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THE RISK OF FISCAL COLLAPSE IN COAL-RELIANT COMMUNITIES

BY ADELE C. MORRIS, NOAH KAUFMAN AND SIDDHI DOSHI
JULY 2019

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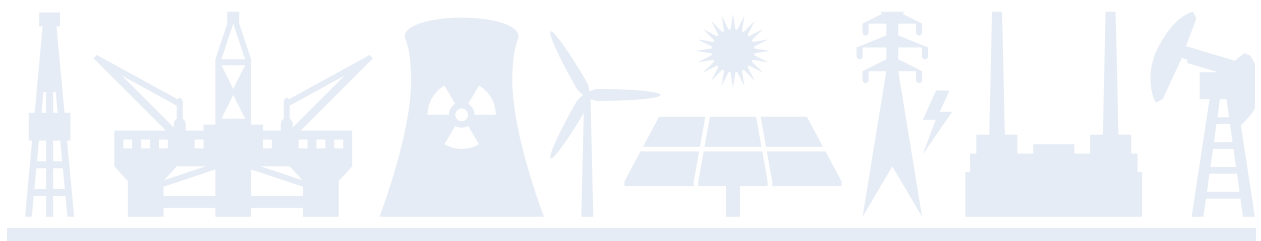
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EXECUTIVE SUMMARY

If the United States undertakes actions to address the risks of climate change, the use of coal in the power sector will decline rapidly. This presents major risks to the 53,000 US workers employed by the industry and their communities. 26 US counties are classified as “coal-mining dependent,” meaning the coal industry is a major employer. In these areas, the industry is also an important contributor to local government finances through a complex system of property, severance, sales, and income taxes; royalties and lease bonuses for production on state and federal lands; and intergovernmental transfers.

While climate-related risks to corporations have received scrutiny in recent years, local governments—including coal-reliant counties—have yet to grapple with the implications of climate policies for their financial conditions. Importantly, the risks from the financial decline of coal-reliant counties extend beyond their borders, as these counties also have significant outstanding debts to the US municipal bond market that they may struggle to repay.

To be sure, national climate policy in the United States is uncertain. Experts have long recommended strong policy action to reduce emissions, and for years, policy makers have largely ignored their advice. Nevertheless, with growing support by the public and policy makers, meaningful climate policy in the United States may be on the horizon, and those dependent on coal should be looking ahead to manage their risks.

This paper examines the implications of a carbon-constrained future on coal-dependent local governments in the United States. It considers the outlook for US coal production over the next decade under such conditions and explores the risk this will pose for county finances. The paper also considers the responsibilities of jurisdictions to disclose these risks, particularly when they issue bonds, and the actions leaders can take to mitigate the risks. In short, the paper finds the following:

- Coal production in the United States fell by one-third between 2007 and 2017. Projections of the US energy system show this decline continuing gradually under current policies. However, even a moderately stringent climate policy could create existential risks for the coal industry, with potential declines in production of around 75 percent in the 2020s.
- A careful look at three illustrative counties shows that coal-related revenue may fund a third or more of their budgets. The exposure is compounded because school districts and other special districts within the counties also receive coal-dependent revenue. The complex system of local revenue instruments and intergovernmental transfers plus a lack of sufficiently detailed budget data makes it difficult to parse out just how reliant jurisdictions are on the coal industry.
- Estimates of the direct linkages between the coal industry and county budgets will almost certainly understate the risks because lost economic activity and jobs will have ripple effects across the economy. Case studies show that the rapid decline



of a dominant industry has led to downward spirals and eventual collapses of local governments' fiscal conditions, including the inability to raise revenue, repay debt, and/or provide basic public services.

- Coal-dependent communities have a variety of outstanding bonds, and the risk of collapse of the coal industry threatens their ability to repay them. Despite regulations requiring disclosures to reflect risks to the financial health of municipalities, our review of the outstanding bonds indicates that municipalities are at best uneven and at worst misleading (by omission) in their characterizations of climate-related risks. Ratings reports are not much better than official statements in describing the risks associated with the exposure of some local governments to the coal industry.
- Climate policies can be combined with investments in coal-dependent communities to support their financial health. A logical source of funding for such investments would be the revenues from a price on carbon dioxide emissions, a necessary element of any cost-effective strategy for addressing the risks of climate change. A small fraction of revenue from a federal carbon price in the United States could fund billions of dollars in annual investments in the economic development of coal-dependent communities and direct assistance to coal industry workers.
- In considering reforms, several questions emerge for stakeholders. These include whether regulators should develop additional requirements for the disclosure of risks from future climate policies; whether ratings agencies should increase attention to the risks to local governments of climate policies; and whether stakeholders in the municipal bond market, such as borrowers, insurers, and underwriters, are appropriately accounting for risks to the coal industry.



INTRODUCTION

Corporations have faced increasing demands by powerful investors to disclose climate-related risks. So-called transition risks include investments and business operations that could become unprofitable under certain climate policy scenarios. Another set of entities has received far less attention but may be just as vulnerable: local governments. Some governments across the United States rely heavily on a combination of severance taxes, royalties, property taxes, and sales taxes that derive directly or indirectly from fossil fuel production, and they could face profound downturns from policies that reduce that production.

Coal-reliant areas are most at risk from climate policy. Coal is the most carbon-intensive fuel, and it competes with numerous cleaner technologies in its primary market, electric power production. Coal production in the United States has gradually declined over the past decade, and if federal climate policy is implemented, coal production is likely to decline precipitously (National Association of Development Organizations 2018). In that scenario, coal-dependent jurisdictions will experience shrinking revenue, falling property values, a dislocated workforce, and a steep fall in economic activity (Kent 2016). Some of these areas are already facing economic downturns because of existing factors that are driving down coal demand. The question arises whether policy makers in these communities are appropriately planning for the risks of even more challenging times that may lie ahead.

We begin with a review of the history of US coal production and modeling projections for US coal production with and without new policies. Because not all coal-producing areas will be affected in the same way, we review evidence on where in the United States climate policy will result in the greatest declines. Then we analyze revenue and budget data for select county governments across the United States to determine which ones are most heavily dependent on coal and how their fiscal conditions are likely to deteriorate in a carbon-constrained future. To learn from other contexts, we consider previous instances in which geographically concentrated industries have collapsed and explore the extent to which policy responses buffered the impact.

Given the profound economic risks, we ask how well they are communicated to market actors. For example, do municipal bond issuers disclose their vulnerabilities in the documents they file? Although default on municipal debt has historically been rare, we find that some highly coal-reliant jurisdictions have issued bonds that will potentially mature in a time frame in which carbon constraints are a clear possibility. This raises questions for borrowers, investors, large mutual fund companies, ratings agencies, and insurers. Are they assessing risks appropriately? Can policy makers undertake the politically difficult measures to get ahead of the fiscal and economic problems that await them? What happens if they don't?

Finally, we emphasize the critical need for actions that mitigate the risks to coal-dependent local governments without sacrificing progress toward rapid reductions in greenhouse gas emissions. Realistically, this will require large investments and thus significant external support for already-struggling coal-dependent communities and workers. We also raise questions for participants in the municipal bond market about whether and how they should call for improved budget data and disclosure to take into appropriate account the risks associated with climate policy.



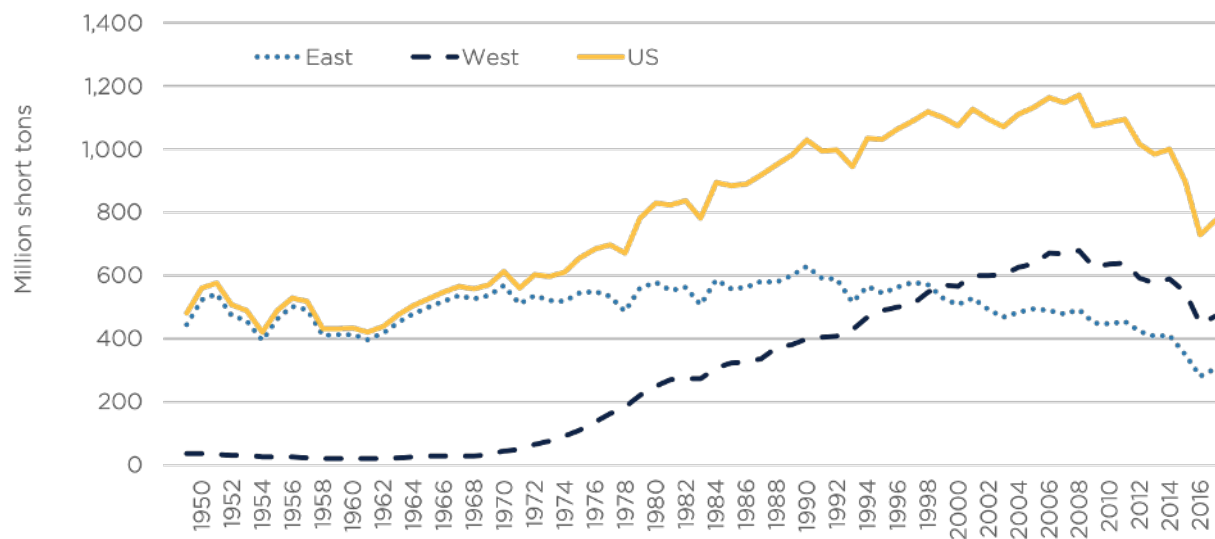
QUANTIFYING THE FISCAL EXPOSURE TO COAL

In this section, we walk through recent declines in coal production and projections of coal production, focusing on scenarios with federal climate policy. We discuss the implications for coal-reliant jurisdictions.

US Coal Production, Consumption, and Labor Demand

In the early 1900s, coal was the dominant energy source in the United States. In the second half of the 20th century, this dominance declined with the emergence of oil and natural gas (Houser et al. 2017). However, coal remained the country's primary source of electricity generation, and US coal consumption nearly tripled between the early 1960s and 2000s (EIA 2018), as shown in figure 1. Through about 1970, US coal mines were concentrated east of the Mississippi River, primarily in Appalachia. After that, increases in US coal production came predominantly from the Powder River Basin in Wyoming and Montana, which evolved into the largest coal-producing region in the country (Houser et al. 2017). Total coal production in the United States declined by 32 percent between 2007 and 2017, with declines of 36 percent and 30 percent east and west of the Mississippi River, respectively (EIA 2018; Kolstad 2017).

Figure 1: Tons of coal output per year, by U.S. region (1949-2017)

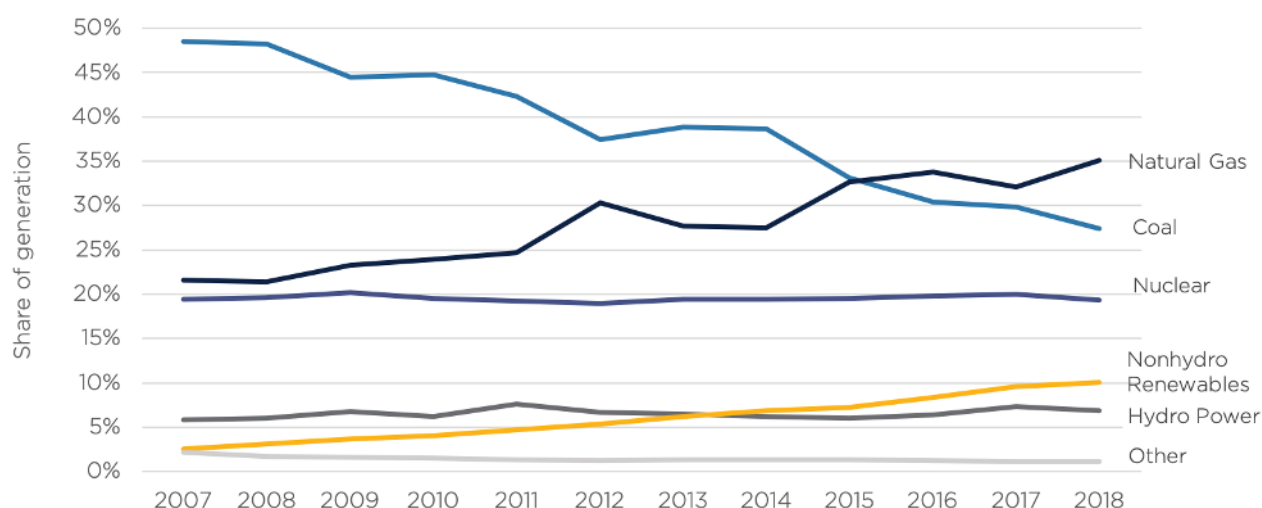


Source: U.S. Energy Information Administration



The primary market for coal has long been electric power production. For example, in 2016 over 80 percent of US-produced coal was used in the US power sector. As shown in figure 2, in recent years coal-fired electricity has been facing increasing competition from other fuels. In the early 2000s, coal fueled about half of the electricity generated in the United States (Houser et al. 2017). The transition away from coal accelerated around 2007, when coal-fired electricity generating capacity in the United States totaled 313 gigawatts (GW) across 1,470 generators (EIA 2018). 10 years later, about 70 GW of this capacity had been retired, and virtually no new coal capacity has come online since.

