview with the Prairie Populist, "We want more[28]."



Sale Price to Utility	Project Investment	Capacity Factor	Yearly Production	Households Powered	Jobs
$0.039 kWh	$40,000,000	30.8%	56,660 MWh	5,165	80 construction 3 O&M

The Musselshell wind site started operations in 2012 and is currently owned by Potentia Renewables. The gearless, magnetic turbines spin near the town of Shawmut in Wheatland county. The financial data for this site was provided by landowner Roy O'Connor.

Costs & Benefits (for Tax Year 2018)

SITE DEVELOPER/OWNER

Development Costs		Operating Costs	
Development Investment	$40,000,000	Land Lease	$60,000
Land Lease	$60,000	Employee Salaries	$163,110
Employee Salaries	$2,832,000	WET Tax	$8,499
Impact Fee	$2,000,000	Property Tax	$325,284

Property Tax	$325,284	Producer's Tax	$11,332
TOTAL	**$45,217,284**		**$568,225**

Annual Revenue		Annual Profit	
Revenue from Sales to Utility	$2,232,404	Operating Profit	$1,664,179

LANDOWNER

Costs		Annual Revenue		Annual Economic Profit
Opportunity Cost	$1,970	Lease Payments	$60,000 with 3% royalty	**> $58,030**

WHEATLAND COUNTY

Costs		Revenue		Annual Profit
Viewshed, traffic, noise	$ 2,000,000	Impact Fee	$2,000,000	**$345,115**
		Annual Tax Revenue	$345,115	

Community Impacts

Since the Musselshell site produces far less than Judith Gap, the largest impact of its presence is felt by the landowner, Roy O'Connor. He noted in an interview, simply that the "ranch income" is the best part of leasing his land to Goldwind and now Potentia. And if another developer came along with additional construction prospects, "Sure!" he would lease his land for more turbines. (R. O'Connor, personal communication, July 9, 2020).

Roy describes a community meeting he attended during the proposal stage of the project "in Shawmut with some County Commissioners and local ranchers." In reflecting on their opinions, he remembers that "it was all positive." Since then, Roy has "had ranchers ask what they can do to get turbines on their ranches." He encourages other ranch owners with viable wind speeds and access to transmission lines to "look for [a developer] who is in the area and contact them! Putting up a met tower is the first thing to get necessary data on wind velocities, and it is possible they would be willing to finance it if there is a suitable site on the property" (R. O'Connor, personal communication, July 9, 2020).

The Billings Gazette cites the Federal Renewable Electricity Production Tax Credit as a large motivator for the initial proposal and following development of the Musselshell site[34]. Resoundingly, the finances must line up for everyone involved to turn an idea into electricity, and the Musselshell site did just that.

Wheatland county holds second place, behind Toole county, for the most wind-generated electricity in the state. The Judith Gap site produces 82% of the county's generation, with Musselshell at 12%, and Two Dot at 6%. The combination of these three sites impacts the county in numerous positive ways. Below are tables of the economic benefit to the county through employment and tax revenue.

Employee Impact

Construction Employees	**Construction Salaries**	O&M Employees	**O&M Salaries**
220	**$7,788,000***	16	**$869,920****

*nat'l avg wind facility construction salary = $35,400 **nat'l avg wind facility operations & maintenance salary = $54,370

Tax Impact (for Tax Year 2018)

WET Tax	Producer's License Tax	Property Tax (Class 14)	**TOTAL Tax Revenue**
$ 67,257	$89,676	$1,746,430	**$1,903,363**

Economic Impact

Projects Funded by Wind Facility Taxes

The largest beneficiary of extra tax revenue are the local school systems. These are images of some of the school districts that received extra funding.

*see image citations

Harlowton, Melville, Bridger, Reed Point, Sunburst, Judith Gap, Sweet Grass

Harlowton's Milwaukee Railroad Car

Along with funding education, some counties chose to invest in community projects that showcase their identities and history. One example is Harlowton's 'Save the Engine' Committee which restored the town's historic Milwaukee Railroad Car[28].

Comparative Analysis

To Texas

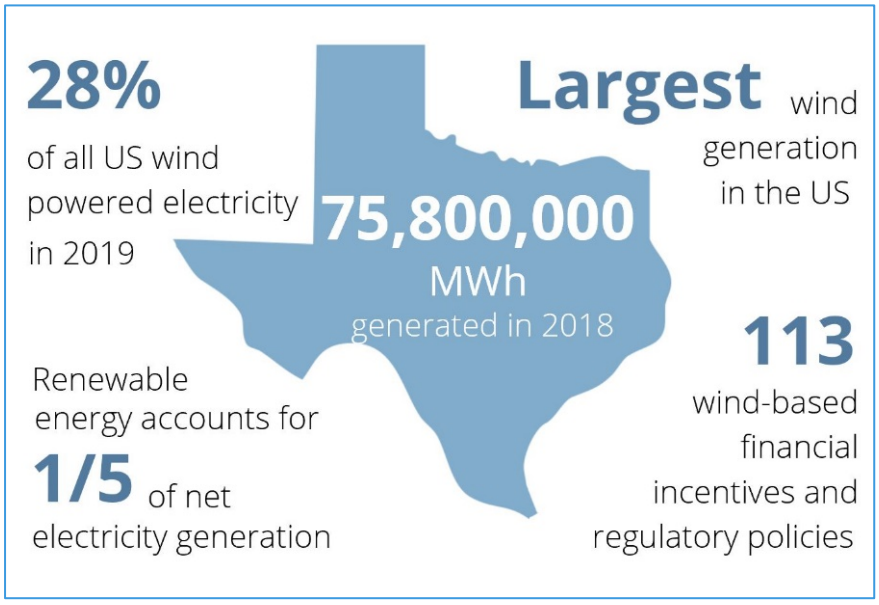
For decades, Texas has led the rest of the country in wind development. The state legislature and Public Service Commission foresaw the benefits of the wind industry and offered an irresistible deal to developers: build facilities in our state, and we will build the transmission network right to your site. As a landowner, Roy O'Connor understands the industry well and reacted to Texas' deal by exclaiming, "Who wouldn't want that? They never would have developed it otherwise. It's just too expensive." In Montana, accessible transmission lines limit development. Even though Montana has not offered to build additional lines, the existing lines still have capacity for more electricity and are surrounded by undeveloped acres.

