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Wind development, tax policy and economic development tradeoffs

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ABSTRACT

Wind energy poses an opportunity for rural communities. Many western states are currently challenged by structural economic changes and serious declines in employment and tax revenues. This opportunity has also led some state policymakers to consider wind taxation increases to create needed new revenue, which could deter such development. Such decisions must be made with a clear understanding of each state's real competitiveness, and with recognition of the potential tradeoffs such decisions could imply.

1. Introduction

Wind energy poses a major opportunity for rural communities nationwide, and in particular in the Rocky Mountain West. States in the Western Interconnection have significant wind resources and also sizeable and demonstrated demand for wind energy. Communities in the west are often eager to take advantage of their wind resource to create additional economic development, and to diversify economies often dependent on energy or agriculture, both of which are prone to economically damaging boom and bust cycles that can wreak havoc on local and regional public, as well as private revenues. The local economic impacts of wind development can be sizable, as other authors have argued (see, for example, Slattery et al. (2011), and Brown et al. (2012)) and we potentially demonstrate below. In the past several years, facing a fall in world oil and domestic natural gas prices due to rapid innovation in the industry (e.g. hydraulic fracturing and directional drilling), and/or reduced coal production from competition in the generation sector from natural gas, energy-dependent states have seen declines in traditional revenues. As such, these energy dependent regions have struggled to finance public services. They have also seen declines in private sector activity and loss of working-age population for the same reasons. Wind development could potentially provide some relief from these challenges by creating a new source of revenue for public services and an opportunity for some of these states and their rural communities to both diversify their economies and revenue structures.

Wind development creates both short- and long-term private economic benefits. In the short term, these capital-intensive projects can bring significant new economic activity to local communities during construction, creating direct benefits from construction employment and activity, and indirect demand for goods and services and employment (e.g. materials, vehicles, fuel, other consumables, and housing and lodging services). Over the longer term, during operations, wind projects may create direct benefits locally through employment and through on-going demand for materials, equipment, and services while also providing income through lease payments to landholders that allow lands to remain in traditional use, preserving a western way of life that is often perceived to be at risk due to increasing urban sprawl and gentrification of rural lands. Public revenues may also be enhanced through the collection of additional property, sales, income, and other taxes.

Exploiting this development opportunity though poses several tradeoffs. First, wind energy and its wide use of space can pose ecological challenges and changes in the landscape, threaten local use of open lands, and create local concerns regarding historical and cultural aesthetics and the connection local people have to their environment. Opposition to wind development over these concerns has often united a diverse group of stakeholders - from politically left-leaning environmentalists to conservative citizens and politicians who do not support renewable development for a wide range of ideological and political reasons. Secondly, the increased activity and employment may also cause increased demand for local public services (e.g. additional emergency services, public and education services to support new workers' family needs, and public infrastructure expansion). These increased demands may create need for additional tax revenues and may therefore create a public incentive to raise taxes on wind generation. Doing so, however, could hinder regional competitiveness to attract wind investment, thus undermining the potential ability of a region to realize the economic benefits of additional development.

Local tax environments can affect which regions successfully attract

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wind investment. Communities have grappled with trying to decide whether to welcome large-scale wind development and potentially reduce its tax burden to competitively attract projects, or to take advantage of such development as it occurs to tax it to compensate for the local costs it imposes and to supplement local, county, and state revenues, especially in regions where traditional revenue sources have been declining. No state likely epitomizes these conflicting incentives more than Wyoming.

The following presents a case study of Wyoming as it confronts the policy tradeoffs between potential development and taxation surrounding a recent tax debate that took place in the state regarding a proposed increase in its unique wind generation tax. Section 2 details the comparative competitiveness conditions to attract wind development across states in the Western Interconnection. A comparative analysis of western wind taxation is then described in Section 3. The potential tradeoff between economic development and Wyoming's proposed tax policy is then developed in Section 4, putting into context the potential conflict between increased tax revenues and the potential losses in economic activity such tax changes may result in if they cause the cancellation of some proposed wind development. Section 5 concludes. The Wyoming case presents the challenge energy-dependent regions face regarding the potential of wind development to be used to diversify local economies and their tax revenues, and the scale of what might be at stake from wind energy "tax competition" in the west.

2. Background

Wyoming's wind resources are considered among the best in the country in terms of potential electricity output. In 2015, the National Renewable Energy Laboratory (NREL) estimated that Wyoming has over 139,000 km^2 of land capable of producing wind generation at or greater than 35% gross capacity factor (GCF) using current technology (NREL, 2015).[1] This ranked the state 11th out of the 50 states, and third among Rocky Mountain and Western states, behind only Montana and New Mexico (Table 1).[2] The first commercial wind generation facilities began construction in Wyoming in the late 1990 s, with commercial wind generation beginning in the spring of 1998. Between 1998 and 2010, Wyoming wind generation grew to over 1400 MW across 21 facilities, and the state now ranks 16th in the country for installed wind capacity, and fifth among Rocky Mountain and Western states (AWEA, 2018).