Figure 2: Composition of U.S. Electricity Generation by Energy Source

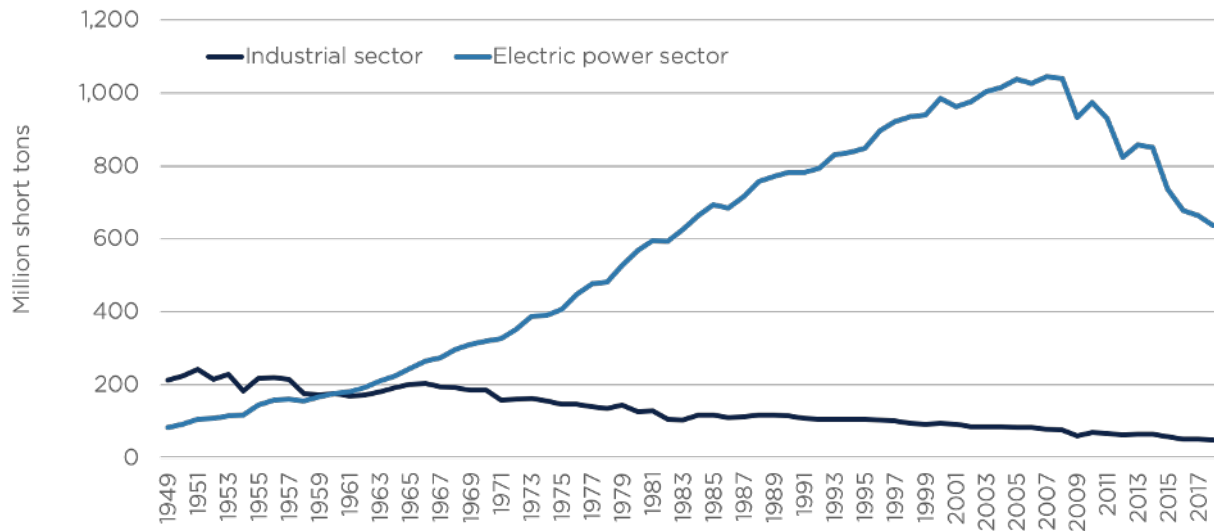


Source: U.S. Energy Information Administration, *Short-Term Energy Outlook*, March 2019

The primary cause of the post-2007 decline of coal was the fall in the price of natural gas, a competitor fuel for power production and industrial applications. This increased competition for existing aging coal plants came from modern higher-efficiency, cleaner-burning natural gas plants. Other factors have also driven coal's decline, including declining costs of renewable energy, slower-than-expected increases in US electricity demand (caused by the Great Recession and improved efficiency), weak exports, and air quality regulations (Houser et al. 2017; Kolstad 2017). Coal-fired power plant retirements peaked in 2015 when the Mercury and Air Toxics Standards (MATS) rule went into effect (EIA 2018), but retirements in 2018 were not far behind. As shown in figure 3, industrial uses of coal have not offset its decline in the US power sector.



Figure 3: U.S. Coal Consumption by Sector

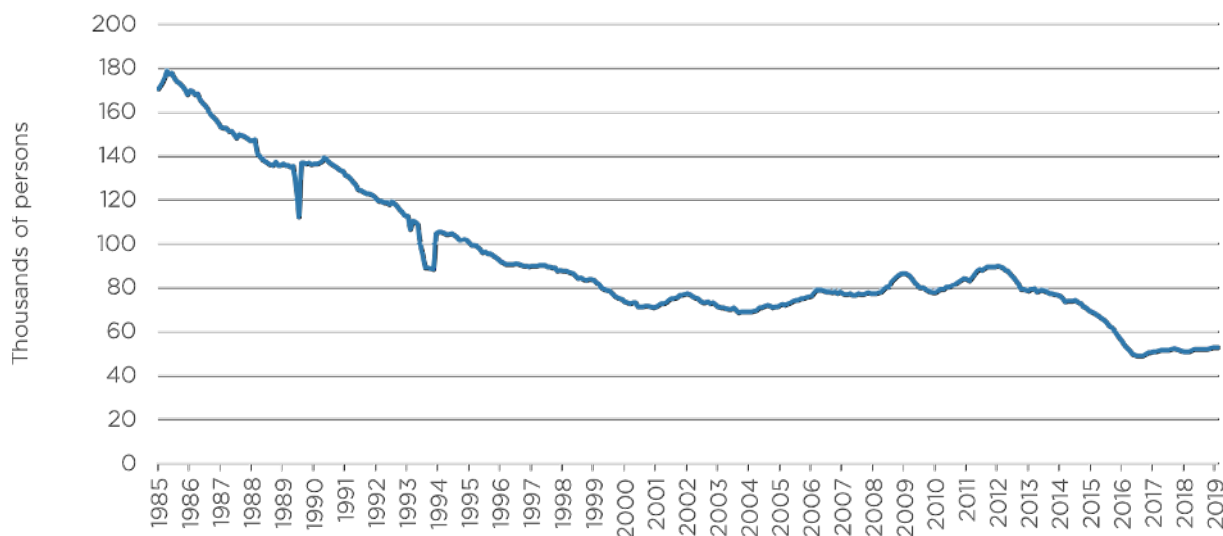


Source: U.S. Energy Information Administration.

Note: Two series have been merged to achieve continuity of data.

Employment declines for coal workers have largely mirrored coal production levels, but mining productivity improvements have amplified the trend. At coal’s employment peak in the 1920s, 860,000 Americans worked in the industry. In the second half of the 20th century, improvements in technology began to cut into the coal industry’s labor demand, and by 2003, only 70,000 US coal workers remained. Labor productivity in US coal mining (i.e., tons of coal production per hour of work by miners) has not increased since the early 2000s (Kolstad 2017), suggesting the recent decline in employment has been caused primarily by the decline in production levels. As shown in figure 4 below, as of January 2019, coal mining employed only about 53,000 people.¹



Figure 4: U.S. Coal Mining Employment

Source: U.S. Bureau of Labor Statistics

The most concentrated job losses have been in Appalachia. Employment in the coal mining industry declined by over 50 percent in West Virginia, Ohio, and Kentucky between 2011 and 2016. State-level impacts mask even more severe effects at local levels. In Mingo County, West Virginia, coal mining employed over 1,400 people at the end of 2011. By the end of 2016, that number had fallen below 500. Countywide, employment fell from 8,513 to 4,878 over this period (Houser et al. 2017), suggesting there could be important labor market spillovers from mining to the broader economy.

The Future of US Coal Production

The decline of the US coal industry thus far begs the question of its future. A wide range of future outcomes are possible. As shown in figure 2, coal remains the second-largest fuel for electricity generation in the country, trailing only natural gas, and generates over one quarter of all US electricity (EIA 2019a). Absent new policies, projections suggest that coal consumption and supply will decline over the next decade, perhaps by 15 to 25 percent below 2018 levels (Larsen et al. 2018; Energy Information Administration 2019c). However, if policy makers adopt measures to control greenhouse gas emissions, future declines in coal are likely to be much larger. This is the fraught scenario facing coal-reliant local governments.

Climate policy in the United States could take many different forms. One approach, recommended widely by economists, would impose a price on carbon dioxide (CO₂) emissions, either in the form of a cap-and-trade program (like the one passed by the US House of Representatives in 2009²) or a carbon tax. Carbon tax bills were introduced in Congress by Democratic, Republican, and bipartisan sponsors in 2018, and discussion early

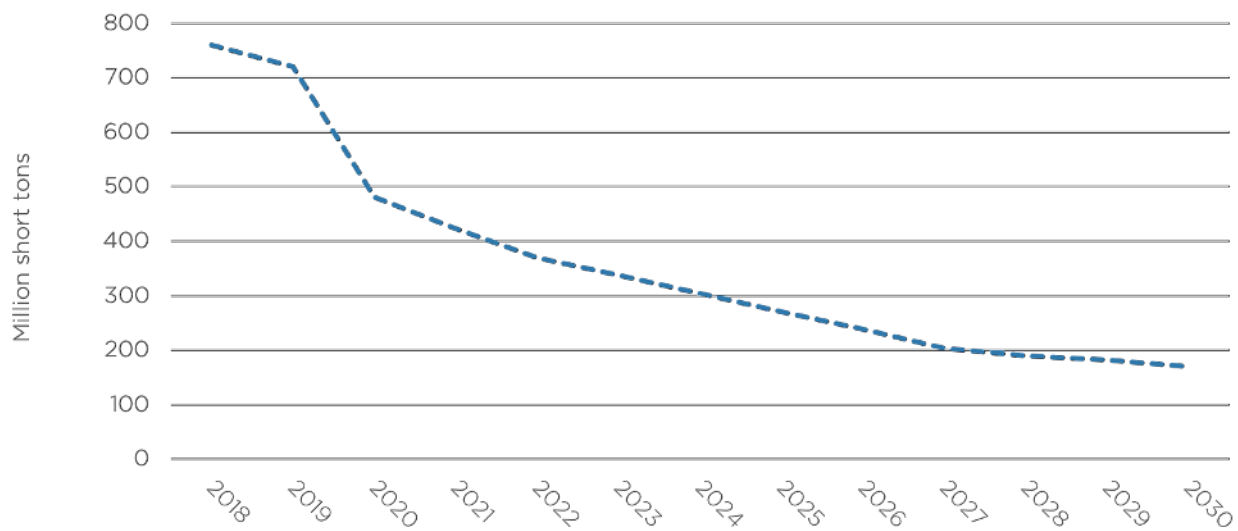


in the 116th Congress suggests carbon pricing remains on the agenda for some members (Kaufman 2018). Alternatively, Congress could adopt a clean electricity standard, which would require an increasing percentage of retail electricity sales to come from non- or low-emitting sources. Without new legislation, the executive branch could pursue policies like the Obama administration’s Clean Power Plan that use existing regulatory authority under the Clean Air Act. Any of these approaches could dramatically reduce the use of coal in the United States.

An extensive literature explores the potential effects of different climate policy options in the United States. For example, analysts can use economic and energy sector models to translate CO₂ prices into effects on market prices for fossil fuels and other goods and services and then project how producers and consumers will shift toward less carbon-intensive activities as a result. The most prominent of these models in the United States is the National Energy Modeling System (NEMS) of the US Department of Energy’s Energy Information Administration (EIA). As part of its 2018 *Annual Energy Outlook*, EIA examined the implications of putting a price on emissions of CO₂ from the power sector only. This “side case” imposes a price of \$25 per metric ton of CO₂ in 2020, rising at 5 percent over inflation each year thereafter.

Under this side case, EIA projects a rapid decline in total US coal production such that by 2030, total US coal production will be 77 percent below 2016 levels.

Figure 5: U.S. Coal Production under EIA \$25/ton Scenario

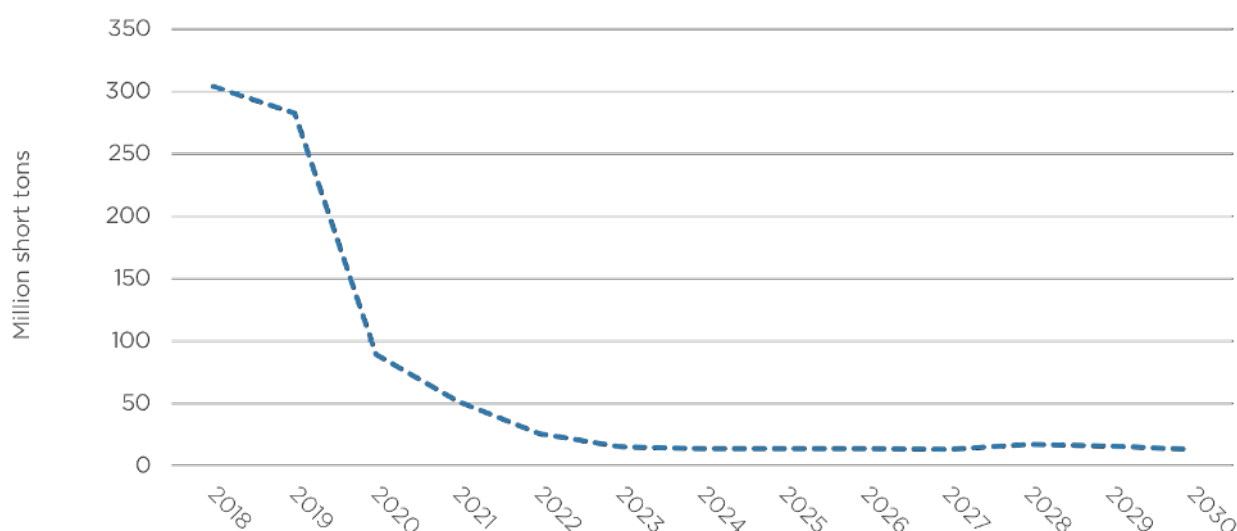


Source: U.S. Energy Information Administration



EIA projects that the sharpest reduction in coal mining would arise in Wyoming’s Powder River Basin, currently the source of nearly 40 percent of US coal. In EIA’s carbon price side case, Powder River Basin coal production declines by 95 percent between 2016 and 2030. One explanation is that Powder River Basin coal is overwhelmingly subbituminous coal from surface mines that is burned at power plants in the United States. EIA projects that coal produced elsewhere in the western United States would experience a similarly dramatic and rapid decline.

