INNOVATIONS

DATA INTENSIVE ECONOMIC REPORT (DIER)

COLORADO COUNTIES

- Moffat
- Routt
- Rio Blanco

UTAH COUNTIES

- Emery
- Carbon
- San Juan

D I E R

AGNC

ASSOCIATED GOVERNMENTS OF NORTHWEST COLORADO

Produced by Grow Economy, Inc., Associated Governments of Northwest Colorado (AGNC), and Nathan Perry, PhD[1] in partnership with the Rural Policy Public Lands Institute (RRPPL) Colorado Department of Local Affairs (DOLA) and U.S. Economic Development Administration (EDA)

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ASSOCIATED GOVERNMENTS OF NORTHWEST COLORADO

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Since the mid-1800s, coal has been part of the culture and economy of northwestern Colorado and eastern Utah, providing fuel for electricity, industry, and transportation in the process. Beyond this, it has provided the region with well-paying jobs and economic stability for innumerable workers, families, and communities. However, changes in the coal economy have led to powerplant and mine closures. As this continues, the last remaining coal power stations and mines that supply them are threatened.

Despite this, coal is still a useful resource that can continue to play an economic role as the feedstock for many innovative products. Through these products, it also has the potential to help alleviate domestic supply chain constraints and make the country more self-reliant.

This report is a product of the Coal Communities Innovation Project conducted between September 2019 and March 2022. During this project, Grow Economy collaborated with RPPL, AGNC and Nathan Perry, PhD to conduct in-depth economic analysis of six coal-impacted counties in northwestern Colorado and eastern Utah. The counties addressed were Moffat, Routt, and Rio Blanco Counties in Colorado and Emery, Carbon, and San Juan Counties in Utah. This effort resulted economic playbooks for the AGNC and eastern Utah regions, as well as a larger economic analysis known as the Data Intensive Economic Report (DIER).

The Data Intensive Economic Report (DIER) that follows contains recommendations for establishing local coal-to-products industries and other innovation initiatives in the project region. This includes recommendations for projects that focus on specific innovation activities and supporting infrastructure projects.

This report is the product of in-depth research conducted by Grow Economy and Nathan Perry, Ph.D.[2] Funding for this project was provided by the Colorado Department of Local Affairs (DOLA), Rural Policy Public Lands Institute (RPPL), and the U.S. Economic Development Administration (EDA).

It is our hope that the information provided herein will help the region move forward as it adapts to changes in the coal Industry. Moreover, that the efforts it encourages will provide the region with resources to create jobs, encourage industry, and diversify local economies in the process.

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Introduction

This Data Intensive Economic Report (DIER) provides a thorough economic analysis of Moffat, Routt, and Rio Blanco Counties in Colorado and Emery, Carbon, and San Juan Counties in Utah. It discusses demographic data, key economic sectors, the economic role of coal, and impact of COVID-19 within the six counties. Additionally, it provides information on local infrastructure that could support innovation. Furthermore, it discusses coal-to-products innovation and the competitive advantage of each county, which could be leveraged for job creation in the region.

The DIER itself is organized into six chapters. Chapter 1 and 2 provide economic overviews of the three Colorado and three Utah counties. This includes population data, employment, economic performance, the role of coal in local economies, and the economic impact of COVID-19 on the region.

Chapter 3 discusses local infrastructure and resources that could help support innovation. This is organized by region (AGNC and Eastern Utah). It discusses physical assets and recommendations for certain infrastructure investments like broadband. This section also identifies potential partners that could aid projects in each region.

Chapter 4 and 5 discuss innovation. Chapter 4 focuses on coal innovation, providing an overview on coal-to-products and resources that could aid initiatives in this area. While Chapter 5 focuses on general innovation and the competitive advantage of each county.

The final chapter (Chapter 6) provides supplemental information. This includes population forecasts for the Colorado and Utah counties and a discussion on fossil fuel regulatory challenges affecting Colorado. It also includes a complete innovation program database that documents major innovation programs in all 50 states. This database represents programs as of late 2020, which include innovation centers, makerspaces, incubators, and venture funding sources. These range from university-based programs to private initiatives supported by industries or community members.

Ultimately, the DIER provides invaluable resources that can aid economic development in the AGNC-eastern Utah region. The pages that follow provide information and recommendations that will aid effective innovation program development. These activities will encourage the expansion of key industries into the region, economic diversity, job creation, and prosperity well into the future.

1 County Economic Overview: Northwestern Colorado

MOFFAT COUNTY

DEMOGRAPHIC INFORMATION: MOFFAT COUNTY

Moffat County is a small rural county in Northwest Colorado with a population of 13,300. The Moffat County population peaked in 2009 during the top of the energy boom that many Western Slope economies experienced. Coal, oil, and natural gas prices drove intense economic activity in these industries from 2005-2010, which in turn created employment and caused a population surge. As the energy bubble burst, Moffat County lost residents and its population declined between 2009 and 2014. According to 2019 data, the Gross Domestic Product in Moffat County is just under $1 billion, at $987,687,000.

	2018	2019
Population	13,200	13,300
Regional Gross Domestic Product	$941,810,000	$987,687,000
GDP Per Capita	$71,349	$74,262
Median Household Income	$59,500	$63,232
Education (Bachelor's Degree Or Higher)	17.1%	17.6%
Education (High School or Higher)	90.9%	88.7%
% Of People Under Poverty Line	12.3%	12.2%

Table 1: Moffat County Overview [3]

Census Bureau data shows that 94.4% of Moffat County is white, with 2.4% Hispanic or Latino and 1.5% American Indian and Alaskan Native. 6.8% of the population is under 5 years old, with 25.4% under 18 years old, and 15.9% over 65 years old. Moffat County is expecting a significant population decline, as forecast by the Colorado State Demography Office. Although birth rates are high, there is expected to be an enormous amount of outmigration from the area over the next few decades. Figure 1 illustrates the current population and the population forecast. Note the run-up in population during the energy boom from 2006 to 2009, and the precipitous decline following the energy bust.

[3] Source: U.S. Census Bureau (USCB). Regional GDP is from the Bureau of Economic Analysis (BEA). Census poverty estimates are from the Small Area Income and Poverty Estimates (SAIPE).

Race/Ethnicity	Percentage
White alone	94.4%
Black	0.8%
American Indian and Alaskan Native alone	1.5%
Asian alone	0.8%
Native Hawaiian and Other Pacific Islander alone	0.1%
Two or More Races	2.4%
Hispanic or Latino	16.2%
White alone, Not Hispanic or Latino	79.7%

Table 2: Moffat County Demographics [4]

Age/Gender	Percentage
Under 5 years old	6.8%
Under 18 years old	25.4%
Over 65 years old	15.9%
Between 18 and 65	58.7%
Female	48.9%
Male	51.1%

Table 3: Age and Gender [5]

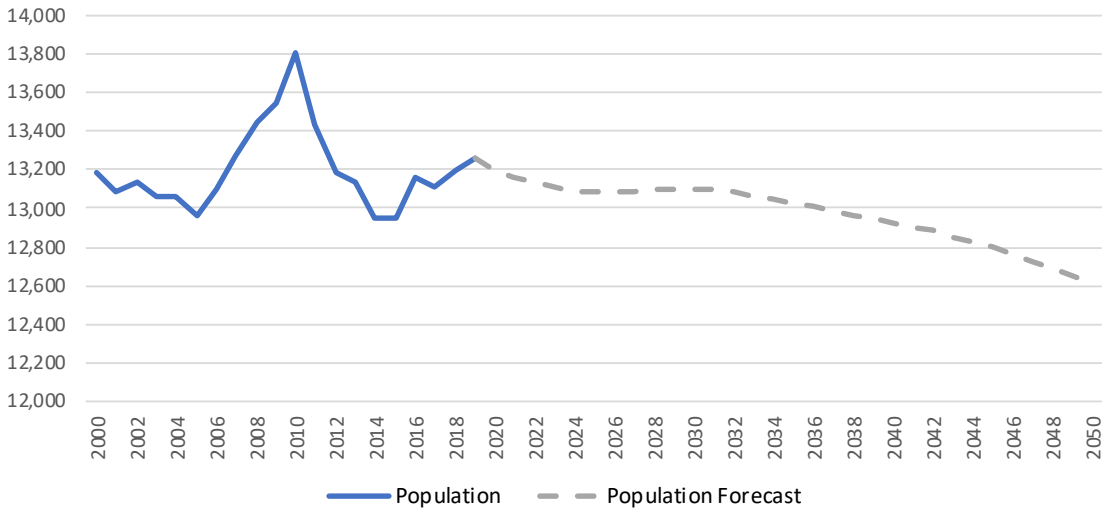

Figure 1: Population Forecast (2000-2050) [6]

[4] Source: United States Census Bureau.

[5] Source: United States Census Bureau.

[6] Colorado State Demographer's Office

INDUSTRIAL COMPOSITION AND EMPLOYMENT: MOFFAT COUNTY

Moffat County Gross Domestic Product (figure 2) peaked in 2006 at close to $1.3 Billion during the runup in coal, oil, and gas prices, and has been in steady decline since. Mining, the industry at the center of the Moffat County economic story, is graphed as a percentage of GDP in figure 3, and has fallen from a peak of 35% in 2006 to a low of just under 20%. Mining, as classified by NAICS codes, includes both coal mining and oil and gas extraction. According to 2019 QCEW data, oil and gas wages made up 2.02% of total mining wages, indicating that currently 98% of the mining NAICS code is actual coal mining, and not natural gas extraction. Note that this excludes support activities for mining due to QCEW's lack of data resulting from privacy restrictions. If coal support activities data were available, this percentage would be higher.

Table 5 illustrates the top contributions by industry to GDP. Mining and Utilities are the top two contributors, at 18.20% of 38.28% respectively. Utilities is where the coal fired power plants in Moffat County are classified. Figure 19 illustrates coal production in both Colowyo and Trapper mines, along with employment at these mines. Although production and employment were lower than in 2009, both employment and production stabilized through 2019.

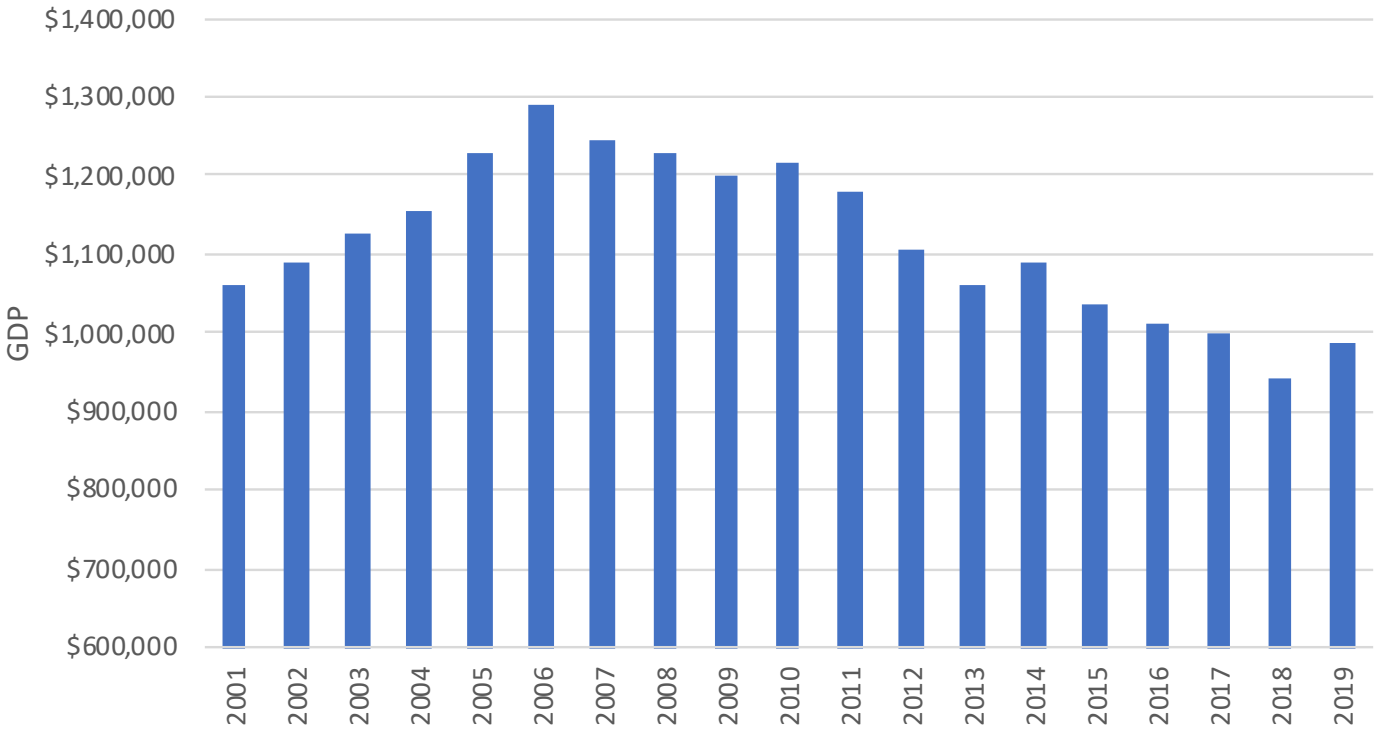

Figure 2: Moffat County Real GDP [7]

[7] Source: Bureau of Economic Analysis. Real GDP is calculated with chained 2012 dollars.

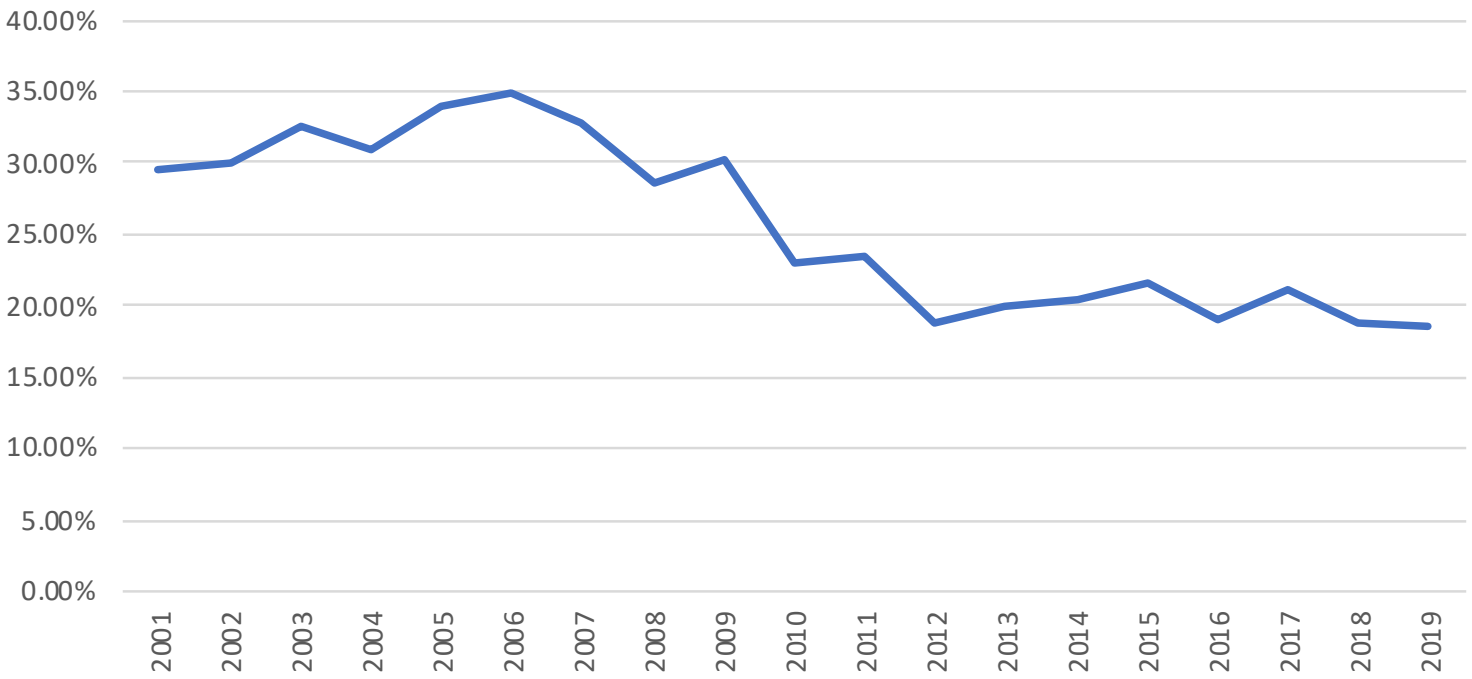

Figure 3: Mining as a Percentage of GDP

LEVEL OF ECONOMIC DIVERSITY: MOFFAT COUNTY

Economic diversity is an important concept in an economy as a more diversified economy is more insulated from specific industry shocks than a non-diversified economy. From QCEW data, it is clear that Moffat County is not diversified in terms of wages, as a large percentage of wages comes from mining (table 5). Note that utilities, which is also a large contributor to the Moffat County economy due to the coal fired power plants, is not available in this dataset due to privacy restrictions. Aside from mining, healthcare is another top contributor to the Moffat County economy, contributing 18.4% of wages and 15.2% of jobs in the QCEW data. Table 5 illustrates Quarterly Census of Employment and Wages (QCEW) data for Moffat County in 2019. Mining has the highest weekly wage at $1,808 and is second in total wage contribution just behind healthcare. Note that if utilities (including Craig Station) were included, the combination of mining and utilities would be significantly higher than healthcare. Table 5 illustrates the divergence between the employment contribution of coal and the wage contribution of coal. In this dataset, coal mining contributes 9.6% of jobs while it contributes 18.1% of wages.

