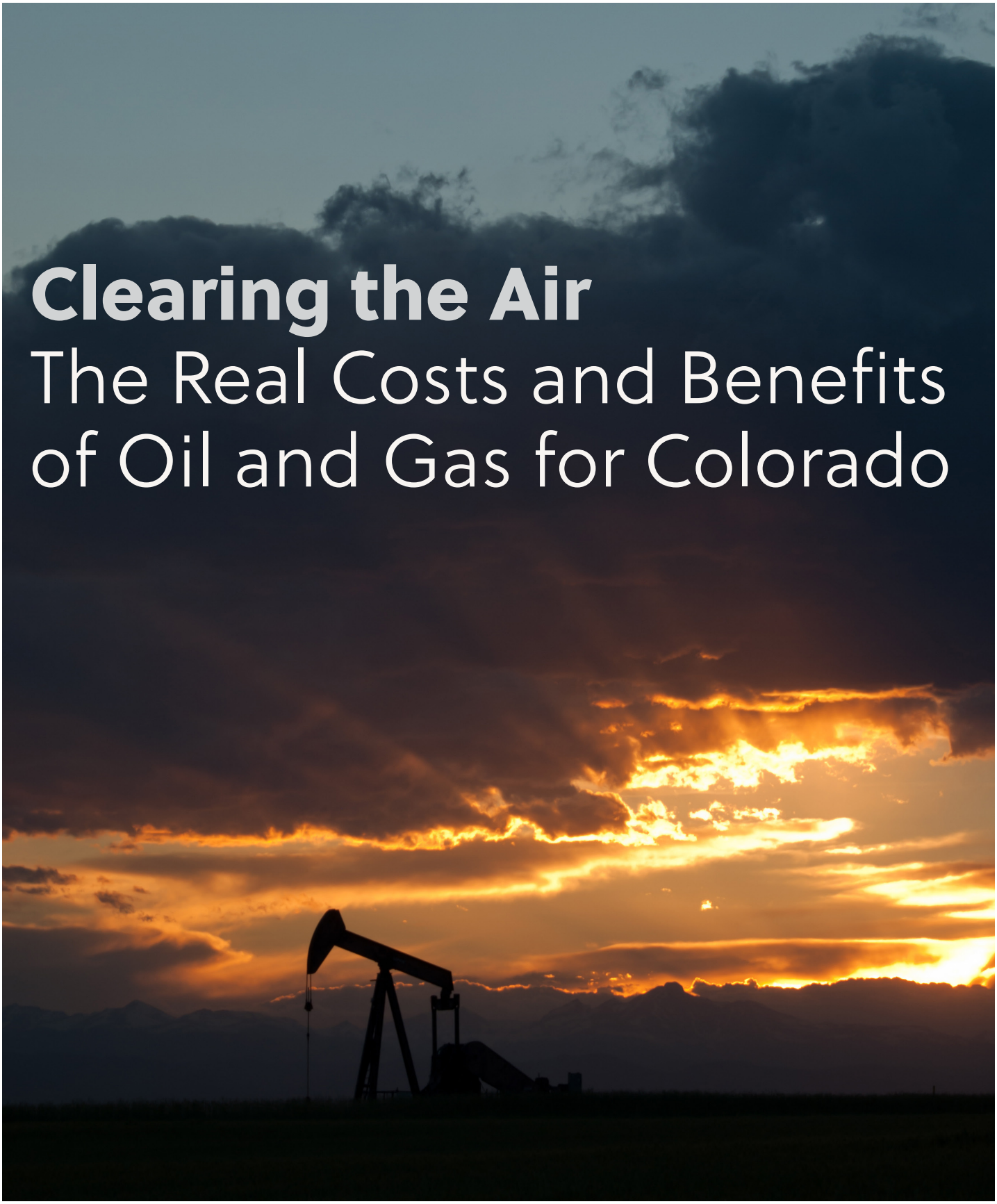
Clearing the Air
The Real Costs and Benefits of Oil and Gas for Colorado



Colorado Fiscal Institute

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Executive summary

Given the United States' commitment to the Paris Agreement and global, federal, and state greenhouse gas emissions reduction targets, states with communities that produce oil and gas are forced to consider how they will diversify economically. One the biggest barriers to these goals is the perception that Colorado is so economically reliant on the oil and gas industry that our state's economy will prohibitively suffer if production declines.

While our climate goals are reliant on a transition to clean energy, which carries costs, pollution created by oil and gas operations comes with costs to our health and our environment. Therefore, it's important for policymakers to have a clear picture of just how much oil and gas factors into Colorado's economy.

To properly gauge this, we must look at both the benefits of the industry and its economic impact, as well as the costs of oil and gas production. Unfortunately, most economic impact analyses of the oil and gas industry tend to ignore the negative economic effects of pollution, and may overstate the industry's total employment, income, and tax base.

A clearer picture of the role of oil and gas in Colorado's economy can support policymakers and elected officials in determining how we responsibly transition from burning climate-harming fuels to a carbon-neutral energy economy. This report aims to quantify both the economic benefits of Colorado's oil and gas industry as well as the costs.

Our analysis found:

- The oil and gas extraction industry, along with the pipeline construction and transportation industries and support industries for oil and gas make up just 1.8% of total wages in the state, 3.4% of total personal income, 3.3% of GDP and less than 1% (0.7%) of total employment.
- While oil and gas operations in Colorado generate local, federal and state tax revenue, some of these taxes and fees are not a net benefit to the state because they go directly toward regulating the industry, including cleaning up pollution or compensating for losses caused by development. Additionally, a significant amount of these taxes are based on self-reporting by the industry. Recent state audits showed the industry paid only about 20% of what they would have owed without exemptions, credits, and undercharging.
- The most significant government revenue from oil and gas operations comes from property taxes, including $621 million in 2021. While this makes up 3.5% of total local school funding in Colorado, it is not evenly distributed. 70% of school districts receive less than 1% of total funding from oil and gas property taxes, and just a handful get more than 10% of their total funding from oil and gas property taxes.
- The industry creates significant health, environmental, and other costs that are paid by Coloradans, not the industry. While some serious impacts of oil and gas development are not quantifiable, many are. Pollution emitted by oil and gas operations in Colorado will cause well over $13 billion of damages between 2020 and 2030, based on calculations of the social cost of oil and gas pollution that are set in state law.
- Other health and environmental costs include emissions of volatile organic compounds (VOC) and Nitrogen Oxides (NOx), which lead to dozens of deaths in Colorado each year, high amounts of water usage, lower property values near oil and gas drilling sites, habitat fragmentation, and costs related to cleaning and plugging abandoned oil and gas wells, much of which is paid for by Colorado communities instead of the companies that made the mess.

- Pollution from oil and gas in Colorado contributes to climate change, which is already causing billions of dollars in damage to Colorado, harming the agriculture and recreation industries, and causing natural disasters. Climate-caused disasters alone have cost the state between $20 billion and $50 billion since 1980.

This report found that oil and gas development, while creating some economic benefits, also carries significant costs. While some communities will have a harder time than others during the transition from pollution-causing fuels to clean energy, this analysis shows it is entirely feasible for Colorado to diversify its economy, move away from oil and gas development, and come together to support the specific towns and counties that will be in most need of support.