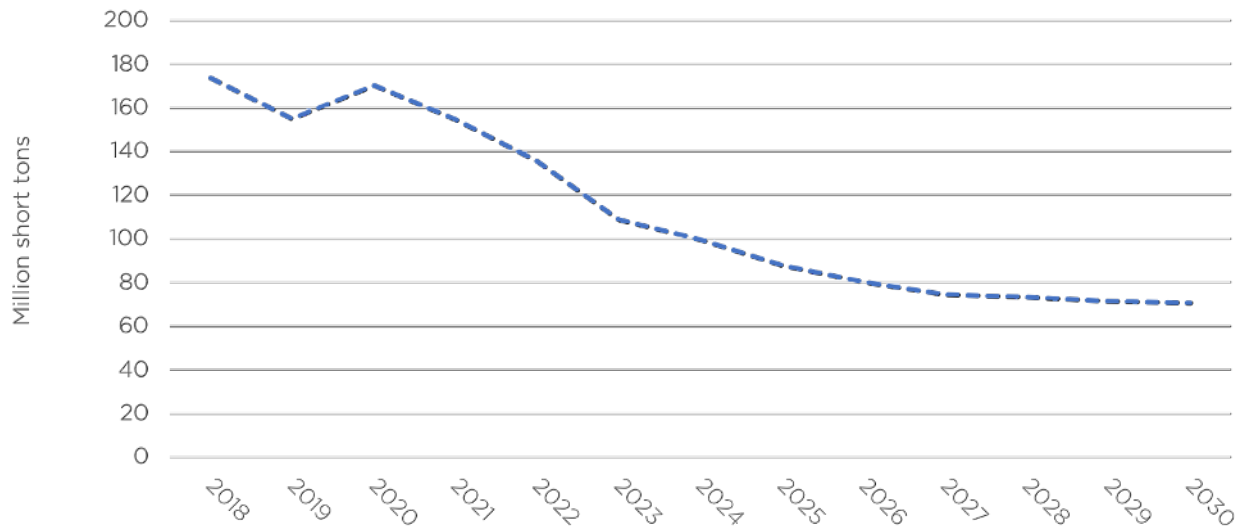
Figure 6: Powder River Basin Coal Production under EIA \$25/ton Scenario



Source: U.S. Energy Information Administration

The EIA projections for the \$25/ton carbon price scenario also show a collapse in coal production from the midwestern and southeastern United States, although not quite as rapid as in the western region. Coal production from northern Appalachia (accounting for 16 percent of current US production and comprised of Pennsylvania, Ohio, Maryland, and northern West Virginia) declines by nearly 80 percent between 2016 and 2030, while production from central and southern Appalachia and the Eastern Interior region (accounting for a quarter of US production and comprised of southern West Virginia, Kentucky, Illinois, Indiana, Mississippi, Alabama, Virginia, and Tennessee) falls by roughly half over that period.



Figure 7: Appalachia Region Coal Production under EIA \$25/ton Scenario

Source: U.S. Energy Information Administration

The results from any single energy model should be interpreted with caution given the large uncertainties in future technologies, economic activity, and behavior of consumers and producers. We focus here on projections from the NEMS model because of its prominence and its publicly available and regionally disaggregated results. Appendix A compares the NEMS results to other studies of similar policy scenarios.

In this side case, EIA modeled one of many possible climate policies, and one may wonder if it is implausibly stringent, or if jurisdictions would take countermeasures to avoid the dramatic production declines displayed above. Arguably, if a new climate policy is implemented in the United States, it is likely to be more stringent and result in deeper declines in coal than the EIA side case estimates. All of the major proposals for federal climate legislation in 2018 would impose carbon prices or limits economy-wide, and some would be far more stringent than the EIA side case.³ Moreover, the EIA side case doesn't price carbon emitted in industry, so the projections from EIA show virtually no decline in coal use as an input to cement and steel. And EIA reports virtually no decrease in exported coal because the side case assumes other countries do not take comparable policy actions. In this Congress, some legislators are pushing to shut down the entire US coal industry by 2030. Finally, like many other energy modelers, EIA analysts have consistently underestimated the declines in the cost of lower-carbon electricity sources (including solar, wind, and natural gas) and may be continuing to do so today, thus underestimating the impacts of a particular carbon price trajectory on US coal production (Gilbert and Sovacool 2016).

To be sure, strong national climate policy in the United States is not certain. Experts have long recommended strong policy action to reduce emissions, and for years, policy makers



have largely ignored their advice. Nevertheless, with growing support by the public and policy makers, meaningful climate policy in the United States may be on the horizon, and those dependent on coal should be looking ahead to manage their risks.

Revenue from Coal Production

How might the projected declines in coal production translate into revenue declines for state and local governments? Ideally, we would project coal production in both no-policy and climate policy scenarios, estimate the respective revenue streams that coal generates, and compare the two outcomes. This is harder than it sounds.

For one thing, the way state and local governments collect and spend coal revenue varies widely, and the types of revenue instruments, tax rates, and intergovernmental transfers differ across states and substate governments (Headwater Economics 2017). For example, in some places and for some taxes, coal revenue goes directly to county governments and local school districts. In other cases, it flows to counties or school systems via coal-funded state trust funds, or states use coal revenue to pay directly for public services that would otherwise fall to counties, such as construction and maintenance of county roads. This means the translation between coal production and fiscal flows to local governments is complicated. Second, other revenues at the state and local levels depend on coal production, including taxes on business and personal income, noncoal property, and sales.

Even tracking revenues from sources most directly tied to coal is challenging.⁴ For example, most states have some version of a levy for the privilege of “severing” valuable deposits, including fossil fuels and other minerals. Typically, a severance tax is a percentage of gross or net value at the point of production, but some states apply it to the volume of production.⁵ Severance tax rates and bases vary widely across and within states, by type of mineral or well or by volume of production, for example.⁶ Severance taxes can apply to production on both private and public land. Owing to variations in both production quantities and commodity prices, revenue from severance taxes can be volatile. It can also amplify the fiscal effects of a downturn in the coal industry. For example, in West Virginia, severance taxes raised \$483 million in 2011, or 12 percent of general revenue. In 2016, severance taxes fell to \$262 million, or 6 percent of general revenue.

States also receive royalties, lease bonuses, and rents from mineral production on state lands, and the federal government gives states a cut of the royalties from production on federal lands in their jurisdictions. Royalties are a payment for extracted resources, determined by a percentage of the resources’ production value.⁷ A lease bonus is a payment to the landowner upon the signing of the mineral lease. Royalty rates to state governments are typically set in law, but lease auctions often determine the bonus payments. Lessees may also be subject to annual administrative fees and rent payments, which are usually a small share of their overall payments to the state.⁸ Royalty receipts vary significantly, owing in part to variation in the patterns of land ownership across states, even ones that are major fossil energy producers. For example, over 61 percent of the land in Alaska is administered by federal government agencies, whereas the federal government administers less than 2 percent of Texas land (Vincent, Hanson, and Argueta 2017). As documented by Fitzgerald (2014), western states have retained relatively more state-owned land and are more likely to have active leasing programs.



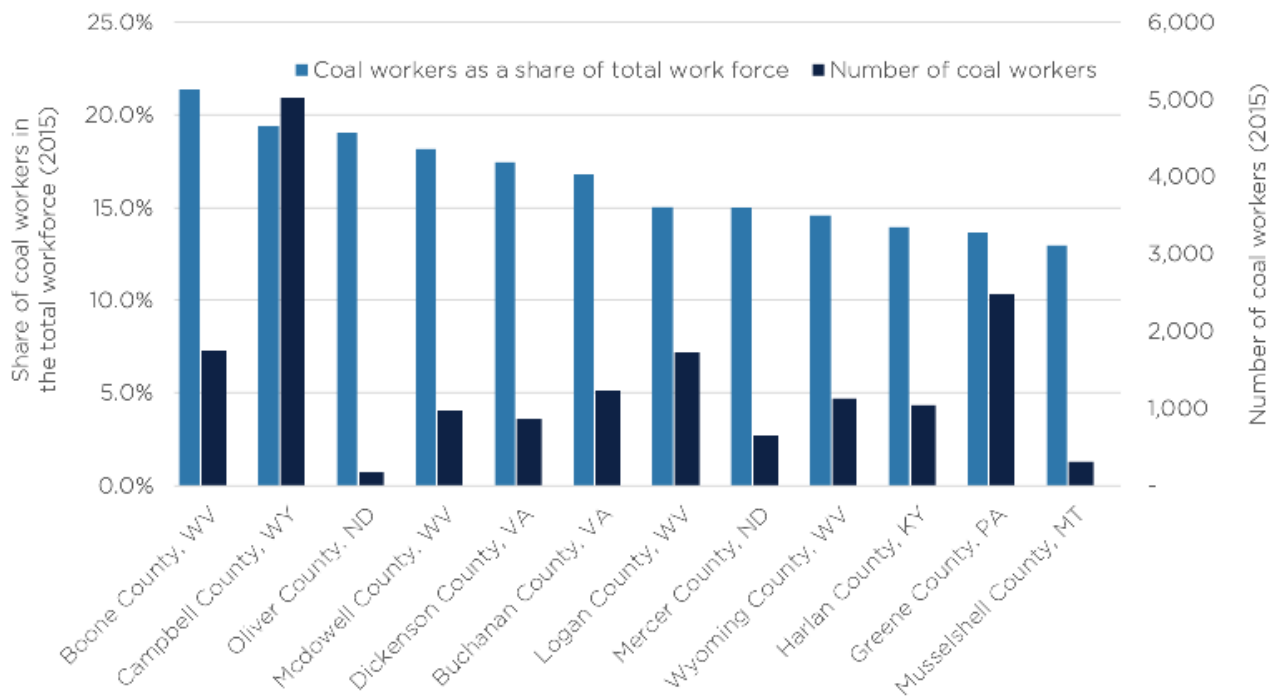
The typical federal royalty rate is 12.5 percent of the gross value of production (US Government Accountability Office 2017). According to Tax Foundation calculations, state governments receive about 17.5 percent of the royalties the federal government collects (Malm 2013).

Finally, in some cases states set local tax rates and bases, collect taxes, and/or distribute the revenues.⁹ So even when the volume of dollars flowing is clear, who controls the spigots may not be. Given the wide variation in the channels of fiscal exposure of substate governments to coal, we focus on the finances of a few illustrative jurisdictions and learn what we can through their particulars. We chose three illustrative counties in three different states: Campbell County in Wyoming, Boone County in West Virginia, and Mercer County in North Dakota. The next section summarizes our findings; additional detail appears in Appendix B.

Finances of Illustrative Counties That Are Dependent on Coal

The US Department of Agriculture’s Economic Research Service defines a county as “mining dependent” if 8 percent or more of its employment is engaged in the mining industry (US Department of Agriculture 2019). Applying that threshold to 2015 employment data (the most recent year available), 26 counties across 10 states in the United States are coal-mining dependent. Figure 8 shows the top 12 counties, each with more than 13 percent of their 2015 labor force tied to coal mining.