	2018	2019	% Change	% of Total GDP
All industry total	$941,810	$987,687	4.87%	
Private industries	$868,373	$918,126	5.73%	92.96%
Agriculture, forestry, fishing and hunting	$4,412	$3,146	-28.69%	0.32%
Mining, quarrying, and oil and gas extraction	$172,785	$179,736	4.02%	18.20%
Utilities	$347,486	$378,105	8.81%	38.28%
Construction	$19,453	$14,722	-24.32%	1.49%
Manufacturing	$7,290	$7,547	3.53%	0.76%
Durable goods manufacturing	$698	$691	-1.00%	0.07%
Nondurable goods manufacturing	$7,160	$7,452	4.08%	0.75%
Wholesale trade	$23,222	$21,407	-7.82%	2.17%
Retail trade	$41,136	$43,711	6.26%	4.43%
Transportation and warehousing	N/A			
Information	$7,875	$7,683	-2.44%	0.78%
Finance, insurance, real estate, rental, and leasing	$107,127	$118,990	11.07%	12.05%
Finance and insurance	$13,409	$13,055	-2.64%	1.32%
Real estate and rental and leasing	$93,786	$106,226	13.26%	10.76%
Professional and business services	N/A	N/A	N/A	N/A
Professional, scientific, and technical services	N/A	N/A	N/A	N/A
Management of companies and enterprises	N/A	N/A	N/A	N/A
Administrative and support and waste management and remediation services	$5,381	$5,092	-5.37%	0.52%
Educational services, health care, and social assistance	$51,254	$58,241	13.63%	5.90%
Educational services	N/A	$315	N/A	0.03%
Health care and social assistance	N/A	$57,917	N/A	5.86%
Arts, entertainment, recreation, accommodation, and food services	$16,981	$16,820	-0.95%	1.70%
Arts, entertainment, and recreation	$3,923	$3,998	1.91%	0.40%
Accommodation and food services	$13,114	$12,884	-1.75%	1.30%
Other services (except government and government enterprises)	$11,698	$11,737	0.33%	1.19%
Government and government enterprises	$72,692	$69,326	-4.63%	7.02%

Table 4: Moffat County GDP by Industry [8]

[8] Source: Bureau of Economic Analysis, thousand of chained 2012 dollars.

NAICS SECTOR	Average Employment 2019	Total Quarterly Wages 2019	Average Weekly Wage 2019
Total, All Industries	4,704	$237,712,970	$972
Health Care and Social Assistance	715	$43,725,213	$1,176
Mining	452	$42,497,366	$1,808
Public Administration	519	$25,748,730	$954
Retail Trade	705	$21,981,148	$600
Construction	229	$11,711,167	$983
Wholesale Trade	171	$8,926,289	$1,004
Accommodation and Food Services	435	$7,688,000	$340
Finance and Insurance	82	$5,280,979	$1,239
Transportation and Warehousing	77	$4,624,203	$1,155
Other Services, Ex. Public Admin	144	$3,986,869	$532
Arts, Entertainment, and Recreation	103	$3,511,203	$656
Professional and Technical Services	77	$3,085,912	$771
Administrative and Waste Services	91	$2,428,462	$513
Manufacturing	54	$1,951,682	$695
Agriculture, Forestry, Fishing & Hunting	40	$1,447,762	$696
Real Estate and Rental and Leasing	35	$1,436,193	$789
Information	36	$1,355,635	$724

Table 5: Moffat County Quarterly Census and Employment Wages (2019) [9]

To understand what this means in terms of industrial diversification, an industrial diversification index was created. Specifically, a Hachman Index was measured for Moffat County compared to Colorado. The Hachman index is a measure of regional economic diversity and compares the target region (say a state) to the larger geographic area (say the nation) as a comparison. In this case, Moffat County was compared to Colorado. The Hachman Index is an index that goes from 0-1, with 1 indicating the same amount of industrial diversity as the comparison region, and 0 indicating the area is completely different. Figure 4 illustrates the Hachman Index for

[9] Source: Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages.

Moffat County over the last 10 years. The most recent measurement for 2019 data is .445. For comparison purposes, Mesa County has a Hachman Index of .8941. .445 indicates that Moffat County is not very diverse and has high industry concentration compared to the rest of the state. This calculation is performed using employment, if it were performed using wages, it would likely show even less industrial diversification.[10]

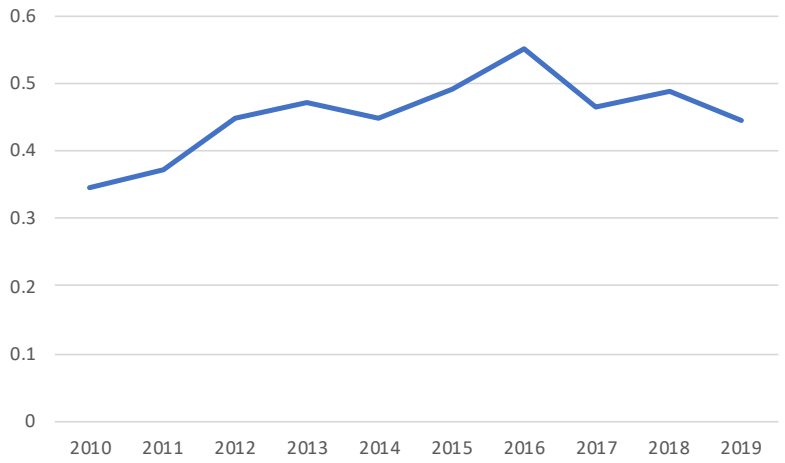

Figure 4: Hachman Index of Moffat County

County	Hachman Index
Moffat	.445
Rio Blanco	.364
Routt	.755
Mesa	.894
Montrose	.757
Delta	.556

Table 6: Hachman Index Comparison (Western Slope)

ROUTT COUNTY

DEMOGRAPHIC INFORMATION: ROUTT COUNTY

Routt County is in northwest Colorado, east of Moffat County, northeast of Rio Blanco, north of Eagle County, and west of Jackson and Grand Counties. As of 2019, the county's population was 25,560 and it is expected to see accelerated growth. Figure 5 illustrates the population forecast from the Colorado State Demography Office. Unlike the expected population decline in Moffat and Rio Blanco Counties, Routt County's

[10]Data for the Hachman Index taken from the USCB American Community Survey (Employment Data 5-year Average). We utilized American Community Survey data instead of QCEW or BEA data because QCEW and BEA data omit industries that have too few companies reporting (such as utilities).

population is expected to increase by approximately 60% through 2050.

Routt County's economic output (measured by GDP) peaked in 2002, trended downward through 2006, and increased during the oil, gas, and mining boom through 2011. From 2011 through 2016, Routt County experienced the same economic depression that many Western Slope counties experienced. Like most counties in this region, their GDP began to increase from 2017 to 2019 to a GDP of $1,742,862 (a GDP per capita of $68,187). Despite up and down growth over the last 20 years, Routt County's median household income has increased since 2012 every year. In 2019 median household income was $87,691, which is significantly higher than that of Moffat and Rio Blanco Counties. Routt County's education level (as measured as a bachelor's degree or higher) is 49.8%, which is also significantly higher than Moffat and Rio Blanco Counties and even that of Colorado's (42.7%). The percentage of Routt County residents who have graduated high school is 96.8%, which is higher than Colorado's rate of 92.4% as well. Routt County's poverty estimate is 7.2%, which is lower than Colorado's rate of 9.4%.

Routt County's demographics are similar to the rest of Northwestern Colorado with a high percentage of White population (95.7%). Other races that make up county population include Hispanic (6.9%), African American (1.1%), and Native American or Alaskan Native (0.7%).

	2018	2019
Population	25,579	25,560
Real Gross Domestic Product	1,677,924,000	1,742,862,000
GDP Per Capita	$65,597	$68,187
Median Household Income	$81,033	$87,691
Education (Bachelor's Degree Or Higher)	50.4%	49.8%
Education (High School or Higher)	96.8%	96.8%
% Of People Under Poverty Line	7.0%	7.2%

Table 7: Routt County Overview [11]

[11]Source: U.S. Census Bureau (USCB). Regional GDP is from the Bureau of Economic Analysis (BEA). Census poverty estimates are from the Small Area Income and Poverty Estimates (SAIPE).

Race/Ethnicity	Percentage
White alone	95.7%
African American	1.1%
Native American and Alaskan Native alone	0.7%
Asian alone	0.9%
Native Hawaiian and other Pacific Islander alone	0.1%
Two or more races	1.5%
Hispanic or Latino	6.9%
White alone, not Hispanic or Latino	89.6%

Table 8: Routt County Demographics by Race [12]

Age/Gender	Percentage
Under 5 years old	4.4%
Under 18 years old	17.8%
Over 65 years old	16.6%
Between 18 and 65	65.6%
Female	48.1%
Male	51.9%

Table 9: Routt County Demographics by Age [13]

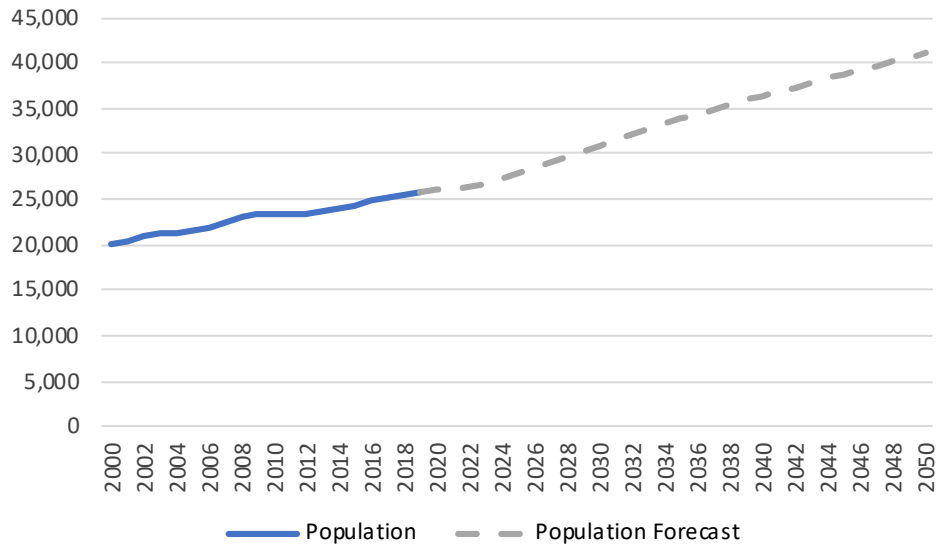

Figure 5: Routt County Population Forecast [14]

[12] Source: U.S. Census Bureau (USCB)

[13] Ibid.

[14] Source: Colorado State Demography Office

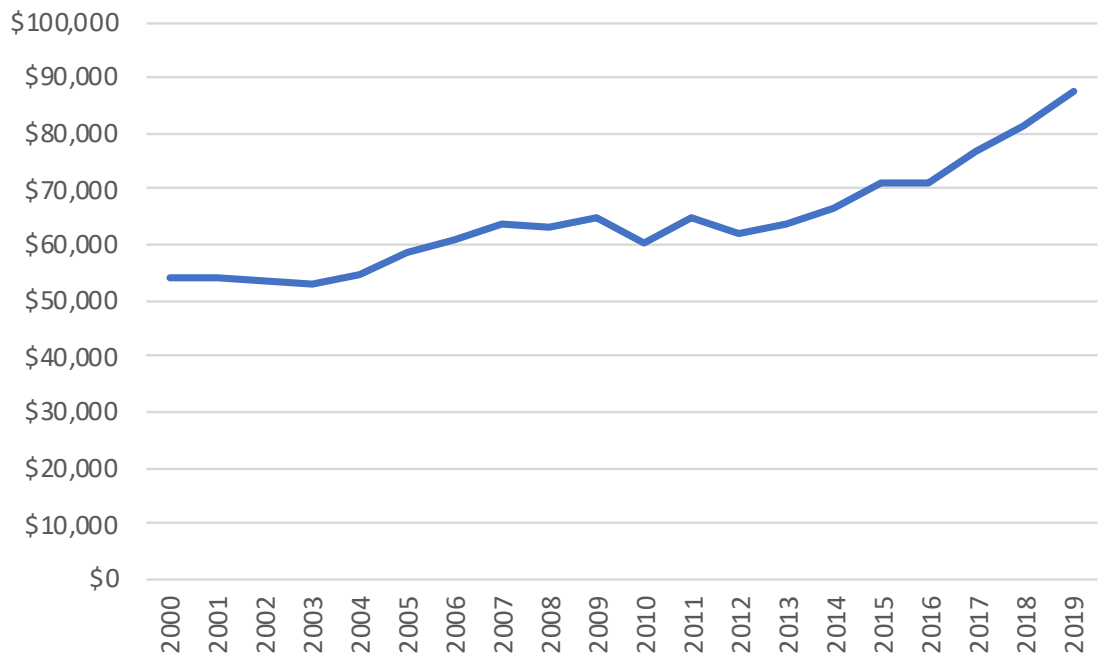

Figure 6: Routt Median Household Income [15]

INDUSTRIAL COMPOSITION AND EMPLOYMENT: ROUTT COUNTY

The economy of Routt County is not as reliant on energy extraction as Moffat and Rio Blanco Counties. As of 2019, 5.74% of Routt County's GDP resulted from oil and gas or coal. Utilities (includes Hayden Power Station) make up about 7.42% of the GDP. However, coal does contribute to GDP in the western part of the county, while the eastern portion is more focused on tourism and professional-based services. The center of economic activity in the county is Steamboat Springs. The largest industries by GDP percentage are real estate, rental, and leasing at 23.54%. This is followed by professional, scientific, and technical services at 21.94%. The third largest industry as measured by GDP is accommodation and food services at 12.27%.

[15] Source: U.S. Census Bureau

Description	2018	2019	% Change	Percentage of Total GDP
All industry total	$1,677,924	$1,742,862	3.87%	
Private industries	$1,504,575	$1,566,473	4.11%	89.88%
Agriculture, forestry, fishing and hunting	N/A	$2,834	N/A	0.16%
Mining, quarrying, and oil and gas extraction	$123,400	$99,982	-18.98%	5.74%
Utilities	N/A	$129,251	N/A	7.42%
Construction	$99,212	$107,997	8.85%	6.20%
Manufacturing	$10,717	$11,579	8.04%	0.66%
Wholesale trade	$8,171	$8,559	4.75%	0.49%
Retail trade	$2,552	$3,016	18.18%	0.17%
Transportation and warehousing	$40,192	$41,893	4.23%	2.40%
Information	$114,685	$119,725	4.39%	6.87%
Finance, insurance, real estate, rental, and leasing	$64,241	$60,606	-5.66%	3.48%
Finance and insurance	$18,957	$19,730	4.08%	1.13%
Real estate and rental and leasing	$381,366	$410,319	7.59%	23.54%
Professional and business services	$32,982	$33,243	0.79%	1.91%
Professional, scientific, and technical services	$352,695	$382,344	8.41%	21.94%
Management of companies and enterprises	N/A	$202,713	N/A	11.63%
Administrative and support and waste management and remediation services	$81,087	$84,246	3.90%	4.83%
Educational services, health care, and social assistance	N/A	$33,407	N/A	1.92%
Educational services	$68,786	$83,184	20.93%	4.77%
Health care and social assistance	$89,699	$91,585	2.10%	5.25%
Arts, entertainment, recreation, accommodation, and food services	$12,552	$12,853	2.40%	0.74%
Arts, entertainment, and recreation	$76,905	$78,481	2.05%	4.50%
Accommodation and food services	$212,087	$213,783	0.80%	12.27%
Other services (except government and government enterprises)	$114,051	$115,780	1.52%	6.64%
Government and government enterprises	$98,618	$98,645	0.03%	5.66%

Table 10: Routt County Percent of GDP by Industry [16]

[16] Source: Bureau of Economic Analysis, thousand of chained 2012 dollars.