Colorado Oil and Gas Jobs and Wages

As of March 2022, there were 20,475 oil and gas jobs in Colorado, which made up 0.7% of total jobs in the state. The oil and gas industry paid $948 million in total wages which comprised 1.8% of total wages in Colorado during the first quarter of 2022.

Oil and Gas Jobs and Total Wages in Colorado		
	March 2022 Employment	**Total Quarterly Wages (Q1 2022) in $**
Oil and gas extraction	6,653	572,675,151
Drilling oil and gas wells	1,023	24,653,221
Support activities for oil and gas operations	8,030	232,004,199
Oil and pipeline construction	3,705	70,975,715
Pipeline transportation	1,064	47,789,866
Oil and Gas	**20,475**	**948,098,152**
Total	**2,767,893**	**52,086,837,500**
Oil and Gas Share of Total in Colorado	0.7%	1.8%

Source: Quarterly Census of Employment and Wages

As a comparison, the car dealers and auto parts and car tire industry in Colorado paid $550 million in wages in the first quarter of 2022 which represented 1.1% of total wages. Colorado's hotel and restaurant industry makes up 3.8% of wages.

Lost 12,000 Jobs in the Oil and Gas Sector Since 2019		
	March 2019 Employment	**March 2022 Employment**
Oil and gas extraction	9,228	6,653
Drilling oil and gas wells	1,679	1,023
Support activities for oil and gas operations	13,738	8,030
Oil and pipeline construction	6,633	3,705
Pipeline transportation	1,420	1,064
Oil and Gas	**32,698**	**20,475**
Total	**2,693,297**	**2,767,893**
Oil and Gas Share of Total Jobs in Colorado	1.2%	0.7%

Source: Quarterly Census of Employment and Wages

The median wage of an oil rig laborer in Colorado in 2021 was $46,740. Drill operators make more, with a median wage in 2021 of $75,910. For comparison the median wage in Colorado for all occupations was $47,940.

Managers, Supervisors, and Business Operations Employees in the oil and gas industry make much more. The median salary for a Financial Operations employee was $103,460 in 2021. Engineers in the oil and gas industry have a median wage of $131,100. The average oil and gas office worker doing administrative support has a median wage of $60,160.

Jobs and Wage Distribution of Common Oil and Gas Jobs in Colorado						
	Total Employment in CO 2021	**10th Percentile Salary**	**25th Percentile Salary**	**Median Salary**	**75th Percentile Salary**	**90th Percentile Salary**
Derrick Operators, Oil and Gas	470	$35,820	$38,520	$39,750	$49,840	$74,680
Rotary Drill Operators, Oil and Gas	300	$44,840	$48,890	$75,910	$75,940	$96,460
Service Unit Operators, Oil and Gas	2,150	$37,840	$46,910	$51,390	$65,240	$79,190
Excavating and Loading Machine and Dragline Operators, Surface Mining	480	$37,840	$46,140	$59,180	$75,920	$75,920
Roustabouts, Oil and Gas	1,350	$36,750	$37,300	$46,740	$50,240	$76,390
Helpers--Extraction Workers	230	$35,370	$37,130	$37,700	$43,280	$60,800
First-Line Supervisors of Construction Trades and Extraction Workers	160	$84,600	$100,700	$122,330	$128,550	$137,040
Business and Financial Operations Occupations (Oil and Gas)	1,220	$63,960	$80,930	$103,460	$131,920	$167,270
Architecture and Engineering Occupations (Oil and Gas)	1,060	$77,930	$101,230	$131,100	$166,660	#
Sales and Related Occupations (Oil and Gas)	390	$61,400	$97,320	$125,110	$154,260	$202,110
Office and Administrative Support Occupations (Oil and Gas)	420	$44,210	$47,770	$60,360	$78,020	$99,790

Source: Bureau of Labor Statistics Occupational Employment Statistics industry-level (OES) 2021 Colorado data

Share of Oil and Gas in Colorado's Economy

Oil and Gas made up 3.3% of Colorado's economy measured by GDP in 2021. This includes oil and gas extraction, support activities for oil and gas, drilling oil and gas wells, pipeline construction, and pipeline transportation.

The oil and gas industry was a smaller part of the economy in 2021 than it was from 2018-2020. In 2018, oil and gas represented $18.5 billion in GDP in Colorado—5% of the economy. In 2021, oil and gas represented $14.5 billion in GDP in Colorado—3.3% of the economy. During the same period, Colorado's GDP increased by 17.2% while the oil and gas sector shrank by 21.4%. The overall positive trendline of Colorado's economy during a time of decline for the oil and gas industry lends credibility to the idea that the state is not economically dependent on oil and gas.

Gross Domestic Product (millions of current dollars)	**2018**	**2019**	**2020**	**2021**
All industry total	372,212	394,535	391,263	436,360
Oil and gas extraction	12,141	10,479	5,775	10,510
Support activities for mining	3,123	2,943	1,710	1,753
Portion of Support Activities from "Oil and Gas Wells" and "Oil and Gas Operations"	97.1%	97.0%	96.2%	95.3%
Construction	21,719	23,352	23,517	24,528
Portion of Construction from "Pipeline Construction"	3.35%	4.20%	2.52%	2.11%
Pipeline transportation	2,628	1,794	1,799	1,856
Total Oil and Gas Industry	**18,528**	**16,109**	**9,809**	**14,554**
Percent of Colorado's GDP	**5.0%**	**4.1%**	**2.5%**	**3.3%**

Source: Bureau of Economic Analysis State GDP; Quarterly Census of Employment and Wages "Total Annual Wage" by NAICS 237120 as portion of NAICS 23 and NAICS 213111 and NAICS 213112 as portion of NAICS 2131.

Taxes and Fees Charged to the Oil and Gas Industry

Fees and taxes that are specific to Oil and Gas are 1) leases and royalties for operations on state and federal lands, 2) fees that go into the Environmental Response Fund, and 3) Severance Taxes. These fees and taxes comprise a large portion of what industry groups claim is a benefit to the state, although a large portion of that public money goes toward offsetting social, environmental, and economic costs of the oil and gas industry.

A portion of revenue from leases and royalties goes toward funding schools. As discussed below, nearly all revenue from oil and gas leases on state lands goes to schools, and 50% of the money coming to Colorado from Federal Mineral Leases (FML) goes to schools. 10% of FML disbursements go to the Water Conservation Board, and 40% goes to the Local Government Mineral Impact Fund. 50% of that is disbursed directly to local governments who are affected by oil and gas development, and 50% goes to the Energy Impact Assistance Fund (EIAF), the purpose of which is to "assist political subdivisions that are socially and/or economically impacted by the development, processing, or energy conversion of minerals and mineral fuels." In total, 40% of Federal Mineral Lease disbursements from oil and gas go toward compensating communities for the negative social and economic impact of oil and gas development.

It's hard to count the Environmental Response Fund as a benefit to the state, because like the EIAF, it simply offsets some of the costs associated with the oil and gas industry. The Environmental Response Fund is funded

through certain fees and penalties collected from oil and gas operators. By law this fund can only be spent to fund the regulation of the oil and gas industry and the remediation of environmental damage caused by oil and gas operations. C.R.S. § 30-60-124.