Figure 8: Top Twelve U.S. Counties by Coal Employment Share



Source: U.S. Bureau of Labor Statistics



Figure 8 shows that Boone County, West Virginia, and Campbell County, Wyoming, have the highest labor shares in coal mining. To choose a third county in another state, we skip over tiny Oliver County, North Dakota (population 1,898) to its larger neighbor, Mercer County (population 8,267).¹⁰ To be sure, these are three of the most coal-mining dependent counties in the United States, so they represent extreme examples. Further research is necessary to ascertain the degree to which their situations are generalizable, particularly to the other 26 or so counties that are coal-mining dependent. Further research is also necessary to consider the fiscal implications of climate policy in coal-reliant counties that are also dependent on natural gas and oil production. Our focus is strictly on coal because modeling suggests that coal would be the fossil fuel most rapidly and dramatically wrung out of the economy under climate policies, but we do not intend to suggest that dependence on the other fuels is unimportant, particularly over the longer run.

While we primarily discuss revenues to the county governments themselves, each county also contains a collection of municipalities, school systems, and special districts, such as for libraries and fire departments. Each of these has its own exposure to the coal industry via state funds, property tax revenues, and the like.

Boone County, West Virginia

Boone County (population 22,000) lies in southern West Virginia and forms part of the Central Appalachian coal basin. Along with other southern West Virginia counties, it has long been a center of coal extraction (US Department of the Interior 2019). The county revenue directly from coal is primarily from property and severance taxes. Because coal production has already fallen dramatically in Boone County, its challenges illustrate the trouble that may face other coal-reliant jurisdictions.

Property taxes fund both county governments and school systems in West Virginia. Proceeds from coal severance taxes flow to local governments primarily via transfers from the state; 4.65 percentage points of the 5 percent severance tax goes to the state government.¹¹ The state distributes 75 percent of the remaining 0.35 percentage points to coal-producing counties and 25 percent to other counties and municipalities.¹² Coal-producing counties in West Virginia can recapture some of the state's share when they face budget shortfalls, a policy known as a reallocation tax. This revenue funds the county commission, jails, community programs, public transit, the health department, and trash collection activities.¹³

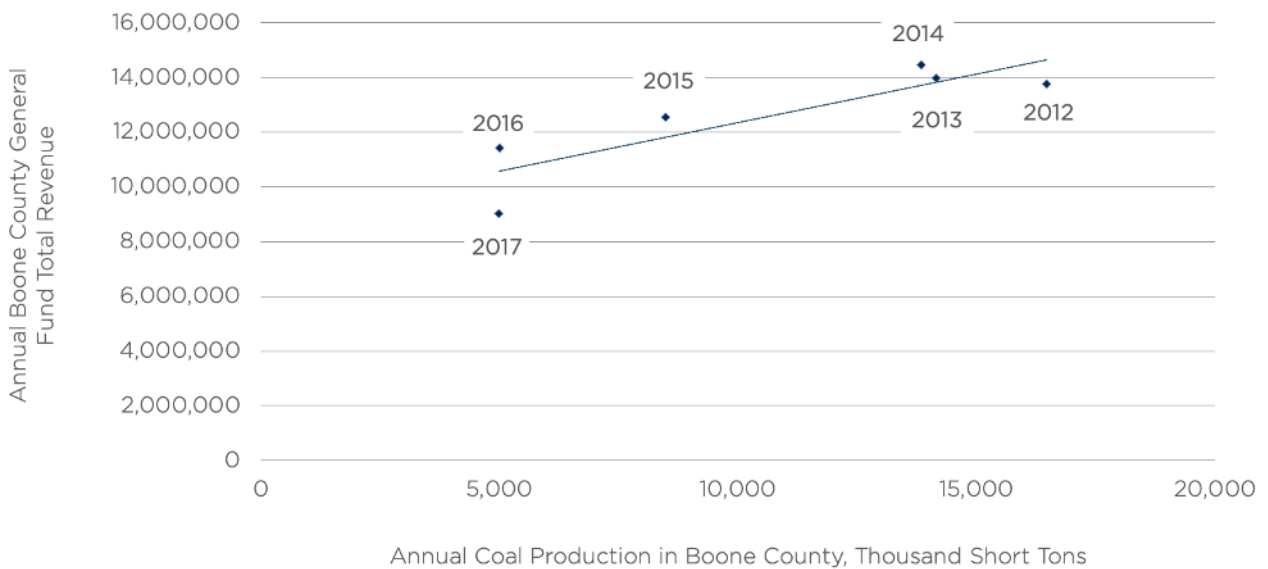
The most recent data that distinguish coal-related revenue from other revenue are from 2015. The numbers suggest that about a third of Boone County's revenues directly depended on coal in the form of property taxes on coal mines and severance taxes. In 2015, 21 percent of Boone County's labor force and 17 percent of its total personal income were tied to coal.¹⁴ Coal property (including both the mineral deposit and industrial equipment) amounted to 57 percent of Boone County's total property valuation.¹⁵ Property taxes on all property generated about half of Boone County's general fund budget,¹⁶ which means that property taxes just on coal brought in around 30 percent of the county's general fund. Property taxes on coal also funded about \$14.2 million of the \$60.3 million school budget (24 percent).¹⁷ In total, coal-related property taxes generated approximately \$21 million for Boone County's schools, the county government, and specific services.¹⁸ In addition, Boone County received over \$1.6



million from severance taxes and an additional \$800,000 from the reallocation tax.¹⁹

In 2012, 31 mines in the county produced 16.4 million short tons of coal. Just five years later in 2017, only 11 mines remained, producing only 5.0 million short tons, a 70 percent decline.²⁰ This resulted in a 50 percent decline in property tax revenue for the county government and a 38 percent decline in its total revenue.²¹ Coal prices were fairly flat over the period, so the relationship is mostly a function of the volumes of coal produced. Figure 9 below illustrates the relationship between coal production and county revenue from 2012 to 2017. Each marker represents the values for a year within that period, and the line indicates the linear trend in the data.

Figure 9: Boone County Revenue and Coal Production



Source: US Energy Information Administration and West Virginia State Auditor's Office .

Revenue declines have driven painful spending cuts. In 2015, Boone County closed 3 of its 10 elementary schools (Jenkins 2015). Bankruptcies of coal companies left the county with \$8 million in uncollected property tax revenue in 2015 (Kent 2016), and West Virginia passed an emergency bill for school funding in 2016 to provide for a \$9 million shortfall due to one such bankruptcy (WSAZ News 2016). To make up for these shortfalls, Boone County cut back services such as its solid waste program. To attract more investment and employment by coal companies, West Virginia passed two bills in 2019 giving tax breaks to the coal industry. House Bill 3142 reduces for two years the severance tax rate from 5 to 3 percent on coal that is used in power plants.²² House Bill 3144 creates a 35 percent investment tax credit that would offset up to 80 percent of a coal company's severance tax liability.²³



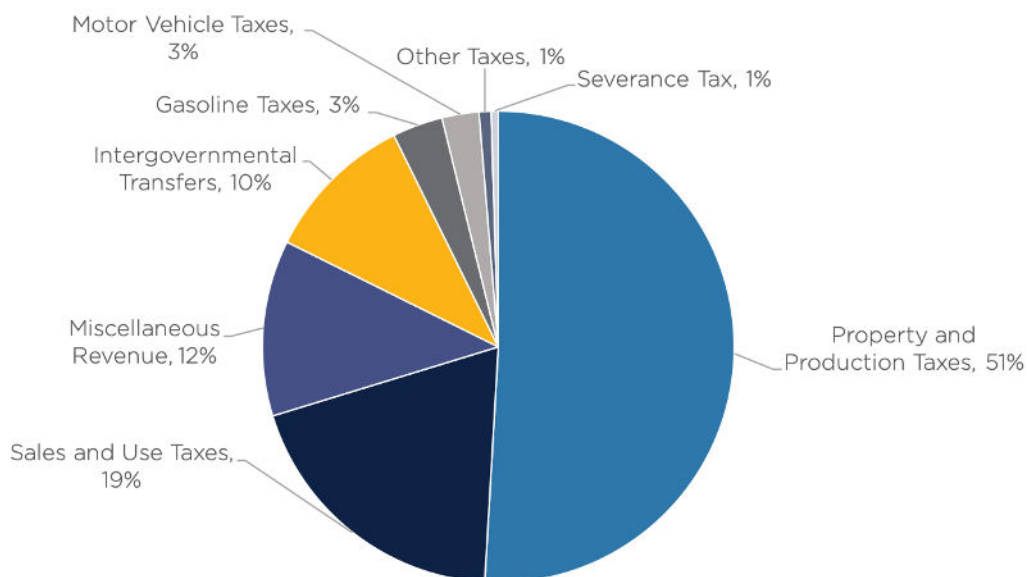
Campbell County, Wyoming

Campbell County (population 46,170) lies in northeast Wyoming in the Powder River Basin.²⁴ It is home to the largest coal mine in the world,²⁵ and mining is its largest sector, employing about 20 percent of the county’s labor force (Campbell County Board of County Commissioners 2017).

In Wyoming, coal generates government revenues through four main instruments: property taxes, federal mineral royalties, coal lease bonuses, and severance taxes. The generation and flow of these revenues to local governments is complex.²⁶ Some coal-related revenue goes directly to local governments. Coal-related revenues to the state travel via various trust funds to a myriad of substate jurisdictions. Some are targeted to specific local expenditure categories, and some amounts are contingent on whether a certain revenue threshold is exceeded. If one wanted to design a fiscal system to obscure local governments’ full dependence on coal production, it would be hard to improve on the current approach in Wyoming.

The composition of 2018 revenues to the Campbell County government appears in figure 10 below.²⁷ The property tax generates more than half of the county’s tax revenue. It includes the county tax on assessed property values and an ad valorem tax on the value of minerals extracted in the county, including coal, natural gas, and oil. The next-largest revenue sources are the sales and use tax and intergovernmental transfers.

Figure 10: Campbell County Revenue Sources, Fiscal Year 2018



Source: Campbell County Audit, FY Ending June 2018



The coal-related share of the wedges in figure 10 are difficult to parse out, but they include the coal share of the property and production tax, the coal-related share of sales and use tax proceeds, and some of the transfers from the state and federal governments. According to the county's 2018 audit statement, mineral production taxes comprise about 81 percent of the property and production tax, but how much was from coal is not specified.²⁸

A 2017 special report by the Campbell County Board of Commissioners sheds some light on this. Of the \$5.3 billion in total county assessed property valuation (which includes the value of minerals produced) in the 2016–17 fiscal year, 89 percent was oil and gas production and coal mining and their associated production and transportation facilities.²⁹ More narrowly, 79 percent was from mineral production, and coal was 75 percent of that, meaning in that year, about 59 percent of the county's overall property and production valuation was directly associated with coal mining.³⁰ In that same year, 29 percent of the county's total sales and use tax revenue came from mining, but the share from coal per se is not reported. Likewise, it is unclear what shares of intergovernmental transfers flow from state coal-related revenues.

Coal revenues are falling. In 2018, including revenues to the county government, the school system, and other special districts within the county, the property and production tax in Campbell County raised over \$266 million. This was a sharp decline from 2016, when those collections were over \$317 million.³¹

County officials recognize the challenge of a declining coal-related tax base. The county's fiscal year 2017–18 report addresses the issue directly:

Assessed valuation for the 2015–2016 fiscal year (derived from 2014 calendar year production and property) was \$6.2 billion. The assessed valuation for the 2016–2017 fiscal year declined to \$5.29 billion and then to \$4.19 billion for the 2017–2018 fiscal year. Proactive decisions by this board, and previous boards, helped to make this transition as painless as possible because of substantial investments in savings and reserves, a relatively new age of facilities and plants, and an early retirement incentive that lowered employment expenses. . . . It is important for Campbell County to effectively plan for a future with significantly less coal production and the ad valorem taxes that it pays.³²

To prepare for a future with lower coal production, the county has established reserve and maintenance funds for capital replacement, vehicle fleet management, buildings, and recreation facilities. Nonetheless, concerns are rising that coal production in Wyoming is declining faster than the area can absorb (Richards 2019). Wind power development in the Midwest is dampening demand for coal in key markets, and natural gas prices remain low.

Like Boone County, Campbell County has experienced the costs of coal-related bankruptcies, and more could be on the horizon. The 2015 bankruptcy of coal producer Alpha Natural Resources left Campbell County with over \$20 million in unpaid taxes. Campbell County litigated and collected most of the money, but its legal expenses were significant. Subsequently, local leaders have called for changes in laws and tax collection structures in Wyoming to place the interests of taxing entities above investors and creditors (McKim 2018; Campbell County 2018).