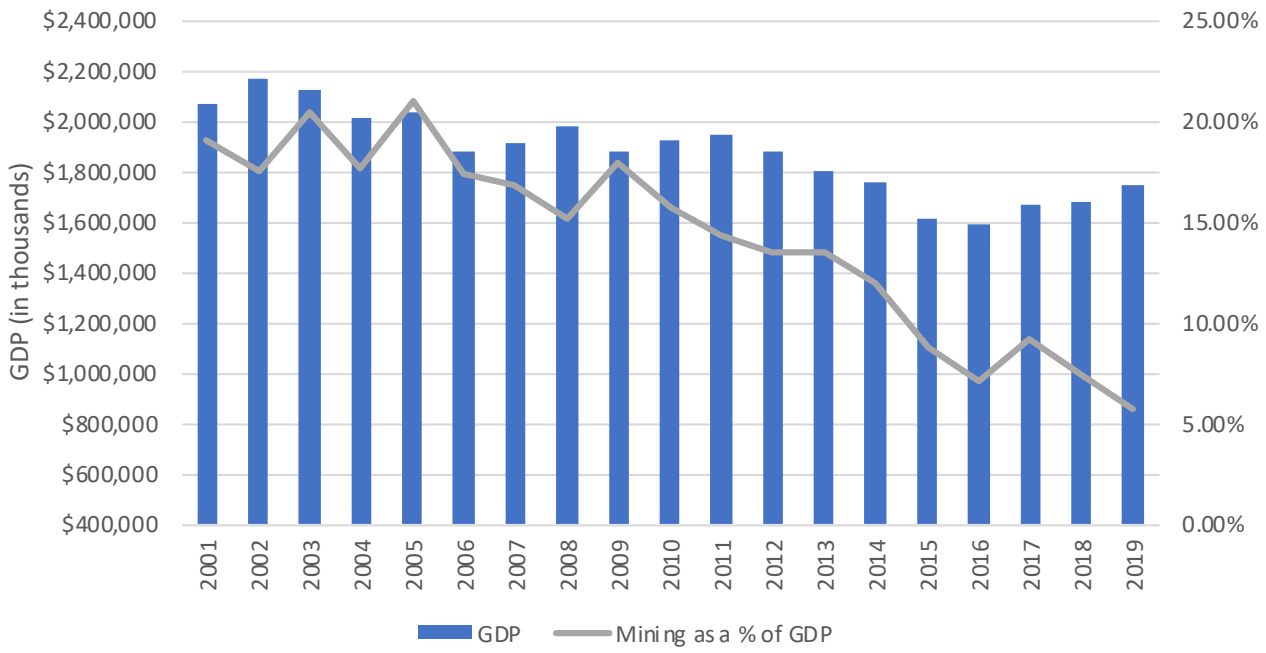

Figure 7: Routt County Real GDP and Percent of Mining GDP

LEVEL OF ECONOMIC DIVERSITY: ROUTT COUNTY

Industrial Diversification

GDP data shows how industries contribute to total output. Another dataset that provides insight into wages and jobs is the Quarterly Census of Employment and Wages. This dataset collects information from firms that send quarterly information to the federal government about unemployment insurance. The data source is very accurate for the firms that respond to the survey, but it omits farming and sole proprietors who are exempt from unemployment insurance. However, it works well for assessing wages changes, average wages, and contributions to economic output as viewed by wages. The data for Routt County shows that the top wage contributors are healthcare, construction, and accommodation and food services. Mining is 13th on the list and utilities is 14th, but each have high average weekly wages of $1609 and $1,838, respectively. The highest weekly wages are in finance and insurance ($1,904).

NAICS SECTOR	Average Employment 2019	Total Quarterly Wages 2019	Average Weekly Wage 2019
Total, All Industries	15,585	$711,972,082	$879
Health Care and Social Assistance	1,734	$98,174,661	$1,089
Construction	1,295	$68,701,498	$1,020
Accommodation and Food Services	2,368	$63,771,456	$518
Administrative and Waste Services	957	$58,639,962	$1,178
Retail Trade	1,674	$58,045,016	$667
Public Administration	900	$50,950,243	$1,089
Arts, Entertainment, and Recreation	1,629	$44,837,596	$529
Real Estate and Rental and Leasing	1,028	$44,090,867	$825
Educational Services	1,028	$37,420,205	$700
Professional and Technical Services	586	$36,136,710	$1,186
Finance and Insurance	315	$31,182,344	$1,904
Wholesale Trade	350	$25,980,905	$1,428
Mining	304	$25,430,255	$1,609
Utilities	175	$16,727,842	$1,838
Other Services, Ex. Public Admin	438	$15,385,764	$676
Transportation and Warehousing	307	$11,726,797	$735
Information	173	$8,954,733	$995
Manufacturing	142	$6,417,605	$869
Management of Companies and Enterprises	50	$4,872,526	$1,874
Agriculture, Forestry, Fishing & Hunting	133	$4,519,097	$653

Table 11: Routt County Quarterly Census and Employment Wages (2019) [17]

Figure 8 illustrates oil, gas, and mining jobs overlaid with the percentage of jobs in these industries over time. Figure 9 illustrates the same concept using wages instead of jobs. Each of these graphs show the magnitude that coal and oil and gas have on the Routt economy, with the jobs graph falling since the peak of 2012. The percentage of total wages that mining contributes has fallen the most in the last 10 years.

[17] Source: Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages.

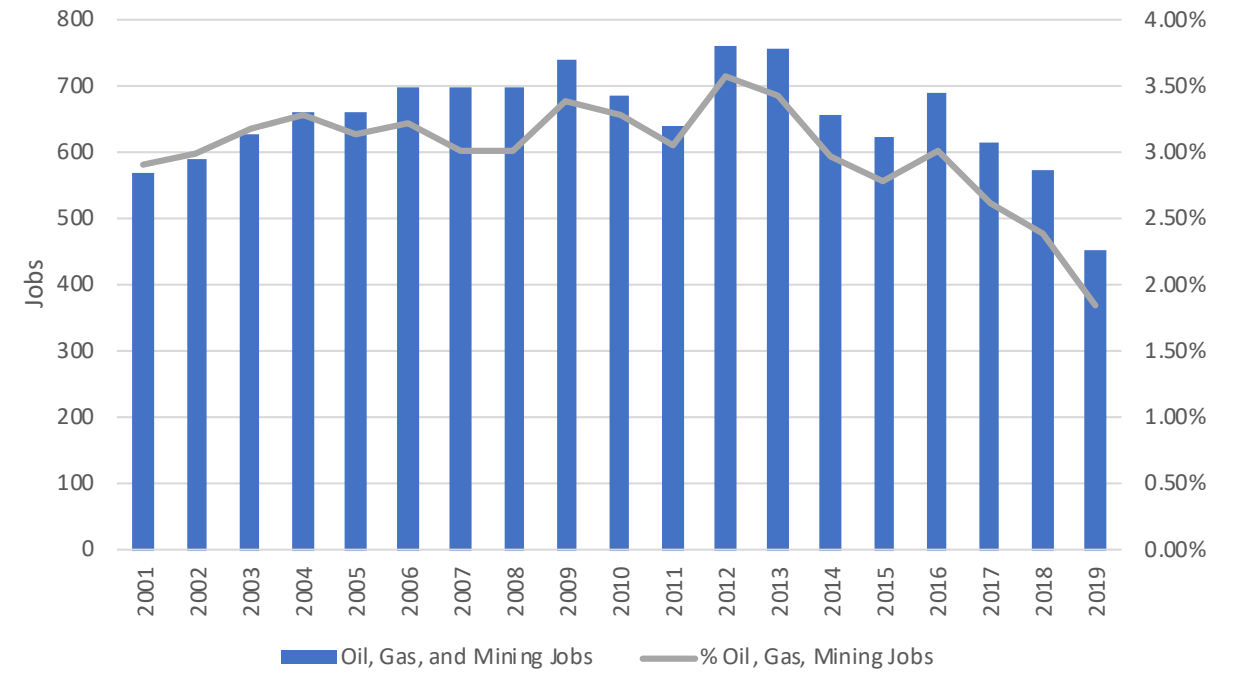

Figure 8: Oil, Gas, and Mining Jobs Total Change and Percentage Change [18]

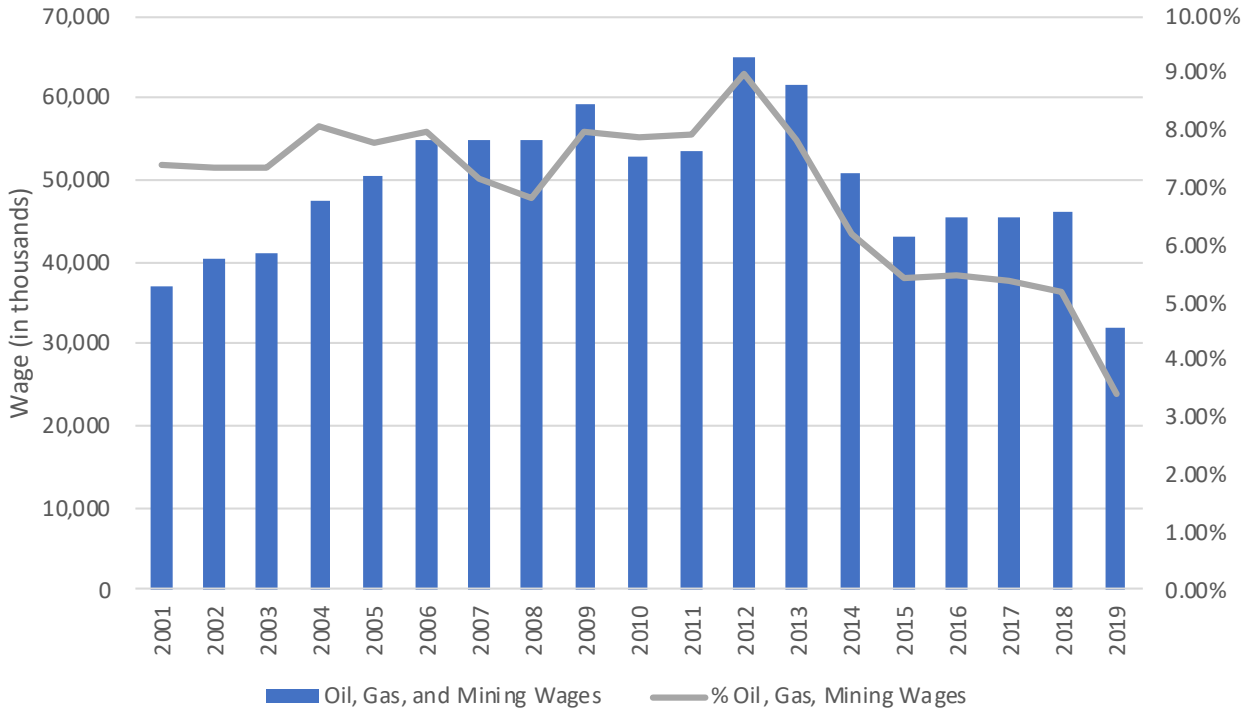

Figure 9: Oil, Gas, and Mining Wages Total Change and Percentage Change [19]

[18]Source: Bureau of Economic Analysis

[19]Ibid.

A Hachman Index measured for Routt County compared to the rest of Colorado illustrates the level of economic diversity in the region. As mentioned before, the Hachman Index goes from 0-1. A rating of 1 indicating the same level of industrial diversity as the comparison region, while 0 indicates the opposite. Figure 10 shows the Hachman Index for Routt County over the last 10 years. The most recent measurement for 2019 was 0.755. For comparison purposes, Mesa County has a Hachman Index of 0.8941. An index of 0.755 indicates that Routt County has a diverse economy when compared to Moffat and Rio Blanco Counties, but less diverse when compared to Mesa County. The general trend the last 10 years is that Routt's Hachman Index is steady, staying right around .755.

The key point to many extractive based economies is to have non-extractive industry job growth. Figure 11 illustrates mining/gas employment and non-mining/gas employment. Mining and gas employment has fallen since 2012 and now makes up a significantly smaller portion of the Routt economy. Meanwhile, non-mining and gas employment has risen since 2010, demonstrating that the non-mining sectors are growing and creating more economic opportunities outside of mining.

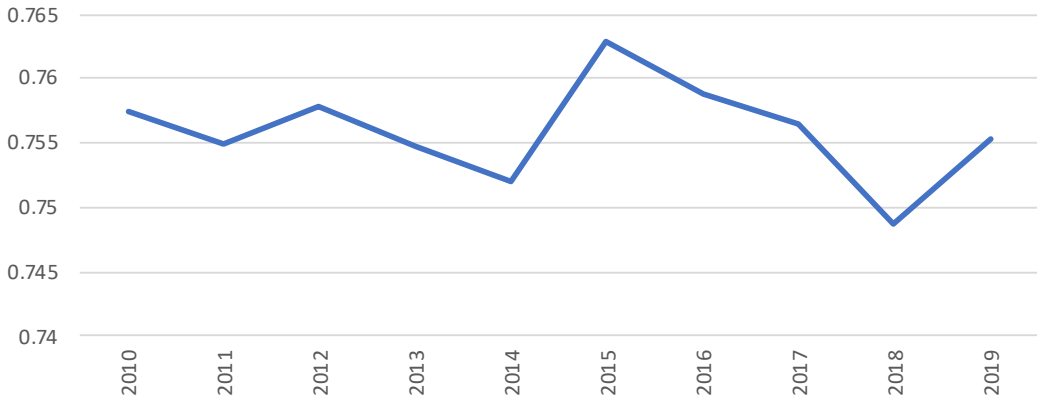

Figure 10: Routt County Hachman Index

County	Hachman Index
Moffat	.445
Rio Blanco	.364
Routt	.755
Mesa	.894
Montrose	.757
Delta	.556

Table 12: Hachman Index Comparison (Western Slope)

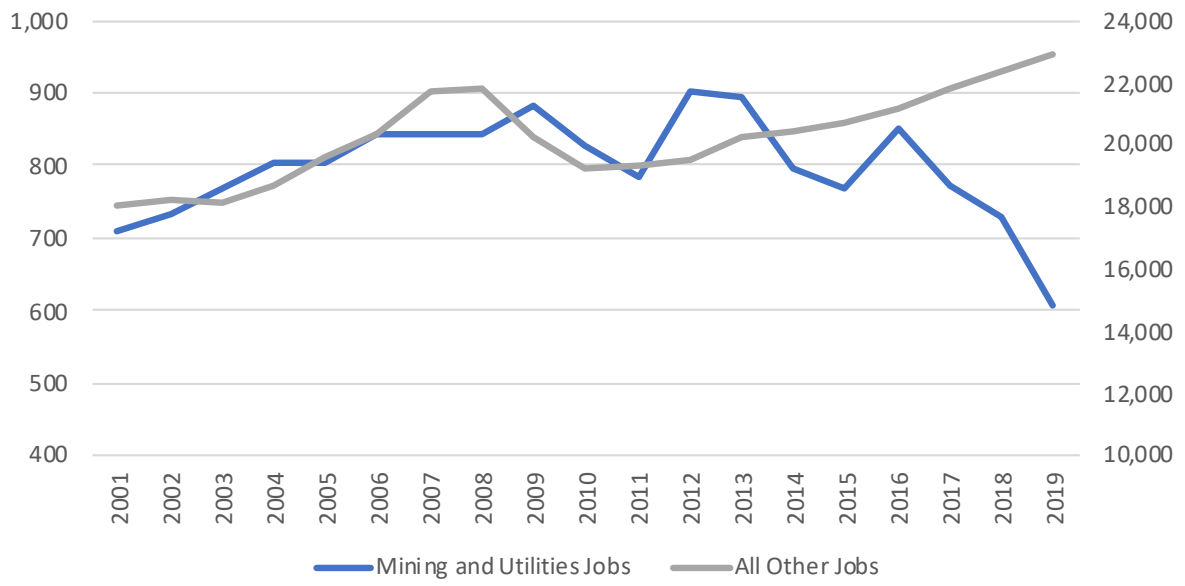

Figure 11: Mining/Gas Compared to Non-Mining/Gas Employment in Routt County [20]

RIO BLANCO COUNTY

DEMOGRAPHIC INFORMATION: RIO BLANCO COUNTY

Rio Blanco County is in northwest Colorado (south of Moffat County, west of Routt County, north of Garfield County, and east of Uintah County in Utah). Rio Blanco County's population was 6,307 as of 2019 and it has been in decline since the peak of the oil and gas boom. Table 21 illustrates the population forecast from the Colorado State Demography Office. This illustrates expected population declines in Rio Blanco County as they transition away from coal, oil, and gas.