Incentive policies offer another productive way to promote development by keeping the sites near existing transmission lines. Montana's current 27 policies surrounding wind development are far overshadowed by Texas' 113 financial incentives and policies that promote further growth of the industry[35]. Texas took advantage of the policies below.

- USDA Rural Energy for America Program (REAP) Grants are federal grants that "agricultural producers and rural small businesses" apply for to cover up to 25% of the implementation cost of a new renewable energy system[36].
- The Solar and Wind Energy Business Franchise Tax Exemption benefits "manufacturers, sellers, installers" within the state of Texas by exempting them, without a ceiling, from Texas' version of a corporate tax. If Montana developed its own version, it would encourage business with these specialties to start up within the state and developing renewable energy facilities to source locally[37].
- The Solar and Wind Energy Device Franchise Tax Deduction allows a Texan corporation to deduct the cost of their renewable energy system from company's taxable value or deduct 10% of energy system's cost from the corporation's income. This encourages corporations to invest in the renewable energy industry and would undoubtedly grow commercial renewables in Montana[38].

Comparing Montana's wind generation at 16% of the state's generating capacity to Texas' wind generation at 23.4%, further quantifies the differences[39]. Montana may be a leader in wind energy potential, but Texas successfully harnessed their resources, boosting their economy with a diversified energy portfolio.

The graphic (right) states a few more impressive statistics about wind energy in Texas.[40] [41] [42]



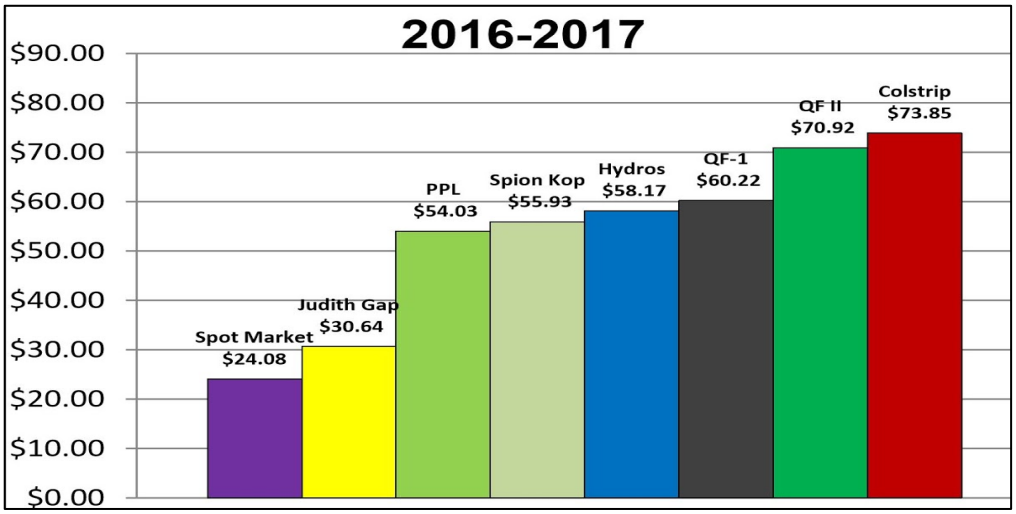
To Other Fuel Sources

Stacking different fuel sources next to each other places wind generation in context and proves its economic advantages.

NorthWestern Energy's Electricity Costs per MWh

The table and graph below, presents data from NorthWestern Energy on their cost for a MWh of energy. The differences between the fuel types highlights the lower costs for wind energy in comparison to coal and hydro power. NWE still pays for electricity from coal plants like Colstrip because the cost is repaid to them by their consumers due to the 10% return on equity agreements.

NWE Unit Costs per MWh in Montana[24]



This graph visually represents the cheaper costs of wind and the table below supplements it with details and percentages. At most, the production of one MWh of wind energy costs 76% of Colstrip's production costs and as little as 41%.

Plant Name	Electricity Source	% of Colstrip's Cost
Colstrip	coal	100%
QF – II*	fossil fuel waste	96%
QF - I	private renewables	82%
Hydros	hydroelectric dam	79%
Spion Kop	wind	76%
PPL**	coal	73%
Judith Gap	wind	41%
Spot Market***	supplemental	33%

*QF stands for Qualifying Facilities that NWE must purchase a set percentage of energy from, enforced by the PSC
**PPL Montana, now Talen Energy
***Spot Market fills in for high demand or supplements for NW's own production when it's too expensive. It comes from the extra stores of all plants with excess production.

Without the return on equity agreement, NWE would have no economic incentive to invest in coal or gas instead of wind. But as it is now, from NWE's standpoint, it is more profitable to buy expensive assets, such as Colstrip, which boosts the amount of their 10% return and raises consumer rates.

"What is hopeful for me is how much less expensive wind is than coal. It's really just striking." – Tom Woods, Montana House of Representatives

Montana Officials Comment on Wind Energy

These comments offer insight into Montanan perspectives of the wind industry. Local officials know policies, regulations, and development processes inside and out. Here's what they have to say about wind energy in Montana.

County Commissioner

(personal communication, June 6, 2020)

*wished to remain anonymous

> I think we need to consider efficiency, base load generation, and the true cost of renewables, so that we can plan our future energy needs accordingly.

This commissioner thinks critically about all aspects of a new project. They understand that for renewables to rise to the top of energy preferences, they need the credentials of economical, sustainable, dependable, and available.

> We gave around 900 thousand dollars to a school district in south central Montana.

Bill Bullock

Carbon County Commissioner

(personal communication, June 9, 2020)

Like many other counties in Montana, the new tax revenue goes directly into funding school systems. Bill Bullock expressed how his ultimate concern is sustaining his communities and supplying them with the available revenue streams. Luckily for Carbon County, everything lined up for a wind facility.

Tom Woods

Member of Montana House of Representatives,

2020 PSC Candidate for District 3

(personal communication, June 25, 2020)

> Diversify the utility portfolio and allow someone other than the monopoly to do the power generation.

With experience as a state legislator, Tom Woods understands Montana's electricity from a policy standpoint. He believes that NWE runs a monopoly and he fears what that means for the clean percentage of Montana's energy mix. For Woods, the solution comes from redistributing some generation to rooftop solar, private turbines, and small systems for corporations.

> The problem with the energy paradigm that guides our energy activities today is that it rests on an incomplete spreadsheet. There are far too many negative externalities in the current system.