Elsewhere in the Western Interconnection, wind development has also expanded over the past two decades, especially since 2010. Fig. 1 shows the annual installed wind capacity in the western states since 2000. Fig. 2 shows how state wind generation capacities have changed since 2010 in the west. Comparison of the two figures indicates a change in the pattern of wind development. In 2010, Wyoming ranked fourth among western states in wind development, trailing only California, Oregon, and Washington. By 2017, however, the state had fallen to sixth in the west, with Colorado and New Mexico surpassing Wyoming's total wind capacity. Furthermore, as shown in Fig. 2, wind capacity growth in all other states in the Western Interconnection exceeded Wyoming's despite Wyoming's superior wind potential. In this period, six states (Arizona, Colorado, Idaho, Montana, Nevada, and New Mexico) more than doubled their capacity while Wyoming added only 77 MW. Given the economic and revenue benefits new wind capacity offers both from construction and operations, Wyoming's relative lack of growth since 2010 poses an important policy question in understanding what may drive western wind development.

Despite its natural advantages, assessment of Wyoming's competitive position in terms of attracting wind development indicates several challenges. Wyoming has a small local market to use such power, and is relatively farther from the largest markets on the western grid than other western states. For these reasons, wind development in the state is dependent on transmission infrastructure to deliver power (Godby et al., 2016). Such transmission capacity out of the state, however, is currently quite limited. Several industry transmission planning reports and academic studies have discussed the need for greater transmission development if wind generation in Wyoming and the west is to be developed on much larger scales than seen today (see for example: GE Energy, 2010; and Godby et al., 2014). These concerns seem validated by some currently proposed wind development projects in Wyoming as well. Two very large proposed developments - the Power Company of Wyoming's Chokecherry and Sierra Madre project (3000 MW), and the Pathfinder Project (2100 MW) – include costly transmission expansion as part of their proposals, since current transmission infrastructure is inadequate to deliver the proposed projects' power to California markets.[3] The inclusion of such transmission capacity in wind projects is rare and increases the total cost of such development significantly.

Furthermore, technological advances in wind generation may also be reducing Wyoming's relative competitiveness among western states. Specifically, taller towers and longer blades developed for use in lower wind potential areas have improved potential capacity factors and productivity in states previously considered relatively less attractive for wind development, and have facilitated development in such areas. Wiser et al. (2017) document the convergence of capacity factors between medium, higher and highest wind resource regions

While technology, infrastructure and locational challenges may have reduced the attractiveness of developing wind in Wyoming in recent years, other states in the west also face such challenges and differences in state wind policy may also explain recent development patterns. Given all western states have locations suitable for economically competitive wind development, the competitiveness of a state to attract wind development is also affected by the policy environment it creates to incentivize such development. Such incentives can affect market demand for wind inthe state, reduce development costs or serve to reduce wind generation owners' tax liabilities and therefore increase after-tax returns for developers.

3. Tax conditions in the West

Tax conditions vary greatly with respect to types of taxes, taxation levels on wind energy, and incentives available by state to attract wind. With respect to incentives, the most common state-based incentive program is a renewable portfolio standard (RPS), requiring a certain amount of electricity generation come from renewable sources within a state. Such policies have been shown to help drive demand for wind energy development in other states (see Black et al., 2014; Hitaj, 2013; Carley, 2011; Adalaja and Hailu, 2007; and Menz and Vachon, 2006). All but three states in the Western Interconnection have an RPS standard, as shown in Fig. 3.[4] Wyoming does not provide any statewide tax incentives or credits to develop wind, nor does it have a RPS requirement. Furthermore, the RPS incentive is increasingly bolstered by technologically reduced cost per MWh. Wind is the lowest-cost source of new electricity generation in many areas of the country (Lazard, 2017).

[1] Gross capacity factor (GCF) refers to the percentage of potential output expected to be generated in a given year from a wind generator. NREL assumes current wind generation technology using towers 110m in height with current blade design technologies. Earlier technology used 80m towers. Near future technologies assume 140m hub heights with 110m blade diameter. See NREL (2015).

[2] This ranking assumes current technology. The western states shown in Table 1 comprise those in the Western Interconnection.

[3] The Power Company of Wyoming is developing what will be the largest wind project in the country at 3000 MW. The project, also includes a DC transmission line over 650 miles in length called TransWest, to deliver power to Southern California. The Pathfinder project in central Wyoming has been dormant for several years but proposed building a 525-mile transmission line to deliver power to market in Southern California.

[4] While not having an RPS standard, in 2008 Utah established a voluntary renewable portfolio goal of 20% by 2025.

Table 1
Estimated western state land area and generation wind potential for wind generation Assuming Gross Capacity Factor (GCF) of 35+%.

State	Land Area with 35+% GCF			Wind Capacity Potential 35+% GCF			
	Circa 2008 turbine technology (km^2)	Current 2014 turbine technology (km^2)	Near future turbine technology (km^2)	Circa 2008 turbine technology (MW)	Current 2014 turbine technology (MW)	Near future turbine technology (MW)	National rank based on current 2014 technology
MT	140,943	224,102	235,096	687,803	566,977	430,225	3
NM	69,696	166,799	221,024	340,116	422,000	404,475	8
WY	86,622	139,342	155,016	422,713	352,535	283,679	11
CO	56,220	103,904	125,845	274,353	262,878	230,297	15
AZ	349	29,413	104,352	1,703	74,414	190,964	25
ID	690	29,195	50,820	3,368	73,863	93,000	26
WA	1,309	26,700	53,137	6,386	67,551	97,241	27
OR	1,300	26,273	63,878	6,344	66,472	116,896	28
CA	3,283	25,989	57,626	16,019	65,752	105,456	29
UT	367	22,880	51,231	1,792	57,887	93,752	31
NV	313	16,996	68,351	1,526	43,000	125,083	34

Source: NREL 2015.