Rio Blanco's economic output (as measured by GDP) peaked in 2009 with the oil and gas boom at $963,342,000. The 2019 GDP number was $740,595,000 (76% of the peak). Despite falling GDP, Rio Blanco's median household income continues to rise with 2019 numbers at $65,960 (Table 13). Rio Blanco's education level (measured as a bachelor's degree or higher) is 17.6%, which is significantly lower than Colorado's rate of 42.7%. The percentage of Rio Blanco County residents who have graduated from high school is 88.7%, close to Colorado's state percentage of 92.4%. Rio Blanco's poverty estimate is slightly higher than Colorado's (12.2% versus 9.4%,). Rio Blanco, like the rest of Northwestern Colorado, has a high white population percentage of 93.7%. Other races include Hispanic (10.7%), Black (1.2%), and American Indian or Alaskan Native (1.5%).

[20] Source: Bureau of Economic Analysis

	2018	2019
Population	6,333	6,307
Real Gross Domestic Product	$689,175,000	$740,595,000
GDP Per Capita	$108,822	$117,424
Median Household Income	$63,411	$65,960
Education (Bachelor's Degree or Higher)	20.2%	22.7%
Education (High School or Higher)	92.8%	91.9%
% Of People Under Poverty Line	10.8%	10.3%

Table 13: Rio Blanco County Overview[21]

Race/Ethnicity	Percentage
White alone	93.7%
Black	1.2%
American Indian and Alaskan Native alone	1.5%
Asian alone	0.7%
Native Hawaiian and other Pacific Islander alone	0.1%
Two or more races	2.7%
Hispanic or Latino	10.7%
White alone, not Hispanic or Latino	84.2%

Table 14: Rio Blanco County Demographics[22]

Age/Gender	Percentage
Under 5 years old	6.0%
Under 18 years old	24.3%
Over 65 years old	16.4%
Between 18 and 65	59.3%
Female	48.8%
Male	51.2%

Table 15: Rio Blanco Population Age and Gender

[21] Source: U.S. Census Bureau (USCB). Regional GDP is from the Bureau of Economic Analysis (BEA). Census poverty estimates are from the Small Area Income and Poverty Estimates (SAIPE).

[22] Source: U.S. Census Bureau (USCB)

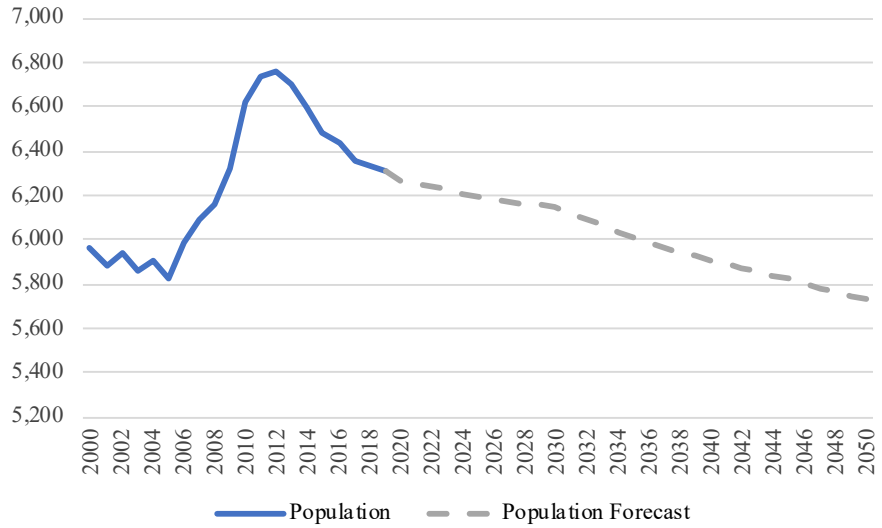

Figure 12: Rio Blanco County Population Forecast [23]

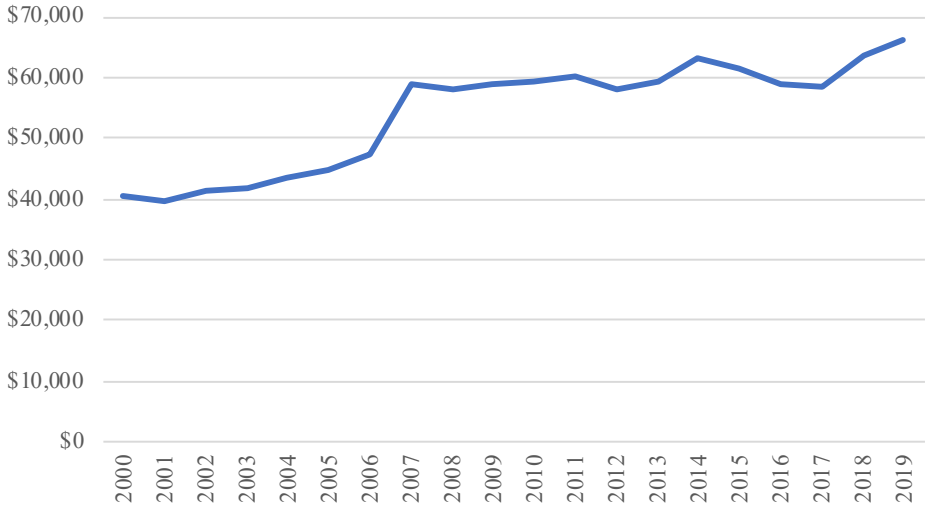

Figure 13: Rio Blanco County Median Household Income [24]

INDUSTRIAL COMPOSITION AND EMPLOYMENT: RIO BLANCO COUNTY

The economy of Rio Blanco County is highly reliant on energy extraction. As of 2019, 67.89% of Rio Blanco's GDP results from oil, gas, or coal. It is important to note that different parts of Rio Blanco County support different industries economically. The western part of Rio Blanco (where Rangely is located) is more exposed to coal, as it occupies the same coalfields as southern Moffat. With the town of Meeker located near the oil and gas activity of northern Garfield County, the eastern part of Rio Blanco is more exposed to these resources. Trailing behind the oil, gas, and coal industry is government, which equates to 9.55% of economic output. Finance, insurance and real estate are the third biggest sectors by output at 8.67%. Beyond these, no one industry occupies more than 3% of GDP.

[23] Source: Colorado State Demography Office

[24] Source: U.S. Census Bureau

	2018	2019	% Change	% of Total GDP
All industry total	$689,175	$740,595	7.46%	
Private industries	$607,540	$664,117	9.31%	89.67%
Agriculture, forestry, fishing and hunting	N/A	$2,986	N/A	0.40%
Mining, quarrying, and oil and gas extraction	$466,663	$502,778	7.74%	67.89%
Utilities	N/A	$6,651	N/A	0.90%
Construction	$12,573	$14,400	14.53%	1.94%
Manufacturing	$3,905	$3,716	-4.84%	0.50%
Wholesale trade	N/A	N/A	N/A	N/A
Retail trade	$9,485	$9,662	1.87%	1.30%
Transportation and warehousing	$8,514	$14,358	68.64%	1.94%
Information	$1,509	$1,891	25.31%	0.26%
Finance, insurance, real estate, rental, and leasing	$56,209	$64,187	14.19%	8.67%
Finance and insurance	$4,981	$4,788	-3.87%	0.65%
Real estate and rental and leasing	$51,582	$60,073	16.46%	8.11%
Professional and business services	$15,913	$16,986	6.74%	2.29%
Professional, scientific, and technical services	$2,769	$2,879	3.97%	0.39%
Management of companies and enterprises	$0	$0	N/A	0.00%
Administrative and support and waste management and remediation services	$13,115	$14,065	7.24%	1.90%
Educational services, health care, and social assistance	$2,181	$2,411	10.55%	0.33%
Educational services	$23	$24	4.35%	0.00%
Health care and social assistance	$2,163	$2,392	10.59%	0.32%
Arts, entertainment, recreation, accommodation, and food services	$8,955	N/A	N/A	N/A
Arts, entertainment, and recreation	$2,544	N/A	N/A	N/A
Accommodation and food services	$6,462	N/A	N/A	N/A
Other services (except government and government enterprises)	$4,798	$4,781	-0.35%	0.65%
Government and government enterprises	$72,522	$70,725	-2.48%	9.55%

Table 16: Rio Blanco GDP by Industry[8]

[8] Source: Bureau of Economic Analysis

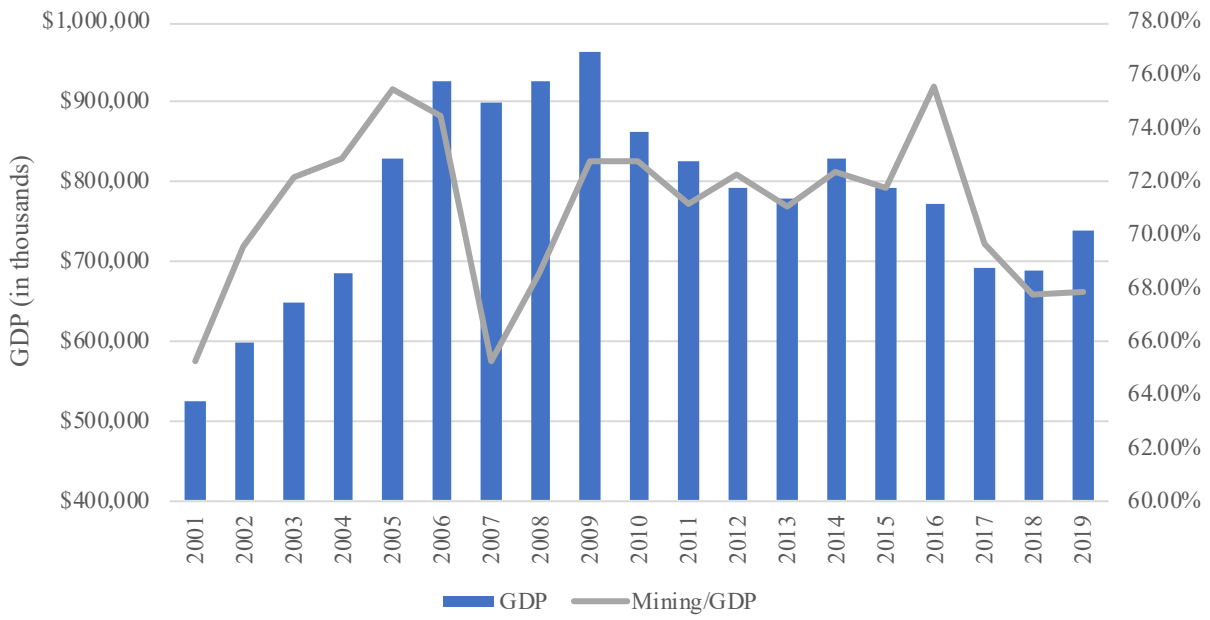

Figure 14: Rio Blanco County Real GDP and Mining GDP

LEVEL OF ECONOMIC DIVERSITY: RIO BLANCO COUNTY

The GDP data illustrates how industries contribute to total output. Another dataset that provides insight into wages and jobs is the Quarterly Census of Employment and Wages dataset. This dataset collects information from firms that send quarterly information to the Federal government about unemployment insurance. This data source is very accurate for the firms it includes. However, the data omits farming and sole proprietors, which are exempt from unemployment insurance. Therefore, this dataset includes about 75% to 90% of the employment and wages for a particular county. Additionally, it works well for assessing wage changes, average wages, and contributions to economic output as viewed by wages. Table 17 shows that mining (representing coal, oil, and gas) is by far the largest wage contributor, totaling 33.5% of wages and 18.4% of employment. Mining has an average weekly wage of $1,871, which is considerably higher than every other industry except utilities. Public administration (government) and healthcare are the next largest contributors. However, their contribution still does not come close to mining, paying roughly half the average weekly wage of that sector.

NAICS SECTOR	Average Employment 2019	Total Quarterly Wages 2019	Average Weekly Wage 2019
Total, All Industries	2,865	$152,809,527.00	$1,026.00
Mining	526	$51,165,286.00	$1,871.00
Public Administration	425	$18,536,748.00	$839.00
Health Care and Social Assistance	335	$16,145,241.00	$927.00
Educational Services	308	$12,145,599.00	$758.00
Construction	215	$12,012,224.00	$1,074.00
Administrative and Waste Services	154	$8,397,759.00	$1,049.00
Transportation and Warehousing	74	$5,293,809.00	$1,376.00
Utilities	46	$4,888,126.00	$2,044.00
Retail Trade	191	$4,360,831.00	$439.00
Accommodation and Food Services	194	$4,171,816.00	$414.00
Other Services, Ex. Public Admin	68	$3,272,306.00	$925.00
Arts, Entertainment, and Recreation	123	$3,072,410.00	$480.00
Agriculture, Forestry, Fishing & Hunting	41	$2,467,531.00	$1,157.00
Finance and Insurance	41	$1,867,439.00	$876.00
Professional and Technical Services	38	$1,816,640.00	$919.00
Manufacturing	35	$1,285,062.00	$706.00
Information	25	$831,473.00	$640.00
Real Estate and Rental and Leasing	21	$749,055.00	$686.00
Wholesale Trade	N/A	N/A	N/A

Table 17: Rio Blanco County Quarterly Census and Employment Wages (2019) [25]

Figure 15 illustrates oil, gas, and mining jobs overlaid with the percentage of jobs that fall into those categories over time. Figure 16 illustrates the same concept using wages instead of jobs. Each of these graphs show the magnitude that coal, oil, and gas have on the Rio Blanco economy. These jobs have largely decreased since their peak in 2008, experiencing a with a slight uptick in 2019 for the first time in 10 years. However, the wages graph is more consistent and shows a slight increase among these industries during past few years.

[25] Source: Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages.

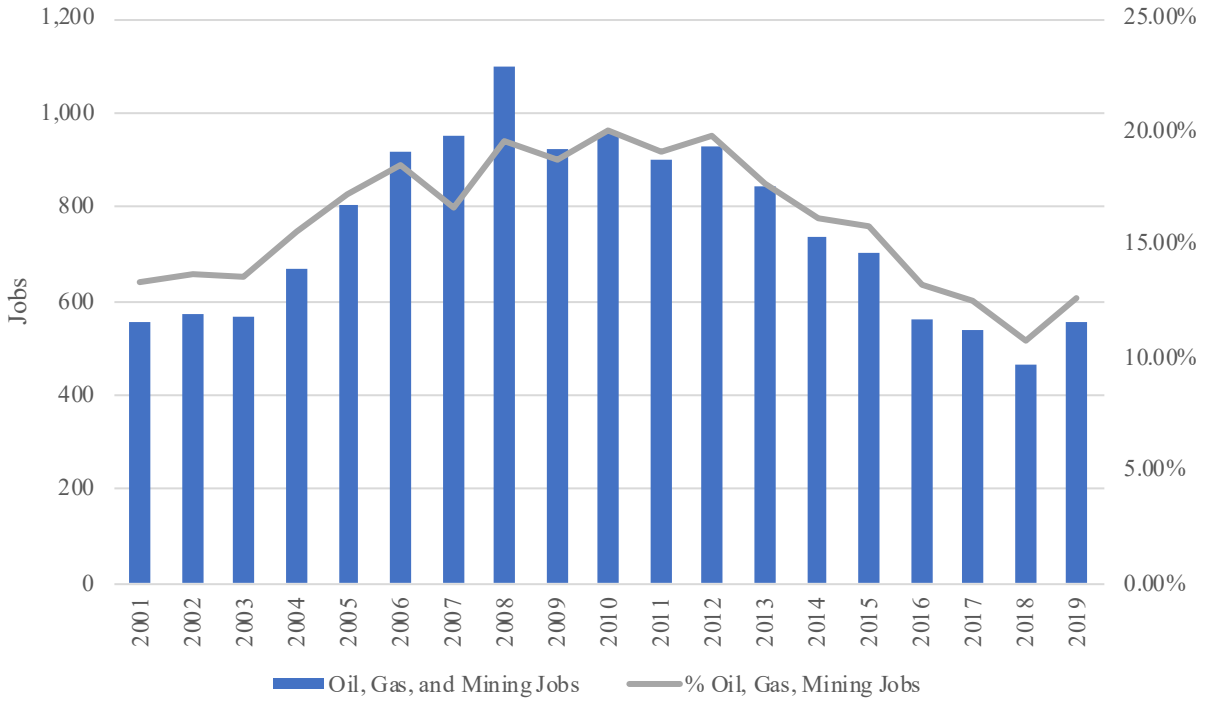

Figure 15: Oil, Gas, and Mining Jobs Total Change and Percentage Change [26]