Mike Phillips

Member of Montana Senate

(personal communication, July 30, 2020)

When Mike Phillips mentions a "spreadsheet," he is referring to a list of costs and benefits associated with each energy decision that are sometimes unaccounted for. He advocates for "establishing a register of emissions" to accurately account for the future costs of different energy sources. Phillips focuses on the future and encourages consumers to consider the impact of carbon emissions on their grandchildren.

Daniel Zolnikov

Chairman of the Energy Committee in the Montana House of Representatives

(personal communication, August 3, 2020)

> We're going to have to export wind if we want an export market. That's the bottom line.

As Chairman of the Energy Committee, Daniel Zolnikov strives to strengthen Montana's energy industry and adhere to the legal requirement for energy sources to be "affordable and reliable." Zolnikov explains that for Montana to compete in the energy export market with other western states, Montana needs to include

"alternative energies"– solar, wind, and hydropower. Notably, Zolnikov recently passed two bills that encourage transparency within the energy industry. One bill, House Bill No 267[43], "ensures that consumer energy data is protected and belongs to the individual" which keeps utility companies from "using private consumer data to sell energy products" (D. Zolnikov, email communication, August 4, 2020). The second bill, House Bill No 597, required NWE to provide the data for their assumptions that justify the company's 20-year resource procurement plan to third-party analysts[44]. In Zolniov's words, it ensures "that energy policy would institute basic constitutional checks and balances."

PSC District 3 Candidate Jim Brown was contacted to provide input for this report, but he declined to comment.

PSC District 4 Candidate Jennifer Fielder was contacted on many different occasions with no response.

Due to time conflicts, an interview could not be scheduled with PSC District 4 Candidate Monica Tranel.

Montana House of Representatives Member Wylie Galt did not respond to the request for an interview before the publication of this report.

Montana's Future

Improvement of Policies and Industry Standards

Changes in policy and industry standards could benefit rate payers and landowners while holding NWE responsible for transparent service.

Based on the research above, these four policies would strongly support economic and sustainable growth:

1. Sale price to utility and contract length that encourages and stimulates development

"Nobody is going to build a facility and no bank is going to loan money for a big facility if after fifteen years you have no guarantees you can sell your electricity, because the only buyer is NorthWestern." – Roy O'Connor (personal communication, July 9, 2020)

2. Retail electricity rates that are fair to the consumer

By abolishing dependence on the 10% return on equity agreements, consumer prices could be solely based on production costs, not controlled by a monopoly.

"NorthWestern Energy executives seem to have gone mad with dollar signs in their eyes, trying to load up their customers with massively expensive fossil-fuel power plants. Remember: the more the utility spends, the more profit it makes." – Brian Fadie, Clean Energy Program Director for MEIC, in his article "Should PSC Oversight of Monopolies be Strengthened or Undermined?[45]"

3. Transparency at the PSC level with their policies and legislature

"The main barrier [to wind development], is the very strange relationship we have, that's pretty specific to this state, between the monopolies and the Public Service Commission and the rate payers." – Tom Woods (personal communication, June 25, 2020)

"You've got to get public policy right so you attract private dollars, so that private investors can make more money chasing green electrons than they can chasing black electrons." – Mike Phillips (personal communication, July 30, 2020)

4. Education about the benefits of wind energy to landowners and ratepayers

The more that wind energy arises in community conversations, the more everyone can understand their role and the benefits to them. The American Wind Energy Association provides numerous resources for education, an overview can be found at www.awea.org/wind-101 .

"The job in front of you, as a responsible citizen, is to cast an *informed* vote."

- Mike Phillips, Montana Senate

Storage

One of the main concerns about the viability of wind energy revolves around consistency and dependability. While the wind might not blow all of the time at most site locations, storing a percentage of the generation ensures electricity on demand.

Barton Churchill, Director of the Power Division at Energy 1 and long-time advocate for renewable storage, confidently remarks in an interview that "the future of renewables is being changed dramatically by battery storage" (personal communication, June 30, 2020). He understands the hurdles that the wind industry faces but recognizes that currently "the challenges are regulatory, not technology-based, and certainly not price." This statement implies that while an energy storage expert endorses the capability of storage technology to expand the wind industry, effective growth still starts from the top, with policies and legislation.

The storage industry grew quickly throughout the past decade and currently costs a record low amount of $200-400 per kWh, depending on the storage type. According to The Energy Collective Group, "batteries, in particular lithium-ion batteries, are reported to be the most cost-effective stationary utility-scale energy storage systems—for storage durations up to four hours. For longer duration storage requirements, compressed air energy systems and pumped hydro systems are reported to be cost-competitive." [46] Researchers from the National Renewable Energy Laboratory predict that the industry trend will continue, reaching prices as low as $124 / kWh by 2030 and $76 / kWh by 2050[47].

As storage facilities increase in viability themselves, they also promise a new avenue for the growth of renewable energy projects. Barton assures Montanans in his interview that "within 6 months [his company] could have any battery storage system of any size anywhere in the state."

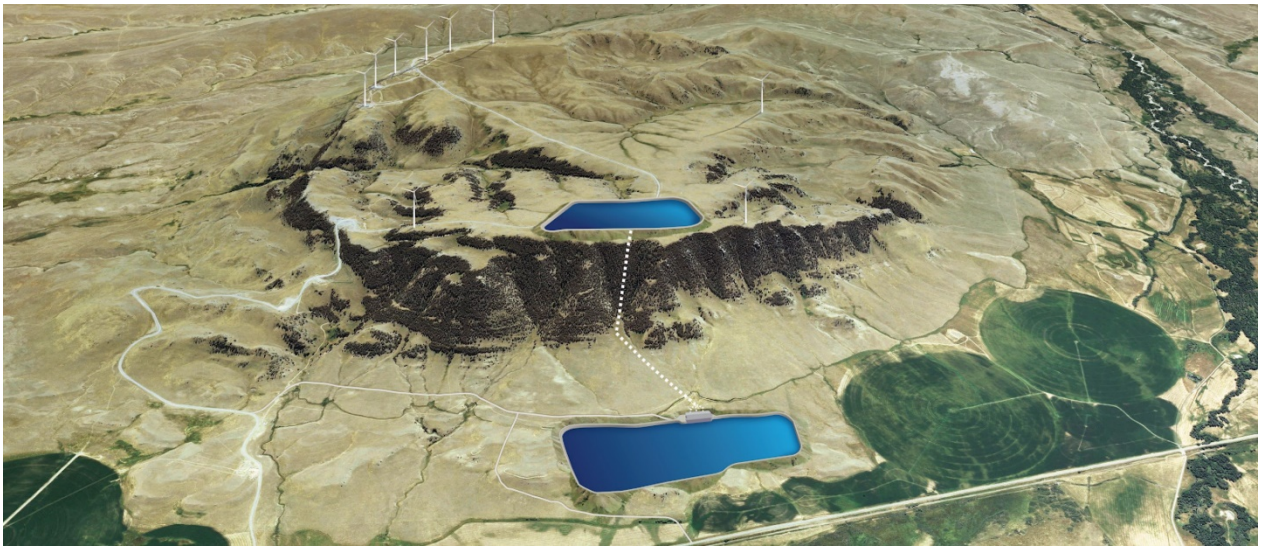
And even looking beyond the wind industry, the entire "grid network can be made much more efficient with storage," remarks Barton. The benefits of storage technology for convenience and dependability are undeniable.

