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# Assessing the Future of Oil and Gas Production and Local Government Revenue in Five Western US Basins

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# Abstract

Oil and gas production is a major source of economic growth, employment, and public revenue in many US regions, but considerable uncertainty exists over the future of demand for hydrocarbons, particularly due to the need to reduce greenhouse gas emissions. To inform decisionmakers at local, regional, and national levels, we model how oil and gas production and related government revenue could change in five western US regions (in four states) depending on future oil and natural gas prices under three scenarios of climate policy ambition. Our findings suggest there is substantial variation across regions and scenarios: the Green River (Wyoming) and San Juan (Colorado, New Mexico) basins experience production declines across all scenarios, while production in the Bakken (North Dakota), Permian (New Mexico), and Powder River (Wyoming) basins are more dependent on prices. Although we find that government revenue generally follows the direction of production, these relationships are not directly proportional. For example, under the lower price scenarios, revenue declines more steeply than production because it reflects both production and prices, which both decline. Long-term permanent funds, which are in place across all the states we examine, provide an important fiscal cushion for school districts, their primary beneficiary. These results highlight the importance of developing economic resilience in oil- and gas-producing regions to prevent the potential negative impacts of a long-term reduction in demand for hydrocarbons and of long-term thinking when managing volatile and unpredictable natural resource revenues.

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# 1. Introduction

Oil and natural gas development are important to numerous US regional economies. If the nation and the world are to reduce greenhouse gas emissions and achieve a “net zero” economy, demand for oil and natural gas will very likely decline considerably in the decades ahead (IPCC 2022; Raimi et al. 2022a), with clear consequences for regions most dependent on their production for employment, economic activity, and government revenue.

We consider how a global reduction in demand may affect some of the US regions that are most economically dependent on the production of these commodities. We deploy the Dynamic Oil and Gas Market Analysis (DOGMA) model, an original modeling tool designed to estimate how US oil and gas drilling and production activity change in response to changes in market prices, policies, and other factors.

We use DOGMA to estimate how production changes under a set of stylized scenarios across five oil and natural gas basins in four states: the Bakken (North Dakota), San Juan (Colorado and New Mexico), Green River (Wyoming), Permian (New Mexico), and Powder River (Wyoming) basins.<sup>1</sup> We choose these regions for several reasons: they are some of the most significant US producers of oil and gas; their geological characteristics and production histories vary considerably; and they incorporate a diverse mix of mineral ownership, including significant federal, tribal, state, and private ownership.

We then use a series of state-specific models representing federal, tribal, state, and local fiscal policy to estimate how oil- and gas-related revenues change for local governments under our scenarios. Finally, we use simple employment multipliers to provide some intuition of how regional oil and natural gas employment may change under these scenarios.

Our modeling focuses exclusively on the consequences of future trajectories of oil and gas development; we do not account for the potential for regional economies to generate new revenue streams, such as from zero-carbon energy development or other industries, to substitute for potential declines in oil and gas revenue. Hence, our results reflect the potential vulnerability of local communities if they are unable to develop new drivers of economic growth and tax revenue.

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1 The Bakken is a hydrocarbon-bearing geological formation in the Williston basin. The Permian basin stretches across New Mexico and Texas, but we focus only on New Mexico. We refer to all regions as “basins” for simplicity.

## 2. Related Research

In recent years, policymakers and researchers have increasingly focused on the need for a “just transition” that seeks to ensure that shifting to net-zero emissions does not exacerbate inequities or create new ones related to energy production and consumption. Key principles articulated by scholars include the need to support low-income households, rectify disproportionate impacts from pollution, and ensure that workers and communities that are heavily dependent on fossil fuels for jobs and government revenue can take advantage of new economic opportunities (Just Transition Centre 2017; Cha et al. 2019; Muttitt and Kartha 2020; Just Transition Fund 2020; Look et al. 2021).

In international and US contexts, most efforts have focused on regions that underwent or are expected to experience economic shocks due to declining coal demand (Cecire 2019; Blended Finance Taskforce and Centre for Sustainability Transitions 2022; Plumer 2022). However, the US oil and natural gas sector is considerably larger in its share of energy consumption, employment, and contribution to government revenue (Raimi et al. 2022c, 2022b). The United States has recently become the world’s largest producer of both fuels (bp, 2021).

Although oil and gas demand continues to grow globally, net-zero emissions goals imply considerable decline in demand for these fuels in the years ahead. To address the resulting economic effects, scholars and practitioners have emphasized the need to build economic resilience well in advance of major changes in the energy system (Haggerty et al. 2018; Cha et al. 2019; Just Transition Fund, 2020). However, very little work has characterized how a net zero transition is likely to affect US oil- and gas-producing communities.

In this section, we review the literature on how oil and natural gas contribute to economic growth and employment in international and US contexts. This literature examines how specialization in natural resource extraction affects social and economic outcomes over various time scales. Our goal is to understand whether and to what extent the lessons from this literature can inform decisions to boost local economic resilience in the face of a long-term decline in oil and natural gas production.

## 2.1. Booms, Busts, and the “Resource Curse”

### 2.1.1. International Evidence

The large-scale exploitation of fossil fuels spurred the industrial revolution, helping to generate widespread prosperity. However, for regions that host oil and natural gas extraction, the outcomes for sustainable, long-term economic growth are complex. For example, Sachs and Warner (1995) observed that countries rich in natural resources grew more slowly than resource-poor countries from 1970 to 1980, reflecting a “resource curse.” Under this theory, exploiting natural resources diverts investment from manufacturing activities and drives up the prices of domestic commodities, which undermines the competitiveness of manufactured exports. Scholars note that “crowding out” can extend to education and innovation, as entrepreneurial activity moves towards the globalized and export-oriented natural resource industry (Gylfason 2001). The resource curse may also concentrate wealth among elites, exacerbating authoritarianism and political corruption (Auty 2000).

Other scholars, however, dispute parts of the resource curse hypothesis. Alexeev and Conrad (2009), for example, argue that the evidence for a curse as a rule rests on a myopic application of gross domestic product (GDP) data. Focusing on the oil industry, they find that countries are economically better off, on average, if they are able to exploit their natural resource wealth, asserting that the slow growth of oil producers in the contemporaneous period reflects the depletion of their resources rather than a consequence of their initial endowment. Furthermore, a lack of access to reliable data before the 1960s makes it difficult to assess long-term economic trends, particularly for nations where production began during the first half of the 20th century.

Lashitew et al. (2021) find that outcomes depend in part on which metrics researchers choose to measure the importance of natural resources in a given economy. For example, they find that resource *dependence* (the share of resources in exports or GDP) tends to be negatively associated with factors that improve a country’s global economic competitiveness (e.g., human capital, innovation performance, infrastructure stock, financial access), whereas resource *abundance* (the level of natural resource rents per capita) tends to have a more positive effect on those same factors. They find no simple formula for ensuring positive economic outcomes but note that oil-rich nations have generally struggled to build economic diversification and international competitiveness outside of the oil sector.



## 2.1.2. Evidence from the United States

In a US context, scholars have sought to understand the extent to which a resource curse may exist at local or regional scales. In one analysis of states' gross state products (GSP) from 1977 to 2002, Freeman (2009) found that a single percent increase in natural resource intensity (the share of total employment in agriculture and mining) corresponded to a half percent reduction in GSP growth, similar to the findings in Papyrakis and Gerlagh (2007). Resource earnings were also negatively correlated with annual growth in per capita personal income in US counties from 1980 to 1995 (James and Aadland 2011).

Oil and gas resources are particularly susceptible to boom-and-bust cycles that compound the challenges regional economies face after specializing in these sectors. In a study of US county-level data from 1970 to 2012, Ouedraogo (2012) estimates that gains in employment during boom periods were overshadowed by the losses after busts. This finding, together with evidence that positive shocks for mineral resource extraction contracted manufacturing growth and attenuated retail trade and service sector employment, earnings, and earnings per worker, gives weight to the resource curse hypothesis.

However, a national-level analysis may obscure how regional outcomes differ. Michaels' (2011) study of oil-abundant counties within the US South (1890–1990) suggests that geographically concentrating oil and gas industrial activity—extraction, refining, petrochemical manufacturing—improves resilience and local incomes. He argues that agglomeration increases labor productivity and promotes investment into critical infrastructure, such as airports, which has long-term benefits for industrial development across multiple sectors.

In the American West, however, where populations are more geographically dispersed, these agglomeration effects may be less likely. Jacobsen and Parker (2014) examine counties from 1969 through 1998, finding that per capita incomes in boom counties were lower than a counterfactual scenario where the boom had not occurred. Similarly, Haggerty et al. (2014) find evidence of adverse consequences of long-term specialization in oil and gas extraction for 1980–2011 for per capita income, crime, and educational attainment.

An important caveat to all of these studies is that the US prices for and aggregate values of coal, oil, and natural gas produced during the time when the studies were carried out generally declined (EIA 2012, 2). This trend suggests that negative economic outcomes may result from the period of analysis rather than dependence on the resource sector, per se.

### **2.1.3. Evidence from the Shale Era**

As US oil and gas production surged during shale revolution, researchers have examined how this boom has affected communities across a variety of geographies. This work generally indicates clear short-term benefits but offers less insight into long-term outcomes; in some cases, it suggests that booms could reduce human capital over the medium to long terms.

For example, analysis across all major producing regions suggests the shale boom has discouraged high school enrollment (Zuo et al. 2018), a trend that held for Montana, North Dakota, and West Virginia (Rickman et al. 2017), and lowered student test scores in Texas despite increasing the tax base for those schools (Marchand and Weber 2020). Although residential property values can be negatively affected by proximity to shale wells (Muehlenbachs et al. 2015), aggregate property values have generally increased in regions with shale development (Weber and Hitaj 2015; Weber et al. 2016; Newell and Raimi 2018a), as has personal income, particularly for mineral owners (Weber 2012; Brown et al. 2016).

In a review of community impacts of shale development, Klasic et al. (2022) highlight findings that wages in counties experiencing booms climbed up to 10 percent, with spillover effects that raised the wages of other industries up to 17 percent. Each million dollars' worth of oil and gas production was shown to return around \$80,000 in additional wages and roughly \$132,000 in business income and royalties.

For our purposes, the key unanswered question in the literature is whether and to what extent a long-term decline in demand for oil and natural gas could affect local economic outcomes, particularly if communities are unable to develop new contributors of local economic growth.

## **2.2. Employment**

Many studies of the oil and gas industry have focused on modeling its contribution to local, regional, and national employment. In 2020, the sector directly employed roughly 100,000 people (US Census Bureau 2022). However, additional employment occurs in support and service sectors, and studies often estimate such indirect and induced employment. Econometric approaches, which rely on historical data and seek to control for numerous factors through statistical techniques, suggest that for each direct hire, 0.3–0.8 jobs are added outside the sector (Brown 2015, 2014; Weinstein et al. 2018). Similarly, econometric analysis indicates that each additional drilling rig results creates roughly 30 jobs immediately and 240 in the long run (Agerton et al. 2015; Brown 2015). Input–output approaches, which account only for employment changes within a given sector, estimate employment multipliers of 1–5 (Deck 2008; Considine et al. 2010, 2011; IHS 2012; Krupnick and Echarte 2017).

Like local and regional economies dependent on oil and natural gas extraction, employment is also subject to the boom-bust cycle. Recent research from Alberta, Canada estimates that a single dollar change in the global oil price alters regional

economywide employment by nearly 1 percent (Scheer et al. 2022). However, Hafstead et al. (2022) note that certain approaches will tend to overestimate the effect of environmental policies and use general equilibrium modeling tools to suggest that the economywide employment impacts of changes in the energy system may be quite modest. The same is likely true of changes in demand for hydrocarbons, which will shift labor demand from one set of energy-producing activities to another.

Regardless of the accuracy of any particular modeling approach, policymakers have expressed a clear focus on preserving and increasing high-quality jobs during a transition to a net-zero future (e.g., IEA 2022a; White House 2022). In addition, changes in oil- and gas-related employment may have profound effects at the community level, even if these effects are small in a national or global scale. In such a context, researchers have argued that policymakers can leverage the existing skill sets and infrastructures associated with the oil and gas industry to tailor regional economic and workforce development efforts (Greenspon and Raimi 2022; Ravikumar and Latimer 2022).

### **2.3. Fiscal Impacts**

Another of the most prominent policy concerns associated with energy and natural resource development is how it affects government budgets. Natural resource development can generate significant economic rents, providing the opportunity for substantial revenue (Segal 2012); this allows local and state governments to tax other sources less, providing near-term benefits to citizens but creating structural challenges to transition (James 2015). However, a resource boom can strain local government resources through an influx of population and increased demand on infrastructure, which was of major concern in the late 1970s and early 1980s across parts of the western United States (Gulley 1982).

The question of fiscal impacts has become more salient as US oil and natural gas production expanded as a result of the shale revolution. It dramatically increased both costs and revenues for many local and state governments, and most local governments have reported that increased revenues have outweighed increased costs, even through recent boom-bust cycles (Newell and Raimi 2018b).

However, a long-term decline in oil and gas production raises a different set of fiscal challenges. In Appalachian coal communities that have experienced decades of decline, some local governments face major fiscal risk (Morris et al. 2021). Across the US, fossil fuels generate roughly \$138 billion annually for governments, with several states relying on them for 10 percent or more of their annual revenues (Raimi et al. 2022c). Although clean energy projects can boost local tax revenues, renewable energy resources typically do not pay severance taxes, and several states exempt them from local property taxes, as states or local governments seek to encourage their deployment (Hintz et al. 2021; Uebelhor et al 2021). The combination of these factors suggests that a long-term decline in oil and natural gas production, without changes to tax structures, would pose considerable fiscal risks for local and, in some cases tribal and state governments.