In addition to the costs of community compensation for damage costs, the industry also has regulation costs. Regulatory costs come in four main forms: the Colorado Oil and Gas Conservation Commission (COGCC) budget, the failure of the COGCC to charge adequate fees, the costs of plugging or reclaiming orphaned wells (PROW) and staffing specific to oil and gas in the Colorado Department of Natural Resources.

Additionally, the PROW program has nowhere near the resources required to plug and fill all the abandoned wells in the state. This is largely because it is cheaper for producers to keep wells barely producing oil (making them into so-called "stripper wells") than to properly plug them. In 2018, 58% of oil wells and 73% of gas wells qualified as stripper wells.[1] The cost of plugging and cleaning up a well can range from an average of $20,000 per well, to over $1 million depending on the type and age of the site.[2]

The biggest state revenue source that the oil and gas industry pays comes in the form of severance taxes. Severance taxes are a graduated tax imposed on 'severing' natural resources such as coal, oil, and minerals from the ground. For perspective, In FY2021-22 severance tax was $308.7 million, which is only about 1.7% of gross general fund revenue (including State Education Fund transfer) of $18.7 billion. This revenue was during a good year, and severance taxes closely track the boom-and-bust cycle of oil and gas prices (see chart below). A closer look at the 2020 report from the state auditor's office and comparison to other states reveals that the industry is getting off easy when it comes to severance taxes.[3]

State auditors estimated the underpayment of tax by the operator with the highest number of incomplete or missing reports. In 2016 alone, this operator missed 1,123 monthly reports, failing to report more than 850,000 barrels of oil and 4 million MCF of gas, which could have resulted in approximately $2.6 million worth of severance taxes, prior to other fees or credits. Accounting for the delinquent reports of every operator in the state for the past six years would be nearly impossible, but this single case from 2016 goes to show just how much underreporting is costing Colorado.

The COGCC has the power to enforce the submission of monthly reports with a $200-per-day-per-well late fee, increasing after 30 days of tardiness. However, even though an estimated 316 well operators were out of compliance with reporting, the commission imposed no fees on any operators. Had the commission imposed the $200-per day fee for 30 days on each of the 51,264 delinquent reports (assuming they turned in their reports after 30 days), operators could have been liable for more than $300 million in fines from 2016-2018. Had the commission only enforced this penalty in the case of the three worst offenders during this period, those three operators could have been held accountable for more than $120 million in fines. Each of those operators had more than 5,000 missing reports.

In addition to chronic underreporting by well operators, there are two main routes through which the oil and gas industry in Colorado pays significantly less in taxes than they would in other states. The first of these is the ad valorem tax credit, a law passed in 1977 which allows oil and gas companies to claim 87.5% of the ad valorem property taxes as a credit on their severance tax liability.[4] This tax credit can go unnoticed because it shares a name and value with the assessment rate for oil and gas property but in fact can reduce severance bills by up to 92.8%. This tax credit alone was responsible for $149 million in severance tax refunds in 2021 and even more in 2019 when the credit was worth $430 million.

Tax Year	Gross Liability	Ad Valorem Credit	Percent of Gross Liability	Net Tax Liability
2008	430,590,389	167,703,452	38.9%	262,912,030
2009	190,979,702	160,991,461	84.3%	30,007,579
2010	278,418,846	133,581,819	48.0%	144,839,008
2011	307,839,571	154,736,951	50.3%	153,112,212
2012	272,855,723	163,920,883	60.1%	108,948,651
2013	388,121,572	191,045,636	49.2%	197,077,279
2014	543,794,057	284,876,842	52.4%	258,927,136
2015	325,109,120	301,843,159	92.8%	23,268,339
2016	260,674,621	214,726,300	82.4%	45,952,977
2017	378,724,058	249,453,562	65.9%	129,429,438
2018	561,574,826	374,857,470	66.8%	186,766,212
2019	506,104,659	430,778,139	85.1%	75,358,079
2020	281,747,126	265,691,162	94.3%	16,063,439
2021	290,724,229	149,059,933	51.3%	141,683,611
Average	**358,375,607**	**231,661,912**	**65.8%**	**126,738,999**

Source: Colorado Department of Revenue, Legislative Council Staff calculations

Colorado oil and gas producers also pay less than producers in other states due to what is known colloquially as the 'stripper well exemption'. This exemption states that wells with an average daily production of less than 15 barrels or 90k MCF are not charged a severance tax. The ad valorem credit and stripper well exemption reduced the effective severance tax rate from a statutory 2-5% (graduated, depending on the output of the well) to an average of 1.5% in FY 2018-19. The effective rate across the nine states compared in the report prepared for the Colorado Legislature was 4.8%.

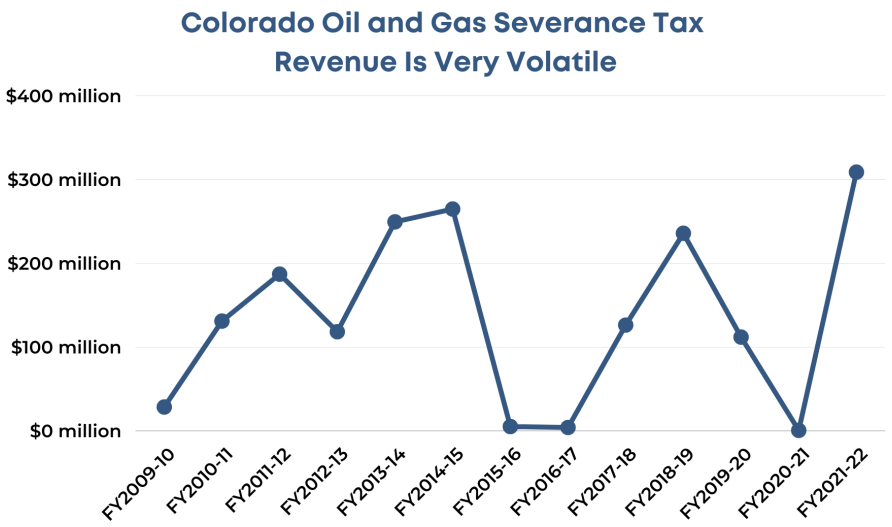
Tax Year	Net Severance Tax Liability	Percent Exempt	Value of Exemption
2008	262,912,030	16.1%	79,137,055
2009	30,007,579	17.8%	10,624,561
2010	144,839,008	18.7%	45,538,108
2011	153,112,212	20.4%	50,426,087
2012	108,948,651	20.7%	35,802,436
2013	197,077,279	16.7%	49,736,857
2014	258,927,136	12.4%	43,471,438
2015	23,268,339	10.6%	3,464,881
2016	45,952,977	11.1%	8,179,947
2017	129,429,438	9.7%	17,986,670
2018	186,766,212	7.7%	20,035,078
2019	75,358,079	6.8%	7,379,403
2020	16,063,439	7.6%	2,001,786
2021	141,683,611	8.6%	35,729,047
Average	**126,738,999**	**13.2%**	**29,250,954**

Source: Colorado Department of Revenue, Colorado Oil & Gas Conservation Commission, Legislative Council Staff calculations

Severance tax collections are incredibly volatile in large part because of oil and gas price volatility. Because severance taxes are paid on the value of oil and gas produced, big swings in prices cause big swings in revenue collections even if production levels remain relatively constant.