Mercer County, North Dakota

Mercer County is in central North Dakota. Along with its neighbors, McLean County and Oliver County, Mercer County is home to the largest mines in North Dakota (“Where Coal Is Found” 2019). These counties primarily produce lignite coal, nearly 80 percent of which is used to generate electricity (“Lignite” 2019). In 2015, the mining sector employed about 15 percent of Mercer County’s labor force.³³

Compared to Wyoming and West Virginia, the North Dakota government is less dependent on the coal industry.³⁴ However, coal-producing counties like Mercer are highly dependent on coal and would face major shortfalls if the industry collapses. Three main county revenue streams derive from coal-related revenue at the state level that the state then transfers to counties and other substate jurisdictions. The most important is the coal severance tax. The state deposits 30 percent of the revenue from the severance tax into a permanent trust fund that distributes construction loans to school districts, cities, and counties impacted by coal development.³⁵ The remaining 70 percent is distributed to counties. The state also imposes a coal conversion tax on operators of facilities that produce electricity from coal or convert coal to gaseous fuels or other products.³⁶ Third, North Dakota distributes half of its share of federal mineral royalties to counties in proportion of their mineral production and the other half to school districts.³⁷

The North Dakota state government provides documentation of its payments to substate jurisdictions, so we can quantify the flows to Mercer County. According to the North Dakota state tax website, in 2018, Mercer County government received \$1.3 million in coal severance tax distributions, \$0.84 million in coal conversion taxes, and \$0.37 million in mineral royalty distributions.³⁸ We do not know how much of the mineral royalty distribution is related specifically to coal.

The most recent Mercer County audit report is from 2016, so we can put the coal revenue in context for that year. According to the audit statement for the year ending December 31, 2016, the Mercer County general fund received \$1.71 million from coal severance taxes, \$1.25 million from coal conversion taxes, and \$0.76 million from mineral royalty revenue.³⁹ Overall county general revenues were \$7.5 million, making the three sources about half of all county revenues. The exposure is compounded because school districts and other special districts within Mercer County also receive coal-dependent revenue.



LESSONS FROM OTHER CONTEXTS

The previous section illustrated how certain counties in the United States are directly dependent on the coal industry for revenue. Indirect dependencies are important as well but are more difficult to quantify. When a major industrial employer collapses, service sector economic activity could also collapse, leading to lower revenues from sales taxes and amplifying the fiscal stress. In addition, as residents migrate out of the area in search of jobs, they may leave behind unsaleable vacant homes, further depressing property values and tax revenue.

Economists often account for spillovers with multipliers based on how the economy functions under normal circumstances. However, when an economy experiences an unprecedented event like the collapse of its largest industry, typical multipliers may underestimate the outcome.

To anticipate what might happen in coal-dependent communities in the United States, we look to previous examples of industrial collapse. These case studies illustrate the implications of the collapse of key industries on local economies, including on local governments and their ability to provide public services and repay debt. They also show the limited success of steps policy makers have taken to mitigate adverse impacts.

The Collapse of the Coal Industry in South Wales, United Kingdom

The economies of certain areas of the United Kingdom, including South Wales, were built around the coal industry (Arnot 1919). The long decline of the coal industry in the United Kingdom began in the early 20th century. One factor was the transition of railways to diesel and electric power (Macalister et. al. 2015). Labor disputes and strikes in the 1970s led to electricity blackouts and factory closures. In the 1980s, labor interests clashed with the conservative government of Margaret Thatcher, resulting in a policy to close deep pit mines. The final collapse occurred in the 1980s and early 1990s, spurred by the worst recession to hit Britain since the Great Depression of the 1930s and cheap coal imports from Russia and Poland.

In South Wales, 97 percent of coal jobs that existed in 1981, accounting for 21 percent of total male employment in the region, disappeared in the following decades. As of 2004, over 19 percent of men in South Wales claimed incapacity (disability) benefits, and over 11 percent were unemployed (Beatty, Fothergill, and Powell 2007). The population in the region declined due to outmigration, eroding the tax base further. Towns struggled to provide basic public services, schools and libraries closed, and bus services ended (Francis 2015).

Policy makers tried to address the dislocation. Starting in the 1930s, numerous efforts funded by the regional and national governments (and the European Union) supported the transition away from coal mining in South Wales and more broadly. These programs included adult education, retraining, infrastructure investments, broader economic development, and even the relocation of government offices away from London (Merrill and Kitson 2017).

In the 1970s, the Welsh Development Agency (WDA) provided loans and equity investments for businesses and continued an existing government program of land reclamation of



derelict colliery sites. The WDA succeeded in attracting investments and helping to build new factories, though some critics argue that the program did not tailor investments to the communities within South Wales that were most in need. Overall, the scale of the response has proven insufficient to the challenge of counteracting the collapse of the major industry in South Wales.

The Steel Industry Collapses in the US Midwest: The Case of Aliquippa, Pennsylvania

The risks that steel towns faced in the early 1980s parallel those of today's coal communities. In places with large steel plants, like the borough of Aliquippa in Pennsylvania, the steel industry dominated the local economy (Casebeer 1995). Competition from low-priced imports and labor-saving technologies eroded legacy firms' market share. The federal government tried to prop up the declining industry by establishing import quotas and minimum prices at which foreign-produced steel could be sold, to no avail.

Much of the Aliquippa Works shut down in 1984, dislocating 8,000 workers in the process (Ireton 2019). For a total population of around 20,000, the layoffs were catastrophic. By 1986, wage tax revenue fell by half, and payroll tax revenue fell by over 70 percent ("Recovery Plan for the City of Aliquippa" 1988). By 1987, the small town had amassed over \$400,000 in unpayable bills. The local electric utility threatened to shut off service to the streetlights for payment delinquency.

The Pennsylvania state government bailed Aliquippa out, but its problems remain. The population has fallen to around 9,000, about one-third of its peak. Three decades after the collapse, Aliquippa has failed to shed its official status as a "distressed community," which constrains local government tax and spending policies.

A Major US City Declares Bankruptcy: Detroit and the Automobile Industry

The automobile industry dominated Detroit's economy throughout much of the 20th century. By the century's end, 50,000 to 60,000 workers were employed in motor vehicle manufacturing in the Detroit metropolitan statistical area (MSA), about a quarter of total employment there. The industry was hit hard by the global financial crisis that started in 2007. By 2010, the number of workers employed in motor vehicle manufacturing in the Detroit MSA had fallen by more than half, to less than 20,000.⁴⁰

Detroit was uniquely unprepared for the collapse of its major industry. Not only had the city failed to diversify its economy in the face of clear risks—the city's population had been declining for decades, and the auto industry had been in periodic turmoil—the government was also plagued by corruption, inadequate government services (tax collection, record keeping, etc.), and high levels of borrowing.

In 2013, Michigan seized control of the insolvent city, and Detroit declared bankruptcy later that year. The city was \$18.5 billion in debt, and one-third of its budget went toward retiree benefits. Creditors and insurers absorbed losses of around \$7 billion, with creditors receiving



between 14 and 75 cents on the dollar. While the city emerged from bankruptcy relatively quickly, much of the city's overall economy remains economically distressed five years later (Bomey 2017; Saunders 2018).

While a large city like Detroit is unlike the rural towns most dependent on the coal industry, the implosion of Detroit's government finances and debt provides a cautionary tale for investors inclined to view municipal bonds as riskless: the bankruptcy of a major US city shows that municipalities are not too big or too important to fail.

Greenville, South Carolina, Prepares for the Collapse of the Textile Industry

The collapse of a dominating industry has not led to the collapse of local governments and economies in every instance. In the late 1800s, Greenville, South Carolina, was a hub of the textile industry. Initially attracted by the area's fast-moving rivers as a way to power looms, textile manufacturers employed tens of thousands of people in Greenville. As late as 1980, Greenville was recognized as the "Textile Center of the World" (The Greenville Textile Heritage Society 2019).

Primarily owing to changes in technologies and the availability of low-cost imports, the number of South Carolinians employed in textile mills declined from over 140,000 in the early 1970s to under 30,000 by the early 2000s (Jamieson 2010). Nearly all of Greenville's mills closed and many were abandoned, causing economic hardships and environmental problems in the mill communities (Eades, Barkley, and Henry 2007).

Greenville was prepared, however. From the mid-20th century, local and state leaders began a push to diversify the regional economy. They kept taxes and the overall costs of operating businesses in Greenville low. They offered tax incentives and favorable regulations to attract businesses in a globalizing economy, with an emphasis on advanced manufacturing. State-of-the-art manufacturing plants that produce Michelin tires and BMWs opened in the Greenville area, and Clemson University is a nearby source and destination of talent. The city has invested heavily in infrastructure and fostered a walkable downtown area with parks and development (Schechter and Connor 2017).

Greenville not only coped with the disappearance of the textile industry, it has thrived in recent years. It is among the fastest-growing cities in the country;⁴¹ its population grew 16 percent between 2000 and 2016. New businesses start in Greenville at roughly the same rates as in the metro areas of Boston and Chicago. The former textile center of the world has been referred to as "Silicon Valley of the South" (Torres and Saraiva 2018). Greenville's experience may not be easily replicable, but it shows that the collapse of a town's dominant industry is not necessarily a death sentence.



MUNICIPAL BONDS RISKS

Municipal Bonds

Municipal bonds finance a broad suite of capital investments at the state and local levels, including schools, highways, and sewer systems. Bonds can also fund ordinary expenses, or general obligations, such as municipal services, salaries, and pensions. General obligation bonds are funded by dedicated taxes and are often referred to as backed by the “full faith and credit” of the government entity. Revenue bonds, on the other hand, are backed by revenues from a specific project or source. Roughly 50,000 subfederal issuers currently have nearly one million outstanding securities, with an aggregate value of \$3.8 trillion in outstanding debt (*Muni Facts* 2019).

Municipal bond market participants have paid scant attention to the unique risks facing jurisdictions that rely on coal production. In part this may be because municipal bonds are generally considered safe assets. According to analysis by the ratings agency Moody’s, recent default rates in this market were approximately 0.18 percent, a rate that is significantly lower than that of corporate bonds (*Muni Facts* 2019).

Despite these low historical default rates, municipal bonds may be becoming riskier, irrespective of the specific risks to coal communities. Increased leverage and budget pressures, among other factors, expose municipalities to economic downturns and other unexpected shocks. Over 40 percent of the municipal defaults recorded by Moody’s between 1970 and 2016 occurred since 2007 (Hicks 2018). In addition, damages from the impacts of climate change, such as extreme weather events and sea level rise, are posing new risks to government finances (Deese et al. 2019).

When defaults occur, the consequences can be severe. The two most well-known recent examples are the \$18 billion bankruptcy in Detroit, described in the previous section, and the Puerto Rican debt crisis. Once it became clear that Puerto Rico could not repay its over \$100 billion in debt and unfunded pension obligations, the government was forced to reduce pensions, raise fees, and scale back government services; in 2017 the government announced the closure of 184 public schools and shorter hours for teachers (Walsh 2017).

The most prominent energy-related municipal default involved \$2.25 billion in bonds sold by the Washington State Public Power System (nicknamed “WHOOOPS” after this incident) (Blumstein 1983) between 1977 and 1981 to fund the construction of two nuclear power plants. By the late 1970s and early 1980s, signs of the risks associated with large nuclear power projects in general and the Washington projects in particular emerged. But municipal bonds were viewed as safe, so banks and credit agencies largely ignored these risks; the bonds were sold with Moody’s A-1 and Standard & Poor’s A-plus ratings. A combination of operational issues (e.g., cost overruns) and declining electricity demand, driven in part by regulatory decisions, led to default in 1983. Investors in the project were able to recover less than half of the principal and interest (Leigland and Liu 2013).



Regulatory Framework Governing Municipal Bonds

Governments that issue bonds are legally required to disclose risks that could affect their ability to pay back investors, both when the bonds are issued and throughout their lifetimes. The Municipal Securities Rulemaking Board (MSRB) is responsible for ensuring a fair and efficient municipal securities market; it establishes rules, collects information, and offers education pertaining to municipal bonds. The primary rules governing disclosures for municipal securities are the Securities and Exchange Commission (SEC) Rule 15c2-12 on municipal securities disclosure and MSRB Rule G-32 on disclosures in connection with primary offerings. The SEC also regulates the content of disclosure documents under two key antifraud provisions designed to ensure that buyers and sellers have access to necessary information: Section 17(a) of the Securities Act of 1933⁴² and Section 10(b) and Rule 10b-5 of the Securities Exchange Act of 1934.⁴³

In primary offerings, the bond issuers must produce an “official statement,” a document informing investors about the issuer and the project. Additionally, the SEC 15c2-12 rule requires state and local government issuers to provide information to the MSRB about their securities on an ongoing basis, a practice called “continuing disclosure.” These documents include annual financial information and audited financial statements that reflect the financial health of the state and local governments as it changes over time.⁴⁴ These documents are generally submitted to the Electronic Municipal Market Access (EMMA) system, which is operated by MSRB as a public website.⁴⁵

Municipal Debt in Coal Communities

The preceding sections of the paper have shown that serious climate policy will precipitously reduce US coal production. We have also documented how some local governments in the US are highly dependent on revenues from the coal industry and related economic activity. Now we investigate how and whether issuers of municipal bonds in coal-dependent communities are properly disclosing their climate-policy-related risks in their filings.