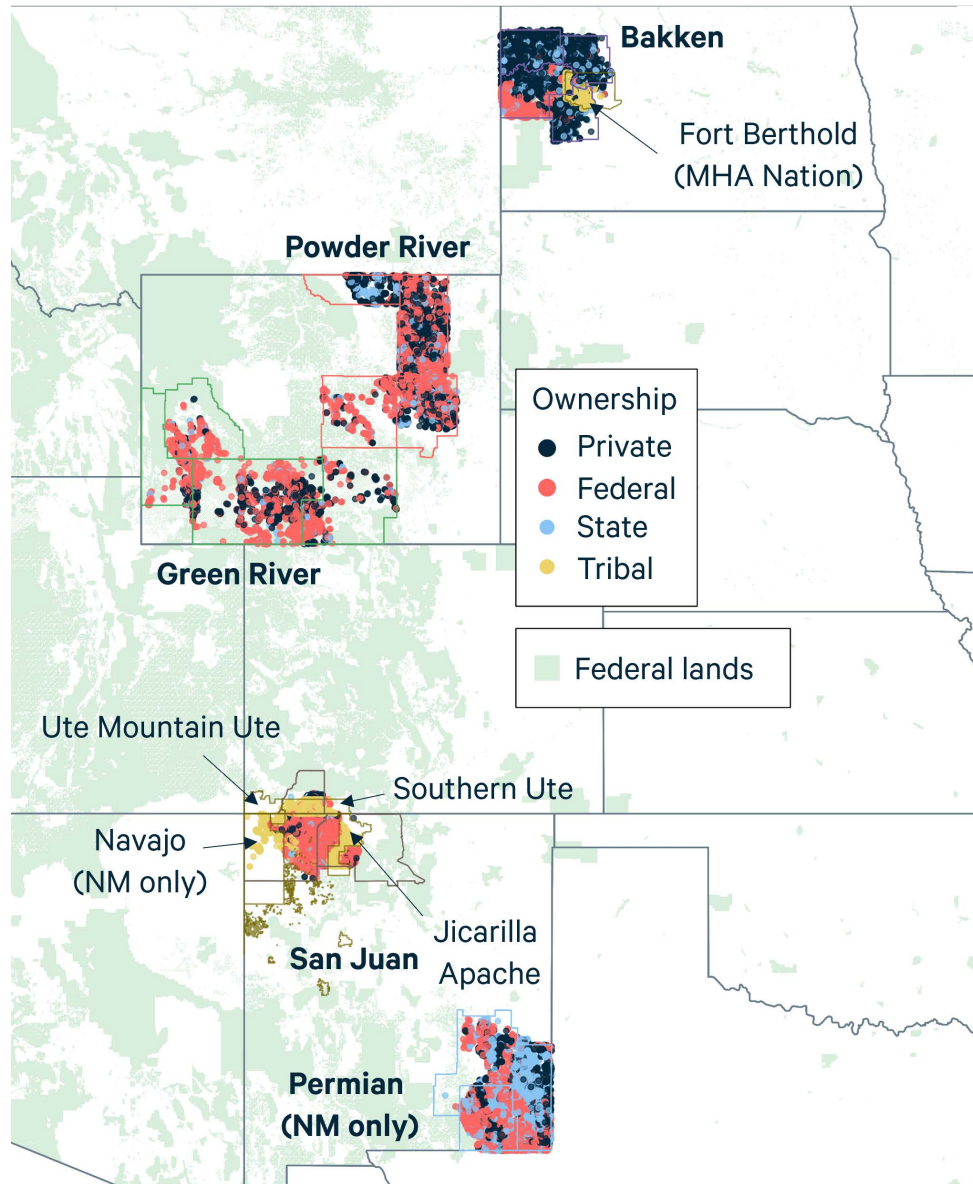
### 3. Data and Methods

We estimate potential future trajectories of oil and gas production and the corresponding flows of government revenues in five key oil and gas basins in the west: Bakken in North Dakota; Green River and Powder River in western and eastern Wyoming, respectively; San Juan in northwestern New Mexico and southwestern Colorado; and the portion of the Permian in southeastern New Mexico. These regions have varied histories, ranging from active development (Bakken and Permian) to secular decline (Green River and San Juan). Each region also has a diverse mix of mineral ownership across private, state, federal, and tribal lands.

We project production trajectories using the DOGMA model, which extends the methodology developed in Prest (2022). Our version of DOGMA produces projected oil and gas production for each of 76 “classes” of wells, with each class uniquely identified by the jurisdiction of its production and the ownership of its mineral rights. Each class also falls into one of the five selected regions (or basins).

The jurisdictions are represented by the 20 counties we focus on, plus oil and gas production on Native American reservations and off-reservation trust land, including the Jicarilla Apache Nation; Mandan, Hidatsa, and Arikara (MHA) Nations of the Fort Berthold Reservation; Navajo Nation; Southern Ute Indian Tribe (SUIT); and Ute Mountain Ute Tribe. Within each class, monthly oil and gas production is projected separately at the well level, which permits us to estimate the amount from low-producing stripper wells, which are given more generous fiscal treatment in many states. The production estimates are used, jointly with the three oil and gas price scenarios (Section 4.2), to generate jurisdiction-specific estimates of tax and royalty revenues. Figure 1 illustrates the regions we examine and their existing oil and gas wells; Table 1 provides a list of the relevant jurisdictions.

**Figure 1. Existing Wells in Study Regions with County and Reservation Borders**



**Table 1. Regions and Jurisdictions Examined**

<b>Region/basin</b>	<b>Jurisdictions (county or reservation)</b>	
Bakken (North Dakota)	Dunn County	Williams County
	McKenzie County	Fort Berthold
	Mountrail County	
Green River (Wyoming)	Carbon County	Sublette County
	Lincoln County	Sweetwater County
Permian (New Mexico)	Chaves County	Lea County
	Eddy County	
Powder River (Wyoming)	Campbell County	Natrona County
	Converse County	Sheridan County
San Juan (New Mexico/Colorado)	La Plata County (Colorado)	Rio Arriba County (New Mexico)
	Jicarilla Apache (New Mexico)	Navajo (New Mexico)
	Southern Ute (Colorado)	San Juan County (New Mexico)
	Ute Mountain Ute (Colorado/New Mexico)	

Notes: “Reservations” refers to on-reservation and off-reservation trust lands.

### 3.1. DOGMA Model

The Prest (2022) DOGMA model used a dataset on the universe of US oil and gas wells from the energy data company Enverus to model drilling, completion, and production in each of eight well “classes.” It is an econometrically calibrated simulation model that captures dynamics and inertia in oil and gas production caused by industry structure, such as lags between the response of drilling to market conditions and the natural decline of production from existing wells. The model takes future trajectories of oil and gas prices, simulates how drilling responds to price changes over time, and projects the resulting production from both newly drilled and existing wells.

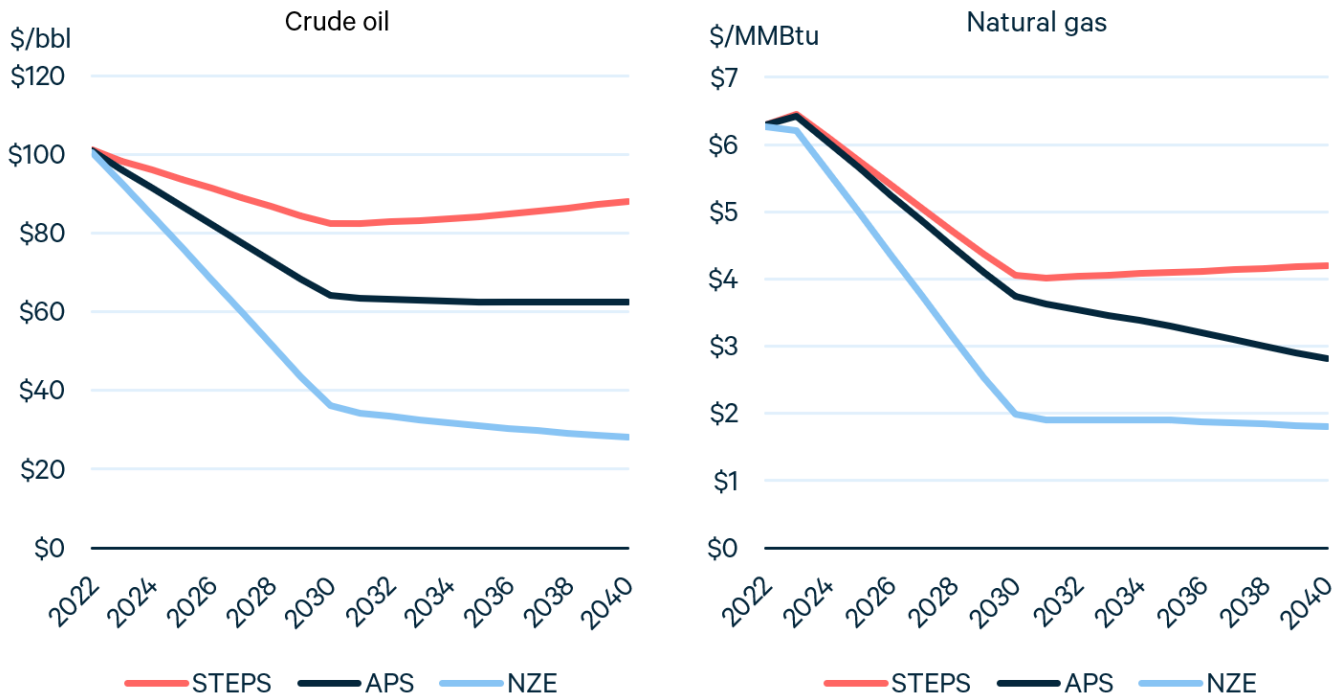
The model produces monthly production estimates at the well level for each of a number of well “classes.” The eight classes in Prest (2022) reflected the permutation of three factors: federal versus nonfederal ownership, oil versus gas, and onshore versus offshore. This paper applies the same general conceptual modeling framework but targets the five specific regions; that narrows the scope, which permits greater granularity in modeling production across different jurisdictions and different mineral ownership statuses. Such granularity is necessary for studying public fiscal exposure because both the jurisdiction and mineral ownership heavily dictate how much taxes and royalties flow to tribal, state, and local governments. We extend the DOGMA model to cover 76 classes, representing the permutation of our 20 jurisdictions (18 counties<sup>2</sup> plus the two largest contributing reservations: Fort Berthold, a major oil producer, and Southern Ute, a major gas producer) and key mineral ownership statuses (private, federal, state, and tribal, including five unique Native American reservations). Public data on tribal mineral ownership is very limited, preventing a detailed decomposition of flows of royalty revenues on most reservations. Each class is associated with one of our five basins. The dataset reflects approximately 191,000 wells (see Appendix Section 6.1 for more details).

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2 We include all counties in our five key basins where at least 2,000 wells have ever been drilled. We additionally include all wells, regardless of county, in the jurisdictions of the two major oil and gas producing Native American reservations, which accounted for nearly all oil (99 percent) and gas (93 percent) production on the reservations in our study regions in 2021. Wells drilled in these 20 jurisdictions collectively account for 96 percent of the wells drilled in the five oil and gas basins we consider. We develop revenue estimates for three additional Native nations (Jicarilla Apache, Navajo, and Ute Mountain Ute) using modeled production from the counties that overlap the borders of their reservations.

We model oil and gas production under three price scenarios developed by the International Energy Agency (IEA, 2022b) in its 2022 World Energy Outlook (WEO): a Stated Policies Scenario (STEPS) that focuses on what governments “are actually doing,” including existing policies and those under development; an Announced Pledges Scenario (APS), which includes announced climate commitments by governments and nongovernmental entities (even if there is no clear plan for implementing these commitments); and a Net-Zero Emissions by 2050 scenario (NZE), in which global net CO<sub>2</sub> emissions reach zero by 2050.<sup>3</sup> In these scenarios, more ambitious climate policies reduce demand for oil and natural gas, which lowers benchmark global oil and domestic (US) gas prices. We adjust these benchmark prices to reflect historical differentials between them and regional benchmark prices (see Appendix Section 6.1). Under STEPS, prices remain relatively high, reflecting strong continued demand; under APS and NZE, prices decline considerably as global demand falls (Figure 2).

**Figure 2. Oil and Natural Gas Prices Under Three IEA Scenarios**



Note: Natural gas prices refer to Henry Hub, and crude oil price refers to Brent. Bbl = barrel and MMBtu = million British thermal units.

Data source: IEA (2022b).

3 The International Energy Agency (IEA) 2022 outlook assumes the full implementation of the 2022 Inflation Reduction Act and other legislation passed by mid-2022.



## 3.2. Public Revenues

After estimating production volumes across each class, we model future public revenues based on existing federal, tribal, state, and local policies. We incorporate severance or other taxes on the value or volume of production; local ad valorem property taxes on the value of oil and gas production property; and royalties generated from production on federal, tribal, and state-owned land (as noted in Section 3.1, limited data on tribal mineral ownership constrains our analysis). Because our focus is on the local—rather than state or federal—economic effects of changes in production, we estimate how each revenue source flows to local governments, including counties, municipalities, school districts, and other taxing entities (e.g., fire or irrigation districts). Where the data allows, we also provide estimates for revenue to Native nations (defined as tribal governments and individual members).

The policies governing collection and allocation of these revenues are complex and vary widely across states and Native nations. To begin, we gathered state-level policies, such as severance tax rates, allowable deductions, and allocation formulas (i.e., the distribution of federal- or state-collected revenues to Native nations and local governments). In Colorado, New Mexico, and Wyoming, local governments levy ad valorem property taxes on the value of oil and gas property, with deductions and exemptions that vary across states. In North Dakota, the state government collects severance taxes in lieu of a property tax and distributes the revenue to local governments based on a complex formula.

For Native nations with oil and gas production, we gathered publicly available information on severance tax and royalty rates and applied those policies to our simulations for tribally owned lands. In Table 2, we simplify and summarize the most significant tax policies, tax rates, and royalty rates in each jurisdiction. A detailed description of these policies, along with an in-depth description of how we estimate revenue flows to each level of government, is provided in the Appendix (Section 6.2).

**Table 2. Major Revenue Policies**

	<b>Severance tax</b>	<b>Ad valorem property tax</b>	<b>Royalty rate</b>
Colorado	2.0–5.0%	Yes	20.0%
Jicarilla Apache	No data	No	13.7%
MHA	None (shares state severance)	No	22.5%
Navajo	4.0%	No	17.8%
New Mexico	3.75% and 3.15–4.0%	Yes	15.3%
North Dakota	5.0% and 6.0%	None (shares state severance)	18.8%
Southern Ute	6.5%	No	20.0%
Ute Mountain Ute	9.5%	No	17.8%
Wyoming	6.0%	Yes	16.7%
Federal	No	No	12.5–16.7%

Notes See Appendix Section 6.2 for data sources.