In 2020, energy prices fell significantly from pandemic-related travel restrictions and people choosing not to travel for health reasons. This led to a collapse in demand for oil and gas and nearly zero severance tax collections in FY2020-21. Demand for oil and gas jumped back rapidly when travel resumed and supply couldn't keep up. This resulted in large spikes in gas prices. As those prices rose, the value of oil and gas produced in Colorado jumped and therefore severance tax revenue jumped.

The ad valorem credit also contributes to Colorado's severance tax collection volatility. Because there is a misalignment between the production year used to calculate the credit and the production year used to calculate severance tax owed, a big credit can be used to offset a year that might be a down year in energy prices. This can amplify swings in severance tax collections.



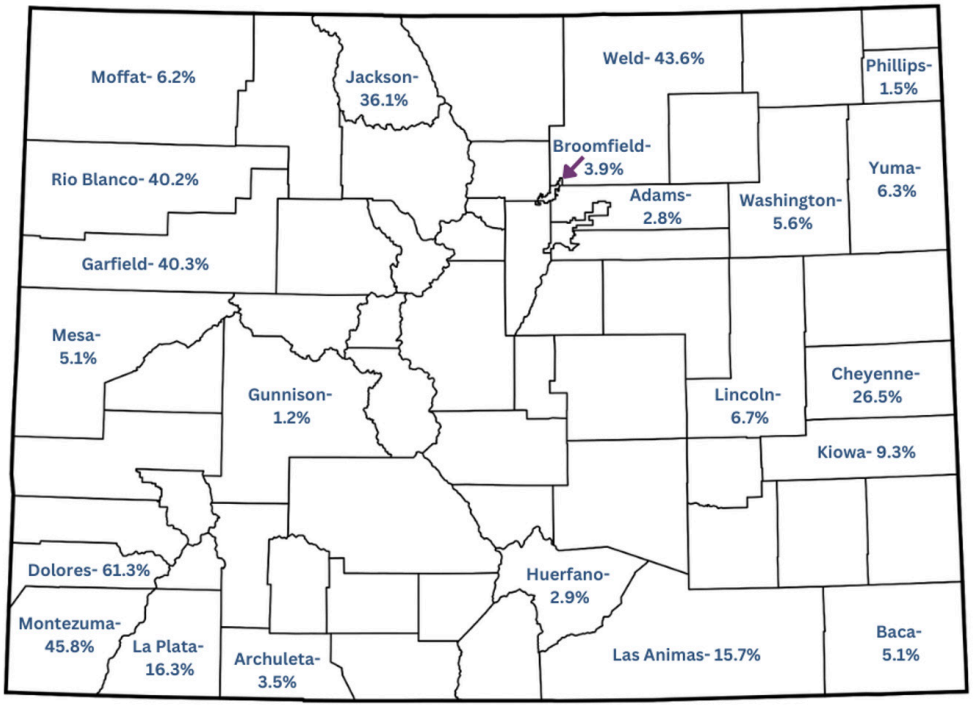
Source: Colorado Legislative Council

Property Taxes Paid by Oil and Gas Companies

In 2021, total property tax in Colorado was $11.9 billion. Of this total, $621 million, or 5.2%, came from property taxes on oil and gas property (see appendix for full breakdown of oil and gas property taxes paid by county).

36 of Colorado's 64 counties had oil and gas assessed property value in 2021. Just nine of those counties get more than 10% of their property tax from oil and gas property. Dolores County has the highest portion of its assessed value coming from oil and gas property at 61.3%, followed by Montezuma (45.8%), Weld (43.6%), Garfield (40.3%), and Rio Blanco (40.2%). Of the $621 million generated for total local governments (schools, counties, cities, and special districts) $128 million went to county budgets.

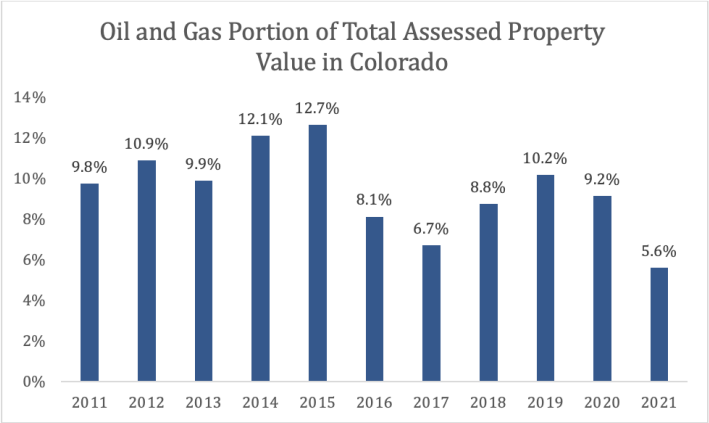
Percentage of County's Assessed Property From Oil & Gas



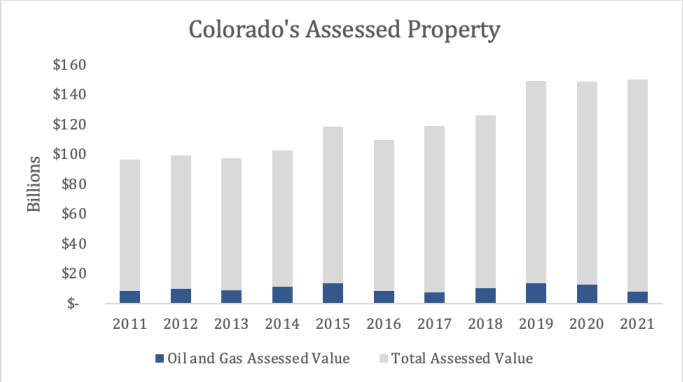
Any counties not labeled have less than 1% oil and gas property

Source: Colorado Department of Local Affairs 2021 Assessed Value by Property Class

Oil and Gas Assessed Property Value has average 9.5% of total assessed property in Colorado over the past 10 years. Like GDP and employment, the share of oil and gas has shrunk over the past several years while totals continue to grow. For example, oil and gas assessed value fell by 42% between 2019 and 2021 while total assessed value grew by 5%.