Bonds from coal-reliant jurisdictions make up a small share of overall subfederal US debt. In 2018, new US issuances reached \$388 billion. The issuances for top coal-producing state governments comprised only about 10 percent of the national total. The share of bonds issued by regions in coal-dependent communities within these states is even smaller. Table 1 lists some of the active bonds issued in two of the three coal-dependent counties discussed in section 2.4.⁴⁶ The Boone County government had no active issuances.⁴⁷



Table 1: Bond issues in select coal-reliant counties⁴⁸

No	CUSIP Number	Issuer	Type of Bond	Maturity Date	Purpose	Principal Amount (\$000)	Ratings (Moody's)
1	13433Q AA0-AQ5	Campbell County, WY	Hospital Revenue Bonds	2012-2034	Campbell County Memorial Hospital	\$ 47,395	
2	134331DH7	Campbell County, WY	Industrial Development Revenue Bonds	11/1/2037	Solid waste disposal facility for waste coal	\$445,480	
3	134333AD5	Campbell County, WY	Pollution Control Revenue Bond	10/1/2024	Pollution control facilities	\$ 12,200	Baa2
4	134340AA6	Campbell County, WY	Solid Waste Facilities Revenue Bonds	7/15/2039	Solid waste disposal facilities	\$150,000	Baa1
5	587849 AA8-AG5	Mercer County, ND	General Obligation Bonds	2017-2036	County courthouse and jail expansion	\$3,500	Baa2
6	587850DN5/DPO	Mercer County, ND	Pollution Control Revenue Bond	2028/2038	Refund of outstanding principal	\$100,000	Aaa
7	587850DM7	Mercer County, ND	Pollution Control Revenue Bond	9/1/2022	Refund of outstanding principal	\$20,790	A2

Source: Electronic Municipal Market Access (EMMA), MSRB <https://emma.msrb.org/>

Most bonds in table 1 fund construction of facilities such as hospitals and solid waste disposal facilities, for which repayment would ostensibly come from the income and fees associated with the facility. Principal amounts range from \$3.5 million to \$445 million. The bond terms range over 20 to 30 years, maturing between 2022 and 2039. In the climate policy scenario portrayed in figure 5, projected US coal production in 2030 falls by about 77 percent below 2016 levels. Thus, much of the bond interest payments and the principal payment could be due during a period of precipitous decline in the coal industry.

The official statements for the bonds in table 1 document their amounts, maturity provisions, trustees, underwriters, and other details. The statements vary widely in their discussion of bondholders' risks. There is no standard format for the statements, and it takes careful reading to dig out any important nuggets disclosing material risks. Some statements allude vaguely to exposure to government policy and economic conditions, while others make no mention of risks of any kind. Only two describe the potential for policies that regulate CO₂ to have "a



significant impact” on the relevant facilities. None discuss the important connections between climate policy, coal production, and the economic and fiscal conditions of local communities.

For example, the statement for the first bond in the table, which funds a hospital construction project, highlights bondholders’ risks such as changes in Medicare and Medicaid policies. With regard to other risks, it reads as follows:

Future economic and other conditions, including demand for healthcare services, the ability of the District to provide the services required by residents, public confidence in the District, economic developments in the service area, competition, rates, costs, third-party reimbursement and governmental regulations may adversely affect revenues and, consequently, payment of principal of and interest on the Series 2009 Bonds.

So it notes the relevance of “economic developments in the service area” but does not explain what that might mean. The statement lacks any recognition of the prospects or local impacts of greenhouse gas regulation, which in 2009 was a lively debate in Congress. Indeed, an appendix describes the local coal-based economy in positive terms:

Campbell County, known as the energy capital of the nation, is located in the heart of the resource rich Powder River Basin. Over 30% of the nation’s coal is produced in area surface mines. . . . Over 25% of Campbell County jobs are mineral-based, directly attributed to coal mining, oil and gas extractions, and supporting operations.

The statement also lists mining and energy companies as the top 10 taxpayers in the county.

Let us consider the other bonds in the table. The second bond finances costs related to a facility that handles waste coal. The third bond finances costs of pollution control facilities at a power plant. Neither of the official statements discusses bondholders’ risks.

The fourth bond funds solid waste disposal and sewage treatment facilities at Dry Fork Station, a coal-fired power plant. The risk factors the issuance discloses are reasonably comprehensive and, although not quantitative, characterize the broad array of environment-related factors that could affect the net revenue from the power plant. The documented risks include the large amount of long-term debt the power company is incurring, along with potential delays or termination of the project owing to opposition from environmental groups and/or regulatory measures. The statement also notes that the company may rely on technology that becomes less competitive, and it describes how laws and regulations related to climate change may “adversely affect our operations and future financial performance.” It even mentions the cap-and-trade legislation passed by the House of Representatives in June 2009 and potential environmental regulation in states that purchase power from the project. However, the document does not address risks to the economy of the surrounding community. If the coal economy collapses and demand for power declines along with it, we have no information about what that would mean for bondholders’ risks.

The fifth bond in the table, a general obligation bond issued by Mercer County, North Dakota, includes just one sentence describing risks (p. 80): “Mercer County is exposed to various risks of loss relating to torts; theft of, damage to, and destruction of assets; errors and omissions; injuries to employees; and natural disasters.” It lists the major employers, which include energy and mining companies, and the Revenue Obligations page notes that “[d]ebt is supported by coal severance



and conversion tax receipts.” Most of the ledgers reporting tax receipts do not break down tax revenues related to coal and other sources, but one that does (p. 16 of an attached audited financial statement for 2013) shows that of about \$7 million in general revenues for Mercer County, about \$3.3 million came from the coal severance and conversion taxes. This extreme dependence on coal production seems an obvious material risk, yet the statement includes no discussion of it.

The statement for the sixth bond, another pollution control issuance for energy operations, reads much like the fourth bond, including a discussion of climate and water quality regulations. It also highlights risks associated with natural gas prices and Federal Energy Regulatory Commission policy. However, like the fourth bond, the document does not address risks associated with the economy of the surrounding community.

The seventh bond lists factors affecting the business operations of the company:

Future Economic Conditions. The Company’s operations and financial performance may be adversely affected by a number of factors including, but not limited to, the Company’s ongoing involvement in diversification efforts, the timing and scope of deregulation and open competition, growth of electric revenues, impact of the investment performance of the utility’s pension plan, changes in the economy, governmental and regulatory action, weather conditions, fuel and purchased power costs, environmental issues, resin prices, and other factors discussed from time to time in reports the corporation files with the Securities and Exchange Commission.

It is interesting that resin prices rise to the significance of specific mention, whereas the potentially calamitous effects of climate policy on coal production do not.

If issuers are at best uneven and at worst misleading (by omission) in their characterization of climate-policy-related risks, can investors turn to ratings agencies for guidance? Ratings agencies have assessed most of the bonds in table 1, ranging from Baa to Aaa, with most bonds falling somewhere in between.

In some instances, ratings reports are not much better than official statements in describing the risks, and sometimes they are worse. For example, Fitch gave the seventh bond in the table an A+ rating in 2015, highlighting only the upside potential of energy development and indicating no risk associated with climate or other environmental policies.

Two of the seven bonds in the table received systematic downgrades from ratings agencies, with exposure to coal cited as a factor in the ratings agencies’ reviews. None have received an upgrade. For example, in 2018 Moody’s downgraded the fifth bond in table 1 to Baa1 “based on the county’s narrowed financial position following consecutive years of declines in liquidity driven by negative expenditure variances. The rating also reflects the county’s moderate tax base with consecutive years of tax base growth, but with some concentration in coal mining and power generation, strong demographics, low fixed costs and debt burden with moderate pension burden.” Arguably, a more forthright statement on coal reliance would be needed to appropriately articulate the risks.



CONCLUSIONS

Coal industry jobs in the United States have declined for decades due to automation and the emergence of competing energy sources. In recent years, coal production has begun to fall as well, owing to low-cost natural gas and renewables, air quality regulations, state renewable and clean electricity standards, and the prospect of federal regulation of greenhouse gas emissions. Economic modeling shows this decline will dramatically steepen if policy makers heed warnings that greenhouse gas emissions must fall rapidly to avoid the most severe risks of climate change. While serious political obstacles remain, momentum for federal climate change policy is growing in the United States.

The production of coal in the United States is highly geographically concentrated. In the three coal-dependent counties we examined in detail—Campbell County, Wyoming; Mercer County, North Dakota; and Boone County, West Virginia—the coal industry is both a major employer and contributor to local government finances through a complex system of property, severance, sales, and income taxes; royalties and lease bonuses for production on state and federal lands; and intergovernmental transfers. A sharp decline in coal production jeopardizes the fiscal health of local governments, degrading their abilities to provide adequate public services and issue and serve debt.

We offer two key conclusions here. First, policy makers in coal-dependent communities must grapple with the severe risks facing their fiscal system. They should prioritize diversifying their economies and revenue systems and otherwise plan for a potentially rapid and dramatic decline in the coal industry. One key step would be to develop and publish more-detailed budget data that reveal just how dependent they are on coal. While some politicians in coal-reliant areas may claim to have a path to bringing coal back, such bluster is irresponsible given the robust negative projections for the industry. To be sure, diversifying an economy that is so integrated with a particular industry is a difficult task, but to shirk the challenge is to commit one's community to an unacceptably high risk of fiscal stress.

A comprehensive review of the options for economic diversification is beyond the scope of this paper, but one could look to examples such as Greenville, South Carolina, and its preparation for the decline of the textile industry. As described above, the city invested heavily in becoming more attractive for residents and businesses. If coalfield counties wait too long, they will have few resources available for such investments.

Realistically, economic diversification will require large investments and thus significant external support for already-struggling coal-dependent communities and workers. The federal government is a potential source of external help. For example, the goal of the Obama administration's Partnerships for Opportunity and Workforce and Economic Revitalization (POWER) was to provide workforce training and spur economic development in Appalachian coal communities. The POWER initiative gave \$14.5 million to 36 programs in 2015,⁴⁹ but the much larger ambitions of the plan (\$9 billion to fund economic diversification was proposed in the 2016 budget) were never realized, and the similar RECLAIM Act proposed in Congress has



not been passed either.⁵⁰ A new source of government revenue may be required to push a serious economic development program across the finish line, and a logical source of these funds would be a federal carbon price. A carbon price could provide hundreds of billions of dollars in new annual federal government revenues, a small fraction of which could be devoted to economic development in coal communities and direct assistance to the residents of these communities.

We direct our second conclusion to participants in the municipal debt market, including issuers, ratings agencies, insurers, banks, and investors. A fiscal tsunami is heading toward coal-backed assets, and it is critical to take the risk seriously. Market participants should ask for budget data that appropriately reveal the coal reliance of the local economy, and they should expect the information to appear in official statements in bond issuances. Vague, opaque, and incomplete disclosures are not only bad governance but also may violate regulatory obligations to bondholders.