Example Location: Gordon Butte outside of Martinsdale, MT

Absaroka Energy realized the potential of pumped storage specifically and received a development and operation license in 2016. They are currently construction ready and hope to produce 1,300,000 MWh annually for in and out of state use[48].

Here's a project description from AP News:

> "The Gordon Butte Pumped Storage Hydro Project was first proposed in 2010 and is intended to make wind turbines and other renewable energy sources more reliable , by storing the electricity they produce until it's needed. Described as a "hydro battery," it would use excess power produced by wind farms or other sources to pump water from a reservoir uphill to a second reservoir. The water would be released during periods of high electricity demand, turning hydropower turbines to generate power. Many utilities use power plants fueled by natural gas to fulfill a similar role. They're needed to balance electricity across the power grid as demand rises and falls over time[49]."



This is a project diagram from the Gordon Butte Energy Park website. It shows the energy generating turbines, the two reservoirs, and the path for the water flow.

More information on pumped storage can be found on the National Hydropower Association's website at https://www.hydro.org/policy/technology/pumped-storage/

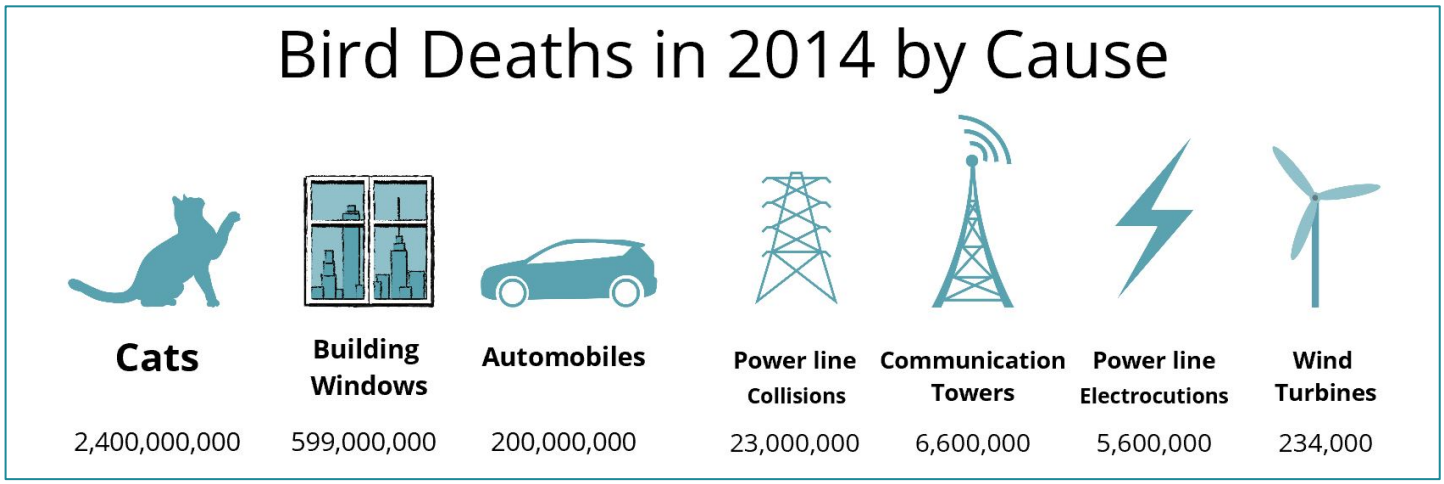
Further Study

Ecological Impacts of Wind Energy

One of the most cited ecological impacts of wind energy is the toll on birds. The common conception inflates the actual death rate and paints wind turbines as bird murderers. But in reality, the largest killers of birds, represented surprisingly accurately by children's books, are cats.

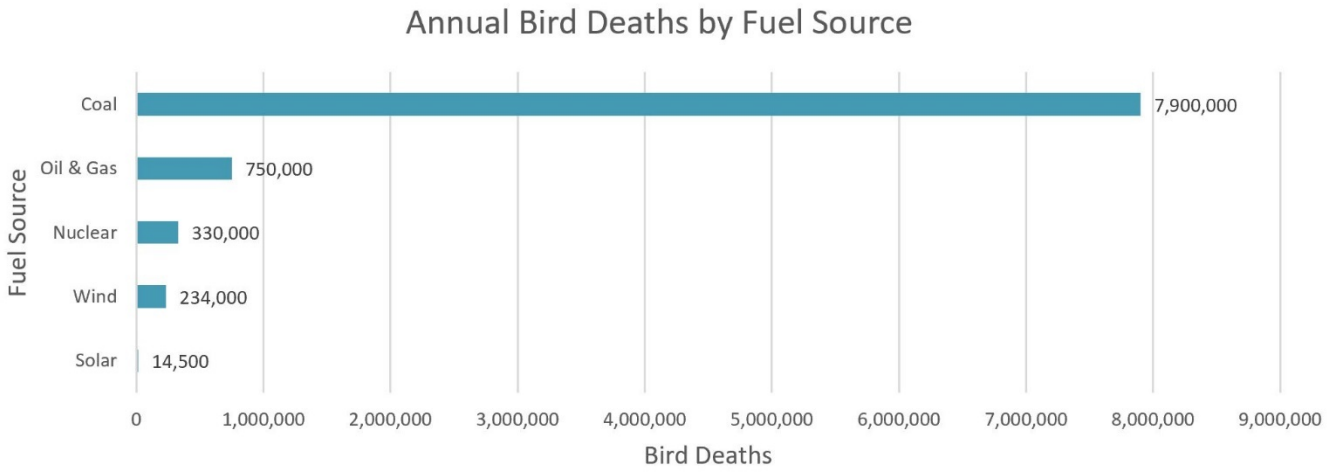
By Anthropogenic Cause

A study titled "Direct Morality of birds from Anthropogenic Causes" published in the *Annual Review of Ecology, Evolution, and Systematics* estimates bird deaths in 2014[50]:



By Fuel Source

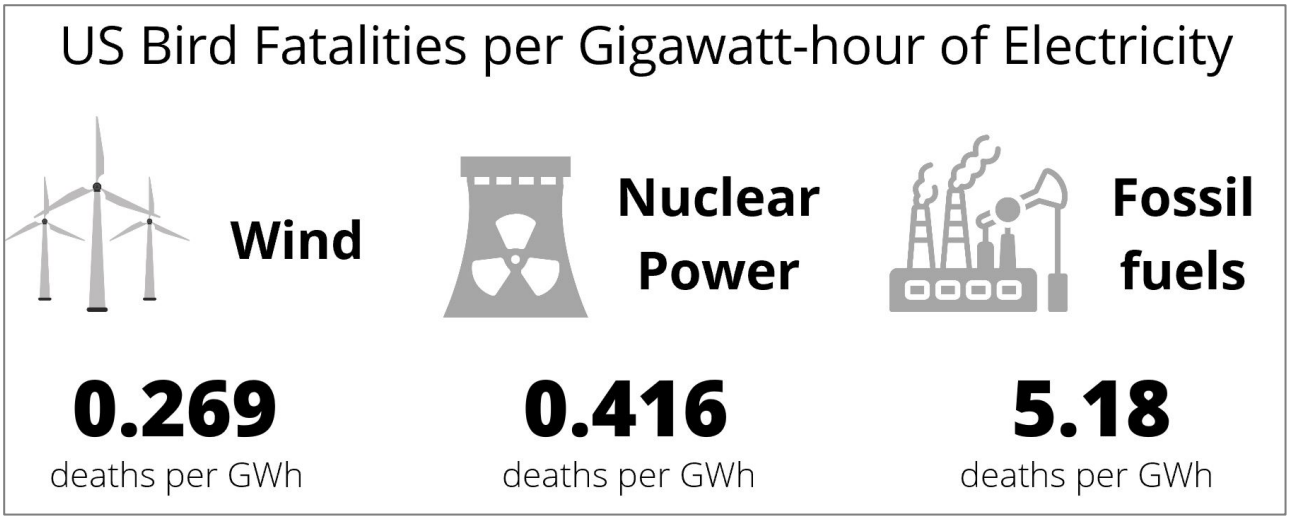
The US News and World Report wrote an article, also in 2014, that cites various studies that outline bird deaths by fuel source, with solar and wind at the bottom.



US News and World Report cites BrightSource and the Center for Biological Diversity for solar, a study in the journal of Biological Conservation for wind, the Bureau of Land Management for the oil and gas estimates, and director of the Danish Center for Energy Technologies for the coal and nuclear estimates. This graph depicts the average of the range of predictions by the different studies[51].

Per Gigawatt-hour by Source of Electricity Generation

The above study shows the general damage in a year, but to truly compare electricity source to electricity source, a study in the international *Renewable Energy* journal found the average number of avian fatalities per gigawatt-hour of electricity generated[52]. This is a useful metric to determine which source is most harmful and which is the least. This graphic represents their findings.



This graphic leaves a clear impression on the bird lover and may help to explain that yes, turbines do kill birds, but the context of other energy sources writes a different narrative. The study attributed bird deaths from oil, gas and coal to "destruction of mature deciduous forests," "collision and electrocution with operating plant equipment, and poisoning and death caused by acid rain, mercury pollution, and climate change."

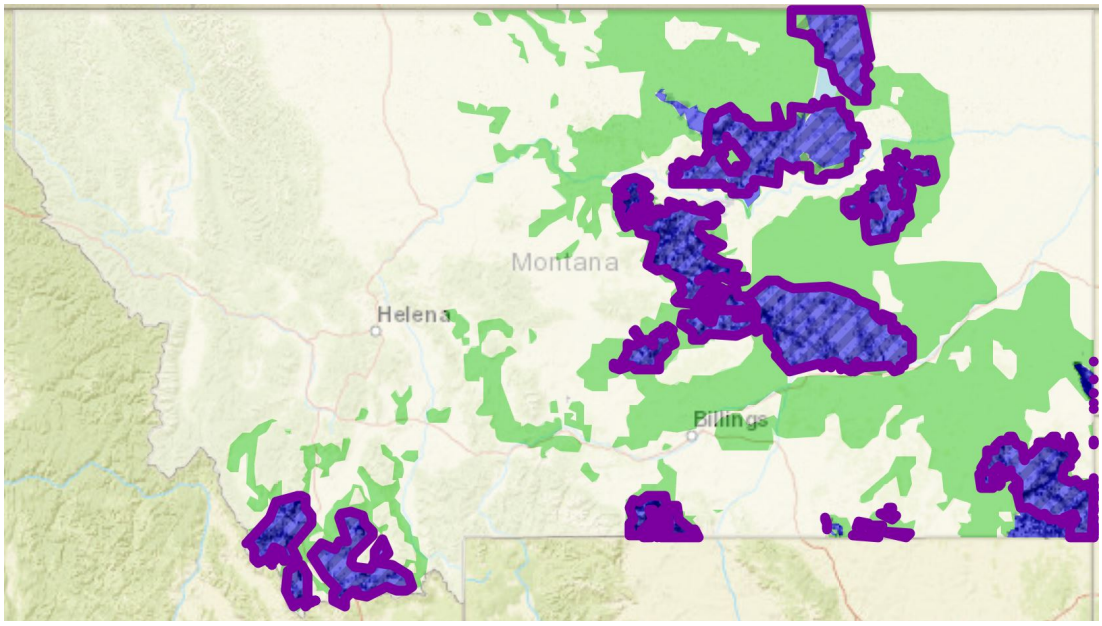
Spion Kop Case Study

Over the course of two years, Montana Fish, Wildlife and Parks conducted a study on the Spion Kop Wind site to measure the impact of the turbines on the bird and bat populations in the area. Spion Kop produces around 107,923 MWh (or 107.923 GWh) of electricity annually and below are the fatality estimates from the study. In general, more bats die from turbines because bats "possibly mistake the turbines for trees," explains the Great Falls Tribune's coverage of the study. The study of the Spion Kop site aligns with industry findings and redefines the overestimated impact of turbines on bird populations[53].