Source: Colorado Department of Local Affairs Assessed Value by Property Class



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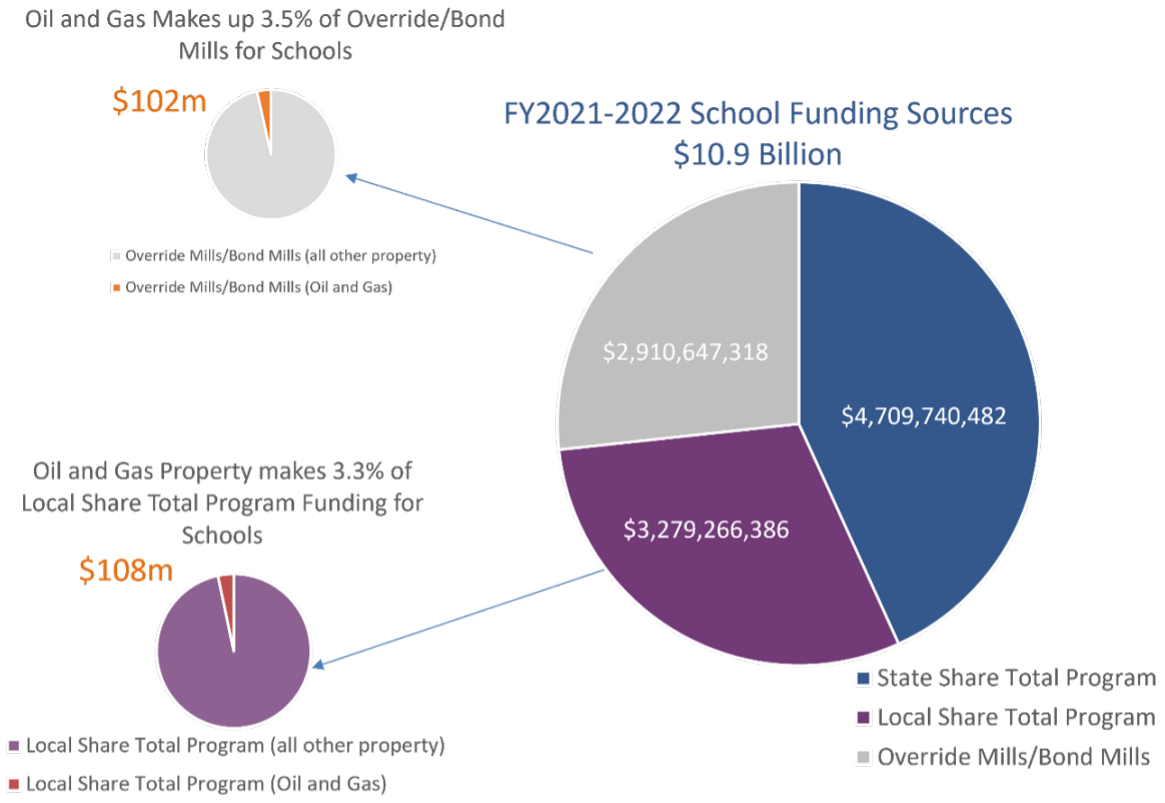
School Funding from Oil and Gas Operations

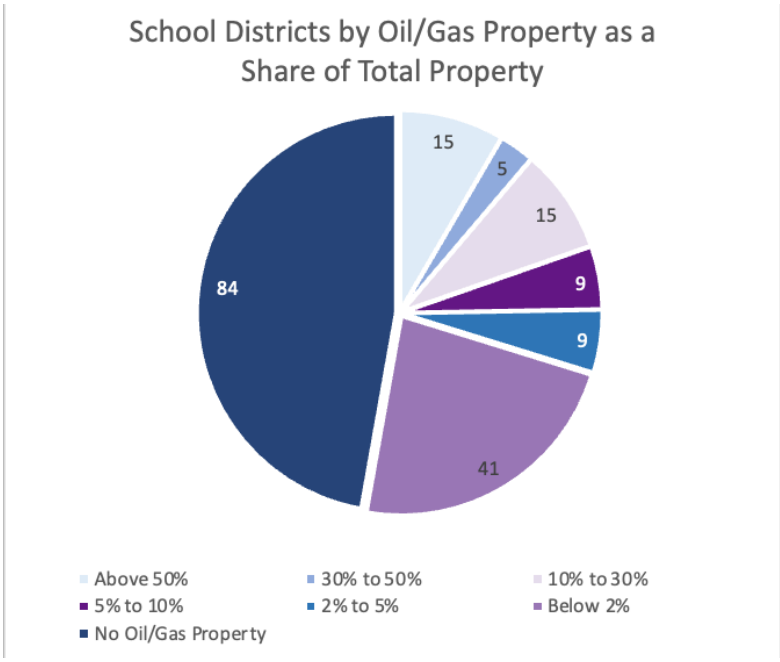
Of the $621 million in property tax revenue generated from oil and gas property in 2021, $210 million of it went to school district budgets. About half of that ($108 million) contributed to "Total Program" funding and a little less than half ($102 million) went to school districts through extra override mills and bond mills. As a share of total property tax that funds schools in Colorado in 2021, oil and gas made up 3.5%. However, only a handful of communities are reliant on oil and gas property to fund schools. 84 of 178 school districts have zero oil and gas property. 94 out of 178 school districts have some oil and gas assessed value. Of those 94 districts, 41 of them get less than 2% of property tax from oil and gas. On the other hand, 15 of those school districts get more than half their property tax from oil and gas.

The state essentially already has a backfilling mechanism for about half of property taxes that would be lost if oil and gas went away. The school finance formula is designed to compensate for property wealth disparities across school districts, so if the local share of school funding falls in a district, the state makes up the difference. In 2021, $108 million in local property tax dollars contributed to "total program" funding. If that suddenly went away, the state would backfill that $108 million.

In addition to total program funding, school districts have asked voters to approve "override" mills. These are additional property taxes that all stay local to the school district and do not impact total program funding. Of the $2.9 billion in override revenue, 3.5% of it comes from oil and gas property ($102 million). This means the real dollar amount needed to make schools that are reliant on oil and gas property whole is $102 million that would not automatically be backfilled with state sources.

The school finance formula's backfill method could act as a model for a mechanism to backfill local governments who lose property tax revenue as we transition away from oil and gas. This would be especially important for counties like Dolores, Montezuma, Weld, Garfield, and Rio Blanco.





Platte Valley RE-7 in Weld County has the most reliance on oil and gas property—86% of their assessed property value comes from oil and gas. Their district gets $17.1 million in total funding from that property, $6.8 million of which comes from taxes but would get backfilled by state sources, and another $5.8 million comes from override property taxes from oil and gas that wouldn't get backfilled by the state when we transition away from oil and gas. Statewide, 15 of 178 school districts' override revenue from oil and gas exceeds 10% of their total funding.

A percentage of mineral leases and royalties on oil and gas produced on state and federal lands also goes to fund schools. Approximately 70% of State Land Board Trust revenue comes from oil and gas leases and royalties, and nearly 99% of this goes to fund education.[5] In 2021, the State Land Board Trust received $81,755,676 in revenue from oil and gas royalties and leases, $80.7 million of which went to education. The federal government also collects fees and royalties from mineral leases on federal lands, returning 49% back to the states.

According to Colorado's Department of Local Affairs, 50% of the Federal Mineral Lease (FML) disbursements Colorado receives from the federal government goes to schools.[6] In fiscal year 2021, the federal government collected $165.9M in Federal Mineral Leasing royalties and fees from oil and gas.[7] 49% ($81.3M) was returned to Colorado, of which $1M is 'bonus'. 50% of the non-bonus federal disbursements, or $40.2M, goes to the State Public School Fund or is disbursed directly to school districts.