## 4. Results and Discussion

### 4.1. Oil and Gas Production

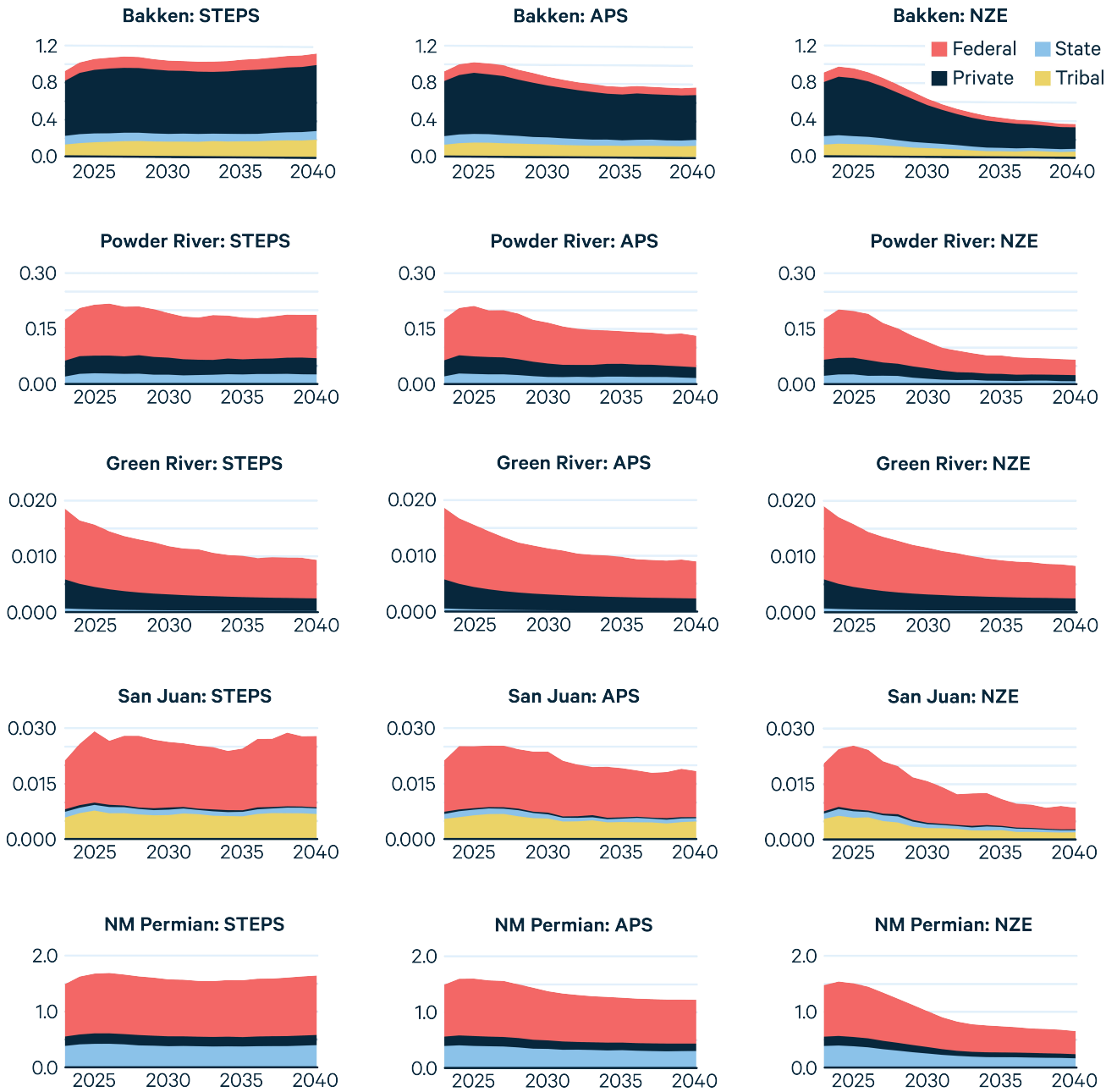
Our modeling results show wide variation across regions and scenarios. Under STEPS, where prices for both oil and gas remain relatively high, production grows considerably in the oil-focused Bakken, Permian, and Powder River regions. But in the Green River and San Juan basins, which are primarily mature natural gas plays that have not seen the same degree of continued drilling activity as the other regions, gas production falls by 59 and 39 percent, respectively, for 2023–2040. This divergence between steady or growing production in oil-focused regions and decline in gas-focused regions is largely due to the relative lack of continued development in the latter, a trend that is not expected to reverse, especially amid declining gas prices envisioned in our scenarios.

Under APS, lower oil and gas prices result in fewer new wells, and production declines considerably across all regions, ranging from decreases of 5 (Permian natural gas) to 61 (Green River natural gas) percent. This dynamic is even more pronounced under the NZE scenario, where production of both commodities declines 44–64 percent across all regions.

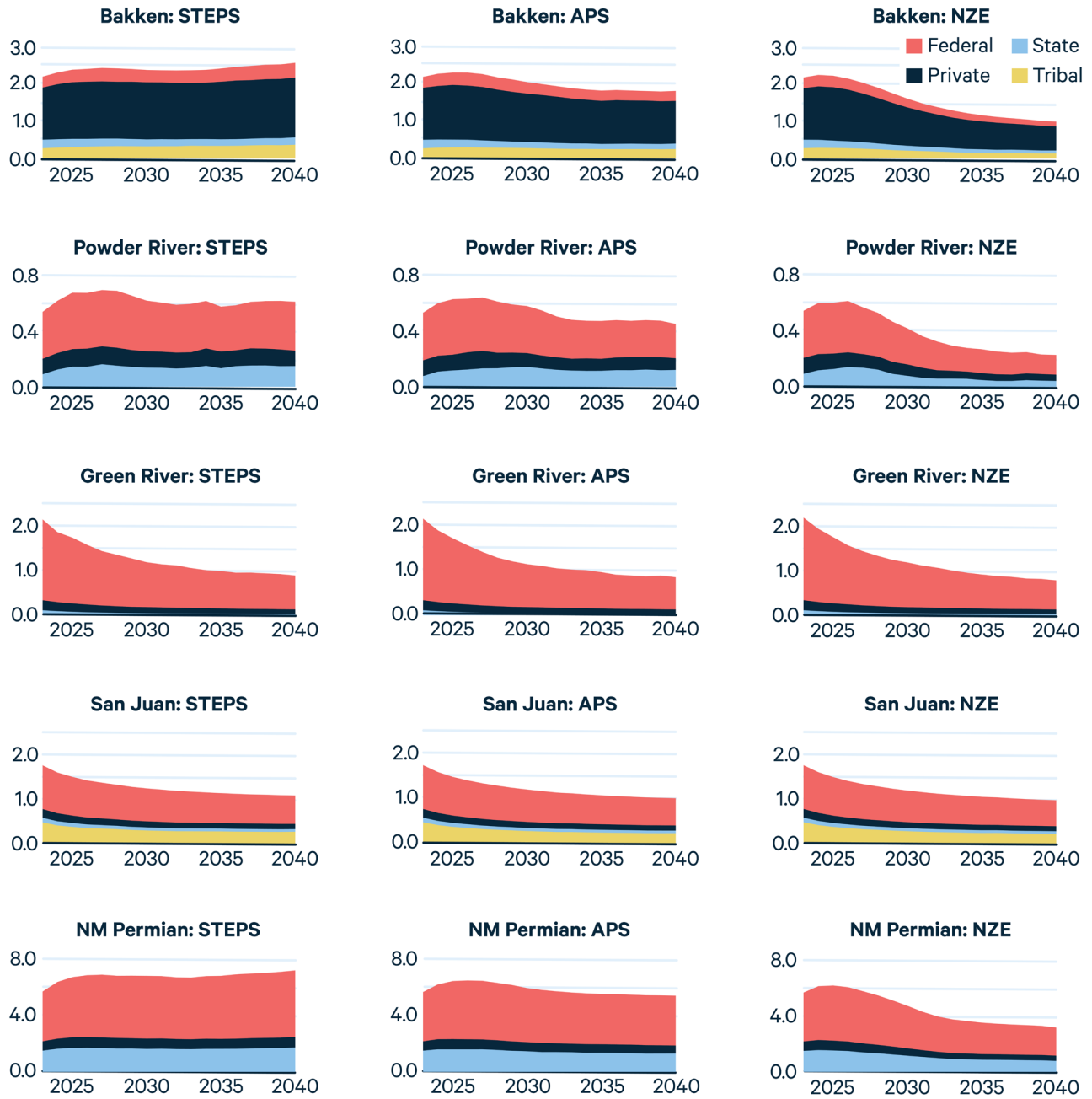
Our modeling also reveals how price differences affect aggregate production across regions. For example, natural gas production declines substantially in all scenarios for the Green River and San Juan basins but within a relatively narrow band, indicating less sensitivity to the price scenario. By 2040, natural gas production declines by 59–64 percent in Green River and 39–45 percent in San Juan, relative to 2023 levels. Production's insensitivity to prices in those regions reflects the scant new development in these basins, and DOGMA indicates that these trends are likely to continue regardless of the price scenario. Hence, the decline in production in those regions is largely due to natural declines in production from existing wells, which is driven more by physics than prices.

The Bakken and Permian regions, by contrast, have been actively developed in recent years, and continuation of that development is contingent on oil prices remaining elevated (in these basins, natural gas is largely a byproduct of oil production). Accordingly, their production levels span a much wider range across price scenarios. Oil production under STEPS in 2040 relative to 2023 is 20 and 10 percent higher, respectively, in the Bakken and Permian, but 61 and 56 percent lower under NZE. Figures 3 and 4 illustrate projected oil and natural gas production, respectively, by scenario through 2040.

**Figure 3. Oil Production in Three Scenarios (million barrels per day)**



**Figure 4. Natural Gas Production in Three Scenarios (billion cubic feet per day)**



## 4.2. Local Government Revenue

Local revenues are not only highly sensitive to oil and gas production volumes and prices under the various climate policy scenarios but also vary widely depending on existing policies that determine the amount of revenue collected, the share invested into long-term savings funds, and the ultimate distribution to different entities across the state. In most cases, higher production values lead to higher revenue levels for local governments and vice versa.

Under the STEPS scenario, revenue increases for most local governments in Bakken and Permian, declines in Green River and Powder River, and is mixed in San Juan. Under APS and NZE, revenues decline for all local governments save local school districts. In the NZE scenario, oil and gas revenues fall sharply for counties and municipalities, which typically rely on ad valorem property taxes and allocations of state-administered severance taxes, both of which depend heavily on production volumes and prices.

School districts, which often collect revenue from volatile property and severance taxes, also enjoy a more stable revenue stream thanks to allocations from state-administered savings funds. These funds, which are capitalized primarily by oil and gas revenue from production on state-owned lands, are invested in return-producing asset portfolios and therefore may grow organically over time.<sup>4</sup> They typically allocate a proportion of their balance each year to school districts across the state in which they operate. In the STEPS scenario, allocations from these funds grow dramatically in North Dakota and New Mexico, sometimes more than doubling by 2040, because revenues from oil and gas production continue to flow into the fund, and market returns boost the balance. School district revenues in these states continue to grow under APS, indicating that higher distributions from growing state permanent funds more than offset declines in revenue from property and severance taxes. In NZE, this trend continues in North Dakota but reverses in New Mexico, as continued growth in permanent fund allocations does not outweigh losses in other revenue sources.

In Wyoming, revenues decline in Green River and Powder River under all scenarios and across all government types. This partly reflects trends in production and prices but is also influenced by our modeling choices for revenue allocation. In short, a substantial portion of revenue from state and federal lands production flows to school districts based on formulas that account for whether local property taxes are sufficient to fund current school operations, a common process known as “equalization.” Over the last 10–15 years, most of these school districts have generated robust property tax revenues due primarily to oil and natural gas production. Because their own funding sources were sufficient, state policy provided relatively little support from state-collected oil and gas revenues (particularly in Green River). Our modeling assumes that the proportion of these funds for each school district remains fixed, even as property tax revenues from oil and gas production decline.

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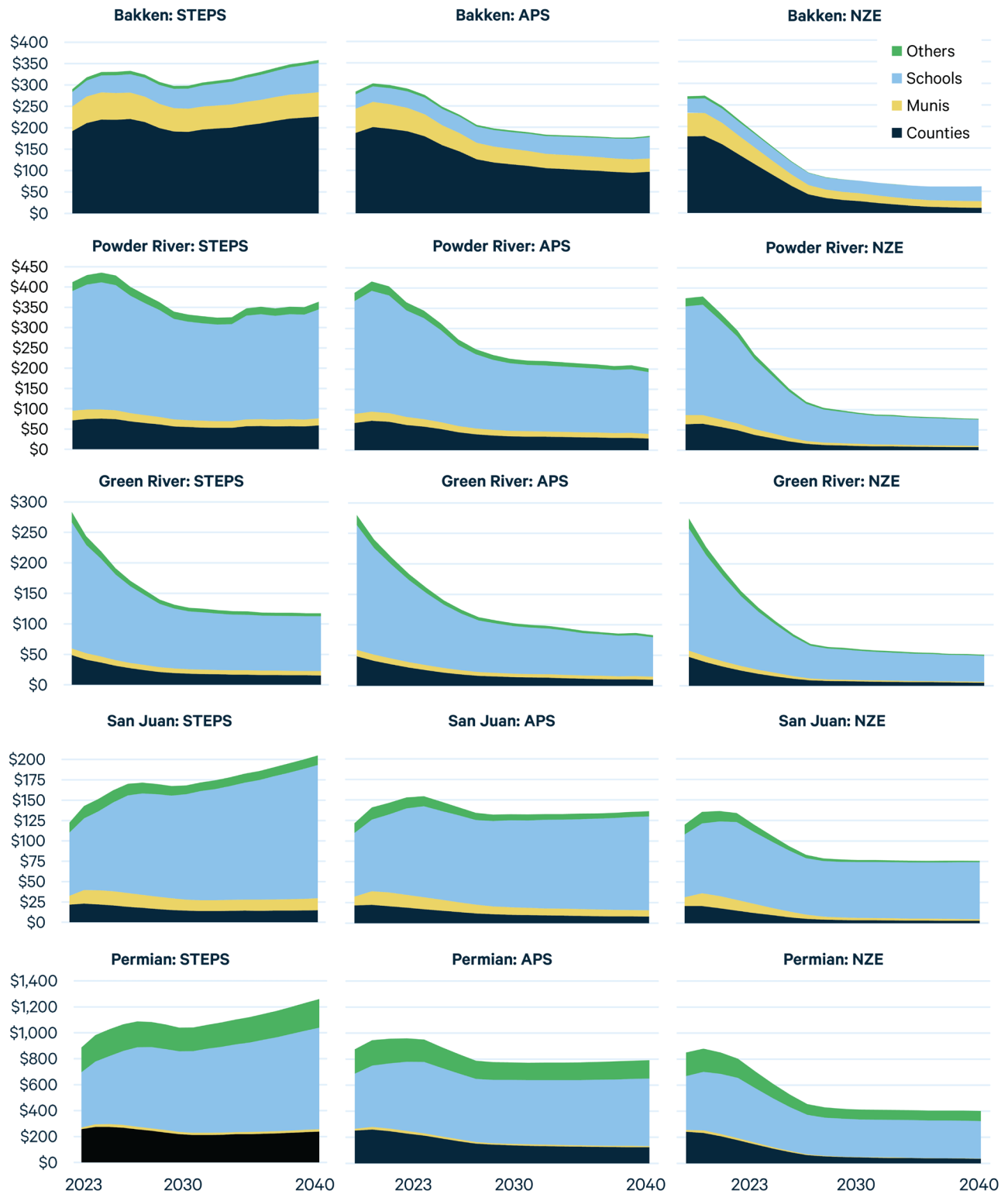
4 Asset allocation for the analyzed funds are typically diversified between US and international equity (~45 percent), core and noncore fixed income (~25 percent), private equity (~10 percent), real return (~10 percent), and real estate (~10 percent) investments. Funds may have a state-level strategy: New Mexico’s Severance Tax Permanent Fund is authorized to invest up to 9 percent of its total portfolio in New Mexico companies (SIC 2017).