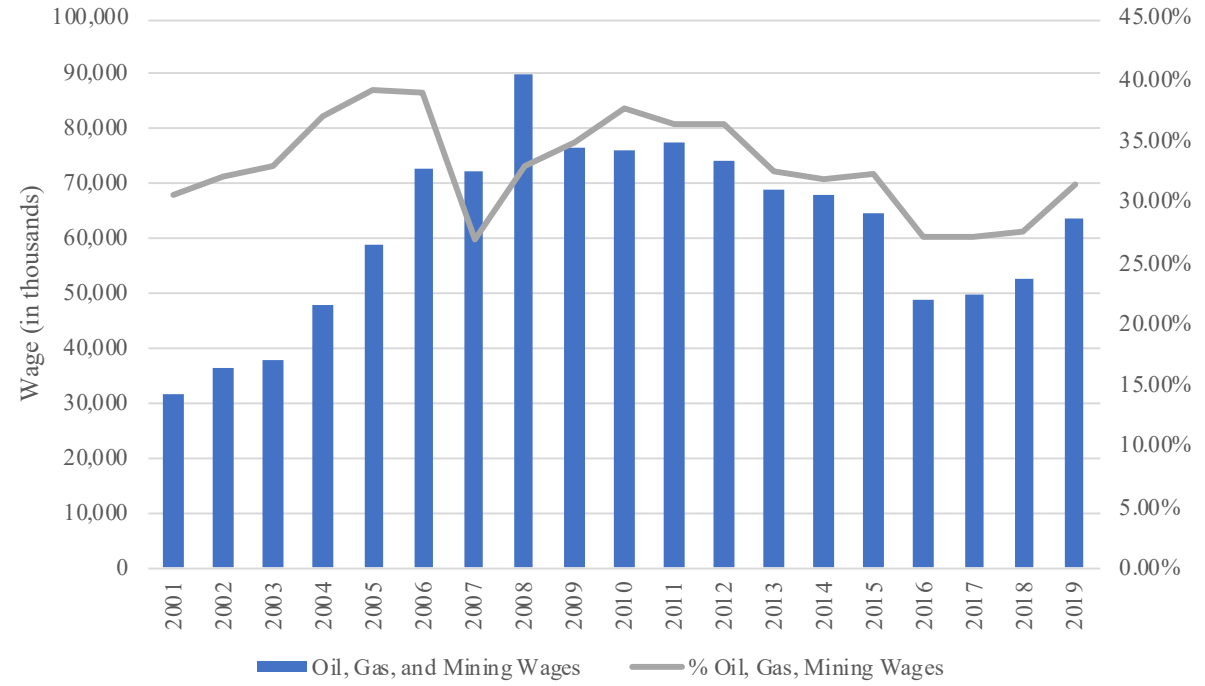

Figure 16: Oil, Gas, and Mining Wages Total Change and Percentage Change [27]

[26] Source: Bureau of Economic Analysis

[27] Source: Bureau of Economic Analysis

The Hachman index below compares the industrial diversification of Rio Blanco County to the rest of Colorado. The Hachman index is a measure of regional economic diversity that compares a target region (such as a state) to a larger geographic area (say the nation) as a comparison. The Hachman Index ranges from 0-1, with 1 indicating the same level of industrial diversity as the comparison region and 0 indicating the opposite. Figure 17 illustrates the Hachman Index for Rio Blanco County over the last 10 years. The most recent measurement for 2019 data is 0.364. For comparison purposes, Mesa County has a Hachman Index of 0.8941. An index of 0.364 indicates that Rio Blanco County is not very diverse and has a high industry concentration when compared to the rest of the state. However, the general trend over the last 10 years is that Rio Blanco is becoming more diversified. This calculation below is based on employment. If it was based on wages, it would likely show even less diversification because of the higher wages in mining, oil, and gas when compared to other industries. [28]

The key point to many extractive based economies is to have non-extractive industry job growth. Figure 18 illustrates mining/gas employment and non-mining/gas employment. Although mining and gas employment has fallen since 2008 (with a recent 2019 uptick), non-mining/gas employment has largely remained steady outside of the 2008 peak. This analysis shows that the recent increase in industrial diversification in the county is likely due to declines in the mining/gas industry, rather than other industries growing.

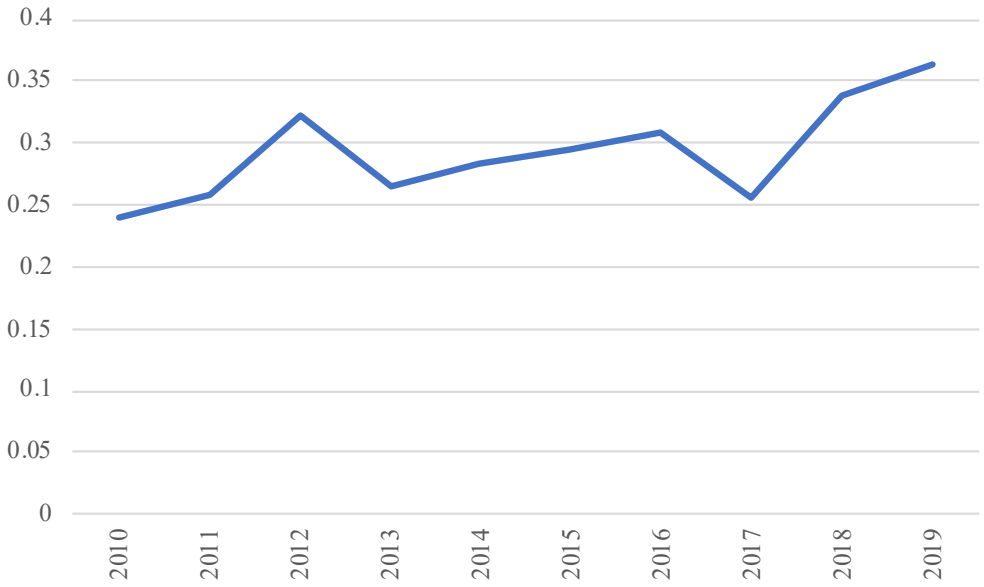

Figure 17: Rio Blanco Hachman Index [29]

[28] Data for the Hachman Index taken from the USCB American Community Survey (Employment Data 5-year Average). We utilized American Community Survey data instead of QCEW or BEA data because QCEW and BEA data omits industries that have too few companies reporting (such as utilities).

[29] Author Calculated. Data for the Hachman Index taken from the USCB American Community Survey (Employment Data 5-year Average). We utilized American Community Survey data instead of QCEW or BEA data because QCEW and BEA data omit industries that have too few companies reporting (such as utilities).

County	Hachman Index
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Rio Blanco	.364
Routt	.755
Mesa	.894
Montrose	.757
Delta	.556

Table 18: Hachman Index Comparison (Western Slope)

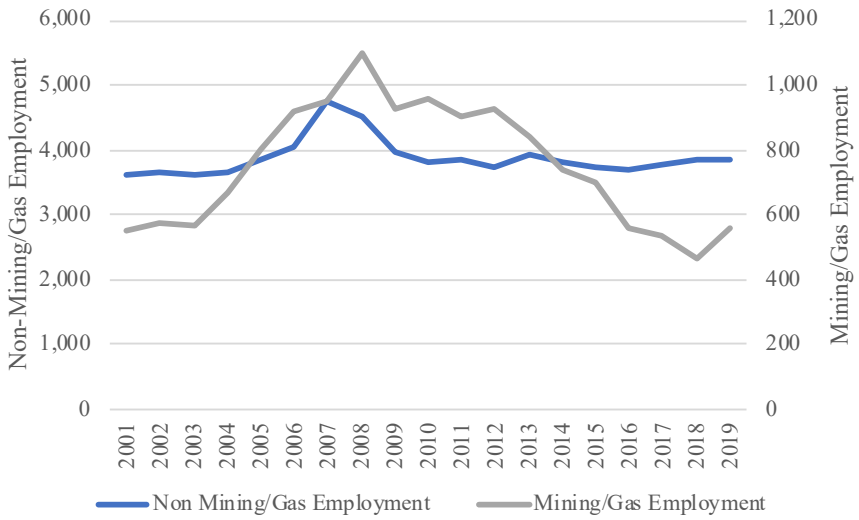

Figure 18: Mining/Gas Compared to Non-Mining/Gas Employment [30]

REGIONAL ECONOMIC CONTRIBUTION OF COAL

As NW Colorado transitions away from coal, there will be job, wage, and regional GDP losses that will take time to replace. One tool used to determine the effects of a region losing an entire industry is an economic contribution study. The actual economic contribution of the coal industry in Moffat County is more complicated than adding up the jobs at the mines and the power plants. Therefore, looking back at the total wage contribution of the industry is a better way to proxy its contribution to the economy. However, even this is too simple an approach to accurately model the contribution a key industry like coal has on Moffat County. Perry (2020) developed a model that measures more accurately the economic contribution of coal and coal power in NW Colorado.[1] This accounts for the direct employment effects of both the coal mines and coal power plants, the severance tax and FML contributions resulting from coal, and the coal related ad valorem tax collected.

[30] Source: Bureau of Economic Analysis

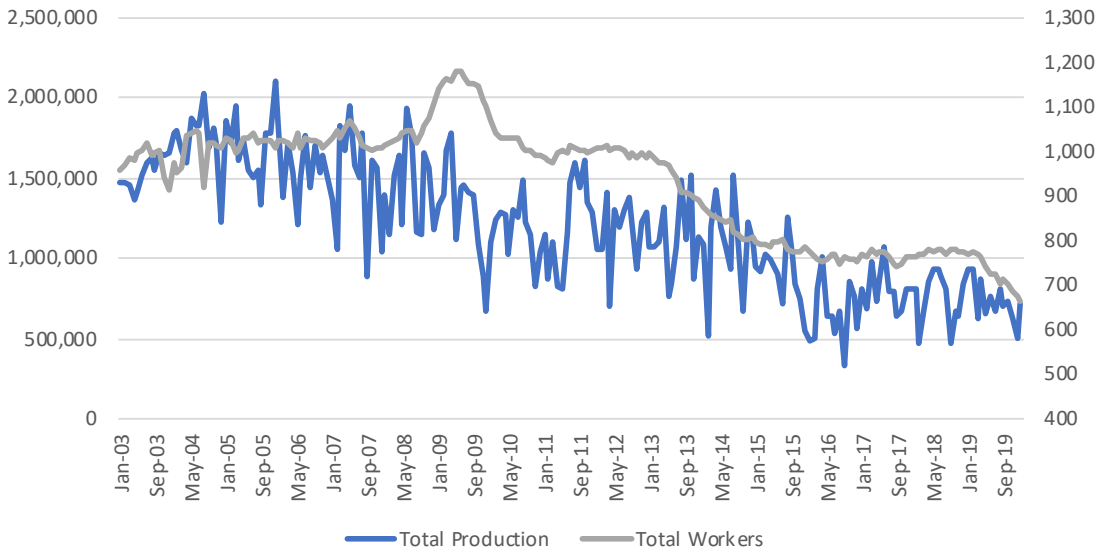

Figure 19: Employment and Coal Production at Trapper and Colowyo Mines (2003-2020) [31]

Direct coal and coal power plant employment is 1,183, meaning there are 1,183 people employed in the coal mines and coal power plants in the three-county region. This does not consider supply chain effects and induced spending (multiplier) effects of this employment. This will be illustrated later in Table 25.

Severance and Federal Mineral Lease taxes are collected when coal is "severed" from the ground. Severance and Federal Mineral Lease contributions resulting from coal are distributed in a variety of ways. The first way is what is called direct distribution, and direct distribution has 3 types of contributions: Direct to local governments resulting from severance taxes, direct to local governments resulting from FML, and direct to school districts resulting from FML. Each of these are estimated in Perry (2020) and listed in Table 19 by the major categories of direct distribution.[2] The left column shows the total amount, while the right column shows the adjusted number, or the numbers that have been tied directly to coal. In addition to direct distribution, money flows from severance and FML taxes to the Energy Impact Assistance Fund. This fund allows municipalities to apply for funds for improvement projects. Table 20 illustrates these projects, and the adjusted amount column is the amount of each project that can be tied directly to coal. Finally, there is the State Public School Fund, which gets funds from FML. Table 21 shows the total amount, the amount that results from FML, and the amount that results directly from coal FML. Table 22 summarizes the severance and FML numbers for Moffat County. Finally, the model includes ad valorem taxes. Table 23 illustrates the ad valorem taxes collected resulting from the coal industry for all three counties. The total ad valorem tax that Moffat receives resulting from coal is $12,124,890.

[31] Source: Colorado Division of the Reclamation, Mining and Safety.

	TOTAL NUMBERS			ADJUSTED NUMBERS		
	SDD $	FML Muni/ County $	FML School District $	SDD $	FML Muni/ County $	FML School District $
Moffat	$559,697	$694,754	$59,054	$385,315	$478,293	$40,655
Rio Blanco	$784,917	$3,111,179	$264,450	$194,525	$771,041	$65,538
Routt	$638,027	$70,028	$5,952	$447,035	$49,066	$4,172
Totals	$1,982,640	$3,875,962	$329,457	$1,026,875	$1,298,399	$110,364
Grand Total			$6,188,059			$2,435,638

SDD $: Distribution that goes directly to local government budgets and is from severance taxes.
FML Muni/County $: Distribution to counties and municipalities from federal mineral lease taxes.
FML School District $: Distribution to school districts from federal mineral lease taxes.

Table 19: Direct Distributions for Moffat, Rio Blanco, and Routt Counties

County	Project Name	Grant Recipient	FML Award Amount	Severance Award Amount	Adjusted Amount
Moffat	Dinosaur Bio-Solid Removal Planning	Dinosaur, Town of	$20,000		$13,769
Moffat	Dinosaur Waste Water Treatment Plant- Phase IIIA	Dinosaur, Town of	$135,000		$92,939
Moffat	Moffat County Community Park Plan	Moffat County		$10,000	$6,884
Rio Blanco	Rangely Water & Gas Distribution System Improvements	Rangely, Town of	$209,000		$51,796
Rio Blanco	Eastern Rio Blanco County HSD Cheimcal Analyzer Lab Equp.	Eastern Rio Blanco Health Service Dist		$60,000	$14,870
Rio Blanco	Meeker Main Street Scholarship	Meeker, Town of		$2,500	$620
Routt	Town of Hayden Washington Street Lift Station Replacement	Hayden, Town of	$90,000		$63,059
Routt	Routt County Phippsburg WW Treatment Liner Replacement	Routt County	$150,000		$105,099
Routt	Timbers WSD Wastewater System Improvements	Routt County	$305,000		$213,699
Routt	NWCCOG Broadband Strategic Plan Implementation	Northwest Colorado Council of Governments		$103,347	$72,410
Routt	Routt County Priority-based Budgeting Program	Routt County		$50,000	$35,033
Routt	Steamboat Springs/Routt County Law Enforcement Facility	Steamboat Springs, City of		$1,000,000	$700,652
Routt	Steamboat Springs Main Street Scholarship	Steamboat Springs, City of		$2,500	$1,752

Table 20: Energy Impact Assistance Fund Awards for 2018

	Total School Funding	Proportion from FML	Proportion from Coal
Rio Blanco	$3,395,585	$53,404	$13,234
Moffat	$6,391,993	$100,530	$69,250
Routt	$14,203,054	$223,379	$156,510
Total	$23,990,632	$377,313	$238,993

Table 21: State Public School Fund FML Local Proportion

Type	Amount
Direct Distribution	$904,263
Energy Impact Assistance Fund	$113,592
State Public School Fund	$69,250
Total	$1,087,105

Table 22: Severance and Federal Mineral Lease Estimates for Moffat County [32]

	Moffat	Rio Blanco	Routt
Craig Station	$9,970,574		
Hayden Station			$5,203,532
Colowyo	$1,162,391	$135,717.35	
Trapper Mine	$991,925		
Blue Mountain Mine		$1,236,571.59	
Foidel Creek			$984,885
Total	$12,124,890	$1,372,289	$6,188,417

Table 23: Ad valorem taxes for Northwest Colorado [33]

[32] For details on how these estimates were derived, see Perry (2020).

[33] Data is from the Moffat, Rio Blanco, and Routt County Assessor's office's and is taken from Perry (2020).