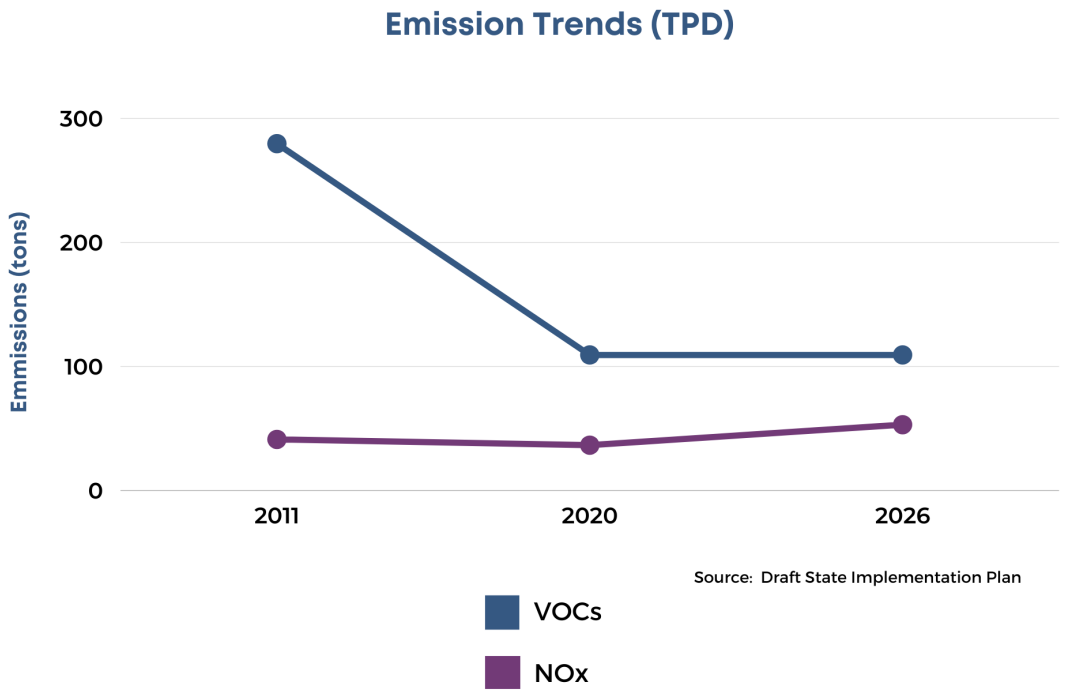
Total Revenue Generated from Oil and Gas in Colorado

Total Revenue Generated from Oil and Gas in Colorado			
	Amount (millions)	**Time Period**	**Primary Uses for Funds**
Property Tax	$621	2021	School, County, City, Special District Budgets
State Severance Tax	$154.6	2021 (Average of FY2020-21 and FY2021-22)	Local Government Grants, water projects, fire mitigation
State Land Board	$81.8	FY2020-21	Schools, Parks, Public Buildings
Federal Mineral Lease	$81.3	FY2020-21	Schools, Water Board, Local Governments
Oil and Gas Conservation and Environment Response Fund	$19.6	FY2020-21	Industry regulation
Total Revenue from Oil and Gas	**$958.7**	FY 2021	

In 2020, Colorado state and local governments collected $79.6 billion in revenue.[8] So the $958.7 million represents 1.2% of total revenue in Colorado for all levels of government.

Costs of Oil and Gas to Colorado

Air quality



Anyone who lives on the front range knows how poor air quality affects our views of the mountains, but pollution is also particularly hazardous to public health. The oil and gas industry is the largest industrial source[9] of emissions of what are called volatile organic compounds (VOCs), which contribute to ground level ozone pollution.

The draft State Implementation Plan[10] (SIP) states that in 2020 the oil and gas industry emitted 109.42 tons per day (tpd) of VOCs and 36.7 tpd of NOx. This inventory represents emissions estimates for an average episode day during the peak summer ozone season of June through September.

VOCs from drilling and fracking operations, together with nitrogen oxides, are responsible for 17 percent of locally produced ozone in Colorado's heavily drilled Front Range.[11] The oil and gas sector is also a large contributor to particulate matter emissions. The PM can either be emitted directly from the source (primary particles) or formed through chemical reactions (secondary particles) of different gases. These gases include Sulfur Dioxide (SO2), Oxides of Nitrogen (NOx), and certain organic compounds.

The table below shows that in 2025,[12] the total cost of ozone precursors NOx and VOCs from the oil and gas sector is estimated to be between $100 million and $180 million (in 2015 dollars). These significant costs are borne by Coloradans, especially those communities sited nearest the oil and gas developments, which research shows are more likely to be communities of color and places where people are more likely to earn low incomes.[13]

Damages per ton of oil and gas related pollutants in Colorado ($2015)					
	Ozone Precursors		**$PM_{2.5}$ Precursors**		
	VOCs	NOx	SO_2	EC/OC	NOx
Health damages	$300–$500	$4,600–$8,200	$27,000-$62,000	$140,000–$320,000	$2,800–$6,300

Source: Fann et al. (2018)

By 2025, the average number of PM2.5 and ozone related premature deaths attributable to oil and gas emissions in Colorado is estimated to be 70 deaths which is the equivalent of 1.9 premature deaths per 100,000 people. This is 210% of the national population-adjusted premature death rate.[14]

Those same researchers estimate that by 2026, the total economic damages from the oil and gas sector in the United States will be between $13 billion-$29 billion, which is mostly due to health damages from premature deaths. Since their premature death estimates for Colorado is about 3.7% of the national estimates, we can infer that total damages for Colorado will be between $480 million and $1 billion.

There are many more unquantified costs associated with drilling and fracking activities. A 2022 Physicians for Social Responsibility (PSR) report[15] reviews about 2000 studies on health impacts of fracking and drilling. They find that more than 200 airborne chemicals have been detected near drilling and fracking operations, as well as significantly higher toxic levels near these sites. Cancers, asthma, respiratory diseases, skin rashes, heart problems, and mental health problems are among the health conditions linked to drilling, fracking, and their infrastructures.

zince 2008, PFAS have been used in fracking operations in at least ten counties in Colorado, mostly in Weld and Garfield counties. PFAS are long lasting chemicals, components of which break down very slowly over time. Exposure to some PFAS may be linked to harmful health effects in humans and animals.[16]