Although it is beyond the scope of our modeling effort, it is reasonable to expect that the share of state allocations to these school districts would increase as their local property tax revenue falls, helping to address fiscal shortfalls. Thus, our estimated declines in school funding may not reflect potential additional sources of state funds. However, this dynamic does not hold true for counties, municipalities, and other governments, which face steep revenue declines, particularly under the APS and NZE scenarios.

We make three important assumptions about school district funding that are crucial to acknowledge. First, we assume that permanent funds will continue to earn rates of return similar to those seen over the last 10–20 years. If returns are lower, allocations to school districts will decline. Second, we assume that the proportion of revenue allocated to school districts across each state remains fixed over time. As discussed, this may not hold true in states where allocations are partially based on whether a district is collecting enough revenue from its own sources (e.g., property taxes) to fund its own services. Third, we are not accounting for other revenue sources (e.g., sales taxes, income taxes) that could be diverted by lawmakers to address changes in oil- and gas-related revenues.

Comparing changes in production to changes in revenue illustrates the heterogeneity of fiscal policies that result in varied revenue responses to production changes. For example, in Bakken, oil and gas production decline by 19 and 17 percent, respectively, under APS; revenue for counties, municipalities, and other local governments declines by 46–60 percent largely due to the combination of lower production and lower commodity prices. In school districts, however, oil and gas revenues grow by 50 percent under the same scenario, as investment revenue from North Dakota's permanent fund continues to grow and benefit schools. A similar dynamic can be seen in Permian and San Juan, where New Mexico's permanent fund generates strong returns for school districts through 2040.

**Figure 5. Local Government Revenue from Oil and Natural Gas Production (millions)**





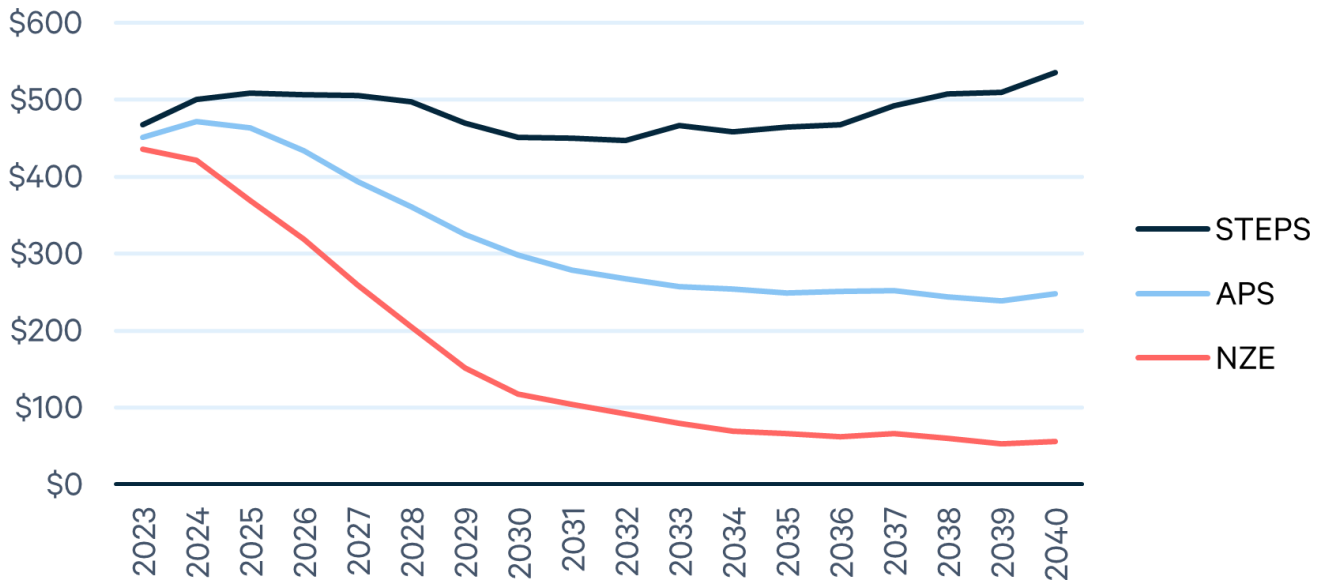
**Table 3. Changes in Oil and Natural Gas Production and Government Revenue, 2023–2040**

	Bakken			Green River			Permian			Powder River			San Juan		
<b>Production</b>	<b>STEPS</b>	<b>APS</b>	<b>NZE</b>	<b>STEPS</b>	<b>APS</b>	<b>NZE</b>	<b>STEPS</b>	<b>APS</b>	<b>NZE</b>	<b>STEPS</b>	<b>APS</b>	<b>NZE</b>	<b>STEPS</b>	<b>APS</b>	<b>NZE</b>
<b>Oil (mb/d)</b>	0.19	-0.17	-0.55	-0.01	-0.01	-0.01	0.16	-0.27	-0.82	0.01	-0.05	-0.11	0.01	0.00	-0.01
<b>Oil (% from 2023)</b>	20%	-19%	-61%	-50%	-51%	-56%	10%	-18%	-56%	8%	-26%	-62%	31%	-14%	-58%
<b>Gas (bcf/d)</b>	0.37	-0.38	-1.19	-1.25	-1.31	-1.40	1.52	-0.26	-2.50	0.07	-0.08	-0.32	-0.67	-0.74	-0.78
<b>Gas (% from 2023)</b>	17%	-17%	-55%	-59%	-61%	-64%	26%	-5%	-44%	14%	-15%	-58%	-39%	-42%	-45%
<b>Revenue</b>															
<b>Counties</b>	18%	-48%	-93%	-68%	-80%	-89%	-7%	-51%	-86%	-17%	-57%	-89%	-32%	-63%	-87%
<b>Municipalities</b>	-1%	-46%	-72%	-34%	-54%	-84%	35%	-28%	-81%	-27%	-50%	-84%	36%	-28%	-81%
<b>Schools</b>	103%	50%	7%	-57%	-68%	-79%	84%	23%	-30%	-9%	-45%	-76%	111%	48%	-9%
<b>Others</b>	3%	-60%	-100%	-71%	-81%	-89%	15%	-25%	-58%	-14%	-55%	-89%	-3%	-49%	-84%

Notes See Appendix Section 6.2 for data sources.

We do not show comprehensive estimates for Native nations because our data on tribal mineral ownership<sup>5</sup> is incomplete. For the MHA Nation, our data does not distinguish between minerals owned collectively by the Nation and minerals owned by individual members via allotment. Results from the Fort Berthold reservation therefore include revenues to individual allottees and the MHA Nation, which is not a proper comparison with the government-only revenues shown in Figure 5. However, to provide some limited information, we report modeling results for the MHA Nation’s portion of North Dakota’s production taxes on oil and gas (Figure 6).

**Figure 6. MHA Nation Revenue from North Dakota Oil and Gas Production Taxes (millions)**



Notes: See Appendix for methods for estimating MHA share of North Dakota state oil and gas production taxes. Excludes royalty revenue from production from tribally owned minerals on the Fort Berthold reservation and on North Dakota state and federal land that flow to school districts within the reservation.

For the four Native nations in the San Juan basin that we model, we have not been able to gather any data on tribal mineral ownership, making it impossible to reliably estimate the amount of royalty revenue from oil and gas production flowing to nations or individual members of the Jicarilla Apache Nation, Navajo Nation, SUIT, or Ute Mountain Ute Tribe. We have estimated revenue flows to these tribes from other sources, including tribal severance taxes and oil and gas revenues collected by the state and allocated to tribal schools and local governments. We hope to be able to publish these estimates along with mineral revenue data in future work in collaboration with these, and perhaps other, Native nations, to inform their decisionmaking about future energy development.

5 To be precise, title to these minerals is not held by Native nations but held “in trust” by the federal government, which is obligated to manage them for the benefit of Native American tribes and individual members.

### 4.3. Local Oil and Gas Employment

Because of the methodological challenges associated with estimating local employment impacts of oil and gas industry expansion and contraction (see Section 2.2), we do not attempt to produce detailed job projections. However, because employment is a major concern for communities and policy leaders, we provide some intuition for potential labor market changes.

Between 2010 and 2020, direct oil and gas employment<sup>6</sup> expanded dramatically in Bakken and Permian, grew modestly in San Juan, remained roughly flat in Powder River, and declined moderately in Green River. For the counties we analyze, oil and gas employment by 2020 exceeded 10,000 jobs in Bakken and Permian, hovered near 5,000 in Powder River and San Juan, and fell to just above 2,000 in Green River (2020 was a year of relatively low employment in the sector due to the low commodity prices associated with the COVID-19 pandemic). Table 4 provides a breakdown of average oil and gas employment for 2015–2020 by subsector.

**Table 4. Direct Oil and Gas Employment in Five Regions**

Employment by NAICS code and region (2015–2020 average)	Bakken	Powder River	Green River	San Juan	Permian
Extraction (211)	1,665	587	595	650	2,597
Support activities for mining (213)	6,725	3,289	1,874	2,455	7,377
Pipeline construction (23712)	862	673	189	1,165	1,174
Oil and gas machinery manufacturing (333132)	*	310	*	334	*
Pipeline transportation (486)	414	324	171	226	302
<b>Total jobs</b>	<b>9,686</b>	<b>5,181</b>	<b>2,854</b>	<b>4,830</b>	<b>11,451</b>

Data sources: Employment data from US Census Bureau (2022). Production data from authors via Enverus.

Notes: \*Indicates values below 100, which are more likely to be subject to data suppression and noise infusion and thus less reliable. Sector 213 includes support activities for coal mining (NAICS 213113), but estimates from the Census and US Bureau of Labor Statistics Quarterly Census of Employment and Wages agree that sector 213 is dominated by NAICS codes 213111 and 213112 (both oil and gas industry codes) in our counties of interest.

6 We include North American Industrial Classification (NAICS) Codes 211 (oil and gas extraction), 213 (support activities for mining), 23712 (pipeline construction), 333132 (oil and gas machinery and equipment manufacturing), and 486 (pipeline transportation). Data is from the US Census’ County Business Patterns series.

As discussed in Section 2.2, one common approach to estimate future employment levels is to use “multipliers” that can produce estimates of job-years created for a given amount of expenditure in a given sector but tend to overestimate the economywide employment impacts of changes within one sector. Despite the limitations of this approach, we present a range of multipliers provided by the Bureau of Economic Analysis from its Regional Input–Output Modeling System that are specific to each region (Table 5).<sup>7</sup> These figures can be interpreted as the total number of economywide jobs that would be supported directly and indirectly (i.e., through supply chains) for each million dollars of output in the relevant sector. For example, each million dollars of investment in oil and gas extraction could support roughly two jobs in Bakken in that sector (NAICS 211). Each million dollars of investment in support activities for mining (e.g., well drilling) could support roughly 1.7 jobs in Bakken for the mining sector (NAICS 213). As noted, these multipliers are likely to overstate the net impacts on overall employment in general equilibrium, as labor is diverted from one sector to another.

**Table 5. Employment Multipliers by Region**

<b>Employment multiplier by NAICS code and region</b>	<b>Bakken</b>	<b>Powder River</b>	<b>Green River</b>	<b>San Juan</b>	<b>Permian</b>
Extraction (211)	2.01	4.28	4.13	2.56	4.37
Support activities for mining (213)	1.70	3.59	3.03	3.34	3.45
Pipeline construction (23712)	2.94	6.33	5.17	4.91	5.59
Oil and gas machinery manufacturing (333132)	4.25	4.26	3.80	4.96	5.35
Pipeline transportation (486)	3.92	6.40	5.65	4.84	5.47

Data source: BEA (2023)

To develop a directional sense of future employment under each scenario, we would need to estimate the economic output of each industry sector listed. Although producing such estimates is beyond the scope of our analysis, employment would be expected to decline under the APS and NZE scenarios, where drilling and production decline. Under STEPS, the direction of employment is less certain and would likely vary by region, largely depending on the amount of new drilling and production.