The final model accounts for direct employment, indirect employment (supply chain effects), and induced spending effects to create a model of economic contribution. Direct coal employment, severance and FML, and ad valorem are all input into an economic contribution model. The study uses IMPLAN economic impact modeling software and the IMPLAN 2018 dataset. Table 24 illustrates the employment, wage, and GDP contribution of the coal industry in Moffat, Rio Blanco, and Routt Counties. For the combined region, if both coal power and coal mining are eliminated the model shows an estimated 2,862.47 jobs lost, with $228,392,533 in wages, and $621,433,561 in regional GDP. For Moffat County specifically, job losses are estimated at 1,398.47, wages losses at $109,992,178, and a regional GDP loss of $321,187,590. This equates to 19.83% of Moffat County employment and 46.99% of regional GDP. [34]

Impact Type	Employment	Labor Income	Regional GDP	Total Output
Direct Effect	1,441.94	$161,455,569	$487,461,651	$852,151,142
Indirect Effect	828.42	$45,778,909	$89,566,257	$215,505,299
Induced Effect	592.10	$21,158,054	$44,405,653	$79,291,455
Total Effect	2,862.47	$228,392,533	$621,433,561	$1,146,947,896

Table 24: The Economic Contribution of Coal in Moffat, Routt, and Rio Blanco Counties

Region	Employment	Labor Income	Regional GDP	Total Output	Employment % of Total	Regional GDP % of Total
Moffat	1,398.47	$109,992,178	$321,187,590	$632,428,130	19.83%	46.99%
Routt	1,074.79	$85,801,045	$199,947,246	$355,846,027	4.54%	11.16%
Rio Blanco	389.21	$32,599,310	$100,298,726	$158,673,740	9.07%	26.06%
Total Effect	2,862.47	$228,392,533	$621,433,561	$1,146,947,896	8.18%	21.73%

Table 25: Coal's Economic Contribution to Individual Counties

[34] Note that these results do not take into consideration any Colorado government programs or revenue backfill that may take place.

Impact	1 - Direct	2 - Indirect	3 - Induced	
Industry Display	Impact Employment	Impact Employment	Impact Employment	Impact Employment
21 - Coal mining	373.26	0.00	0.00	373.26
40 - Electric power generation - Fossil fuel	187.32	0.00	0.00	187.32
542 - * Employment and payroll of local govt, education	79.99	0.00	0.00	79.99
468 - Marketing research and all other miscellaneous professional, scientific, and technical services	0.24	62.81	2.54	65.59
544 - * Employment and payroll of local govt, other services	33.10	0.00	0.00	33.10
509 - Full-service restaurants	0.07	10.73	20.46	31.26
541 - * Employment and payroll of state govt, other services	30.15	0.00	0.00	30.15
447 - Other real estate	1.26	17.93	10.77	29.96
490 - Hospitals	0.00	0.00	27.51	27.51
510 - Limited-service restaurants	0.19	1.43	20.04	21.66
413 - Retail - Nonstore retailers	0.01	6.61	10.81	17.43
395 - Wholesale - Machinery, equipment, and supplies	0.06	16.81	0.32	17.19
469 - Management of companies and enterprises	0.00	14.70	1.70	16.40
476 - Services to buildings	0.60	12.29	2.98	15.87
456 - Accounting, tax preparation, bookkeeping, and payroll services	0.24	12.65	2.98	15.86
442 - Other financial investment activities	0.01	10.15	5.70	15.85
472 - Employment services	0.06	13.22	1.39	14.67
411 - Retail - General merchandise stores	0.00	1.09	12.90	13.99
406 - Retail - Food and beverage stores	0.00	0.43	13.19	13.63
512 - Automotive repair and maintenance, except car washes	0.13	2.81	9.70	12.64
396 - Wholesale - Other durable goods merchant wholesalers	0.09	9.73	1.69	11.50
418 - Transit and ground passenger transportation	2.21	2.88	6.32	11.41
455 - Legal services	0.13	8.76	2.17	11.07
60 - Maintenance and repair construction of nonresidential structures	0.46	9.87	0.61	10.95
525 - Private households	0.00	0.00	10.67	10.67
47 - Electric power transmission and distribution	0.00	10.47	0.19	10.67
445 - Insurance agencies, brokerages, and related activities	0.00	8.69	0.70	9.39
412 - Retail - Miscellaneous store retailers	0.02	0.36	8.96	9.34
20 - Oil and gas extraction	0.01	9.15	0.14	9.30
417 - Truck transportation	0.08	7.96	1.13	9.18

Table 26: Job Losses in Moffat County by Industry

This transition away from coal will happen over the next 16 years (Table 27). On the employment side, there will be coal miners and utility workers who retire, so taken over time as workers voluntarily retire, less workers will be impacted than the Perry 2020 model shows. However, the loss to GDP contribution will not change, leaving a large hole in the Moffat County economy.

Name	County	Estimated Retirement Date	Megawatts	Workers
Power Stations				
Craig Station 1	Moffat	2025	427	253 for units 1, 2, and 3
Craig Station 2	Moffat	End of 2029	410	
Craig Station 3	Moffat	End of 2029	448	
Hayden Station1	Routt	2030	220	100 for units 1 and 2
Hayden Station 2	Routt	2036	221	
Coal Mines [35]				
Deserado Mine	Rio Blanco	None		150
Foidel Creek Mine (20 mile Mine)	Routt	None		266
Trapper Strip	Moffat	End of 2029		172
Colowyo Coal Mine	Moffat	End of 2029		187

Table 27: Retirement Timeline for Moffat County Power Stations and Mines [36]

[35] Data for coal mine workers taken from Colorado Division of Reclamation, Mining, and Safety (2019 data).

[36] Taken from "Economic Transition in Northwest Colorado: The Economic Contribution of Coal Power and Coal Mining, and the Economic Impact of Solar Power and Natural Gas," by Nathan Perry, PhD, 2020.

As coalminers transition into other skillsets and careers, policymakers have an opportunity to assist them in this process. Table 28 illustrates EMSI job compatibility scores for NW Colorado. Each number represents a percent compatibility, with the top row showing coal worker job skill sets and the left column showing all the different job sets that have reasonable compatibility.[4] The table illustrates the median hourly earnings for each job category, estimated annual statewide job openings, and estimated annual openings regionally.

				Compatibility with existing positions							
	Median Hourly Earnings *	Estimated Annual Openings statewide	Estimated Annual Openings regionally	Maintenance & repair	General operations managers	Operating Engineers and Other Construction Equipment Operators	First-Line Supervisors of Construction Trades and Extraction Workers	Electricians	First-Line Supervisors of Mechanics, Installers, and Repairers	Excavating and Loading Machine and Dragline Operators, Surface Mining	Mobile Heavy Equipment Mechanics, Except Engines
Automotive Master Mechanics	$23.68	1,239	17	92		92	85	92		90	97
Automotive specialty Technicians	$22.94	1,341	19	94		88	81	90		88	94
Brownfield Redevelopment Specialists and Site Managers	$32.76	1,503	13						84		
Bus and Truck Mechanics and Diesel Engine Specialists	$24.91	547	5	95		93					
Business Continuity Planners	$38.14	5,146	23		92		80		82		
Business Teachers, Postsecondary	$37.79	3,610	9		83						
Compliance Managers	$46.87	1,726	13		91						
Computer Science Teachers, Postsecondary	$37.79	3,610	9		83						
Computer User Support Specialists	$27.17	1,428						83			
Construction and Building Inspectors	$32.02	557	5				93				
Construction Carpenters	$22.84	2,066	29	93		88		94		90	90
Criminal Justice & Law Enforcement Teachers, Postsecondary	$37.79	3610	9		83						
Electrical Power-Line Installers and Repairers	$45.17	230	9	94						91	
Electricians	$26.17	2,204	18	92		80	88	100	88	84	93
Energy auditors	$29.81	5,146	23	81			93	89	89		80
Energy brokers	$24.89	3,750	15				80				
Excavating and Loading Machine and Dragline Operators	$31.50	143	13	91				87			92

Farmworkers and Laborers, Crop	$18.99	2,109	26	87		93					
1st-Line Supervisors of Construction and Extraction Workers	$33.40	2,387	23	87	85	81	100	92	92	83	84
1st-Line Supervisors of Mechanics, Installers, and Repairers	$34.08	1,292	12				90				
1st-Line Supervisors of Office and Admin. Support Workers	$28.34	2,319	19				85		80		
1st-Line Supervisors of Production and Operating Workers	$31.66	862	5				95				
Forestry and Conservation Science Teachers, Postsecondary	$37.79	3,610	9		81						
General and Operations Managers	$52.66	3,627	31		100		88		87		
Geothermal Technicians	$18.24	544	8	90							
Government Property Inspectors and Investigators	$33.53	881	5				88				
Heating and Air Conditioning Mechanics and Installers	$25.15	1,019	12	95							
Heavy and Tractor-Trailer Truck Drivers	$23.32	3,544	33	89		95		84		94	89
Highway Maintenance Workers	$22.07	361	9	92						93	
Home Economics Teachers, Postsecondary	$37.79	3,610	9		84						
Industrial Machinery Mechanics	$28.72	518	6	93							
Inspectors, Testers, Sorters, Samplers, and Weighers	$21.65	768	5	91							
Licensing Examiners and Inspectors	$33.53	881	5				88				
Light Truck or Delivery Services Drivers	$18.78	2,252	12	88					86		
Loss Prevention Managers	$46.87	1,726	13		93						
Machinists	$22.64	542	1	94							
Maintenance and Repair Workers, General	$19.10	2,704	49	100				94			
Mobile Heavy Equipment	$26.54	582	10	94		89					

Mechanics, Except Engines											
Nursery Workers	$18.35	2,109	26	85		87					
Online Merchants	$38.15	5,649	23		91		80				
Operating Engineers/ Other Construction Equip Operators	$23.43	1,280	34	92			84	86		97	91
Pipe Fitters and Steamfitters	$24.86	1,265	17	94		90		94		91	93
Plumbers	$24.86	1,265	17	95		87		95		88	93
Refrigeration Mechanics and Installers	$25.15	1,019	12	92							
Refuse and Recyclable Material Collectors	$18.54	465	13	87							
Rough Carpenters	$22.84	2,066	29	92		89		92		91	89
Security Management Specialists	$38.14	5,146	23				84		88		
Security Managers	$46.87	1,726	13		91				88		
Service Unit Operators, Oil, Gas, and Mining	$23.72	551	4			88					
Solar Energy Installation Managers	$32.97	1,895	23	81	84		95	90	95		82
Supply Chain Managers	$46.87	1,726	14		93				81		
Sustainability Specialists	$38.14	5,146	23		91		83		80		
Telecommunications Equipment Installers and Repairers	$31.67	608	3	91							
Vocational Education Teachers, Postsecondary	$35.68	2,772	11		90		91	80	88		
Welders, Cutters, and Welder Fitters	$22.55	691	5	93							
Wind Energy Operations Managers	$46.80	1,503	13		92		92	83	94		
Wind Energy Project Managers	$46.87	1,726	13		93				86		

Table 28: EMSI Job Compatibility

DATA IS FROM EMSI, COURTESY OF THE COLORADO DEPARTMENT OF LABOR AND EMPLOYMENT, NORTHWEST WORKFORCE SUB-AREA

REGIONAL ECONOMIC IMPACT OF COVID 19

MOFFAT COUNTY

Moffat County performed relatively well during the COVID-19 pandemic through January 2021. Figure 20 illustrates the continued and initial unemployment claims for the county. This datapoint shows a big spike in unemployment claims (reaching as high as 160) during the late March-early April 2020 government induced shutdowns. During the summer months, the initial claims fell back down into the teens and increased later during the winter months. For comparison, initial weekly claims in 2019 averaged 8. The continued claims below represent the number of people who continue to file for unemployment. Continued claims averaged 60 in 2019 and peaked at 377 in late April 2020. As initial claims started to rise once again in November, continue claims increased with them.[5]

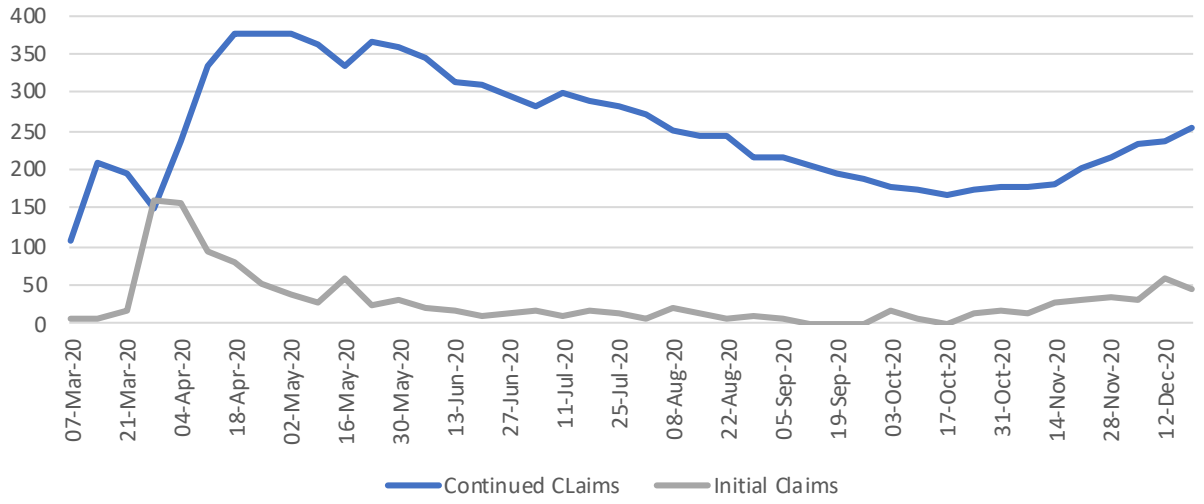

Figure 20: Moffat County Initial and Continued Unemployment Claims [37]

The increase in claims that occurred during late October are partially related to the increase in COVID-19 cases that began at the same time. Figure 21 illustrates Moffat County COVID-19 cases and their 7 day moving averages from March 2020 to April 2021. As can be observed, the numbers in Moffat County were very low until late October.

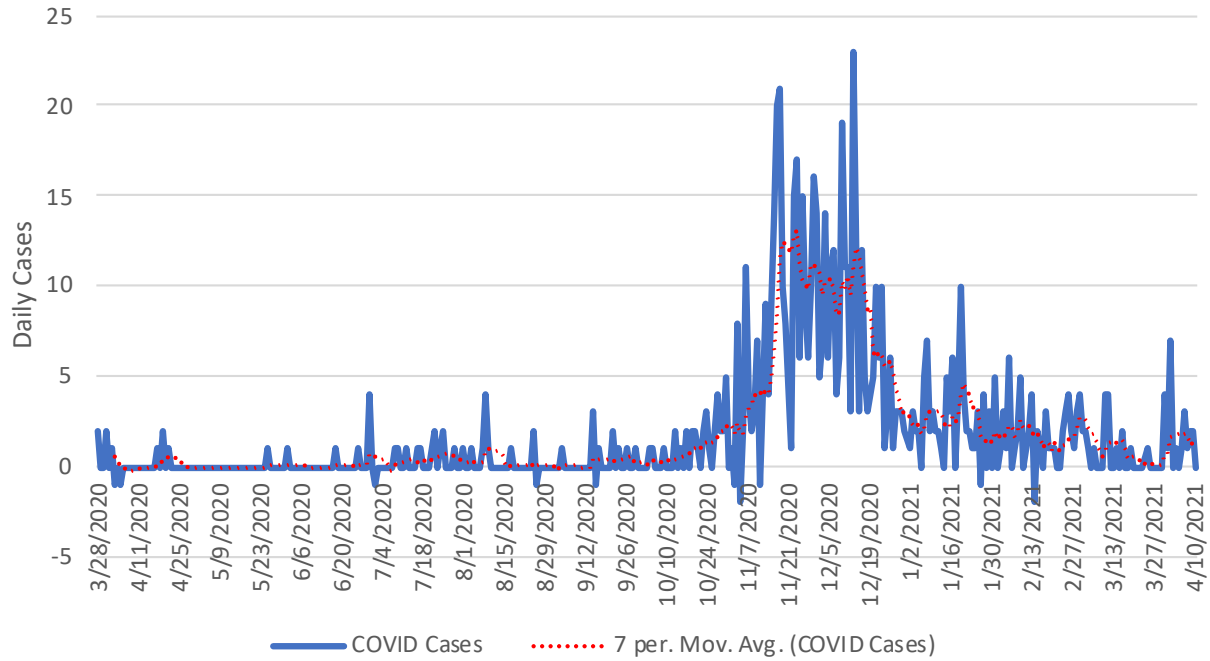

Figure 21: Moffat County COVID Cases (March 2020-April 2021) [38]

[37] Initial claims, continued claims, employment, unemployment, and labor force, unemployment rates, initial unemployment claims by industry, and QCEW data from the Colorado Department of Labor and Employment.

[38] Data from the Colorado Department of Public Health and the Environment (CDPHE).