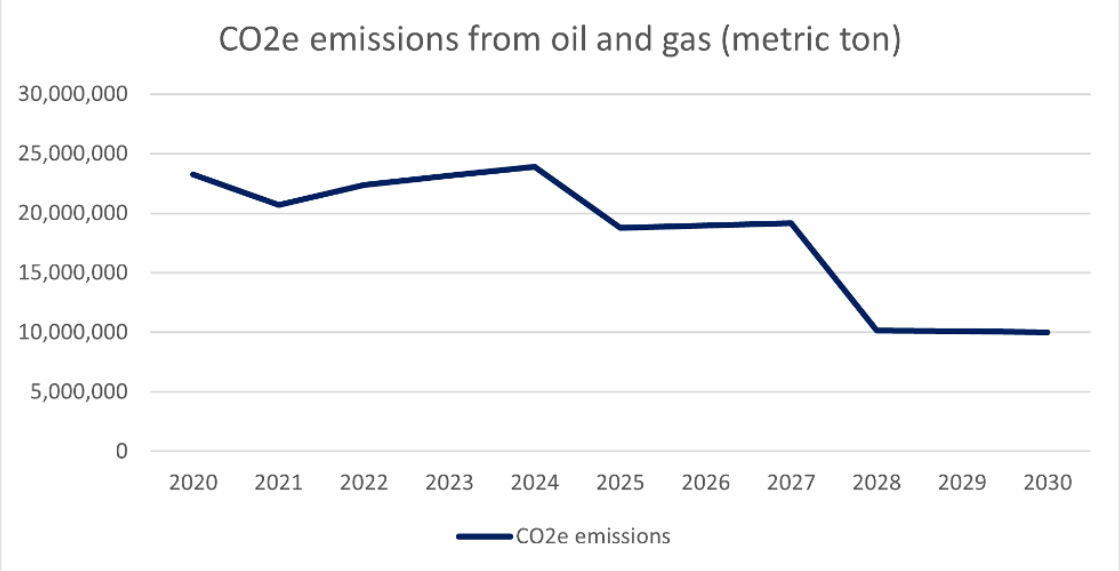
Moreover, fracking in northeastern Colorado has been a significant source of toxic pollutants, including benzene and toluene.[17] Studies have found higher rates of leukemia among children and young adults living in areas dense with oil and gas wells.[18] For people living within 500 feet of a well, lifetime cancer risks are estimated to be eight times higher than the EPA's upper threshold.[19]

In addition to benzene and toluene, ethylbenzene, and xylene (BTEX) are two common air pollutants from drilling and fracking. sperm abnormalities, reduced fetal growth, cardiovascular disease, respiratory dysfunction, and asthma are among the health conditions linked to BTEX air pollutants.[20]

Greenhouse Gas Pollution

The social cost of carbon is a dollar estimate of the economic cost resulting from emitting one additional ton of carbon dioxide (CO2) into the atmosphere. Assessments of damages from climate change are influenced by projections of population, economic growth, and emissions. A recent study by RFF[21] incorporates socioeconomic uncertainty and stochastic discounting in deriving estimates of the SCC and finds mean estimates of between $61 and $168 per ton of CO2 in 2020 dollars (depending on the discount rate). Per Colorado law, the social cost of carbon is calculated at $68 per ton.[22]

The Colorado greenhouse gas reduction roadmap provides annual estimates of CO2 equivalent emissions from the oil and gas sector between 2020 and 2030. The graph below shows these estimates under HB1261 targets. Using these estimates, the total emissions from this sector between 2020 and 2030 is 200.5 million metric tons. Using the estimates of the social cost of carbon, total economic damages from these emissions would be between $12.2 billion (based on RFF low estimates) and $33.7 billion (based on RFF high estimates) by 2030. Using the $68 social cost of carbon in Colorado law, total economic damages over this period would be $13.6 billion.



Cost of Plugging Abandoned Wells

Oil and gas companies are legally obligated to plug wells once they are no longer producing oil. In reality, many operators abandon wells they profit from without paying for their cleanup and closure. The EPA's estimate shows that in 2019, there were about 2 million unplugged abandoned oil and gas wells across the United States.[23] According to the orphan well program, Colorado has at least 215 orphaned wells and 454 associated sites, which can include well pads, storage tanks, flowline locations and other facilities. Moreover, nearly half of the state's unplugged wells are stripper wells—low-producing operations with small profit margins often at the end of their lifespans.

So far, the costs of plugging these wells have been paid through the orphan well program, which uses fees from the oil and gas industry to plug and abandon orphan wells and reclaim orphan well sites.[26] Colorado has about 60,000 unplugged wells (including currently producing wells, stripper wells, injection wells, temporarily abandoned wells, and zombie wells), and Carbon Tracker's estimates show that the costs of cleaning and plugging them are about $7 billion.[27] If the funds collected by the orphan well program are not sufficient, the state will have to pay for these cleaning and plugging costs.

Housing Prices

Oil and gas production can drive housing prices up through increasing employment and subsequently higher demand for housing in the area. On the other hand, environmental and health risks associated with extraction and distribution, including air, water and noise pollution could push housing prices down. Those not nearby active drilling at the time of sale may benefit from the fracking boom, while those near wells being actively drilled at the time of sale suffer loss in property value due to environmental pollution. Overall, they find a reduction in property value of about 1%.[24]

The Western Slope of Colorado (Garfield, Mesa, and Rio Blanco counties) is one of the primary locations of hydraulic drilling in the state. In this region, the houses within one mile of the drill site sell for 34.8% less than comparable properties without proximate drilling.[25] Treated properties are affected by highly intensive drilling (on average 16 wells drilled within a mile). These are properties that do not have mineral rights and do not financially benefit from drilling and are only negatively impacted).

Effect of oil and gas production on housing prices

Location	Type of property	Percent change in property value
Weld County	Drilling within ½ mile of property	-1%
Western Slope	Drilling within 1 mile, no mineral rights	-35%

Water Use and Quality

According to the COGCC, hydraulic fracturing, which has occurred in approximately 90% of oil and gas wells since the 1970s, uses about 1.6 million gallons of water per well (or about 80,000 gallons per year over the average 20-year life of a well).[28] The sourcing of water leads to reductions in its availability for other local requirements. A study by WRA finds that the volume of water required annually for new oil and gas development is enough to serve up to 296,100 people.[29]

Oil and gas development can also impact surface and ground water quality through stormwater runoff and spills, surface spills, leaking waste pits, or poor disposal practices. Some studies have found significantly higher levels of arsenic, selenium, strontium, and total dissolved solids (TDS) in water wells less than 3 km from shale-gas

Habitat Loss and Fragmentation

Oil and gas drilling activities require extensive use of land. Production of oil and gas is associated with direct and indirect impacts to biodiversity and habitat availability (well pads, access roads and other infrastructure including tanks for holding fluids). While renewable energy production can be sustained indefinitely on the same land base, oil and gas extraction requires continuous drilling and use of new land for production. It is estimated that habitat fragmentation damages from oil and gas production in the U.S. amounts to $4.11 billion.[31]

Costs of Climate-Related Disasters

Estimates by the National Center for Environmental Information (NCEI) show that between 1980 and 2022, Colorado has experienced 63 climate-related billion-dollar disasters, 52 of which have happened since 2000 and 38 have happened since 2010. It is estimated that these events have cost Colorado between $20 billion and $50 billion.[32] Drought, flooding, severe storms, and wildfire are among the most damaging climate disasters in Colorado.

It should be noted that these estimates refer to the overall costs of climate related disasters and cannot be attributed to oil and gas production in Colorado only. Rather, these disasters are the result of extraction and burning of all fossil fuels everywhere around the world since the industrial revolution. However, United States is the second largest producer of greenhouse gases in the world and oil and gas sector is responsible for 80 percent of greenhouse gas emissions in the U.S., so oil and gas industry's share in these climate events is not negligible.[33] The Colorado greenhouse gas inventory estimates that in 2019, greenhouse gas emissions in oil and natural gas production has been about 20 million metric tons of CO2 equivalent, which is 16 percent of total greenhouse gas emissions in Colorado.[34]

Conclusion

The oil and gas industry in Colorado represents a small fraction of the economy, contributing 3.3% of Colorado's Gross Domestic Product (GDP) in 2021. In comparison, manufacturing contributed twice as much (6.6%), and the Professional and Business Services sector contributed about 5 times as much (15.5%). As of March, 2022, oil and gas industry employees represented only 0.7% of Colorado's workforce, and they received 1.8% of wages paid in Colorado.