Small Bird Fatalities per GWh (no raptors found)	Bat Fatalities per GWh (primarily hoary and silver-haired bats)
0.259	4.096

Sage Grouse

Since the launch of the Montana Sage Grouse Habitat Conservation Program through the Montana Department of Natural Resources and Conservation, protected habitat must factor into the siting process for a new wind facility. The program works under the jurisdiction of the Sage Grouse Stewardship Act and Executive Order 12-2015 that aim to protect and conserve the bird and its habitat, keeping it off the endangered species list. The map below shows the core, primary habitat in purple and general habitat in green.



Development is allowed in habitat areas only after the approval of an application to build, extensive testing of project impacts, and the payment of the measured "debt" to the species that goes towards conservation in different areas[54].

More information about project specifics and the application for development can be found on Sage Grouse Habitat Conservation Program website: https://sagegrouse.mt.gov/

Conclusions

The data in this report points to renewables and wind specifically as the best electricity source, from both an economic and ecological standpoint. Here are the main points that support wind development in Montana.

Suggestions for Future Research Reports

1. Full economic analysis of NWE's presence in Montana and their benefit to the public
2. In-depth profiles of each Montana wind farm to collect accurate state-wide data
3. Application of National Renewable Energy Laboratory's JEDI model to estimate the economic impacts of wind energy at a state level
4. Historical analysis of Public Service Commission actions and agreements and their impact

Resources for Further Study

Wind Powering America's "Electricity from the Wind: What Landowners Should Know"
https://wind.appstate.edu/sites/wind.appstate.edu/files/WhatLandownersShouldKnow-1.pdf

US Dept of Energy's "Wind Energy Guide for County Commissioners" https://www.nrel.gov/docs/fy07osti/40403.pdf

Synapse Energy Economics' "Comments on NorthWestern Energy's Final 2019 Electricity Supply Resource Procurement Plan":
https://bloximages.chicago2.vip.townnews.com/billingsgazette.com/content/tncms/assets/v3/editorial/4/d7/4d71de27-11d7-5a5b-9bac-7a00c00f28ed/5e5480934690b.pdf.pdf

Citations

[1] *Quick Stats Montana 2019 Agriculture Overview*. (2020, July 14). Retrieved July 6, 2020, from United States Department of Agriculture website: https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=MONTANA

[2] *National Parks*. (2020). Retrieved July 6, 2020, from Montana Office of Tourism website: https://www.visitmt.com/places-to-go/national-parks.html

[3] Garside, M. (2019, November 1). *Leading U.S. States by Coal Production in 2018*. Retrieved July 6, 2020, from Statista website: https://www.statista.com/statistics/380641/leading-us-states-by-coal-production/

[4] *Colstrip Steam Electric Station - Colstrip, Montana*. (n.d.). Retrieved July 15, 2020, from Talen Energy website: https://www.talenenergy.com/plant/colstrip-units-3-4/#:~:text=Colstrip%20Steam%20Electric%20Station%20-%20Colstrip%2C%20Montana.%20The,of%20producing%20up%20to%201%2C480%20Megawatts%20of%20electricity.

[5] Cui, R. Y., Hultman, N., Edwards, M. R., He, L., Sen, A., Surana, K., ... Shearer, C. (2019, October 18). Quantifying operational lifetimes for coal power plants under the Paris goals. *Nature Communications*, *10*, doi:10.1038

[6] *The Power to Change: Solar and Wind Cost Reduction Potential to 2025* (ISBN : 978-92-95111-97-4). (2016, June). Retrieved from International Renewable Energy Agency website: https://www.irena.org/publications/2016/Jun/The-Power-to-Change-Solar-and-Wind-Cost-Reduction-Potential-to-2025

Renewable Power Generation Costs in 2019 (ISBN : 978-92-9260-244-4). (2020, June). Retrieved from International Renewable Energy Agency website: https://www.irena.org/publications/2020/Jun/Renewable-Power-Costs-in-2019

[7] Dudley, D. (2019, May 29). Renewable Energy Costs Take Another Tumble, Making Fossil Fuels Look More Expensive Than Ever. *Forbes*. Retrieved from https://www.forbes.com/sites/dominicdudley/2019/05/29/renewable-energy-costs-tumble/#931c52fe8cea

[8] Penn, I. (2020, July 6). The Next Energy Battle: Renewables vs. Natural Gas. *The New York Times*. Retrieved from https://www.nytimes.com/2020/07/06/business/energy-environment/renewable-energy-natural-gas.html

[9] Fox, J. L. (2020, June). *Wind Solar Report*. Retrieved June 2020, from Renewable Northwest

[10] Hoen, B.D., Diffendorfer, J.E., Rand, J.T., Kramer, L.A., Garrity, C.P., and Hunt, H.E., 2018, United States Wind Turbine Database (ver. 3.0.1, May 2020): U.S. Geological Survey, American Wind Energy Association, and Lawrence Berkeley National Laboratory data release, https://doi.org/10.5066/F7TX3DN0.

[11] *Wind Energy in Montana*. (2020, April). Retrieved from American Wind Energy Association website: https://www.awea.org/Awea/media/Resources/StateFactSheets/Montana.pdf

[12] *2015 Electricity Supply Resource Procurement Plan: Ch 8 Existing Resources*. (2016). Retrieved from NorthWestern Energy website: http://northwesternenergy.com/our-company/regulatory-environment/2015-electricity-supply-resource-procurement-plan

J.Fox, personal communication, Sept. 2, 2020.