Although initial unemployment claims rose during both the April shutdowns and the October COVID-19 spike, Moffat County's labor market data was relatively strong when compared to other areas. As of March 2021, the labor force and employment levels returned to pre-COVID levels in the county. Employment in February 2020 was 7,046, falling only slightly in February of 2021 at 6,930, a difference of 116. The labor force (the number of people willing and able to work who are actively seeking work) has risen from 7,351 in February of 2020 to 7,446 in February 2021.

The major difference that occurred during the pandemic is an increase in unemployment of almost 200 people occurring between February 2020 and February 2021. Moffat County is an area that experiences high seasonal unemployment fluctuations, as seen in the unemployment rate (Figure 22). Therefore, a portion of the spike in unemployment is unrelated to the pandemic. This can be observed between October 2017 and February 2018 when unemployment increased from 196 to 325 (by 131 people). Similarly, between October 2018 and February 2019, unemployment rose from 217 to 349 (an increase of 132). Typically, seasonal unemployment changes are around 130 between October and February. Therefore, an increase in unemployment from October 2020 to February of 2021 of 179 is not that far off from previous numbers. With this basic analysis we can estimate that approximately 50 of these are the result of changed consumer behavior, layoffs, and COVID-19 business shutdowns. Through this analysis we can conclude that the impact of COVID-19 over the winter months was relatively small in Moffat County.

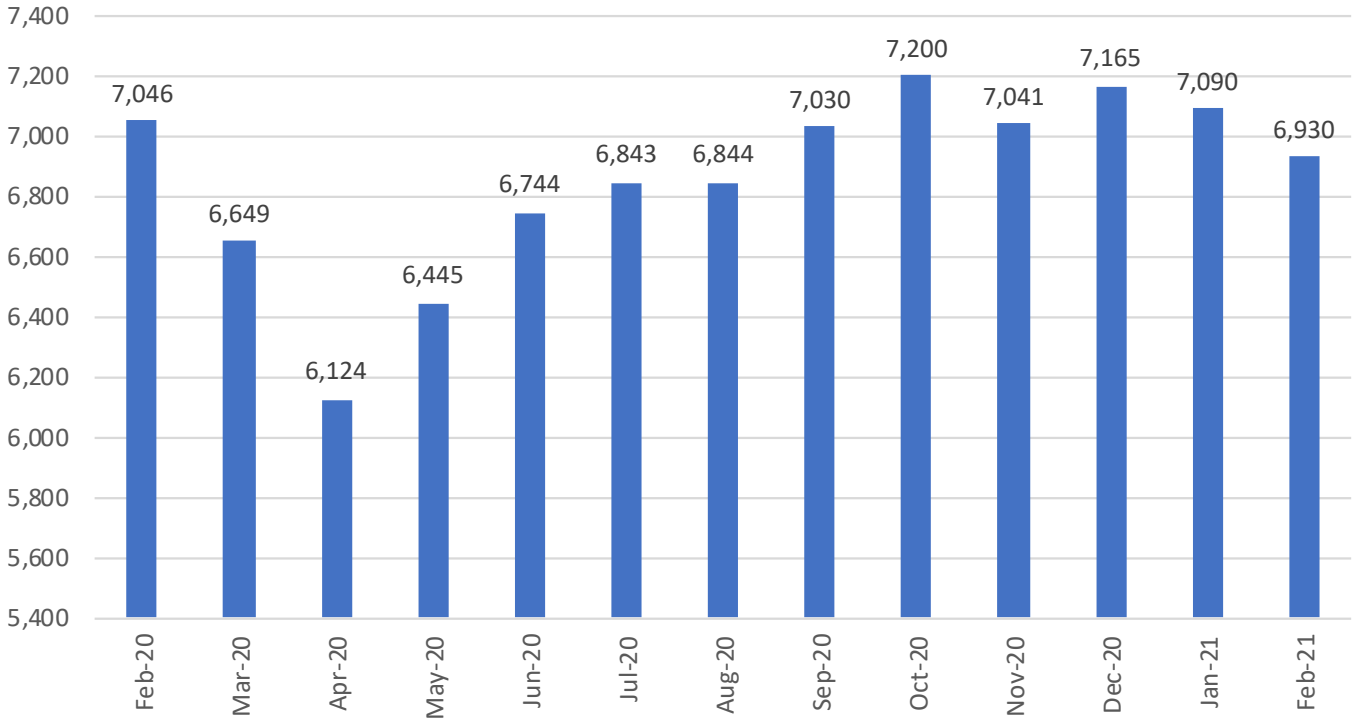

Figure 22: Moffat County Employment February 2020-February 2021

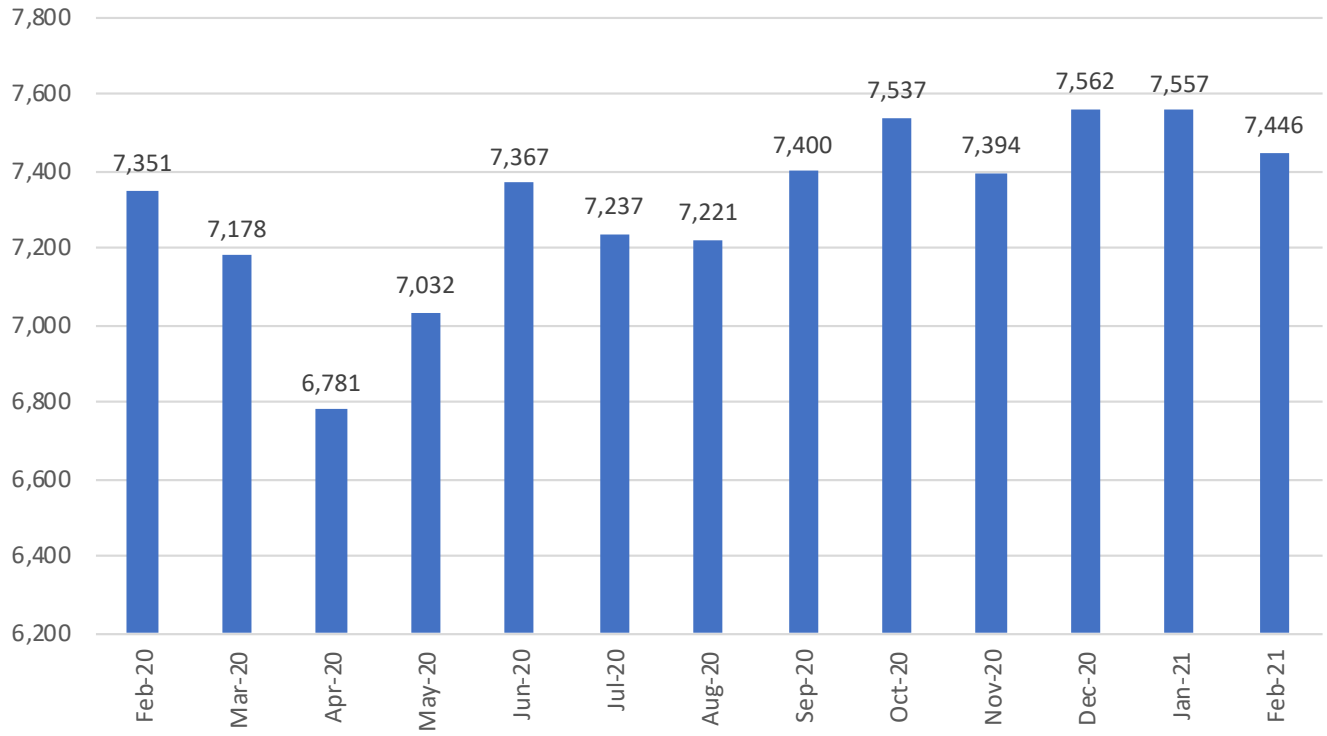

Figure 23: Moffat County Labor Force February 2020- February 2021

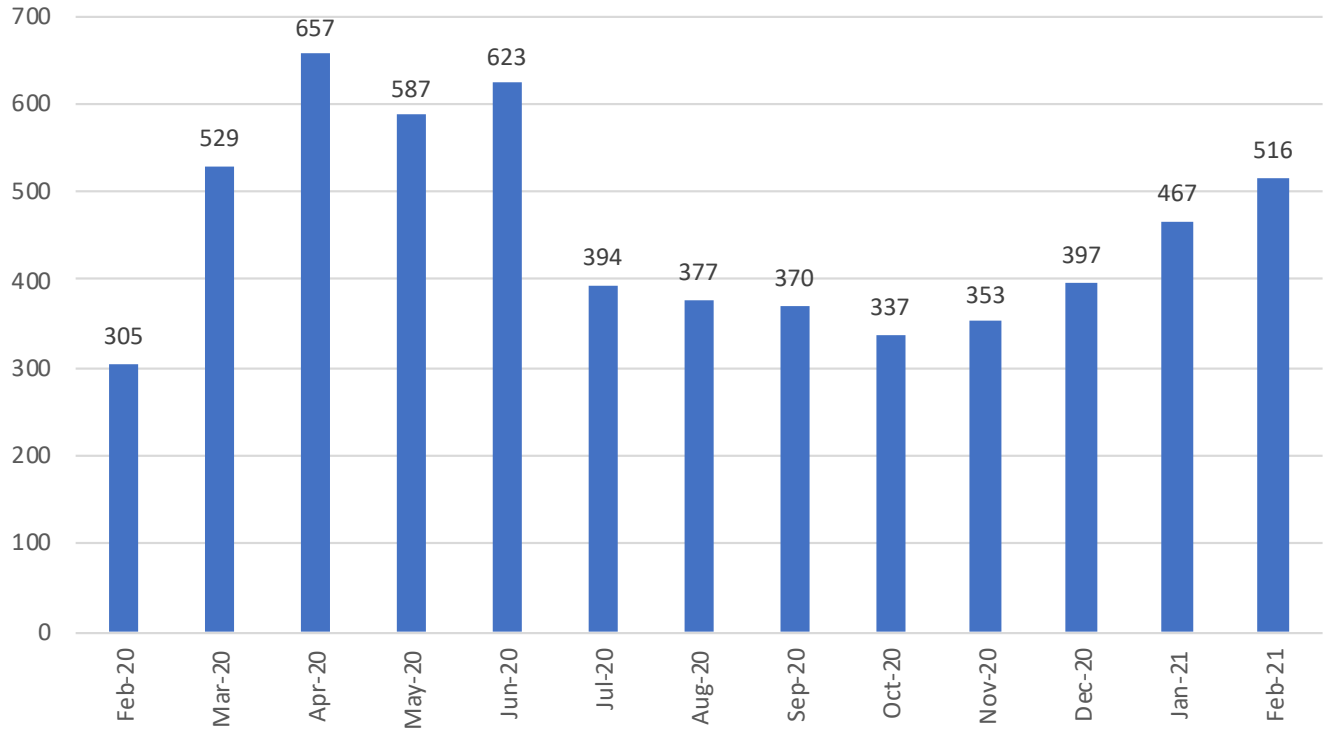

Figure 24: Moffat County Unemployment February 2020-February 2021

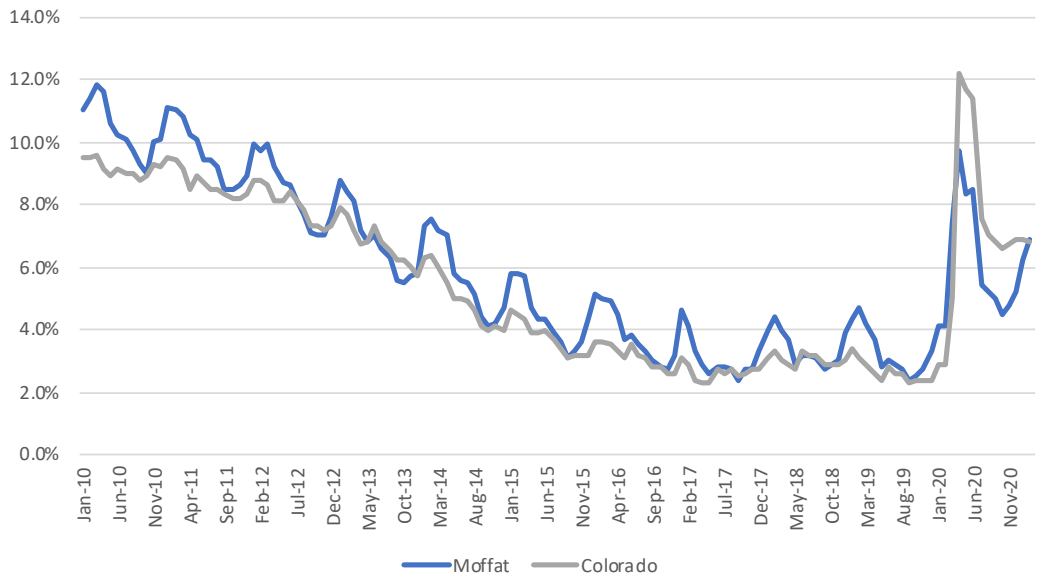

Figure 25: Moffat Count and Colorado Unemployment Rate

Industry Code		Claims 3/15/20 - 12/19/20	Initial Claims 3/15/20 - 12/19/20	Initial Claims in 2019	Initial Claims In 2019	COVID-19 Period vs. 2019
72	Accommodation and Food Services	114,104	21.7%	154	8.4%	2.6
62	Health Care and Social Assistance	61,614	11.7%	161	8.8%	1.3
44	Retail Trade	60,750	11.5%	141	7.7%	1.5
56	Administrative and Waste Services	37,989	7.2%	214	11.7%	0.6
23	Construction	32,695	6.2%	317	17.3%	0.4
31	Manufacturing	27,666	5.3%	104	5.7%	0.9
54	Professional and Technical Services	26,375	5.0%	150	8.2%	0.6
81	Other Services	26,264	5.0%	43	2.3%	2.1
71	Arts, Entertainment, and Recreation	26,250	5.0%	49	2.7%	1.9
61	Education Services	20,954	4.0%	44	2.4%	1.7
48	Transportation and Warehousing	18,878	3.6%	63	3.4%	1.0

42	Wholesale Trade	18,663	3.5%	76	4.2%	0.9
53	Real Estate, Rental, and Leasing	11,618	2.2%	37	2.0%	1.1
92	Public Administration	9,913	1.9%	90	4.9%	0.4
51	Information	9,771	1.9%	51	2.8%	0.7
52	Finance and Insurance	7,440	1.4%	62	3.4%	0.4
21	Mining	7,422	1.4%	29	1.6%	0.9
55	Management of Companies and Enterprises	4,620	0.9%	29	1.6%	0.6
11	Agriculture, Forestry, Fishing and Hunting	2,410	0.5%	17	1.0%	0.5
22	Utilities	625	0.1%	2	0.1%	0.9

Table 29: Colorado Industry Share of Initial Unemployment Claims
SOURCE: COLORADO DEPARTMENT OF LABOR AND UNEMPLOYMENT

Unfortunately, industry level unemployment claims are not available at the county level in Colorado; however, the state trends can be observed in Table 29. Accommodation and food services represent the largest share of initial claim filings (21.7%). This is followed by healthcare (11.7%) and retail trade (11.5%). The performance of these industries can be observed by their employment numbers. Figure 26 shows that retail trade in Moffat County is now higher than its Q1 2020 reduction. Additionally, accommodation and food services started trending back up in Q2 2020. As of early 2021, healthcare and social assistance still had not recovered. This was likely due to surgery and procedure delays that resulted from the pandemic.

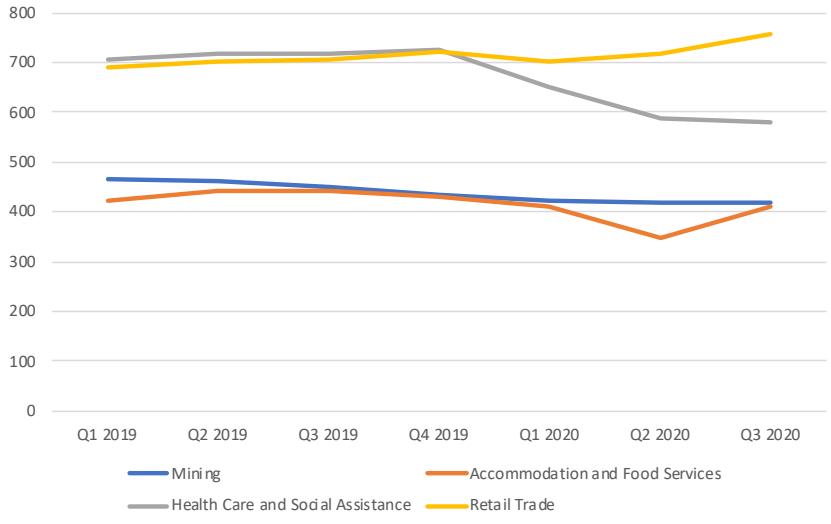

Figure 26: Employment in COVID Impacted Industries

Figure 27 illustrates the change in employment in Moffat County from Q3 2019 to Q3 2020, providing insight on the industries that were most impacted in Moffat County due to COVID-19. Healthcare, accommodation food services, and mining were three areas where job losses occurred. However, the losses in the mining sector likely had little to do with COVID-19 but are more likely associated with ongoing challenges in the coal sector. Despite these losses, gains did occur in retail trade, construction, and public administration. A similar trend exists when looking at changes in wages in the county. Though it should be noted that this is not the case with accommodations and food services, which have low wages and do not reflect as well as other sectors in these figures.