Revenue from oil and gas comes from severance taxes, leases and royalties from oil and gas use of public lands, fees and penalties, and severance taxes. All these taxes, fees, leases, and royalties, along with income tax from oil and gas workers, totals only 1.7% of total state and local revenue in Colorado. The largest portion of tax revenue from oil and gas in Colorado comes from local property taxes. In 2021, Oil and gas represented 5.2% of total property tax, with about half of counties receiving zero property tax revenue from oil and gas and an additional one-sixth receiving less than 1%. Nine counties received over 10% of property tax revenue from oil and gas. Some of the revenue from oil and gas goes toward school funding, making up about 3.5% of local school funding in Colorado.

The costs of the oil and gas industry to the state include lowered property values, lowered air quality and the associated health impacts, habitat loss and fragmentation, water use and quality, and greenhouse gas emissions and the costs associated with those emissions. The social cost of carbon for all of the emissions created during drilling, production, and transmission of oil and gas in Colorado is 1.5 times greater than the revenue the state collects from the oil and gas industry. Climate disasters associated with global production and consumption of fossil fuels have cost Colorado between $20B and $50B.

If the oil and gas industry in Colorado gradually declines due to market forces, regulation, or a combination of these, we can expect the economy to evolve and develop to accommodate these changes. Historically, the economy has shown that over time it has absorbed large changes without adverse affects. Some counties would be disproportionately affected by this change, and Colorado will need to come together to find a solution that will support these communities.

Appendix

Analysis by Oil and Gas Industry Includes "Indirect" and "Induced" Impacts

Public perception that oil and gas is a huge part of the economy could be due in part to information long circulated by industry-funded public relations campaigns and trade groups like the Colorado Oil and Gas Association (COGA). Their current fact sheet is based on a 2018 report prepared for COGA by Global Energy Management Program (henceforth "COGA Report").[35] The fast sheets says that the industry supports 89,000 workers, and the economic impact of the oil and gas sector on the state is $19 billion. These conclusions are based on a method of calculation that includes "induced effects" and differ significantly from the direct jobs and GDP numbers reported earlier in this report. The COGA report explains that "well operators, water supply truck drivers, and contract welders, among others, spend much of their income in Colorado. The share of employment spent, for example, at hardware stores and restaurants and ski resorts attributable to direct and indirect oil and gas industry workers is 'induced' by activities in the oil and gas sector."

This argument relies on the idea that because oil and gas workers spend money, like all of us do, the oil and gas industry should get credit for the jobs of the workers in the establishments where money is spent. If applied to all workers and industries, this method would result in massive double-counting and have an absurd result: it would give the appearance of a Colorado job market that is several times its true size.

Including induced effects can also be misleading because it implies these economic benefits would be irreparably lost if Colorado undergoes a managed transition off oil and gas. Under a gradual, managed transition away from oil and gas production, the workers currently employed in oil and gas would have comparable employment in other jobs and would still be spending the same amount of money as they were when employed in oil and gas, leading to a reapportioning of those jobs and taxes into other sectors.

Inclusion of individual income taxes in the economic contribution of the oil and gas sector is erroneous for the same reason. Under a gradual, managed transition, displaced workers would not be unemployed, but employed in other comparably paid jobs. Income taxes would be coming from the same people, who would be employed in different industries. While it is true that the taxes of oil and gas workers contribute economically to the state, it is not revenue that would necessarily be lost under a transition.

Finally, employment and other data shows the economic condition of the oil and gas industry isn't as tied to the state's overall economy as these groups claim. Because so much of the industry is tied to global economic factors (e.g. the price of oil), there are several examples of the industry cutting jobs while Colorado's overall employment and economy grew. If the industry is really responsible for "inducing" and indirectly creating so many jobs, it stands to reason Colorado would face a recession every time the industry loses jobs, but this is not the case.

Local Property Tax Revenue from Oil and Gas in Colorado		
	Local Property Tax Revenue from Oil and Gas	Total Local Property Tax Revenue
Adams	$31,297,798	$1,135,729,345
Alamosa	$0	$15,422,506
Arapahoe	$7,109,557	$1,289,716,020
Archuleta	$865,598	$24,808,896
Baca	$107,189	$9,284,028
Bent	$24,303	$6,737,059
Boulder	$287,821	$886,443,782
Broomfield	$8,901,788	$230,838,540
Chaffee	$0	$31,468,556
Cheyenne	$1,794,589	$6,821,828
Clear Creek	$0	$29,297,874
Conejos	$0	$6,248,494
Costilla	$0	$9,109,808
Crowley	$0	$3,848,654
Custer	$0	$8,256,413
Delta	$91,768	$23,578,349
Denver	$0	$1,913,598,684
Dolores	$3,825,677	$6,233,310
Douglas	$0	$822,291,773
Eagle	$0	$241,281,878
El Paso	$0	$732,241,401
Elbert	$60,523	$41,436,684
Fremont	$32,813	$40,716,970
Garfield	$61,177,151	$151,893,498
Gilpin	$0	$16,423,767
Grand	$0	$64,395,091
Gunnison	$617,696	$52,198,016
Hinsdale	$0	$3,184,430
Huerfano	$348,553	$12,032,750
Jackson	$1,420,686	$3,927,623
Jefferson	$0	$1,067,799,559
Kiowa	$333,225	$3,591,788
Kit Carson	$5,124	$16,885,978
Lake	$26,186,239	$21,004,414
La Plata	$0	$80,495,096
Larimer	$2,445,092	$677,356,099
Las Animas	$2,266,969	$14,402,716
Lincoln	$834,143	$12,466,157
Logan	$222,127	$26,461,347

Mesa	$8,171,343	$160,488,878
Mineral	$0	$3,537,556
Moffat	$1,781,818	$28,683,841
Montezuma	$14,476,352	$31,616,168
Montrose	$0	$46,362,638
Morgan	$520,174	$55,636,299
Otero	$0	$11,298,389
Ouray	$0	$12,150,291
Park	$0	$34,483,776
Phillips	$132,716	$9,026,747
Pitkin	$0	$155,561,871
Prowers	$35,265	$10,014,469
Pueblo	$0	$205,627,293
Rio Blanco	$12,042,489	$29,973,296
Rio Grande	$0	$14,213,229
Routt	$73,381	$84,950,255
Saguache	$0	$30,246,976
San Juan	$0	$2,214,391
San Miguel	$189,945	$44,508,585
Sedgwick	$4,111	$4,849,143
Summit	$0	$146,138,626
Teller	$0	$37,072,494
Washington	$617,862	$11,057,747
Weld	$431,765,682	$989,330,571
Yuma	$1,421,405	$22,716,048
Colorado Total	**$621,488,970**	**$11,921,688,758**

Source: Colorado Fiscal Institute's analysis of Department of Local Affairs 2021 Assessed Valuation Data by Class and Average Mill Levies.

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Endnotes

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