<sup>7</sup> We purchased the data from BEA in January 2023 for each county. Data is based on 2020 regional information

However, these trends are difficult to anticipate and unlikely to be linear. For example, oil and gas sector employment in the Bakken and Permian regions has declined per unit produced in the last 10 years. In other words, a 10 percent increase in oil and gas production has translated into less than 10 percent increase in oil and gas jobs. This trend likely reflects increased well productivity, process automation, and improved efficiencies across the supply chain as the industry matures. In San Juan, however, total employment per unit has increased, reflecting a relatively steady employment base and declining oil and gas production. This dynamic likely reflects the need for a relatively stable workforce to maintain wells and infrastructure, even with little new drilling.

## 5. Conclusion

Our results highlight a variety of practical issues that policymakers and communities will need to consider as the US and global energy systems change. Our analysis is the first to estimate how lower future demand for oil and natural gas may differentially affect oil- and gas-producing communities in the western United States. It demonstrates that even under relatively high-demand scenarios, regions such as San Juan and Green River—absent major technological innovation or other unforeseen developments—are likely to experience declining oil and gas production, employment, and government revenue. These basins are relatively mature natural gas plays with declining development, a trend that is not expected to reverse, particularly under the declining gas prices envisioned by our scenarios. In these regions, building a more resilient economy will likely require policymakers and communities to identify new growth opportunities and resources to expand into new economic sectors.

In other regions, such as the Bakken, Permian, and Powder River, our modeling suggests that future production levels and associated revenue impacts depend more heavily on policy and prices. In these regions, policymakers will need to consider the extent to which they seek economic diversification as protection against scenarios with a sustained decline in oil and gas production and prices. If domestic and global efforts to limit climate change result in lower prices, which our scenarios assume they do, policymakers and residents of these regions are likely to face substantial revenue and employment declines absent efforts to diversify regional economic drivers.

Our results also highlight the value of investment in long-term permanent funds. In North Dakota and New Mexico, these funds provide long-term fiscal stability for school districts, including regions with and without substantial oil and gas production. In Wyoming, these funds also benefit school districts under all scenarios but have not flowed to oil- and gas-producing regions. The funds' fiscal benefits are considerable regardless of the trajectory of oil and gas production or prices but will vary depending on the long-term investment returns.

A key implication of these findings is that the federal government, which is less dependent on oil and natural gas revenues, could play a greater role in supporting local economies and public finances, particularly if federal policies reduce domestic oil and natural gas production. This support could take a variety of forms, including efforts to bolster local public finances, our main outcome of interest. The Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization and regional “hubs” for new energy technologies are recent examples of targeted federal intervention. Intuitively, our findings suggest that as climate policy ambition grows, oil- and gas-producing communities will require more support to build economic resilience and stable public revenues to provide essential services.

## **6. Appendix**

### **6.1. Dynamic Oil and Gas Market Analysis (DOGMA) Model**

DOGMA separately models the drilling and completion of oil and gas wells and resulting monthly production for each class. Classes reflect the permutation of the jurisdictional areas (counties and reservations) and mineral ownership status (federal, state, tribal, or private). The model is based on well-level data on approximately 191,000 wells in our study regions.

For each well, mineral ownership was identified by overlaying its latitude and longitude with spatial data. Specifically, wells with federally owned minerals were determined using spatial data from state BLM offices. State-owned minerals were determined similarly using spatial data from the state government agencies (the North Dakota Department of Trust Lands, Colorado State Land Board, Wyoming Office of State Lands and Investments, and New Mexico State Land Office). For Fort Berthold, tribal ownership was identified using spatial data from the North Dakota Department of Mineral Resources; for the San Juan basin, all wells falling within reservation boundaries were treated as tribally owned unless state or federal data indicated otherwise. This overstates the share of tribal ownership, but public data on this issue is not available. Wells not falling into any of these ownership categories were treated as having privately owned minerals.

Having categorized each well into one of 76 classes, we model oil and gas production from each class in three stages: drilling, completion, and production over time. This section describes each stage.

### 6.1.1. Modeling Drilling

The drilling stage has been demonstrated to be the key price-responsive margin of oil and gas production (Anderson et al. 2018; Newell et al. 2019; Newell and Prest, 2019). We estimate dynamic basin-level oil- and gas-price elasticities of drilling supply using the same methods from the literature that combines time-series methods with modeling representing industry structure (Newell et al. 2019; Newell and Prest 2019; Prest 2022). Equation (1) shows the model of drilling behavior, which depicts the elasticities of wells drilled in month  $t$  in basin  $b$  (corresponding to our five basins):

$$\Delta \log(Wells\ Drilled_{b,t}) = \sum_{\ell=0}^{12} [\eta_{b,\ell}^{oil} \Delta \log(OilPrice_{b,t-\ell})] + \eta_{b,\ell}^{gas} \Delta \log(GasPrice_{t-\ell}) + \lambda_{b,moy} + \varepsilon_{b,t} \quad (1)$$

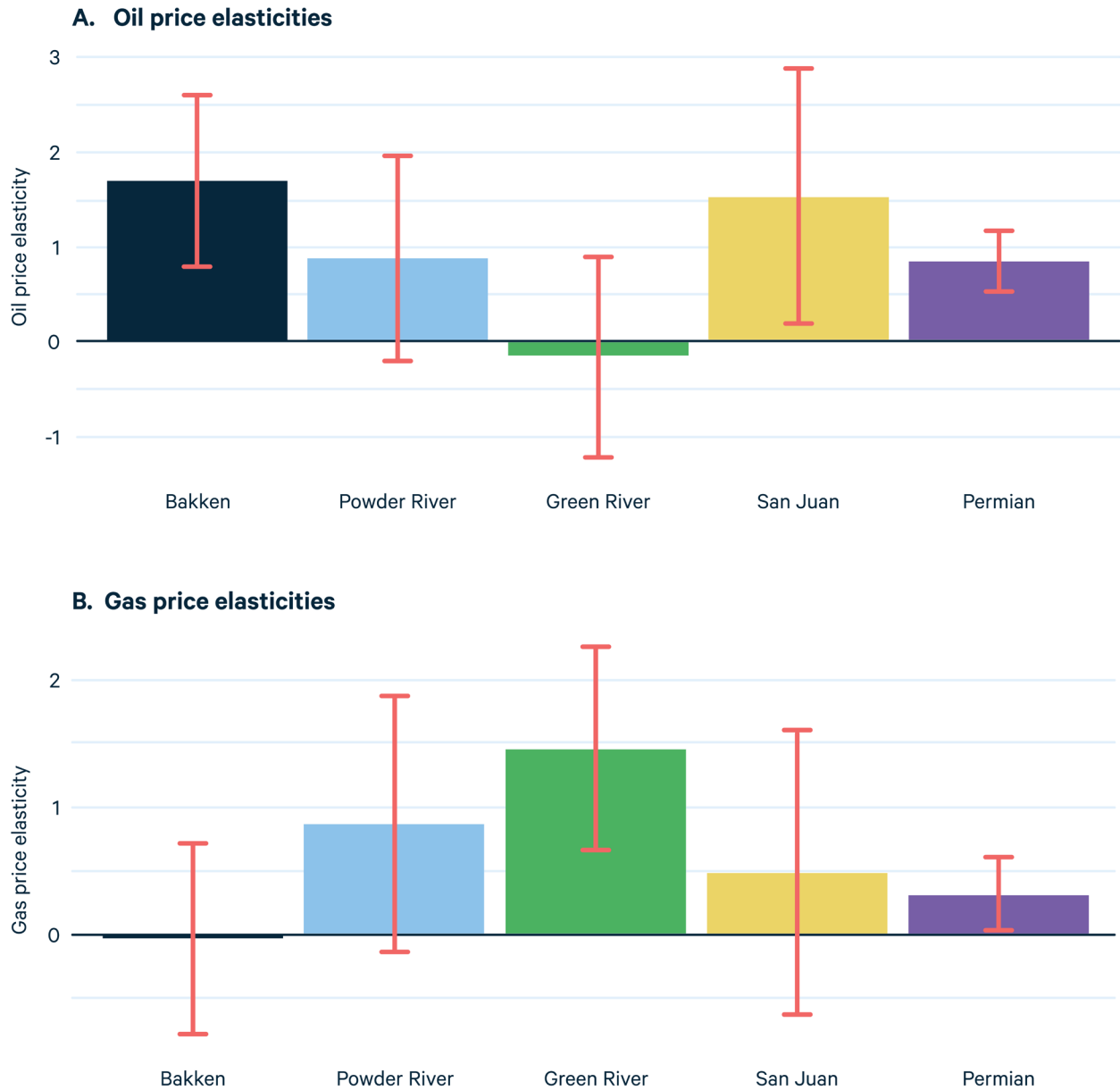
Equation (1) is estimated by ordinary least squares using historical data<sup>9</sup> with Newey-West standard errors, yielding basin-specific dynamic elasticities in response to changes in oil prices,  $\eta_{b,\ell}^{oil}$ , and gas prices  $\eta_{b,\ell}^{gas}$  of lag order  $\ell \in \{0,1, \dots, 12\}$ . The long-run elasticities are given by the cumulative sums,  $\bar{\eta}_b^{oil} = \sum_{\ell=0}^{12} \eta_{b,\ell}^{oil}$  and  $\bar{\eta}_b^{gas} = \sum_{\ell=0}^{12} \eta_{b,\ell}^{gas}$ . We estimate Equation (1) for each of our five basins, rather than each of the 76 classes, due to the small number of observations for some classes with little development, resulting in low statistical power. The basin-level regressions allow for greater precision, at the cost of assuming uniform elasticities for all classes within a basin.

For the  $OilPrice_{b,t-\ell}$  variable, we use historical monthly data on first purchase prices of crude oil for each state<sup>10</sup> from the Energy Information Administration (EIA), as this resulted in higher R-squared values than using West Texas Intermediate prices. For  $GasPrice_{t-\ell}$ , we use Henry Hub prices, which is why  $GasPrice_{t-\ell}$  is not indexed by basin,  $b$ . While some regional natural gas price benchmarks such as El Paso and Waha Hub exist, use Henry Hub prices produced better fits to Equation (1) in all basins. Figure A1 shows the resulting estimates of  $\bar{\eta}_b^{oil}$  and  $\bar{\eta}_b^{gas}$ , along with 90 percent confidence intervals.

<sup>9</sup> Equation (1) is estimated using data from January 1992–December 2021 for basins developed over that full period: Green River, Permian, and San Juan. The Bakken and Powder River did not begin until later, so we estimate Equation (1) using data starting when development began in earnest: January 2005 and January 1995, respectively.

<sup>10</sup> For the San Juan basin, which overlays the New Mexico and Colorado border, we use the New Mexico price, as most wells in this region are in New Mexico.

**Figure A1. Long-Run Price Elasticities of Drilling by Basin, with 90 Percent Confidence Intervals**



For each class, drilling is projected based on 2021 average monthly drilling levels for that class, adjusted dynamically into the future using the basin-level elasticities from Equation (1) applied to trajectories of oil and gas prices. We use the price trajectories from the International Energy Agency’s World Energy Outlook (WEO) 2022 (IEA 2022b). It features three scenarios, which, in order of increasingly ambitious global decarbonization, are the Stated Policies Scenario (STEPS), Announced Pledges Scenario (APS), and Net-Zero Emissions by 2050 (NZE). These scenarios envision that by 2030, global Brent oil prices reach about \$82 (STEPS), \$64 (APS), or \$35 (NZE) per barrel, and US Henry Hub gas prices reach \$4.00 (STEPS), \$3.70 (APS), or \$1.90 (NZE)



per million British thermal unit (MMBtu), typically plateauing after 2030. We interpolate the IEA scenario price trajectories to the monthly level, adjusting their projections of Brent crude oil prices to state-level crude prices as used in Equation (1) using the average percent Brent-to-state discounts during 2016–2022.<sup>11</sup> We then use the estimated  $\eta_{b,\ell}^{oil}$  and  $\eta_{b,\ell}^{gas}$  coefficients from Equation (1) to generate pathways of newly drilled wells for each class  $j$  and month  $t$ , denoted  $d_{j,t}$ , that evolve based on the basin-level elasticities starting from 2021 annual average number of wells drilled each month, by class. Each class  $j$  inherits the elasticity values,  $\eta_{b,\ell}^{oil}$  and  $\eta_{b,\ell}^{gas}$ , from its respective basin  $b$ .

### 6.1.2. Modeling the Completion of Newly Drilled Wells

The drilling model discussed in the previous section produces trajectories of drilling activity—that is, an estimated number of wells drilled of each class  $j$  in each month  $t$ , which we denote  $d_{j,t}$ . Because it takes time to drill and complete a well, a time lag occurs between drilling commencement and production. We convert wells drilled,  $d_{j,t}$ , to newly producing wells in each period, denoted  $w_{j,t}$ , using the distribution of the number of months it takes between drilling commencement and production in a given basin  $b$ . Denoting the share of wells in basin  $b$  coming online  $\ell$  months after drilling commenced as  $s_{b,\ell}$ , the relationship between wells drilled  $d_{j,t}$  and newly producing wells  $w_{j,t}$  is given by