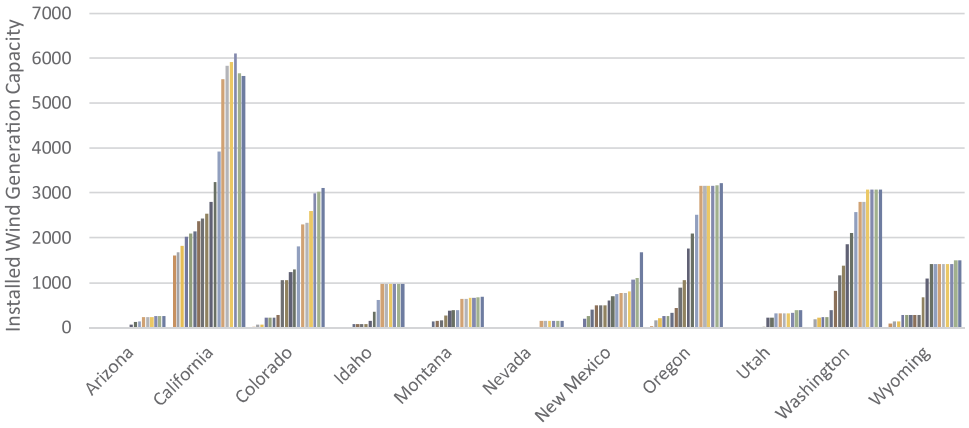

Fig. 1. Annual installed wind capacity total by state: 2000–2017.
Source: Energy Information Agency (EIA).

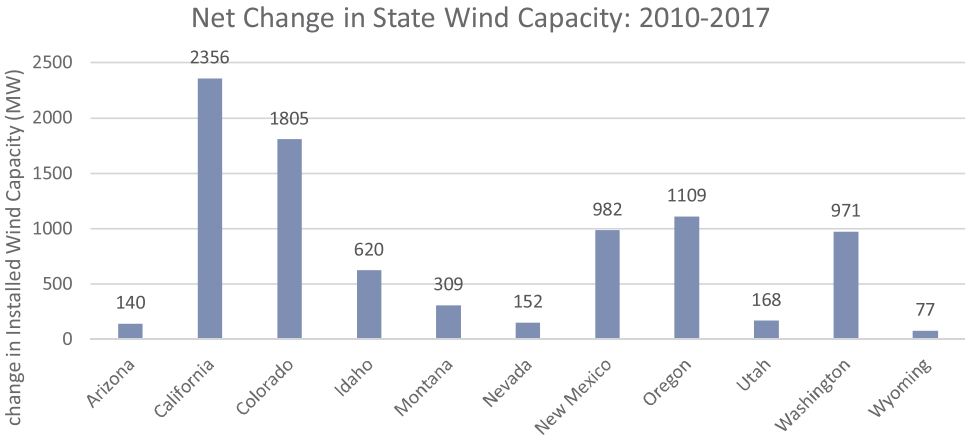

Fig. 2. Net change in western states' wind capacity: 2010–2017.
Source: (EIA).

Differences in tax policy across states are harder to compare because many states do not assess taxes in comparable ways. For example, three states (Wyoming, Nevada, and Washington) do not have corporate income taxes while two (Montana and Oregon) do not assess sales taxes. Furthermore, rules regarding the assessment of various types of tax may vary by state. Despite these differences though, clear sources of variation emerge with respect to wind energy taxation across states. Table 2 summarizes differences among states with respect to policies to encourage wind development.

A review of state incentives in the Western Interconnection shows significant differences among states. To wind developers, tax incentives are important. Arguably the most important is the sales tax, as wind facilities are highly capital-intensive and sales tax requirements can increase the total capital expenditure on a project significantly. Also, wind facilities are often developed and then sold, thus the developers of projects are potentially more concerned with the up-front capital expenditure than taxes paid over time on income or in the form of property taxes. For these reasons, sales tax exemptions (or the lack of a