We conclude with these questions for stakeholder consideration and future research:

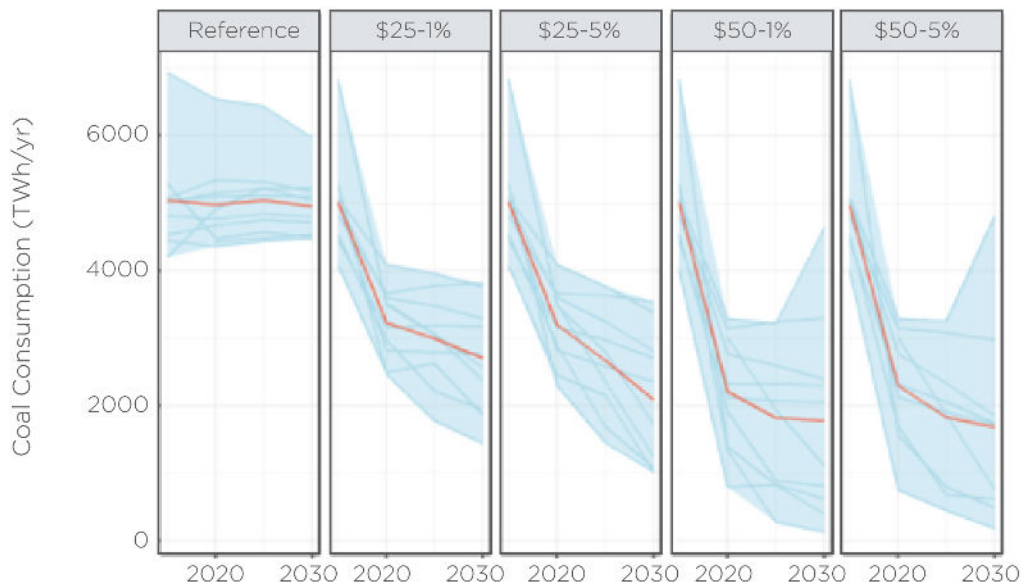
- This paper shows that bond issuers often include only vague and generic references to future regulatory risks and typically do not update these risks over time. Should the regulators develop more specific guidance and/or requirements with respect to the disclosure of climate-related regulatory risks? Should they require the periodic reevaluation of these risks in light of potential changes in policy?
- The Task Force on Climate-Related Financial Disclosures (TCFD) was developed by the G20's Financial Stability Board in 2015 as a voluntary framework for companies to disclose the financial impact of climate-related risks and opportunities. In its short lifetime, the TCFD has already encouraged a dramatic increase in corporate disclosures of climate-related risks. Should a similar voluntary effort apply to risk disclosure from public sector entities?
- Ratings agencies have begun to pay more attention to the risks of climate change, including downgrading bonds of the coal communities. Should ratings agencies further highlight and evaluate the risks to coal communities of a carbon-constrained future?
- The risks described in this study are relevant to all entities in the supply chain of a municipal bond. To what extent do they, or should they, assess risks of future climate policies when deciding whether to, for example, underwrite and insure municipal bonds?
- Finally, we have focused here on bond debt, but many rural governments also take out private bank loans (Ivanov and Zimmerman 2018). The question arises whether climate-policy-related risks to private bank loans in coal-dependent communities are being appropriately evaluated and disclosed.



APPENDIX A: ADDITIONAL MODELING RESULTS

Other modeling teams have analyzed policies like the EIA side case that we discuss in section 2. They have also projected that climate change policy would cause large and rapid declines in the US coal industry, though not necessarily as rapid as projected by EIA. For example, as part the Stanford Energy Model Forum project 32 (EMF 32), 11 modeling teams analyzed the impacts of an economy-wide US CO₂ tax starting at \$25 per metric ton in 2020 and increasing at 5 percent over inflation per year. Figure A1 displays the results, published in 2018, which show that on average, national coal consumption would fall relative to current levels by about 60 percent by 2030⁵¹ as compared to a decline of nearly 80 percent over a similar time period in EIA's power-sector-only \$25 per ton scenario.⁵²

Figure A1: US coal consumptions under four carbon tax stringencies from Stanford Energy Model Forum 32

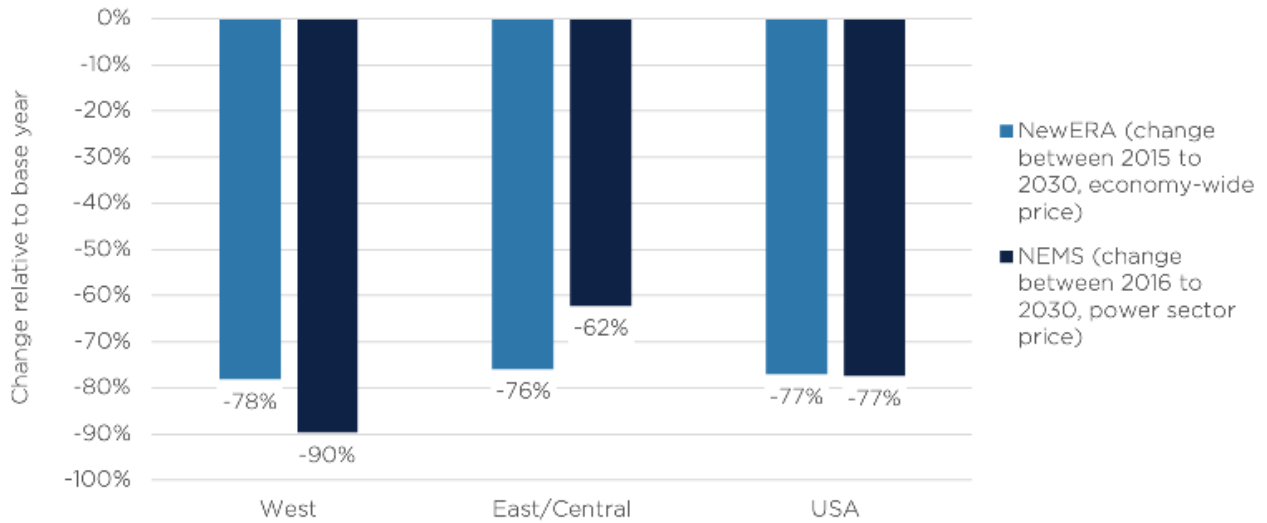


Notes: Blue bands represent the range of model results, darker blue lines show the individual model results, and the red lines show the average value.

Few of the EMF 32 modelers estimated the policy's effects on US coal production by region. One exception is the NewERA model, from NERA Economic Consulting. NERA's results are similar on a nationwide basis to those of EIA (see figure A2), although the authors find the decline is more equally distributed across the east and west regions of the country.



Figure A2: Change in US Coal Production: \$25/ton Carbon Price scenerios



Source: NEMS data from US Energy Information Administration's side case from its Annual Energy Outlook 2018 report that contemplated a carbon price on the power sector starting at \$25 per metric ton in 2020 and increasing at 5 percent per year. NewERA data from the organizers of the Stanford Energy Modeling Forum 32 exercise.



APPENDIX B: NOTES ON FINANCES IN THREE ILLUSTRATIVE COUNTIES

Boone County, West Virginia

1. Property Taxes

- a. Ad valorem property taxes are levied on both real coal (mineral) property and personal (commercial and industrial) property.
- b. These valuations are determined by the State Property Tax Division using the Reserve Coal Valuation Mode (RCVM). (In West Virginia all property is to be valued at 60 percent of its market value, unless otherwise provided.⁵³)
- c. West Virginia levies its ad valorem tax on coal reserves rather than on extraction.
- d. The largest source of revenue for West Virginia counties is the property tax, along with allocations from state severance tax.⁵⁴
- e. Boone County valuation of coal real property has eroded 17 percent since 2011.⁵⁵
- f. Collection and distribution
 - i. The West Virginia legislature established four classes of property. Active coal and coal reserves form a part of class III property (real and personal property outside of municipalities) and are subject to respective levies.⁵⁶
 - ii. The state, counties, county school boards, and municipalities have the power to tax property. These entities prepare tentative budgets and determine tax rates per year accordingly.
 - iii. Schools are funded primarily through property taxes and state aid (for educators, personnel, transportation and administrative costs).
 - iv. The fire department is primarily funded by property tax levies.



Table 2: Coal property tax collection and distribution in Boone County in 2015

Jurisdiction	Levy Rate	Amount Collected from Coal	Total Revenue of the Jurisdiction	Percent of total
State	0.01%	\$83,962	\$11,175,459.00 ⁵⁷	1%
County Budget	0.57%	\$4,802,654	\$14,454,198 ⁵⁸	33%
County Excess Levy	0.25%	\$2,166,229	NA	NA
Schools	1.69%	\$14,223,244	\$60,313,287 ⁵⁹	24%
Total	2.52%	\$21,276,093		

Source: Calculated by authors from official assessed levy rates and state, county and school district budgets

2. Severance Taxes and Coal County Reallocation Severance Tax

a. Collection

- i. 5 percent of the sale price of mined coal is imposed as severance tax.
- ii. Reallocation severance tax is an additional coal severance tax for counties in which the coal was located at the time it was extracted. It was enacted by legislation, which became effective in July 2012, reallocating 1 percent of the state severance tax yield to the coal-producing counties. It is distributed based on coal production in the county.⁶⁰

b. Distribution

- i. 4.65 percent of the 5 percent proceeds go to the state's general fund, and 0.35 percent is distributed to counties.⁶¹
- ii. Of the county share, 75 percent of net proceeds is distributed to coal-producing counties, and 25 percent is divided among all counties and municipalities in the state.⁶²
- iii. The reallocation tax received by Boone County is directed to the Coal Development Fund (CDF), which is used to fund the county commission, jails, community programs, public transit (severance tax is the sole funder), health department (severance tax is the sole funder), garbage department, and cultural and recreational expenses.⁶³
- iv. With falling severance taxes, Boone County considered ending free trash removal and charging residents for the service, since it is funded entirely by coal taxes.⁶⁴

Campbell County, Wyoming

Flowcharts of how Wyoming distributes its revenue appear in the state's annual *Budget Fiscal Data Book*.⁶⁵ For example, it shows how the state devolves its share of federal mineral royalties to schools, towns, the University of Wyoming, and other entities.



1. Assessed valuation and property tax
 - a. Collection of property / ad valorem tax
 - i. Property tax in Wyoming is an ad valorem tax. A determined mill levy for the respective year is imposed on the assessed valuation.
 - ii. The gross product of minerals, including coal, is assessed and taxed in lieu of taxes on the lands. According to the Wyoming constitution, “the value of gross product shall be the fair market value of the product at the mouth of the mine where produced, after the mining or production process is completed.” The gross products tax, therefore, is the de facto ad valorem property tax for minerals in Wyoming. These taxes are collected annually.⁶⁶
 - b. Distribution of property / ad valorem taxes
 - i. Schools: The School Foundation Program (SFP) account is the primary account for financing education in public schools, and it is also linked to the School Capital Construction Account (SCCA). Funds from these accounts flow to school districts across the state.
 - ii. County: This revenue is used to fund expenditures on fire department, natural resources, elections, and roads and bridges.⁶⁷
2. Federal Mineral Royalties (FMR)
 - a. Collection
 - i. Under the Mineral Leasing Act of 1920, the federal government collects royalties on every ton of coal that is mined on federal lands.⁶⁸ This is collected and reported by the Office of Natural Resources Revenue (ONRR) under the Department of the Interior.
 - ii. The federal government manages 12 percent of the total land area in Campbell County, which spans 364,480 acres.⁶⁹
 - b. Distribution
 - i. ONRR transfers approximately half of its FMR back to the states it received the royalties from.⁷⁰
 - ii. Schools: FMRs are one of the largest sources for the SFP account described above, which is the primary account for financing education in public schools.
3. Coal Lease Bonus (CLB)
 - a. Collection
 - i. CLBs are initially paid to the US Department of the Interior, Bureau of Land Management, for coal mining leases on federal lands. Any interested party can



- bid on a coal lease, and the lease is sold to the highest bidder at an auction. The bonuses are typically paid by lessees in five installments.⁷¹
- ii. In 2016, the Department of the Interior collected \$335 million in coal lease bonuses from Wyoming. All of this revenue came from Campbell County.⁷²
- b. Distribution
 - i. The distribution of the CLBs in Wyoming is outlined in the state's annual *Budget Fiscal Data Book*.
4. Severance Taxes
 - a. Collection
 - i. Severance tax is imposed by the Wyoming Department of Revenue Mineral Tax Division for the privilege of "severing" minerals/valuable deposits on all federal as well as private land.⁷³
 - ii. The effective severance tax rate on surface coal in Wyoming is 7 percent, and that on underground coal is 3.75 percent. All the coal in Campbell County is surface coal.⁷⁴
 - b. Distribution
 - i. 1.5 percent of the 7 percent, or about 21 percent of the total severance tax collected, goes into the Permanent Wyoming Mineral Trust Fund. As of October 4, 2016, the balance of the fund was \$7.1 billion.⁷⁵
5. Sales and Use Tax
 - a. Collection
 - i. Wyoming does not impose a sales and use tax on the production of minerals, but it taxes mine operation and mining support activities. This includes taxing supplies and equipment used in extraction and establishments that perform exploration as well as services rendered under the contract for extraction.⁷⁶
 - ii. Wyoming sales tax is 4 percent, and counties are able to collect up to 2 percent of optional additional taxes. Campbell County charged an additional 1 percent of its optional tax rate in 2016, bringing the sales tax for the county up to 5 percent.⁷⁷
 - iii. The sales and use tax is collected by the state government, and then a fraction of it is returned to local governments, including county and municipal governments.
 - iv. 29 percent (\$37.2 million) of the county's collection of total sales and use tax revenue in 2016 came from mining, which includes solid minerals such as coal and ore as well as liquid minerals such as oil.⁷⁸
 - v. 2016 total county sales and use tax revenue declined by 31 percent in 2016 from 2015, while mining sector sales and use revenue declined by 46 percent.⁷⁹



vi. Note that these sales and use tax revenues for Campbell County refer to ALL minerals and not just coal.

b. Distribution

i. Sales and use taxes are a large source of revenue for municipal governments. The revenue is distributed per capita to municipal governments.