$$w_{j,t} = \sum_{\ell=0}^{24} d_{j,t-\ell} s_{b,\ell}. \quad (2)$$

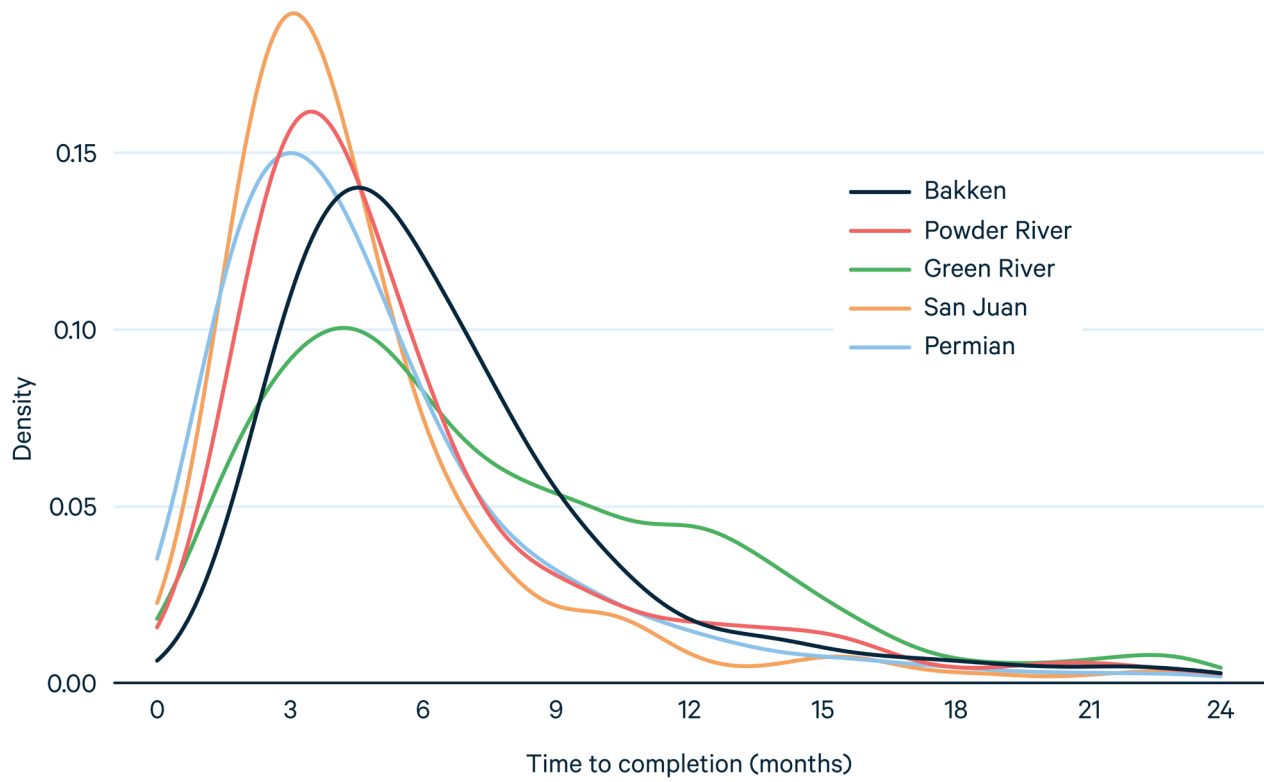
We estimate the distributions of drill-to-production time,  $s_{b,\ell}$ , using the empirical distributions of these values among wells in each basin that came online in or after 2011 (see Figure A2), to reflect the changing nature of completion times driven by the shale boom. We use basinwide average values, rather than well-class-specific ones, due to the small number of wells in some class categories that would produce noisy estimates of  $s_{b,\ell}$  if it were calculated at the class ( $j$ ) level. As in Newell et al. (2019) and Newell and Prest (2019), we include wells with reported completion times of 24 months or less, which accounts for the vast majority of wells.<sup>12</sup> We additionally discretize the resulting  $w_{j,t}$  estimate to reflect that wells are discrete objects.<sup>13</sup>

<sup>11</sup> We take the average discounts starting in 2016 because the repeal of the US crude oil export ban at the end of 2015 changed the market dynamics driving the discount of US crude oil prices. These discounts are 14 percent for North Dakota, 15 percent for Colorado and Wyoming, and 13 percent for New Mexico.

<sup>12</sup> Those reporting longer times are often data errors.

<sup>13</sup> We discretize  $w_{j,t}$  by taking its integer component and adding one well at random with a probability equal to its decimal component. For example, if  $w_{j,t} = 20.33$  for a given class  $j$  and month  $t$ , the discretized number of newly drilled wells would be 20 with 67 percent probability and 21 with 33 percent probability.

**Figure A2. Distributions of Completion Time, by Basin**



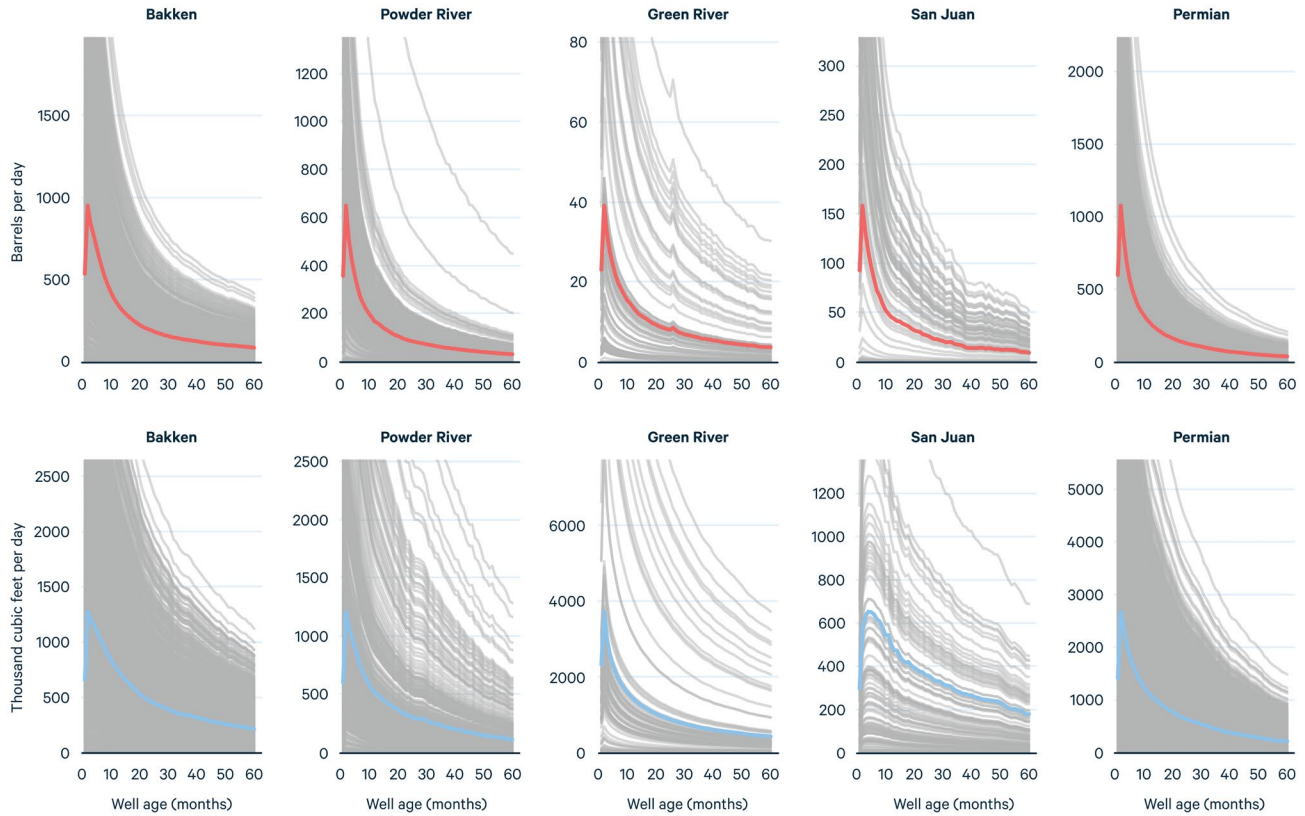
Note: Density reflects relative frequency, or likelihood.

### 6.1.3. Modeling Production from Newly Drilled Wells

The trajectories of newly producing wells convert into production over time. Each well  $i$  of class  $j$  produces oil and gas each month ( $t$ ), denoted  $q_{i,j,t}^{oil}$  and gas  $q_{i,j,t}^{gas}$ . Well  $i$ 's production profile—often called a “type curve”—is assumed to follow a shape equal to the basin-level average type curves for oil and gas production among wells in its basin that came online in 2011 or later, with basin-specific Arps curve extensions beyond the 10-year production horizon that can be estimated with this sample.<sup>14</sup> This curve is normalized to 1 in its first full month of production. To reflect variation in well-specific productivity (which can alter the fiscal terms offered to low-producing “stripper” wells), for each simulated new well, we randomly sample a class-specific initial production flow rate from the distribution wells that entered service during in 2020 or later, to reflect recent upward trends in well flow rates owing to longer well laterals. This flow rate is then multiplied by the normalized type curve to produce well-specific oil and gas production profiles (Figure A3).

<sup>14</sup> Arps curve estimation is discussed in more detail in the next section.

**Figure A3. Type Curves for Production of Oil (Top) and Gas (Bottom), by Basin**



Note: The solid lines represent the average production profile of new wells, and the gray lines represent illustrative random draws for individual simulated wells.

#### 6.1.4. Modeling Production from Existing Wells

In addition to new drilling driving production trajectories, production is likely to continue from the approximately 90,000 wells that were still active as of the end of 2021. For each well, oil and gas production are projected forward according to a well-level Arps curve fit, which is common practice in petroleum engineering. This equation, describing the evolution of well  $i$ 's production of product  $p \in \{Oil, Gas\}$  in period  $t$ , is described in Equation (3):

$$q_{i,j,t}^p = \frac{c_i}{1 + b_i a_i (Well\ Age_{i,t})^{1/b_i}} + \epsilon_{i,t} \quad (3)$$

The Arps curve's parameters, including initial flow rate,  $c_i$ , initial decline rate,  $a_i$ , and curvature,  $b_i$ , are all estimated at the well level via nonlinear least squares and projected forward.

### 6.1.5. Aggregation

These previous subsections result in well-level production from both existing and new (simulated) wells,  $q_{i,j,t}^{oil}$  and  $q_{i,j,t}^{gas}$ . These production values can be aggregated to the class ( $j$ ) or basin ( $b$ ) levels. Retaining the well-level disaggregation, however, is important for calculating revenues, as discussed in the next section, because low-producing “stripper” wells face different fiscal terms in many states.

## 6.2. Revenue Calculations

This section documents our process for estimating how oil and gas production generates revenue for federal, tribal, state, and local governments in each region of our analysis.

### 6.2.1. Colorado

#### 6.2.1.1. Severance Tax

Colorado levies a **severance tax** that scales from 2 to 5 percent depending on the gross revenue at each wellhead. Operators may deduct 87.5 percent of the local ad valorem property taxes paid on oil and gas property in the previous year from their current year’s liability (this figure changes to 76.56 percent in 2025). Stripper wells, defined as producing less than 15 bbl/day and less than 90 mcf/day on average during the tax year, are exempt. Production from tribally owned minerals is exempt from the state severance tax, and on the Southern Ute Indian Reservation (SUIT), are required to pay the tribe’s severance tax, which we discuss later. We do not have data on production and transportation costs in Colorado, so we use estimates from neighboring Wyoming (see Section 6.2.4), which estimates that these costs are roughly 9 percent for oil and 24 percent for natural gas. Table A1 summarizes the state’s severance tax policy.

**Table A1. Colorado Severance Tax Schedule**

Gross income*	Severance tax rate	Deduction
<\$25,000	2%	
\$25,000–100,000	3%	87.5% of the previous year’s local ad valorem property taxes; in 2025, it will be 76.56%.
\$100,000–300,000	4%	
>\$300,000	5%	

Note: Gross income is defined as “fair market value at the wellhead” and applies to all entities with an ownership interest in the well.

Because we do not have proprietary information on operator-level revenue, we estimate annual severance tax liability (before the local property tax deduction) by applying a uniform rate of 5 percent to all production from nonstripper wells, after deductions and exemptions. We believe this is a reasonable approach because under benchmark prices of \$70/bbl and \$4/mcf, a well that meets the state definition of a stripper well (15 bbl/day and 90 mcf/day) would generate gross income of roughly \$500,000 annually. To estimate the local property tax deduction, we multiply our estimated local property tax revenues in the prior year by 87.5 or 76.56 percent, as appropriate, then deduct that total from the severance tax liability in each county. The remaining value is the net severance tax collection in each year.

To estimate the share of severance tax revenue allocated from the state to each of our counties of interest (La Plata), we make the simplifying assumption that the proportion of allocations remains constant over time. We do so because the actual allocations made to local governments are based on a formula that reflects the statewide proportion of oil and gas production, employment, and well permits in each county; along with the discretion of the Colorado Department of Local Affairs, which awards grants and loans to impacted communities. To calculate the proportion of statewide severance tax revenues, we use the average allocations to counties, municipalities, and school districts from 2017 through 2021 based on **data** from the Colorado Department of Local Affairs.

#### **6.2.1.2. Tribal Revenue**

SUIT generates oil and gas production revenue through multiple streams, including its tribally owned and operated companies Red Willow (oil and gas production) and Red Cedar (natural gas gathering and processing). Because we do not have access to confidential business information regarding these companies' revenues and costs, we are unable to independently estimate their historical or future revenues under our simulations. Instead, we focus solely on royalties generated from tribally owned minerals and revenues from SUIT's severance tax.

The SUIT severance tax rate is **6.5 percent**, with deductions for certain transportation costs and exemptions for royalties paid to the tribe or individual members. Because we do not have data on royalty rates negotiated by SUIT or its members, we make the simplifying assumptions that royalties equal 20 percent of net value, equivalent to the **Colorado rate** for production on state lands and similar to the minimum rate of **22 percent** observed for recent leases on the Fort Berthold reservation negotiated by the MHA Nation. We do not have sufficient data on mineral ownership to estimate revenue for the tribe or members.

The Ute Mountain Ute Tribe also has a small amount of production on its reservation in Colorado (and more on the New Mexico side of the border). We assume a royalty rate of 17.8 percent of net value based on data from the New Mexico **Taxation and Revenue Department** and a severance tax rate of 9.5 percent based on **reporting from 2018**. We do not have sufficient data on mineral ownership to estimate revenue for the tribe or members.

### 6.2.1.3. Conservation Fee

In 2020, the Colorado Oil and Gas Conservation Commission (COGCC) increased this levy to 1.5 mills (0.15 percent) of the market value of all oil and gas produced at the wellhead. The fee raises funds to support COGCC work and is not allocated to local governments.

### 6.2.1.4. Property Tax

To estimate local property tax revenues from oil and gas production, we first estimate the value of oil and natural gas produced within each county under our simulation. Because oil and gas property is assessed at a rate of 87.5 percent (**for primary production**), we multiply the countywide value by 87.5 percent. We then multiply this value by the 2021 county millage rate in 2021 (the most recent available year) to estimate county government revenue.