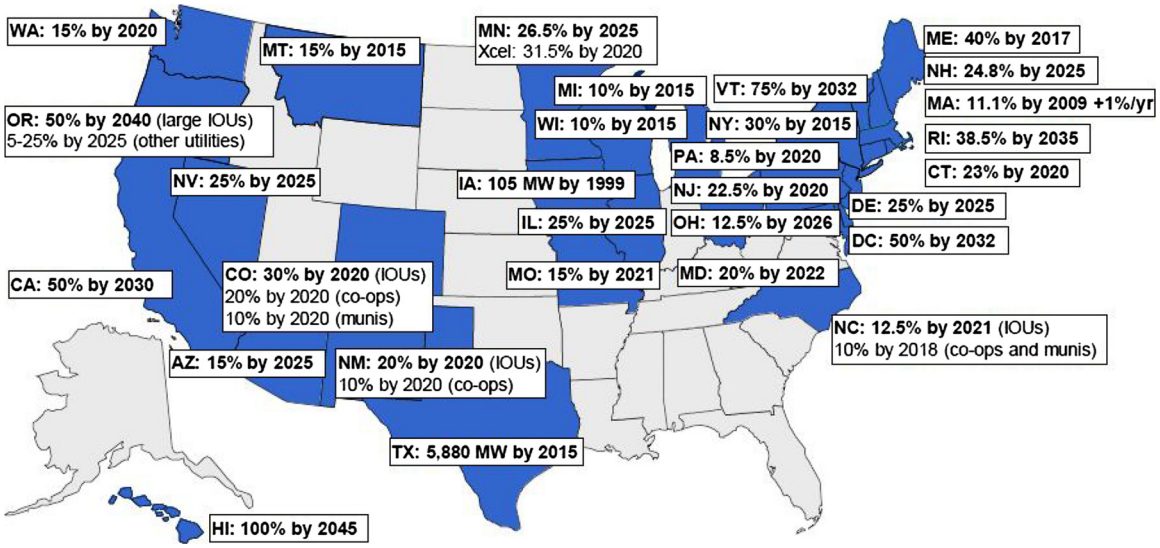

Fig. 3. Renewable portfolio standards in the United States, July 2017.
Source: Wiser et al. (2017).

sales tax entirely in Montana and Oregon) have been a primary concern of wind developers. Two states currently offer full exemptions to sales taxes (Colorado, and Utah) while Montana and Oregon have no sales tax, as previously noted, and Nevada reduces the potential tax to 2.6%. Wyoming, however, acted to eliminate its previously existing sales tax exemption on wind development in 2010.

Despite the fact that the capital-intensive nature of wind generation potentially creates a greater focus on sales tax levels, income and property taxes are also an important concern. This is true both for developers wishing to operate facilities they build, or those planning on selling such facilities once built, as both types of developers will have to account for the effects taxes have on net income streams the installations will create. As noted previously, three states, including Wyoming, lack a corporate income tax. Nevada also offers a property tax exemption for wind developments. Those states that do impose corporate income taxes often offer significant tax credits to offset this cost. Arizona, Colorado, Montana, New Mexico, and Utah for example all have a variety of programs that attempt to reduce the burden of their state's corporate income tax on developers locating in their states. With respect to property taxes, five states offer full or partial reductions in the tax rate charged (Arizona, Colorado, Montana, Nevada, and Oregon) for wind development. Wyoming offers no property tax exemption.

An example of a less common form of (dis)incentive policy is Wyoming's generation tax on wind energy of $1 per MWh. Unique nationally, Wyoming's tax charges wind developers for the privilege of producing electricity in Wyoming. As the only such tax in the country, this has increased the cost of operations of such facilities in Wyoming relative to all other states.[5] This tax was passed in early 2011 and assessment of the tax began Jan. 1, 2012. Since then, Wyoming lawmakers have considered raising the wind tax to as high as $5 per MWh during two legislative sessions (in 2016 and 2017). While these bills have never come close to being passed, this tax discussion has potentially sent a negative signal to wind developers regarding the state's enthusiasm for wind generation, and created uncertainty regarding future tax liability in Wyoming.

Overall, assessment of Wyoming's tax structure, incentives and renewable policies indicates a potential competitive disadvantage with respect to the state's ability to attract wind developers. Wyoming's primary tax benefits are the lack of an income tax and relatively low property taxes. Offsetting these advantages are the fact that the state does have a statewide sales tax, it lacks both sales and property tax exemptions for wind developers, and the state taxes wind generation, unlike any other state. Wyoming also is among a minority of states in the west (and nationally) that do not have a state RPS requirement. In Wyoming, the lack of such a standard, tax conditions, and transmission access problems could seemingly explain the relative lack of wind development in the state since 2010.

4. Estimating the potential tax revenue/economic development tradeoff in Wyoming

While wind development in Wyoming has lagged western states since 2010, interest in the Wyoming's wind potential continues. As of 2018, this includes the 3000 MW Chokecherry/Sierra Madre wind development owned by Power Company of Wyoming, 1311 MW of new wind generation announced in early 2018 by Rocky Mountain Power (the Wyoming subsidiary of PacifiCorp), a 500 MW of potential called Boswell Springs owned by Alterra Power Corp., and an 1870 MW facility proposed by Viridis Eolia in planning stages.[6] This list of projects may or may not actually be built as planned as all but the Power Company of Wyoming's Chokecherry/Sierra Madre project are in initial phases of planning and permitting. Due to the size of several of these projects, transmission expansion will also likely have to occur before some reach production.[7] Benefits to the state from such development include increases in local taxes collected from the new wind facilities, and the private economic benefits from the additional economic activity these projects would create in the state.