Mercer County, North Dakota

1. Property Tax

a. Coal severance and conversion taxes are levied in lieu of property tax.⁸⁰

b. A privilege tax, in lieu of property taxes, is imposed monthly on a coal conversion facility. The land on which the plant is located, however, remains subject to property tax.⁸¹

2. Federal Mineral Royalties

a. 3.9 percent of North Dakota is federally owned.⁸²

b. Collection

i. Mercer County produced 3.8 million tons of coal on federal land in North Dakota in 2016. That's approximately 81 percent of total coal production on federal lands in North Dakota in 2016.⁸³

c. Distribution

i. Approximately 50 percent of FMRs are typically returned to the state by the center.

ii. A portion of the total FMRs received by the state is distributed among the counties. These are distributed quarterly to counties by the state in proportion of the ratio of each county's mineral royalty revenue to the total mineral royalty revenue received by the state for that quarter.⁸⁴ The counties may use these royalties only for planning, construction, and maintenance of public facilities and provision of public services.

iii. The remaining FMRs received by the state are distributed to school districts.

3. Severance Taxes

a. Collection

i. The coal severance tax is imposed on all coal and commercial leonardite severed for sale or industrial purposes, except coal used for heating buildings in the state, coal used by the state or any political subdivision of the state, and coal used in agricultural processing and sugar beet refining plants in the state or adjacent states.⁸⁵

ii. The tax is in lieu of both the sales and use taxes on coal and commercial leonardite



- and the property tax on minerals in the earth.
- iii. Coal and commercial leonardite are taxed at a flat rate of 37.5 cents per ton.
 - iv. A 50 percent reduction in the 37.5-cent tax is allowed for coal burned in a cogeneration facility designed to use renewable resources to generate 10 percent or more of its energy output. Counties may grant a partial or complete exemption from the counties' 70 percent portion of the 37.5-cent tax for coal or commercial leonardite that is shipped out of state.
 - v. An additional 2-cent-per-ton tax is levied for the lignite research fund.
- b. Collection
- i. Administering this tax is the responsibility of the state property tax division.
- c. Distribution
- i. Revenue from the 37.5-cent severance tax is deposited in the CDF.⁸⁶
 - ii. The CDF is a permanent fund (only the earnings from this fund can be used). As of June 2019, the balance of the CDF was \$70,486,812.⁸⁷
 - iii. 30 percent of the tax deposited in the CDF is distributed to a permanent constitutional trust fund administered by the Board of University and School Lands. The trust fund is used to supply loans to school districts for school construction and loans to cities, counties, and school districts impacted by coal development. Investment income from the trust fund is first used to replace uncollectible loans made from the fund, and the balance is deposited in the state general fund. 70 percent of the tax collected and deposited in the permanent trust fund must be deposited in the lignite research fund. In 2016, the balance of the trust fund was \$68 million.⁸⁸
 - iv. 70 percent is distributed among the coal-producing counties apportioned by the amount of coal each county produces.
 - v. Revenue allotted to each county is further apportioned as follows: 40 percent to the county general fund, 30 percent to the cities within the county, and 30 percent to the school districts.⁸⁹
 - vi. Revenue from the additional 2 percent tax goes to North Dakota's Lignite Research, Development and Marketing Program.⁹⁰
 - The program is a multimillion-dollar state/industry partnership that concentrates on research and development to preserve and enhance development of North Dakota's abundant lignite resources.
 - It is funded from several sources, including the coal severance tax, coal conversion tax, and Strategic Investment and Improvements Fund, with



approximately \$7.5 million available each year for the program.

- As of 2016, the balance of the program was \$10.8 million. This balance has grown to \$29.7 million as of May 1, 2019.

4. Coal Conversion Tax

- a. The coal conversion facilities privilege tax is imposed on the operator of a coal conversion facility for the privilege of producing electricity or other products from coal conversion plants.⁹¹
- b. A coal conversion facility is defined as (1) an electrical generating plant that has at least one unit with a generating capacity of 10,000 kilowatts or more of electricity, (2) a plant other than an electrical generating plant that processes or converts coal and uses or is designed to use over 500,000 tons of coal per year, or (3) a coal beneficiation plant.
- c. This tax is in lieu of property taxes on the plant itself, but the land on which the plant is located remains subject to property tax.
- d. Collection
 - i. It is administered by the property tax division.
 - ii. Electrical generating plants are subject to two separate levies. One levy is 0.65 mill times 60 percent of installed capacity times the number of hours in the taxable period. The other levy is 0.25 mill per kilowatt-hour of electricity produced for sale.
 - iii. A coal gasification plant is subject to a monthly tax measured by 13.5 cents per thousand cubic feet of gas produced for sale or 4.1 percent of gross receipts, whichever is greater.
 - iv. Plants converting coal to products other than gas are taxed at 4.1 percent of gross receipts.
 - v. The tax rate for a coal beneficiation plant is 20 cents per ton of beneficiated coal produced for sale or 1.25 percent of gross receipts, whichever is greater.⁹²
- e. Distribution
 - i. The revenue from the 0.25 mill levy on production is deposited in the state general fund.
 - ii. The revenue from the 0.65 mill levy on installed capacity and other coal conversion plants is distributed as follows:
 - 85 percent goes to the state general fund. 5 percent of all funds allocated to the state general fund must be allocated to the lignite research fund.
 - 15 percent goes to the county in which the plant is located. The amount



distributed to each county is further apportioned as follows: 40 percent is deposited in the county general fund, 30 percent is divided among all incorporated cities in the county according to population, and 30 percent is divided among all school districts in the county on the basis of average daily membership.⁹³

- iii. The general fund is the chief operating fund of North Dakota.



NOTES

1. Data from the US Bureau of Labor Statistics, All Employees: Mining and Logging: Coal Mining [CEU1021210001], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/CEU1021210001>.
2. American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong. (2009).
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4. An analysis of state and local revenue sources and uses from oil and gas production appears in Newell and Raimi (2018).
5. A compendium of state severance tax policies for natural gas appears here: <http://www.ncsl.org/research/energy/taxing-natural-gas-production.aspx>. Weber et al. (2016) also has an appendix that documents state severance tax policies.
6. The variation of severance tax policies by state can be seen here: <http://www.ncsl.org/research/energy/oil-and-gas-severance-taxes.aspx#severance>.
7. “Natural Resources Revenue Data,” US Department of Interior, accessed June 2019, <https://revenuedata.doi.gov/>.
8. An understanding of the federal mineral revenue collected at each stage of coal mining can be found here: <https://revenuedata.doi.gov/how-it-works/coal/>.
9. The US Census Bureau a tax as state-level if the state performs at least two of these three duties, as described on page 4-4 of this document: https://www2.census.gov/govs/pubs/classification/2006_classification_manual.pdf.
10. Population estimate as of July 1, 2018. Demographics of Mercer County appear here: <https://www.census.gov/quickfacts/fact/table/mercercountynorthdakota,US/PST045218>.
11. As described by the West Virginia State Tax Department, p. 1: <https://tax.wv.gov/Documents/Reports/SeveranceTaxes.TaxData.FiscalYears.2015-2018.pdf>.
12. *State of the Treasury* (2015), p. 11.
13. West Virginia State Auditor (2016).
14. Data for 2015 from the US Census Bureau, US Bureau of Labor Statistics, and US Bureau of Economic Employment.
15. The total assessed valuation for Boone County for 2015 is \$1.5 billion as per *Levy Rates for the County and Cities in Boone County 2015*, p. 2. The total valuation for coal industrial and



mineral property is \$840 million, as calculated from Kent (2016), pp. 13–14. This implies that coal forms about 57 percent of total Boone County valuation. This is in line with the findings of O’Leary (2011), p. 6, that coal forms about 60 percent of the total property tax revenue for Boone County.

16. Calculated by authors from West Virginia State Auditor (2016). Property taxes generate about \$6.3 million of the county’s \$12.5 million budget.
17. We calculated this by applying the schools total levy rate for class 3 and 4 property (1.69 percent) from Boone County Government (2015), p. 1, to the assessed valuation of coal as described in footnote 12 above.
18. We calculated this by applying the total levy rate for class 3 and 4 property (2.53 percent) from Boone County Government (2015), p. 1, to the assessed valuation of coal as described in footnote 12 above.
19. We calculated annual revenues by combining amounts derived from quarterly severance and reallocation tax distribution documents published by the West Virginia State Treasurer: <https://www.wvtreasury.com/Banking-Services/Revenue-Distributions/Coal-Severance-Tax/Coal-Severance-Tax-Archive>.
20. Data from the 2018 and 2012 *Annual Coal Report* published by the EIA.
21. Kent (2016) found that revenues from coal severance tax to West Virginia counties declined from a total of \$30.5 million in 2011 to \$16.1 million in 2015. Boone County severance tax revenue declined from \$5 million in 2011 to \$1.6 million in 2015.
22. Relating to reducing the severance tax on thermal or steam coal. House Bill 3142. Regular Session (2019).
23. North Central Appalachian Coal Severance Tax Rebate Act. House Bill 3144. Regular Session (2019).
24. Population estimate as of July 1, 2018. Demographics of Campbell County appear here: <https://www.census.gov/quickfacts/campbellcountyywoming>.
25. Mining Technology ranked the North Antelope Rochelle coal mine as the biggest in the world in 2012. <https://www.mining-technology.com/features/feature-the-10-biggest-coal-mines-in-the-world/>.
26. Flowcharts of various revenue streams appear in the Wyoming Legislative Service Office’s *2019 Budget Fiscal Data Book*.
27. *Campbell County Financial and Compliance Report* ending June 30, 2018, p. 25.
28. *Campbell County Financial and Compliance Report* ending June 30, 2018, p. 51.
29. Campbell County Board of County Commissioners, *A Campbell County Profile: Socioeconomics* (2017), p.10.



30. Ibid., p. 37.
31. State of Wyoming Department of Revenue *2018 Annual Report*, pp. 23, 17.
32. Campbell County FY *2017-18 Annual Report*, pp. 3-4.
33. Data from US Bureau of Labor Statistics and US Mine Safety and Health Administration.
34. North Dakota Tax Commissioner. *State and Local Taxes: An Overview and Comparative Guide*. Ryan Rauschenberger (2018), p. 3.
35. Ibid., p. 16.
36. The land on which the plant is located is still subject to property tax.
37. North Dakota Tax Commissioner, op. cit., p. 16.
38. North Dakota State Treasurer. Website. North Dakota State Government. Accessed 2019. <http://www.nd.gov/treasurer/revenue-distribution/>.
39. Mercer County audit 2016.
40. Data from the US Bureau of Labor Statistics, Unemployment Rate in Detroit-Warren-Dearborn, MI (MSA) [DETR826URN], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/DETR826URN>.
41. As per data released by the US Census Bureau in 2017: <https://census.gov/newsroom/press-releases/2017/cb17-81-population-estimates-subcounty.html#fastest-growing>.
42. 15 US Code § 77q(a).
43. 15 US Code § 78j(b) and 17 CFR 240.10b-5.
44. Detailed information about the categories of financial disclosures and related documents can be found here: <http://www.msrb.org/msrb1/pdfs/Issuer-Guide-to-Making-Financial-Disclosures.pdf>.
45. See <https://emma.msrb.org>.
46. As found on the EMMA website operated by MSRB, as of April 2019.
47. West Virginia has issued infrastructure general obligation bonds secured in part by severance tax collections. Entities, such as towns within Boone County, have issued bonds; they tend to be much smaller than the bonds in table 1. A compendium appears here: <http://mbc.wv.gov/AnnualReports/AnnualReport2018.pdf>.
48. For more information, see <https://www.sec.gov/investor/alerts/municipalbondsbulletin.pdf>.
49. POWER stands for Partnerships for Opportunity and Workforce and Economic Revitalization. See <https://obamawhitehouse.archives.gov/the-press-office/2015/03/27/fact-sheet-partnerships-opportunity-and-workforce-and-economic-revitaliz>.



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52. Cite EIA 2018 data tables.
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