To estimate revenue for school districts, municipalities, and other taxing entities, we gathered data on 2021 property tax revenue from the Colorado Department of Local Affairs (2021 Annual **Report**, 957–958). The data shows total tax revenue collected by each type of taxing entity (i.e., county, school district, municipality, and other districts) in 2021. We use the data to calculate revenue collected by each taxing entity within each county relative to the county government. For example, the data showed that municipalities, special districts, and school districts in La Plata County collected 22, 136, and 293 percent, respectively, of the amount collected by the county government. We then multiply the estimated county government revenue by each of these factors to estimate revenue for municipalities, special districts, and school districts. For example, if the La Plata County government collected \$100 in oil and gas property tax revenue in a given year, our approach assumes that school districts would receive \$293 in that year.

This approach is somewhat limited because we do not have oil- and gas-specific property tax revenue data from which to derive the relative revenues for governments other than counties and because it assumes that these proportions remain fixed over time. In reality, there will be variation across space and time, particularly if and when property tax rates change.

Oil and natural gas production from tribally owned minerals on the SUIT reservation are exempt from local property taxes. As SUIT has acquired minerals over time, they have negotiated a **revenue sharing compact** with La Plata County and Colorado to make an annual payment in lieu of taxes that reflects the foregone property taxes that would have been collected if the land had remained under its previous ownership. In 2020, the La Plata County **Comprehensive Annual Financial Report** indicates this payment was \$38,267 (120). Because of its modest scale, we exclude it from our revenue modeling.

### 6.2.1.5. Federal Leasing Revenue

We assume that the federal government applies a gradually increasing royalty rate, from 12.5 percent in 2023 to 16.7 percent by 2032, to all production on federal lands within our counties of interest. The federal government distributes 49 percent of Colorado oil and gas lease revenues (50 percent minus an administrative fee of 2 **percent of that 50 percent**) to the state government. The state distributes this to multiple funds, including 40 percent to a local government mineral impact fund and 1.7 percent (with an annual limit of roughly \$5.7 million in fiscal year [FY] 2023) to school districts within impacted counties (Colorado Revised Statutes **§34-63**).

To estimate the share of federal leasing revenue allocated from the state to each of our counties of interest, we make the simplifying assumption that the proportion of statewide leasing revenue remains constant over time, because the actual allocations made to local governments are based on a formula that reflects the statewide proportion of oil and gas production, employment, and well permits in each county and the discretion of the Colorado Department of Local Affairs. To calculate the proportion of statewide federal mineral revenues, we use the average allocations to counties, municipalities, and school districts for 2018–2022 based on **data** from the Department of Local Affairs. This includes both direct distributions, which are allocated via formula, and state “impact grants,” which are awarded at the state’s discretion.

### 6.2.1.6. State Leasing Revenue

A small portion of revenue from state oil and gas leases supports the Colorado State Land Board, and most funding flows to a state trust fund for public education (Colorado Revised Statutes §36-1-116). We do not directly estimate the share of local school district revenue from this state fund.

## 6.2.2. New Mexico

### 6.2.2.1. State Severance Tax

New Mexico levies two severance taxes on oil and natural gas production: the Oil and Gas Severance Tax and the Oil and Gas Emergency School Tax. Both are applied to the value **at the wellhead** and **allow for deductions** for any royalties paid to the federal government, state, and any “Indian tribe, Indian pueblo, or Indian” and the “reasonable expense of trucking any product from the production unit to the first place of market.” We deduct these royalties from tax liability based on our modeling results. For transportation and processing expenses, we use a constant rate of \$0.20 per barrel of oil and \$0.74 per mcf of natural gas, based on average deductions reported to the New Mexico Taxation and **Revenue Department** for 2018–2022.

Stripper wells pay a reduced rate depending on commodity prices and are defined as producing less than 10 bbl/d (for an oil well), less than 60 mcf/d (for a natural gas well), or less than 10 barrels of oil equivalent per day during the previous calendar year (Tables A2 and A3). However, prices never reach these levels under our simulations, so these wells pay the full 3.75 percent rate in our modeling.

**Table A2. New Mexico Oil and Gas Severance Tax Schedule**

<b>Commodity</b>	<b>Tax rate</b>
Oil, liquids, and natural gas	3.75%
Stripper well rates	
Oil and liquids if oil price is $\leq$ \$15/bbl in previous calendar year	1.875%
Oil and liquids if oil price is \$15.01–18/bbl in previous calendar year	2.8125%
Natural gas if price is $\leq$ \$1.15/mcf in previous calendar year	1.875%
Natural gas if price is \$1.16–1.35/mcf in previous calendar year	2.8125%

Data source: **Oil and Gas Severance Tax.**

**Table A3. New Mexico Emergency School Tax Schedule**

<b>Commodity</b>	<b>Tax rate</b>
Oil and liquids	3.15%
Natural gas	4%
Stripper well rates	
Oil and liquids if oil price is $\leq$ \$15/bbl in previous calendar year	1.58%
Oil and liquids if oil price is \$15.01–18/bbl in previous calendar year	2.36%
Natural gas if price is $\leq$ \$1.15/mcf in previous calendar year	2%
Natural gas if price is \$1.16–1.35/mcf in previous calendar year	3%

Data source: **Oil and Gas Emergency School Tax.**



Revenues from the Oil and Gas Severance Tax have two destinations: the Severance Tax Bonding Fund and the Severance Tax Permanent Fund. Each legislative session, the legislature sells bonds backed by future severance tax revenue to finance statewide capital projects. Pursuant NMSA 1978 7-27-8, funds that remain after authorizing new projects and servicing bond debt are transferred to the Severance Tax Permanent Fund; 4.7 percent of its average year-end market value over five years is distributed into the state’s general fund as per its Constitution article VIII section 10.

To model county-level investment through the Bonding Fund, we collected data from annual capital outlay **charts** that tabulate new projects that it funds. By aggregating data from the **New Mexico Investment Council** and **New Mexico Tax Research Institute** and oil and gas industry data from the **New Mexico Department of Finance and Administration**, we estimated the average ratio of 2012–2022 funds committed to new capital outlay projects over those servicing debt and the proportion of the committed funds allocated to our counties of interest. Combining these two ratios, we estimate the future availability of funds for capital outlay based on the projected revenues from the production model.

In 2022, for example, of the nearly \$1.9 billion in severance tax collected, roughly \$800 million was committed to the severance tax bonding fund. The governor then authorized \$680 million to finance capital outlay projects across the state, with 2.4 percent for projects in San Juan County. Considering that roughly 36 percent of the total severance tax collected went to capital projects, we estimate that, for 2022, roughly 0.86 percent of revenues from the state severance taxes were distributed to San Juan County.

### 6.2.2.2. Oil and Gas Conservation Tax

Table A4 presents the schedule for the state **Oil and Gas Conservation Tax**.

**Table A4. New Mexico Oil and Gas Conservation Tax**

<b>Commodity</b>	<b>Tax rate</b>
Oil and liquids if WTI oil price is ≤\$70/bbl in previous quarter	0.19%
Oil and liquids if WTI oil price is >\$70/bbl in previous quarter	0.24%
Natural gas (regardless of price)	0.19%

Note: No exemptions or deductions exist. All owners pay the tax, including tribes “to the extent authorized or permitted by law” (New Mexico Statutes **§7-30-4**).

We model this provision with rates that vary annually based on the average annual price of oil. In years when the price exceeds \$70, we apply a tax rate of 0.24 percent to the gross value of oil production (with no deductions); when the price falls below \$70, we apply a rate of 0.19 percent. This revenue is used to support the state **Oil and Gas Reclamation Fund**, which decommissions orphaned oil and gas wells; none is allocated directly to local governments.

### 6.2.2.3. Property Tax

To estimate ad valorem property tax revenues for local governments in New Mexico, we begin with the same approach as described for Colorado and Wyoming but make one adjustment based on New Mexico law. We first estimate the value of oil and natural gas produced within each county under our simulation. In New Mexico, oil and gas property is valued at 150 percent of the wellhead price multiplied by the “uniform assessment ratio,” excluding the same deductions for royalties paid to governments and for transportation as in the state’s severance taxes (New Mexico **Statutes Annotated §7-32-1**). According to email communication with Department of Taxation and Revenue staff, the uniform assessment ratio for oil and gas property is 33.3 percent.

To estimate revenue collected by taxing entities, we gathered data on 2021 property tax revenue published by the state **Department of Finance and Administration**. The data shows total oil and gas tax revenue collected by each type of entity (i.e., county, school district, municipality, and other districts) in 2021 and allows us to calculate the proportion of total oil and gas property taxes by type, which we apply to all future years.

This approach is preferable to the estimates developed for Colorado and Wyoming that are not specific to oil and gas but still limited because it assumes that the proportionality of oil and gas revenue remain fixed over time. In reality, there will be variation across space and time, particularly if and when property tax rates change or oil and gas development shifts geographically.

Unlike Colorado and Wyoming, ad valorem oil and gas taxes flow to the state, where they are mostly allocated to local governments and educational institutions. A relatively small portion (5–10 percent) funds state debt service. To estimate allocations of ad valorem tax revenue to local governments, we rely on 2022 data from the state Department of Finance and Administration, which reports **monthly revenue distributions** to counties, college funds, municipalities, hospitals, schools, and the state. We make the simplifying assumption that the proportion of ad valorem revenues distributed to each entity in each county in 2022 remains fixed.

#### 6.2.2.4. Federal Leasing Revenue

For oil and gas produced on federal lands in New Mexico, we assume that the royalty rate gradually increases from 12.8 percent to 16.7 percent through 2023 to 2032. As per the Federal Mineral Leasing Act (MLA), 50 percent of federal royalty revenues are disbursed to the states in which the oil production occurred, with a 2 percent administrative fee. Though returned revenues are deposited in the General Fund, New Mexico Statute §22-8-34 directs the vast majority of these revenues to the Public School Fund, which disburses revenue to school districts in accordance with the State Equalization Guarantee. NM Statutes Annotated §9-29A-1 rules that, starting July 1, 2022, if the yearly net receipts returned to the state under the Mineral Leasing Act exceed the annual average revenue over the five preceding years, the excess is distributed to the Early Childhood Education and Care Fund; as its county-level disbursements have not yet been defined, we exclude these funds from the study.

To estimate future distributions of MLA revenues, we obtained historical data (2015–2022) from annual **General Fund audits** that report MLA income and school district distributions from the FY2021 **State Equalization Guarantee** (SEG) adjustment spreadsheet. Using the ratio of funds dedicated to school districts in our counties of interest to the total amount of SEG funds committed by the state, we estimate how future MLA contributions to the Public School Fund are distributed in each of our production scenarios.

#### 6.2.2.5. State Leasing Revenue

For oil and gas production on New Mexico’s state trust lands, we assume a royalty rate of 15.3 percent. Royalties are transferred into the Land Grant Permanent Fund (LGPF), whose largest beneficiary is the Public School Fund, with 87.16 percent LGPF ownership as of September 2022. The New Mexico Military Institute is the second largest beneficiary at 2.62 percent. Using audit reports from the **State Investment Council**, we calculated the average percent share that is distributed each year from the state royalties to these two recipients. The New Mexico Constitution Article XII, §7(f) sets forth a statutory annual distribution of 5 percent of the five-year average value of the fund to the beneficiaries. In the November 8, 2022 general election, voters approved the “Funding for Early Childhood Programs Amendment” through a referendum; it increased LGPF distributions by 1.25 percent and mandated that new funds support early childhood education and enhanced instruction for at-risk children (New Mexico Constitution Article XII, §7(h)).

As both MLA revenues and distributions from the Public Schools Beneficiary of the LGPF are disbursed from the Public Education Department Fund in accordance with the SEG, we use the same process as for federal royalties to estimate revenues to county entities. However, the distributions to local school districts depend on not only LGPF revenues from oil and gas production but also the performance of the permanent fund.

To better project the growth of the fund, we assume that over the 2023–2040 study period, the State Investment Council meets its 7 percent **target rate of return**.

#### **6.2.2.6. Tribal Revenue**

Oil and natural gas are produced in substantial quantities within New Mexico’s portion of the San Juan basin on three sets of tribal lands: Jicarilla Apache, Navajo, and Ute Mountain Ute.

We were unable to locate extensive documentation on tribal severance taxes, royalty rates, and other relevant revenue sources or identify mineral ownership on these lands. Because land and mineral ownership is often “checkerboarded” as a result of 19th-century federal policy regarding Native American lands, it is likely that only a portion of the mineral ownership is held by tribes or members. Because of these limitations, we do not attempt to model future revenues for these tribes but hope to gather additional data that would allow for such analysis. The following descriptions document the data we were able to gather with regard to oil and gas revenue for Native nations in New Mexico’s San Juan basin.

For the Jicarilla Apache, Navajo, and Ute Mountain Ute, data from the New Mexico **Taxation and Revenue Department** indicates royalty rates of 13.7, 17.8, and 17.8 percent of net value, respectively. The Navajo appear to levy a severance tax of 4 percent based on regulations accessed through the **Office of the Navajo Tax Commission**, and press reports **from 2018** indicate that the Ute Mountain Ute have collected roughly 9.5 percent of production value through a severance and possessory interest tax.

### **6.2.3. North Dakota**

#### **6.2.3.1. State Severance Tax**

North Dakota levies two severance taxes: a gross production tax and an oil extraction tax. The former applies a 5 percent rate to the wellhead value of oil and a volumetric fee to natural gas that is adjusted annually. In FY2023, this fee was \$0.0905/mcf. Operators may deduct the value of royalties paid to federal, tribal, state, or local governments from their tax liability. Our reading of the statute did not identify any additional deductions (e.g., for transportation or processing costs). However, we do include deductions when estimating royalty revenues and assume that transportation and processing costs are equal to those in Wyoming, the closest state for which we have reliable estimates (see Section 6.2.4), equal to 8 and 24 percent of the value of oil and natural gas production, respectively.

Stripper wells are exempt from taxation and defined in the Bakken/Three Forks formation as having a depth of greater than 10,000 feet and producing 35 bbl/d or less. Outside of those formations, the definition varies by well depth and production levels (Table A5). In our simulation, all wells are drilled in Bakken and Three Forks. Table A5

reflects the policy for wells drilled after 2013. For all wells drilled before 2013, the schedule for “Other” applies.

**Table A5. North Dakota Stripper Well Definition**

Avg. annual oil production	Depth	Formation
35 bbl/d	>10,000 ft.	Bakken/Three Forks
10 bbl/d	≤6,000 ft.	Other
15 bbl/d	6,000–10,000 ft.	Other
30 bbl/d	>10,000 ft.	Other

Data source: North Dakota Century Code **§57-51.1**.