While these projects have been under development, Wyoming legislators have been under pressure to find new sources of revenue to replace lost energy revenues from oil, natural gas, and coal that account for up to 80% of the state's operating budget needs. As noted in the previous section, some lawmakers have recommended increasing Wyoming's wind generation tax as a potential new source of revenue.

[5] Stating that Wyoming is the only state in the nation with a wind generation tax is not strictly true. Minnesota assesses up to a $1.20 tax per MWh on wind generation facilities larger than 12 MW in capacity; however, the tax is imposed in lieu of assessing property taxes on the improved value of the land and therefore is not an additional tax on wind generation as in Wyoming.

[6] This list includes only active and recently announced projects in Wyoming, and excludes projects that have been proposed previously but now appear to be inactive.

[7] In addition to the TransWest line associated with the Chokecherry/Sierra Madre project, Rocky Mountain Power also plans a 140-mile expansion of its own transmission network to accommodate their wind proposal.

Table 2
Summary of wind taxes and incentives by western state.

	State Corporate Income Tax Rate	State Business Tax Rate	Exemptions from Corporate or Business Taxes	Sales Tax Rate (Avg. state & Local)	Sales Tax Exemption	Property Tax Exemption/ Incentive	Other Incentives/ Subsidies*	State RPS Standard	Specific Wind Taxes
Arizona	6.968%	N.A.	-investment tax credit of 10%, 1¢/ kWh Production tax credit	5.6% (8.25%)	No	-taxed at 20% of depreciated value	No	15% by 2025	No
California	8.840%	N.A.	No	7.5% (8.48%)	-limited to non-generation equipment	No	No	33% by 2020, 50% by 2050	No
Colorado	4.630%	N.A.	−80% exemption for facilities in state enterprise zones	2.9% (7.5%)	-state sales tax exemption for wind facilities	-graduated reductions in property tax rates for larger facilities	No	30% IOUs/20% coops/ 10% MOUs by 2020	No
Idaho	7.400%	N.A.	No	0% (6.04%)	No	−3% of annual energy earnings if not regulated by IPUC	-IPPs can request financing from Idaho Energy Resources Authority	No	No
Montana	6.750%	N.A.	−35% investment tax credit, 1% of new wage payroll if jobs increase by 30%	N.A.	-all equipment exempt - no sales tax in the state	−50% for facilities over 1 MW **in first** five years, increases to 100% over next 10 years	No	15% by 2025	No
Nevada	N.A.	−0.136% of the Nevada gross revenue exceeding $4 million	-Revenues from power exported from the state would be exempt	6.85% (7.98%)	-reduced to 2.6% on purchases in the first three years of operation	-over 10 MW, the property tax is reduced by up to 55% for up to 20 years	No	25% by 2025	No
New Mexico	7.60%	N.A.	−0.01¢/kWh credit up to the first 400,000 MWh produced	5.13% (7.55%)	No	No	-Industrial revenue bonding to avoid gross receipts, state property tax.	20% by 2020	No
Oregon	6.600%	N.A.	No	N.A.	-all equipment exempt - no sales tax in the state	-Property used in renewable energy generation is exempt from taxes	No	−50%(IOUs)/ 5% to 25% for smaller entities by 2040	No
Utah	5.000%		−10% investment tax credit, $0.0035/kWh production tax credit in first four years, 75% post-performance credit available	5.95% (6.76%)	-renewable energy equipment is exempt	No	No	Voluntary, with goal of 20% by 2025	No
Washington	N.A.	−0.00484% of gross receipts	−12¢/kWh - 18¢/kWh refund to a maximum of $5000 per year	6.5% (8.9%)	No	No	No	15% by 2020	No
Wyoming	N.A.	N.A.	-no taxes on income or earnings	4% (5.4%)	No	No	No	No	$1/MWh

* Includes grants and financing assistance.

Increases in the wind tax that have been suggested range from an additional $1 per MWh to as high as $5/MWh. Such proposals have drawn a critical reaction from developers, with some threatening to cancel projects. For example, the chief executive of Power Company of Wyoming, which owns the largest proposed project, recently stated that with these proposals the state was at risk of "taxing this project out of existence."[8]

The problem facing Wyoming policymakers trying to develop new tax revenues is the fact that the responsiveness of wind development to cancel planned projects in the face of tax increases, or their "tax elasticity," is unknown. To attempt to quantify the unknown potential financial tradeoff facing Wyoming lawmakers, the following summarizes the potential tax benefits of increasing Wyoming's wind generation tax versus the benefits five generic but representative wind projects in Wyoming would create in terms of private economic development and through new tax revenues if taxes were unchanged. The project descriptions we presume representative as likely potential projects to be developed in the state based on current proposals are shown in Table 3 and total 6140 MW.[9]

To define the nature of the potential tradeoff facing lawmakers between increased wind energy revenues and the possibility such tax increases could cause projects to choose not to develop, we compare:

- The new tax revenues that would accrue + the private economic development impacts from projects in Table 3. These benefits assume these projects *will be developed* if taxes do not change based on current proposals for wind development in Wyoming.
- The estimated tax revenues created from an increase in the state's wind generation tax assuming it was increased from the current level of $1 per MWh to $2 per MWh, $3 per MWh, or $4 per MWh. Revenues are computed assuming (i) the best case scenario that all proposed wind projects continue to develop even in the face of such tax increases, and assuming all existing wind facilities in the state continue to operate, and (ii) the worst case scenario that assumes all five new projects choose not to develop in Wyoming after such a tax change. We also detail the incremental revenues at risk if any of the projects in Table 3 choose not to develop.[10]

Results are summarized below. Complete methodological description and computations are described in Godby et al. (2016).