[13] *PURPA Qualifying Facilities*. (2020, August 10). Retrieved August 13, 2020, from Federal Energy Regulatory Commission website: https://www.ferc.gov/industries-data/electric/power-sales-and-markets/purpa-qualifying-facilities

[14] *HB 487: Undermine Montana's Renewable Portfolio Standard*. (n.d.). Retrieved July 15, 2020, from Montana Environmental Information Center website: https://meic.org/2019/02/hb-487-undermine-montanas-renewable-portfolio-standard/

[15] *Electricity 101*. (n.d.). Retrieved July 2020, from United States Department of Energy - Office of Electricity website: https://www.energy.gov/oe/information-center/educational-resources/electricity-101#sys4

[16] Wiser, R., & Bolinger, M. (2018, August). *2017 Wind Technologies Market Report* (DOE/EE-1798). Retrieved from Department of Energy - Office of Energy Efficiency & Renewable Energy website: https://www.energy.gov/eere/wind/downloads/2017-wind-technologies-market-report

[17] *Quick Facts Montana*. (2018). Retrieved July 2020, from United States Census Bureau website: https://www.census.gov/quickfacts/fact/table/MT/PST045219

[18] *EIA-923 Monthly Generation and Fuel Consumption Time Series File, 2019 December*. (2019, December). Retrieved June 2020, from U.S. Department of Energy, The Energy Information Administration website: https://www.eia.gov/electricity/data/eia923/

[19] *Wind Energy in Montana*. (n.d.). Retrieved June 2020, from WINDExchange - Office of Energy Efficiency & Renewable Energy website: https://windexchange.energy.gov/states/mt

[20] *Electric Power Transmission Lines* [Diagram]. (2020). Retrieved from https://hifld-geoplatform.opendata.arcgis.com/maps/edit?content=geoplatform%3A%3Aelectric-power-transmission-lines

[21] *Montana Distribution Service Area* [Diagram]. (2016). Retrieved from https://www.northwesternenergy.com/our-company/about-us/electric-transmission

[22] Nowakowski, S., & Graff, T. (2017, September). *Qualifying Facilities in Montana: A Snapshot of QF Contracts and Policy*. Retrieved from Montana Legislative Services Division - Legislative Environmental Policy Office website: https://leg.mt.gov/content/Committees/Interim/2017-2018/Energy-and-Telecommunications/Meetings/Sept-2017/Exhibits/QF-Introduction-Tab%208.pdf

[23] *Montana Tariffs and Rates - Qualifying Facility Power Purchase*. (2018). Retrieved July 2020, from NorthWestern Energy website: http://northwesternenergy.com/docs/default-source/documents/MT_Rates/Electric/qf-1

[24] *Montana Electricity Rates and Consumption*. (2020). Retrieved July 2020, from Electricity Local website: https://www.electricitylocal.com/states/montana/

[25] By Order of Montana Public Service Commission. (2008, November 13). *Application by NorthWestern Corporation for Approval of its Interest in Colstrip Unit 4- Final Order* (DOCKET NO. D2008.6.69 - Order 6925f). Retrieved from https://dataportal.mt.gov/t/DOAPSC/views/EDDISearch_15650306559830/PSCEDDISearch?iframeSizedToWindow=true&%3Aembed=y&%3AshowAppBanner=false&%3Adisplay_count=no&%3AshowVizHome=no&%3Aorigin=viz_share_link

By Order of Montana Public Service Commission. (2014, September 26). *Application for the Approval of the Acquisition of PPL Montana LLC's Hydroelectric Generating Facilities in Montana* (DOCKET NO. D2013.l2.85 - ORDER NO. 7323k). Retrieved from https://dataportal.mt.gov/t/DOAPSC/views/EDDISearch_15650306559830/PSCEDDISearch?iframeSizedToWindow=true&%3Aembed=y&%3AshowAppBanner=false&%3Adisplay_count=no&%3AshowVizHome=no&%3Aorigin=viz_share_link

By Order of the Montana Public Service Commission. (2012, February 16). *Application of NORTHWESTERN ENERGY for Approval to Purchase and Operate the Spion Kop Wind Project- Final Order* (Docket No. D2011.5.41 - ORDER NO. 7159l). Retrieved from https://dataportal.mt.gov/t/DOAPSC/views/EDDISearch_15650306559830/PSCEDDISearch?iframeSizedToWindow=true&%3Aembed=y&%3AshowAppBanner=false&%3Adisplay_count=no&%3AshowVizHome=no&%3Aorigin=viz_share_link

By Order of the Montana Public Service Commission. (2009, May 20). *Application for Approval to Construct and Operate the Mill Creek Generating Station to Supply Regulation Service - Final Order* (Docket D2008.8.95 - Order No. 6943a). Retrieved from https://dataportal.mt.gov/t/DOAPSC/views/EDDISearch_15650306559830/PSCEDDISearch?iframeSizedToWindow=true&%3Aembed=y&%3AshowAppBanner=false&%3Adisplay_count=no&%3AshowVizHome=no&%3Aorigin=viz_share_link

[26] By Order of the Montana Public Service Commission. (2017, November 24). *IN THE MATTER OF NorthWestern Energy's Application for Interim and Final Approval of Revised Tariff No. QF-1, Qualifying Facility Power Purchase – Order on Reconsideration* (Docket D2016.5.39 – Order No. 7500d). Retrieved from

https://dataportal.mt.gov/t/DOAPSC/views/EDDISearch_15650306559830/PSCEDDISearch?iframeSizedToWindow=true&%3Aembed=y&%3AshowAppBanner=false&%3Adisplay_count=no&%3AshowVizHome=no&%3Aorigin=viz_share_link

[27] *Montana Department of Revenue Biennial Report*. (2018, December). Retrieved from Montana Department of Revenue website: https://mtrevenue.gov/publications/biennial-reports/

[28] *Tax Policy*. (n.d.). Retrieved July 2020, from American Wind Energy Association website: https://www.awea.org/policy-and-issues/tax-policy

[29] Brown, J. T. (2017). *Residential Electricity Rates of NorthWestern Energy through June 2017*. Retrieved from Montana Consumer Counsel website: https://leg.mt.gov/content/Committees/Administration/Consumer%20Counsel/Reports/NWERateGraphs.pdf

[30] Prairie Populist. (2018, August 1). *Wind Power is Blowing Up Local Economies*. Retrieved July 2020, from Prairie Populist website: http://prairiepopulist.org/judith-gap-wind-farm/

[31] ratio based on rates provided by Musselshell ranch owner

[32] Hamilton, J., & Liming, D. (2010, September). *Careers in Wind Energy*. Retrieved July 2020, from U.S. Bureau of Labor Statistics website: https://www.bls.gov/green/wind_energy/#relevmanu

[33] *Wind Turbine Technician Salary*. (2020). Retrieved July 2020, from U.S. News and World Report website: https://money.usnews.com/careers/best-jobs/wind-turbine-technician/salary