The distribution of gross production tax revenue follows a complex formula that includes allocations to state and local government entities, summarized in **this report** from the Legislative Council based on the North Dakota Century Code **§57-51-15**. We estimate revenue flows to each government entity within our counties of interest based on these summaries. To begin, each county that generates \$5 million or more in production tax revenue is allocated \$5 million. After this initial allocation, 30 percent of revenues flow to oil- and gas-producing counties, and the remainder goes to various state programs. We then assume that the 30 percent of revenues flowing to counties is apportioned based on the share of production in each county, with a county sharing revenue between its government, schools, cities, and townships based on a predetermined formula. We assume this following conversations with Legislative Council staff, who take the same approach in internal revenue modeling. In practice, this approach simplifies the actual allocation formulas, which include data on population levels, school enrollment, and other factors that we do not incorporate in our projections. We also estimate gross production tax revenue flowing to the MHA Nation (see Section 6.2.3.2).

The state **oil extraction tax** applies only to oil and levies a 6 percent tax on the gross value at the wellhead (stripper wells, defined identically as in the gross production tax, are exempt). Based on our reading of the statute and associated summaries, the tax does not allow for a deduction for royalties paid to governments or members of Native American tribes. When oil prices fall below a “**trigger price**” (\$94.69/bbl in 2022), the tax rate falls to 5 percent. To estimate a trigger price, we assume that it increases by 2.56 percent annually, which is the average of the 2022 10-year breakeven inflation rate, accessed via the **Federal Reserve Bank of St. Louis** on November 16, 2022.

The oil extraction tax also provides a credit for wells deploying flare mitigation systems (Century Code **§57-51.1-02.2**) worth \$0.75/MMBtu of flaring mitigated, up to \$6,000 per well per month. However, this policy is slated to expire in July 2023, so we do not account for it in our revenue modeling.

We do, however, account for flaring in our revenue projections. In the early 2010s, producers vented or flared 30 percent or more of natural gas gross withdrawals (EIA 2023). In recent years, flaring has declined consistently; in 2020 and 2021, it was 10 and 7 percent, respectively. Because these lower rates reflect a build-out of the natural gas pipeline network in the Bakken region and none of our scenarios envision a large scale-up in oil and gas production, we assume that the flaring rate remains at 7 percent.

Distributions of revenue from the oil extraction tax are summarized in **this report** from the Legislative Council based on Century Code **§57-51-15**. We follow these sources in our modeling. After accounting for revenue to the MHA Nation (see Section 6.2.3.2), 30 percent of revenues flow to the state legacy fund. After this allocation, 10 percent of revenues flow to the Common Schools Trust Fund, which generates a return on its investment and allocates a portion of its corpus to school districts across the state. We account for this process and describe our methods in Section 6.2.3.6. The remainder of this revenue is allocated to various state programs, none of which is dedicated to oil- and gas-producing counties, based on our readings of the summaries and statutes.

### **6.2.3.2. MHA Nation Revenue**

For oil and gas production on the Fort Berthold reservation, North Dakota shares revenue with the MHA Nation. For oil and gas from minerals owned by the nation or its members, the nation receives 80 percent of revenues and the state 20 percent. For production that occurs on the reservation but from minerals not owned by the nation or members, this allocation is reversed.

To estimate these revenue flows, we use geospatially resolved modeling output from DOGMA to calculate the share of production for minerals owned by the MHA Nation or members using mineral ownership data obtained from the state Department of Mineral Resources (which acquired it from the Bureau of Indian Affairs). Although the data do not distinguish between minerals owned collectively or individually, this distinction has no bearing on estimating the allocation of tax revenue. It does, however, have major implications for whether revenue is flowing to the MHA Nation collectively or its members. Because our data does not allow us to make this distinction, we do not attempt to estimate royalty revenues to the MHA Nation.

We do include two other relatively small sources of revenue for the MHA Nation: allocations from the Common Schools Trust Fund (Section 6.2.3.6), which receives revenue from production on state-owned lands and distributes it to school districts across the state. A large proportion of MLA revenue also flows to a statewide fund that supports schools statewide. To estimate the proportion of these revenues that went to schools that served the MHA Nation, we examined distributions from the state public instruction budget for FY2019–2021 and identified the proportion of revenues to school districts centered on the Fort Berthold reservation. In modeling future revenues for

these school districts, we assume that these proportions remain fixed over time and allocate state and federal leasing revenue accordingly.

### **6.2.3.3. Conservation Fee**

We have not identified any conservation fees or similar mechanisms in North Dakota.

### **6.2.3.4. Property Tax**

North Dakota's gross production tax is levied in lieu of local property taxes, with a substantial share of the state-collected tax allocated to local entities, as described in Section 6.2.3.1.

### **6.2.3.5. Federal Leasing Revenue**

For oil and gas produced on federal lands in North Dakota, we assume that the royalty rate increases linearly from 12.8 to 16.7 percent for 2023–2032. Per MLA, 50 percent of federal royalty revenues are disbursed back to the states in which production occurred, with a 2 percent administrative fee. In North Dakota, MLA revenues are split equally between county governments and the public instruction budget. Pursuant to Century Code §15.1-27-25, the state treasurer transfers federal mineral leasing revenues to counties depending on the proportion of production on federal lands that occurred in their jurisdictions. Using data published by the **state treasurer**, we calculated the percentage of total federal royalty revenues returned to our counties of interest from 2012 to 2022. We use these historic distributions to estimate future disbursements from federal mineral leasing revenues to county governments. Century Code §15.1-27-25 subsection 6 directs the state treasurer to distribute the remaining of federal leasing funds to the school districts based on an equalization formula defined in the chapter. We estimate future allocations by calculating the average proportion, over 2019–2021, of total state aid funding that has been committed via the equalization formula to the school districts in our counties of interest, as reported by the North Dakota **Department of Public Instruction**.

### **6.2.3.6. State Leasing Revenue**

We assume that North Dakota takes an average royalty of 18.8 percent for oil and gas production on state lands (this estimate was reported in a 2015 analysis from the **Center on Western Priorities** that cites personal communication with a state official indicating royalties of 18.75 percent for Bakken leases and 16.67 percent in the rest of the state). Royalties are distributed across various government funds, with the two largest being the Common School Trust Fund (CSTF) and the Strategic Investment & Improvements Fund (SIIP). Using the **North Dakota Department of Trust Lands'** 2013–2022 annual financial statements, we calculated that nearly 60 percent of royalties were distributed to CSTF and 35 percent to SIIP. As SIIP primarily funds one-time expenditures, we did not include its appropriations in our distributions to our counties of interest.

From 2013 to 2022, CSTF has made an annual distribution of 2.9 percent into the public instruction budget. In 2022, it was roughly \$210 million (**North Dakota Department of Trust Lands**, 16). The state government supports local schools through the State Aid program. To estimate how the distribution from the CSTF was appropriated across school districts, we calculated the proportion of funding of the total State Aid commitment to the school districts in our counties of interest for 2019–2021, with data provided by the **Department of Public Instruction**. For our projections, we assume that the fair value of CSFT investments grows at the same average annual rate as it did 2013–2022, distributes 5 percent per year to the public instruction budget, and receives 10 percent of the oil extraction tax and contributions each year from state oil and gas royalties.

## 6.2.4. Wyoming

### 6.2.4.1. State Severance Tax

For wells drilled before July 1, 2020, Wyoming levies a severance tax of 6 percent on the fair market value of oil and natural gas. For wells drilled between July 1, 2020 and December 31, 2025, the rate is reduced to 4 percent during the first six months of production and 5 percent during the following six months if oil and natural gas prices fall below \$50/bbl and \$2.25/MMBtu, respectively. However, prices remain above these levels in all of our simulations through 2025, so we retain the full 6 percent rate. Operators may deduct royalties paid to government entities as well as transportation and processing costs from their severance tax liability. These costs are substantial: a **2018 study** commissioned by the state legislature found that they averaged 9 and 24 percent for oil and natural gas, respectively, for 1999–2017. We apply these factors to estimate the severance tax base under our simulation.

Stripper wells, defined as oil wells producing less than 10 bbl/d (or 10–15 bbl/d when prices fall below \$20/bbl), pay a rate of 4 percent (Wyoming Statutes **§39-14-201**). We were unable to identify any definition that referenced natural gas, so we assume that low-producing natural gas wells pay the full 6 percent rate. Operators may deduct processing and transportation costs from their tax liability, following rules laid out in statutes **§39-14-203**. Because the oil price never drops below \$20/bbl in our scenarios, we assume no production from stripper wells.

The severance tax is distributed according to statutes **§39-14-211**, with 25 percent to the permanent Wyoming mineral trust fund and 75 percent to the severance tax distribution account. This account is distributed according to statutes **§39-14-801**, with the bulk of the revenue flowing to support state funds and programs. However, some funds are allocated to counties and cities according to statutes **§39-14-801** subsection (e)v–(e)viii.



Funds are allocated to counties based on population, road mileage, and countywide property valuation. By our interpretation, counties receive roughly 4 percent of severance tax revenues. Because the formulas for determining distribution are complex and primarily based on each county's statewide share of population, our model distributes funds by countywide population, which provides a reasonable proxy. We use data from the **2020 US Census**.

Based on our interpretation of the statutes, cities and towns are allocated roughly 6 percent of total severance tax revenues based on their share of population relative to the statewide population of all cities and towns. To calculate each county's proportion of city and town residents, we use data from the **2020 US Census**.

#### **6.2.4.2. Conservation Fee**

According to state statutes **§30-5-116**, the state levies an Oil and Gas Conservation Tax of 0.8 mills (0.08 percent) of fair market value of oil and natural gas production (the same tax base as the state severance tax) and uses it to fund the Oil and Gas Conservation Commission.

#### **6.2.4.3. Property Tax**

To estimate property tax revenues for local governments in Wyoming, we take the same approach as described for Colorado and New Mexico. We estimate the value of oil and natural gas produced within each county under our simulation. Because oil and gas property is assessed at a rate of **100 percent in Wyoming**, we do not need to adjust this valuation before multiplying it by the county millage rate in 2021 (the most recent available year) to estimate county government revenue. However, we do need to deduct royalties paid to governments and transportation/processing costs, which we do according to the process described for severance taxes. We gather county property tax rates from the **Wyoming Department of Revenue's 2021 Annual Report (23)**.

To estimate revenue for school districts, municipalities, and other taxing entities, we gathered data on 2021 property tax revenue from the 2021 Annual Report (23). The data show total tax revenue collected by each type of entity (county, school district, municipality, and other districts) in 2021. We use the data to calculate revenue collected by each entity within each county relative to the county government. For example, municipalities, special districts, and school districts in Campbell County respectively collected 6, 40, and 396 percent of the county government's collection. We then multiply the estimated county government revenue by each of these factors to estimate revenue for municipalities, special districts, and school districts. For example, if the Campbell County government collected \$100 in oil and gas property tax revenue in a given year, our approach assumes that school districts in the county would collect \$396 in that year.

This approach is somewhat limited because we do not have oil- and gas-specific property tax revenue data upon which to derive the relative revenues for governments other than counties and it assumes that these proportions remain fixed over time. In reality, there will be variation across space and time, particularly if and when property tax rates change.

#### **6.2.4.4. Federal Leasing Revenue**

According to the 2021 State Treasurer’s **Annual Report**, based on statutes §9-4-601, federal mineral royalties are allocated primarily to the state School Foundation Fund and Highway Funds. The first \$200 million in annual revenues are allocated according to a formula that includes direct distributions to cities and towns and loans and grants for capital projects for local governments (the Capital Construction Account and Public School Capital Construction Account). Excess funds flow to the University of Wyoming system, School Foundation Fund, and state Budget Reserve Account. Because our modeling captures the vast majority of statewide production, the state share of federal revenues (49 percent) exceeds \$200 million in most years.

Allocations to cities and towns are based on a formula that includes county population and school enrollment. For simplicity, we apportion these revenues based on city and town population relative to statewide city and town population, as we did for state severance taxes.

To assess the share of revenues from the Capital Construction Account and Public School Capital Construction Account for each county, we examined relevant state statutes: §9-4-604(g) and §21-15-111(a)(i), respectively. These statutes give discretion to policymakers to loan or grant funds. Because they are relatively modest (roughly \$13M annually), distributed across the state, and discretionary, we do not estimate these distributions.

Each year, appropriations are made from the School Foundation Fund to the School Foundation Program, which funds school districts according to a formula that accounts for the unique characteristics of the schools, staff, and students within the districts. In some counties, a substantial proportion of these funds are “recaptured” because local resources, primarily local property taxes, provide adequate resources. To estimate the proportion of MLA revenues distributed through the School Foundation Fund to our counties of interest, we first calculated the 2017–2021 average proportion of expenditures toward the School Foundation Program to the Fund’s total expenditure, using the state auditor’s **Annual Comprehensive Financial Reports**. Then, we use **statewide payment models** from the Department of Education to determine the average 2017–2021 proportion of program funds that were allocated to school districts, accounting for the “recapture” of local resources.

#### 6.2.4.5. State Leasing Revenue

We assume that Wyoming charges royalties of 16.67 percent of the net value of oil and natural gas produced on state lands. In recent years, 94.3 percent of this revenue has flowed into the School Capital Construction Account and CSPLF, with one-third to the former and two-thirds to the latter (the remaining 5.7 percent goes to other state institutions). Wyoming Statutes §9-4-719(d) set out a scheduled reduction in the spending policy amount of CSPLF: from 2020 to 2022, the annual distribution is 5 percent of its average market value during the previous five years; in FY 2023, it is 4.75 percent; and from 2024 and each FY thereafter, it is 4.5 percent. In FY2022, CSPLF held a balance of nearly \$4.2 billion ([Wyoming State Treasurer](#), 29). We assume that the trust fund follows a spending schedule pursuant to the statute and grows with a rate of return equal to 5.56 percent each year—its average annual rate for 2012–2022. Investment performance is reported in the state treasurer’s annual [reports](#). As CSPLF distributions are deposited into the School Foundation Fund, we project distributions from state leasing revenues to school districts with the same proportions obtained by the same method as for MLA revenues. We do not estimate how state leasing revenues are distributed through the School Capital Construction Account because project approval is at the discretion of lawmakers.

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