The potential tax benefits from the five projects assumed are described in Table 4. If no laws were changed in Wyoming, total tax revenues from both construction and operations over the 20-year life of the projects would be nearly $1.9 billion. Some 23% of these revenues accrue from construction (approximately $442 million), with the remaining 77% ($1.457 billion) paid over the life of the projects. The scale of the wind facility determines the share of potential revenues generated at current tax rates in the state, with the 80 MW facility estimated to create only 1.3% of total potential tax revenues, while the 3000 MW site creates 48.9% of the total potential benefits if all 6140 MW of new generation were built. Clearly, Wyoming's relative lack of development since 2010 has resulted in significant loss in potential tax revenues from wind generation.

Table 3
Description of modeled representative potential wind projects in Wyoming.

Proposed Capacity	Location (county/ nearest town)	Assumed Market (Customer)
120 MW	Uinta/Evanston	Wyoming/Regional
2100 MW	Platte/Chugwater	California
80 MW	Converse/Glenrock	Wyoming /Regional (Rocky Mountain Power Co/PacifiCorp).
3000 MW	Carbon/Rawlins	California
840 MW	Carbon/Medicine Bow	Unknown

In addition to the new tax revenues proposed development in Wyoming would create at current tax rates, the projects would create significantly larger benefits to the private sector through the increased economic activity in the state. The additional economic activity occurs in two phases: the construction phase, and the operations and maintenance phase. Total estimated economic impacts of the construction and operations of the facilities detailed in Table 3 are described in Table 5.

Total expenditure to build a set of projects in Table 3 totaling 6140 MW is estimated to be $10.7 billion using NREL's JEDI model and information contained in Power Company of Wyoming's Chokecherry/Sierra Madre project permit application to the state. We assume 77% of these costs would be spent on machinery and equipment, none of which is presumed to be procured in Wyoming. Also, due to the small size of Wyoming's resident construction workforce, the majority of construction labor payments (80%) are also assumed to be made to out-of-state residents. Overall, to build the facilities, we estimate $2.4 billion would be spent in Wyoming. Despite these conservative assumptions, using IMPLAN to model a set of standard economic impact computations, construction of the facilities described in Table 3 would create an additional $1.1 billion in indirect (supply-chain) and induced (activity caused by new income spent in the state) expenditures, for a total construction impact of $3.5 billion. Assuming 5 years to build all five projects in Table 3, construction would employ an average of 4443 people in the state annually.

Operations and maintenance of the plants during their 20-year lifetime creates an additional $3.6 billion in new economic activity, with $2.6 billion created by direct plant expenditures and another $1 billion in additional indirect and induced economic activity. We estimate the projects would create 28,962 job-years of employment during their operation, or an average of 1448 jobs annually. This additional employment would add $1.7 billion in new labor income in the state.

Combining the impact of the two phases, the building and operation of the assumed wind facilities over their 20-year lifetime is estimated to create $7.1 billion in new state economic activity, 51,178 job-years of new employment and $3.0 billion in new labor income. Overall, the combined benefits of the additional public tax revenue detailed in Table 4, and the additional economic activity from construction and operations in Table 5 would total $9.0 billion. This assumes no changes in tax rates and the 6140 MW of new wind capacity detailed in Table 3 is built in the state.

The potential revenue increases that Wyoming policymakers might create by raising the generation tax are shown in Fig. 4 and Table 6. Three tax levels were considered: increasing the existing rate from $1 to $2 per MWh, to $3 per MWh, and to $4 per MWh. These are actual levels discussed in committee hearings where legislation was debated in 2016 and 2017.[11] Fig. 4 describes how tax revenues would accrue due to an increased assessment on existing wind facilities, and from new facilities assuming all the projects in Table 3 are built and existing

[8] See Yardley (2016) "Who owns the wind? We do, Wyoming says, and it's taxing those who use it," *Los Angeles Times*, Aug. 14, 2016.

[9] Given the uncertainty of any wind project between proposal and completion, the generic projects were developed after consideration of proposed project plans and sized to create a continuum of projects that might be developed in Wyoming. The assumed locations, markets and sizes reflect current proposals and range from the size of a "qualifying facility" under PURPA of 80 MW equivalent to the last wind project built in Wyoming, to a 120 MW facility similar to sites already developed in Wyoming, to a 3,000 MW site like the Chokecherry/Sierra Madre project. The other project sizes considered could be thought of as representing scaled down or slightly scaled up versions of other currently proposed projects in the state.

[10] We detail the total revenues at stake from the 21 existing facilities in the state but do not model the potential revenue losses if any individual facilities ceased operating in the face of a new tax.