[34] Lutey, T. (2012, October 18). *Shawmut Wind Farm to Spin by Year's End*. Retrieved July 2020, from Billings Gazette website: https://billingsgazette.com/news/state-and-regional/montana/shawmut-wind-farm-to-spin-by-year-s-end/article_b69f786c-ba03-5fc3-b6e2-978225b0647f.html

[35] *Texas Programs*. (2020). Retrieved July 2020, from DSIRE NC Clean Energy Technology Center website: https://programs.dsireusa.org/system/program?fromSir=0&state=TX

[36] *USDA - Rural Energy for America Program (REAP) Grants*. (2018, August 21). Retrieved July 16, 2020, from DSIRE NC Clean Energy Technology Center website: https://programs.dsireusa.org/system/program/detail/917

[37] *Solar and Wind Energy Business Franchise Tax Exemption*. (2015, April 27). Retrieved July 16, 2020, from DSIRE NC Clean Energy Technology Center website: https://programs.dsireusa.org/system/program/detail/82

[38] *Texas Solar and Wind Energy Device Franchise Tax Deduction*. (2015, April 27). Retrieved July 2020, from DSIRE NC Clean Energy Technology Center website: https://programs.dsireusa.org/system/program/detail/81

[39] *Texas Quick Facts*. (2019, February). Retrieved from ERCOT, Inc. website: http://www.ercot.com/content/wcm/lists/172484/ERCOT_Quick_Facts_02.4.19.pdf

[40] *Texas Overview*. (2020, March 19). Retrieved July 2020, from EIA Beta website: https://www.eia.gov/beta/states/states/tx/overview

[41] *Texas Analysis*. (2020, March 19). Retrieved July 2020, from EIA Beta website: https://www.eia.gov/beta/states/states/tx/analysis

[42] Clemente, J. (2019, September 5). *These U.S. States Generate the Most Wind and Solar Power*. Retrieved July 2020, from Forbes website: https://www.forbes.com/sites/judeclemente/2019/09/05/these-u-s-states-generate-the-most-wind-and-solar-power/#64e58a5e5c70

[43] H.R. 0267, 66th Leg. (2019).

[44] H.R. 0597, 66th Leg. (2019).

[45] Fadie, B. (n.d.). *Should PSC oversight of monopoly utilities be strengthened or undermined?* Retrieved July 2020, from Montana Environmental Information Center website: https://meic.org/2019/03/should-psc-oversight-of-monopoly-utilities-be-strengthened-or-undermined/

[46] Botsford, C. (2020, July 10). *Utility-Scale Energy Storage: When Free Isn't Cheap Enough*. Retrieved July 16, 2020, from Energy Central - The Energy Collective Group website: https://energycentral.com/c/ec/utility-scale-energy-storage-when-free-isn't-cheap-enough#:~:text=The%20%24200-400%2FkWh%20is%20the%20rough%20cost%20range%20of,for%20shorter%20durations%20because%20the%20balance-of-plant%20costs%20dominate.

[47] Cole, W., & Frazier, A. W. (2019, June). *Cost Projections for Utility-Scale Battery Storage* (NREL/TP-6A20-73222). Retrieved from National Renewable Energy Laboratory website: https://www.nrel.gov/docs/fy19osti/73222.pdf

[48] *Gordon Butte Pumped Storage Hydro Facility Project Overview*. (2020). Retrieved July 2020, from GB Energy Park website: https://gordonbuttepumpedstorage.com/project-overview/

[49] Brown, M. (2019, July 12). *Montana Energy Storage Project Lines up Financial Partner*. Retrieved July 2020, from AP News website: https://apnews.com/8c3bd5aff52a400592ea141bf0061968

[50] Loss, S. R., Will, T., & Marra, P. P. (2015). Direct Mortality of Birds from Anthropogenic Causes. *Annual Review of Ecology, Evolution, and Systematics*, *46*(1), 99-120. Retrieved from https://www.annualreviews.org/doi/pdf/10.1146/annurev-ecolsys-112414-054133

[51] Neuhauser, A. (2014, August 22). *Pecking Order: Energy's Toll on Birds*. Retrieved July 2020, from U.S. News and World Report website: https://www.usnews.com/news/blogs/data-mine/2014/08/22/pecking-order-energys-toll-on-birds

[52] Sovacool, B. K. (2013, January). The Avian Benefits of Wind Energy: A 2009 Update. *Renewable Energy*, *49*, 19-24. DOI 10.1016.

[53] Puckett, K. (2017, July 21). Bat, Bird Deaths Focus of Wind Farm Study. *Great Falls Tribune*. Retrieved from https://www.greatfallstribune.com/

[54] *MT Sage Grouse Habitat Conservation Program*. (2020). Retrieved July 2020, from Montana Department of Natural Resources and Conservation website: https://sagegrouse.mt.gov/

Image Citations

Bridger High School [Photograph]. Retrieved from https://www.facebook.com/158015710902264/photos/a.364870560216777/364870580216775/?type=3&is_lookaside=1

Gordon Butte Pumped Storage [Diagram]. Retrieved from https://gordonbuttepumpedstorage.com/

Harlowton Train Car [Photograph]. Retrieved from https://www.montanapictures.net/harlowton-montana-montanapictures-net/

Judith Gap School [Photograph]. Retrieved from https://billingsgazette.com/news/state-and-regional/montana/judith-gap-population-celebrates-milestone-birthday/article_ccd36646-a256-5b9f-951f-4e0a050eaf9d.html

Montana Schools [Photograph]. Retrieved from https://montanahistoriclandscape.com/tag/montana-schools/

Musselshell Wind Projects [Photograph]. Retrieved from https://potentiarenewables.com/project/musselshell-wind-projects/

NorthWestern Energy Logo [Diagram]. Retrieved from https://www.bozemandailychronicle.com/news/economy/montana-supreme-court-denies-northwestern-million-in-rate-increases/article_eea144b6-16bc-5d40-9385-92ac300057d0.html

Reed Point School Montana [Photograph]. Retrieved from https://www.montanapictures.net/reed-point-montana-picture-tour-montanapictures-net/

State of Texas [Diagram]. Retrieved from https://www.termlimits.com/can-we-get-term-limits-without-congress-consent-yes/

Sunburst School Montana [Photograph]. Retrieved from https://www.montanapictures.net/sunburst-and-kevin-montana-picture-tour-montanapictures-net/

Sweet Grass County School Districts [Photograph]. Retrieved from http://sweetgrasscountygov.com/government-departments/county-govt/superintendent-of-schools/county-school-districts/

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