[11] A $5 per MWh tax has also been discussed. We do not consider it here. Potential benefits at this level can be determined by taking the data in Table 7 for the $4 per MWh values and multiplying by 1.33, resulting in $1.9 billion in revenues over the 20-year lifetime of the facilities, assuming all existing wind facilities remain in service.

Table 4
Estimated incremental tax revenues for proposed wind facilities at current tax rates.

MW Capacity	Annual Generation Tax ($1/MWh)	Annual O&M Sales and Use Tax	Annual Property Tax	Annual Total Tax	20-Year Total O&M-based Tax Revenue	Construction Sales and Use Tax
3000	$10,500,000	$2,328,871	$23,808,048	$36,636,919	$711,738,381	$215,898,826
2,100	$7,350,000	$1,630,210	$16,665,634	$25,645,843	$498,216,867	$151,129,178
840	$2,940,000	$652,084	$6,666,253	$10,258,337	$199,286,747	$60,451,671
120	$420,000	$93,155	$952,322	$1,465,477	$28,469,535	$8,635,953
80	$280,000	$62,103	$634,881	$976,985	$18,979,690	$5,757,302
6140	**$21,490,000**	**$4,766,423**	**$48,727,138**	**$74,983,561**	**$1,456,691,220**	**$441,872,930**

Table 5
Estimated economic impacts of proposed projects.

Construction Impacts	
Estimated total project costs	$10.7 billion
Wyoming expenditures (total direct expenditures)	$2.4 billion
Non-resident labor expenditure	$366.5 million
Resident labor expenditure	$91.6 million
Non-labor construction expenditure	$1.5 billion
Sales and use tax revenues	$441.9 million
Total indirect and induced activity	$1.1 billion
Total economic activity: Construction phase	**$3.5 billion**
Estimated employment generated	**22,216 job-years**
Labor income generated	**$1.3 billion**
Average per job income	**$58,858**
Operations/Maintenance Impacts (Annual)	
Total operations & maintenance expenditures	$240.8 million
Wyoming O&M expenditures (total direct expenditures)	$129.8 million
O&M labor expenditure	$21.5 million
O&M non-labor expenditure	$32.5 million
State-local government payments	$75.7 million
Total indirect and induced activity	$49.5 million
Total economic activity: O&M phase	**$179.3 million**
Estimated employment generated	**1,471 job-years**
Labor income generated	**$74.4 million**
Average per job income	**$57,381**
20-year O&M direct impacts	**$2.6 billion**
20-year O&M indirect impacts	**$1.0 billion**
20-year estimated employment impact	**28,962 job-years**
20-year total labor income	**$1.7 billion**
Total 20-Year Impacts (Construction + O&M)	
Total direct impacts	$5.0 billion
Total indirect impacts	$2.1 billion
Total new economic activity over 20 years	**$7.1 billion**
Total new employment generated over 20 years	**51,178 job-years**
Total new labor income created in the state over 20 years	**$3.0 billion**

facilities continue to operate.[12] This defines the maximum potential benefit of raising taxes in the state. In total, increasing the generation tax to $2 per MWh would increase state revenues by approximately $476 million over 20 years, while an increase to $4 per MWh would create an approximate increase of $1.43 billion. Table 6 shows how each project in Table 3 would contribute to the total new revenues created, and also allows identification of the potential tax revenue loss should any of these projects cancel development due to the change in taxes.

From the computations presented regarding the benefits of new development at existing tax rates and the benefits from increasing the generation tax in Wyoming to any of the new values considered, the potential tradeoff between new tax revenues and lost economic development depends on a tax elasticity assumption. Lacking any data on what the actual tax sensitivity of new developments might be, lawmakers would have to make an assumption of what they believe the consequences of the tax increase on new development will be. For example, if the policy decision being considered is an increase in the generation tax to $4 per MWh or leaving it at current rates, and it is assumed that all new development would be canceled in the face of such a tax increase, the tradeoff policymakers should consider would be the increased tax revenues from existing facilities (a gain of $266 million in new tax revenues over 20 years) relative to the lost tax revenues at current rates and lost economic development benefits of the proposed development ($9 billion). Clearly under such an assumption the tax increase would be costly to the state. Alternatively, if lawmakers assumed for the same tax decision, none of the proposed facilities would cancel their projects, then the increase in the generation tax would net the state an additional $1.43 billion in tax revenues, in addition to the $9 billion realized from the new development they presume will occur. In this case the tax increase creates a significant amount of desperately needed new revenues. There are many other possibilities depending on how it is assumed any tax change might affect any individual project's decision to develop in Wyoming (and existing facilities' decision to continue operations). In each possible case, the appropriate decision regarding increasing the tax (or not) would depend on the relative tradeoff consistent with these assumptions.

While it is unclear what effects new changes to tax policy regarding wind generation in Wyoming could have, the fact that Wyoming appears to have competitive challenges relative to other states due to its relatively higher rates of taxation and potential lack of transmission capacity should worry legislators. Additional increases in taxes could deter future development in Wyoming or drive it to other states. Any tax change that reduces the state's competitiveness could result in less wind development in the future occurring than would otherwise, and could unintentionally cause the state to forego significant tax benefits that would occur otherwise if legislators are too optimistic in their assumptions. While the sensitivity of currently planned projects to continue if tax changes are implemented cannot be known with certainty, the state does need to consider and attempt to determine the likelihood such policy changes could result in project cancellations before implementing such decisions to avoid potentially very significant unintended impacts. The state should also consider the fact that raising taxes will further reduce the state's competitiveness to attract future projects yet unknown, and that even the discussion of such tax changes may be reducing the chances such projects locate in Wyoming if talk of such tax changes results in additional project uncertainty that deters other wind development. Given such considerations and the potential benefits of wind generation locating in Wyoming, the state might wish to recast its discussion regarding revenue increases, and instead consider what actions might be taken to increase the probability of wind development occurring in the state.

5. Concluding remarks

Wind energy poses a major opportunity for rural communities

[12] To compute these numbers, we assume that existing facilities operate at a 40% capacity factor to recognize technological improvements in wind farm productivity since existing facilities were built. Existing facilities are assumed to operate at 34% capacity factor, their historical average recently. We assume for simplicity that no new investment in existing facilities is made and that they continue to run at this 34% throughout the 20-year time horizon. Revenues from new facilities begin after they have been in operation for two years consistent with current statute.

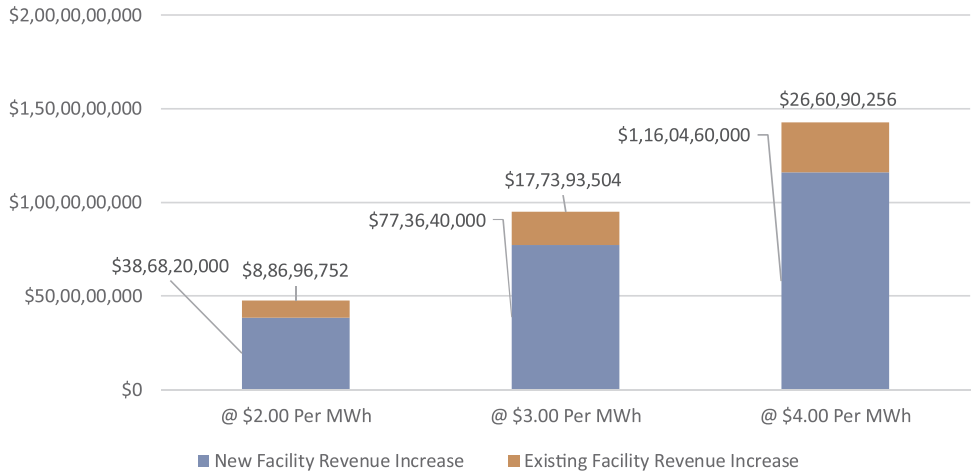

Fig. 4. 20-year potential revenue assumed increases in the wind generation tax.

Table 6
Sensitivity of 20-year potential revenue increases for wind generation tax by proposed new facility.

	Generation Tax Level Per MWh		
Facility	@ $2.00 Per MWh	@ $3.00 Per MWh	@ $4.00 Per MWh
3000 MW	$189,000,000	$378,000,000	$567,000,000
2100 MW	$132,300,000	$264,600,000	$396,900,000
840 MW	$52,920,000	$105,840,000	$158,760,000
120 MW	$7,560,000	$15,120,000	$22,680,000
80 MW	$5,040,000	$10,080,000	$15,120,000
Existing Facilities (1489 MW)	$88,696,752	$177,393,504	$266,090,256
Total	$475,516,752	$951,033,504	$1,426,550,256

nationwide. This opportunity comes at a critical time, as many western states are currently challenged by structural economic changes that have resulted in serious declines in employment and tax revenues. Wind energy offers the potential to expand the economic base of these states, providing jobs to displaced workers, and providing much needed revenue to offset some of the current revenue shortfalls from traditional sectors, while creating greater economic diversity and resilience. This opportunity, however has also led to some state policymakers to consider taxation increases in the wind sector to create badly needed new revenue streams. Other states have taken the opposite approach, and have attempted to use taxes as a means of attracting such development. Such decisions must be made with a clear understanding of each state's real competitiveness and ability to attract new wind development, and with recognition of the potential tradeoffs in terms of income, employment, and revenue such decisions could imply. These issues are of special concern because any change in tax policy that unintentionally affects such development could be very costly.

Industry trends in electricity production away from coal, traditional tax structures that depend on fossil fuels, and/or attempts to add taxes on wind put energy dependent states like Wyoming in a difficult position. These states need new tax revenues, but if they tax growth areas in energy development like wind, developers may become increasingly more footloose, following the incentive to look elsewhere for tax conditions that are more favorable. Adding to the tax burden in these growing industries could unintentionally make state and local government finances worse off, while simultaneously reducing potential economic growth. Such states potentially lose both because of the tradeoffs from added taxes (or tax exemptions), and from market shifts to different sources of electricity. Relying on good wind conditions may not be enough to attract wind development. Improved technology is also expanding the potential locations that firms can choose to develop, making the choices facing energy-dependent states even more difficult and problematic. Given such considerations, states may wish to recast their discussions regarding revenue increases, and instead consider what actions might be taken to increase the wind development occurring in their states to avoid unintentional impacts on such outcomes.

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