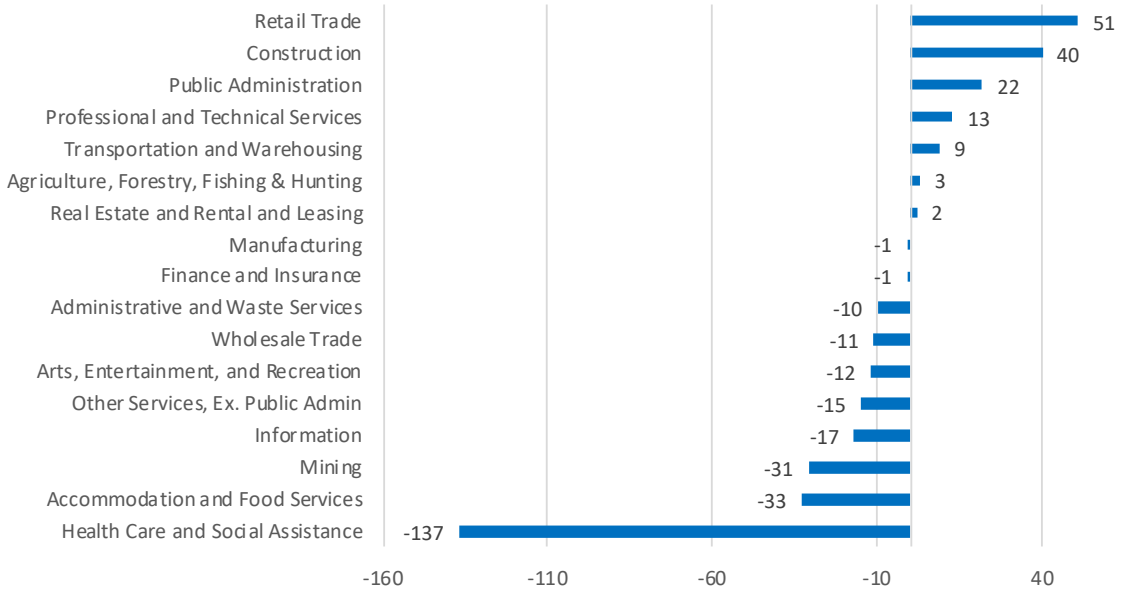

Figure 27: Change in Employment Q3 2019-Q3 2020

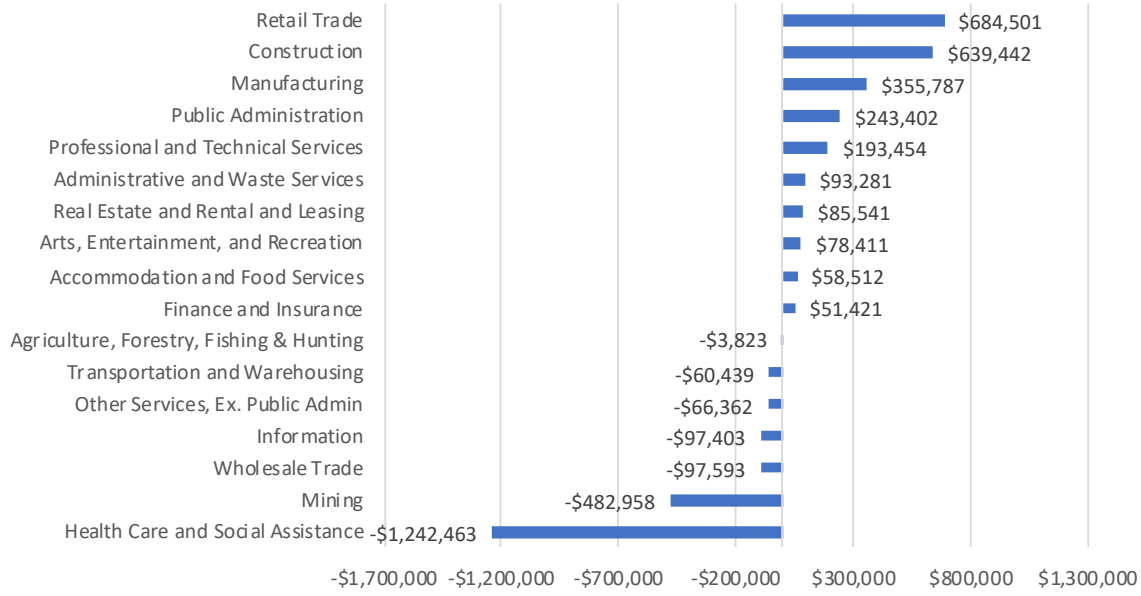

Figure 28: Wage Changes Q3 2019-Q3 2020

The most noticeable impact COVID-19 has had in Moffat County involved small business, which did have the same resources to survive economic downturns as large businesses. Figure 29 illustrates small business data on jobs and revenue for Moffat County. Revenue fell 49% while open businesses fell by 55%. Therefore, small businesses have taken the brunt of the economic damage and it may be some time until they recover to 2019 levels.[6]

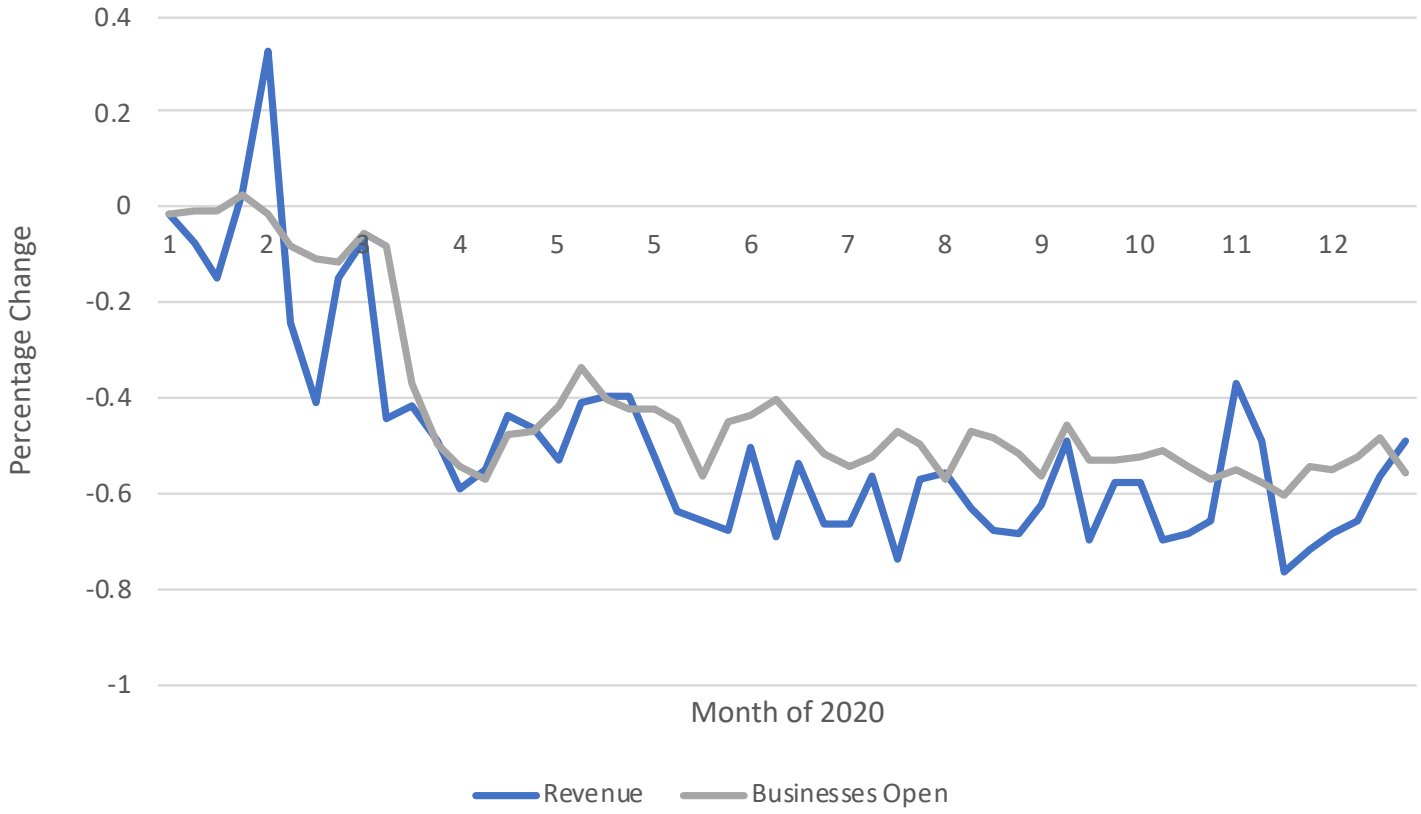

Figure 29: Small Business Revenue and Number of Small Businesses Open from January 2020-January 2021

RIO BLANCO COUNTY

Like the rest of the nation, Rio Blanco County's initial unemployment claims spiked during the government induced shutdowns that occurred during April 2020. The initial claims for that month spiked as high as 43 during the first week and quickly fell until they spiked again during late December. The weekly average of initial clams during 2019 was 4 per week. Average continued claims remained higher in 2020 when compared to 2019 (86 for 2020 and 19 for 2019).

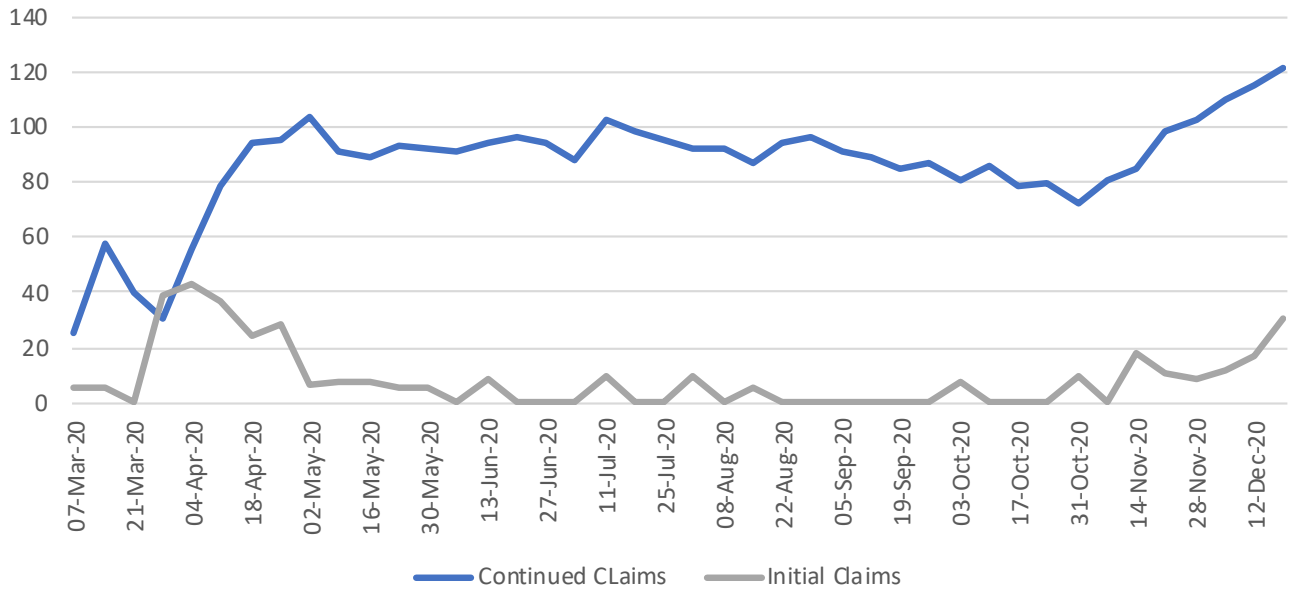

Figure 30: Rio Blanco County Initial and Continued Claims [39]

Like the rest of the state, COVID-19 cases spiked during the winter months, beginning in early November. Before October 2020, COVID-19 cases were uncommon with only 25 being recorded prior to that month. Figure 31 illustrates COVID-19 cases and the 7-day moving average of COVID cases.

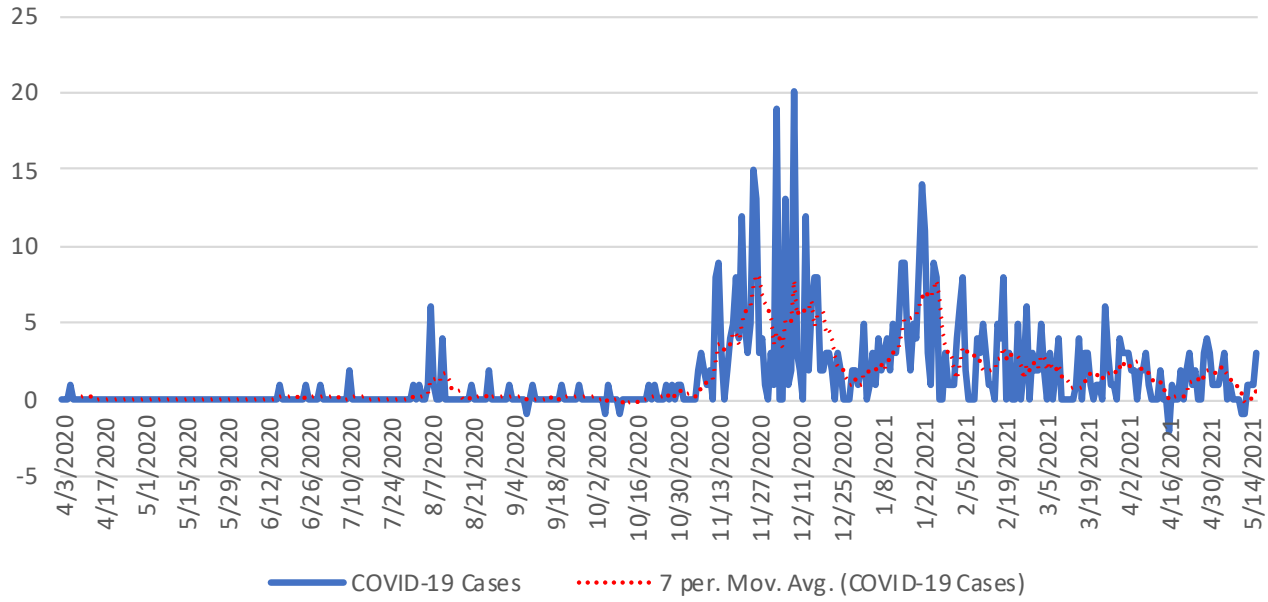

Figure 31: Rio Blanco County COVID Cases [40]

[39] In this section, Initial claims, continued claims, employment, unemployment, labor force, unemployment rates, initial unemployment claims by industry, and QCEW data from the Colorado Department of Labor and Employment.

[40] Data from the Colorado Department of Public Health and the Environment (CDPHE).

Employment during February 2020 was 2,818. Although employment for the same month in 2021 was down slightly at 2,771, typically employment peaks during late fall and declines during late winter in the county. From October 2020 to February 2021 employment fell by 181. However, a similar trend occurred during 2019-2020 when employment fell by 98. Other late winter employment drops occurred during 2014, 2017, and 2018. This trend illustrates that unemployment changes between October and February are typically volatile in Rio Blanco County. Additionally, it demonstrates that the October 2020/February 2021 COVID-19 spike did not result in significantly more unemployment than that of the preceding year, which was 204. Therefore, it is difficult to attribute the spike in winter unemployment to an increase in COVID-19 cases, which is likely more related to routine seasonal unemployment.

The labor force in Rio Blanco actually grew between February 2020 and February 2021, which is important, as many economists were concerned with people leaving the labor force during COVID-19. Although the Rio Blanco unemployment rate did spike during March of 2020, it was not as high as the rest of Colorado. Additionally, under normal circumstances, the unemployment rate is a good way to gauge economic conditions. However, additional COVID-19 related unemployment benefits have distorted traditional labor market incentives. Therefore, it is likely the unemployment rate would be lower under normal unemployment insurance conditions, which makes a historical comparison difficult.

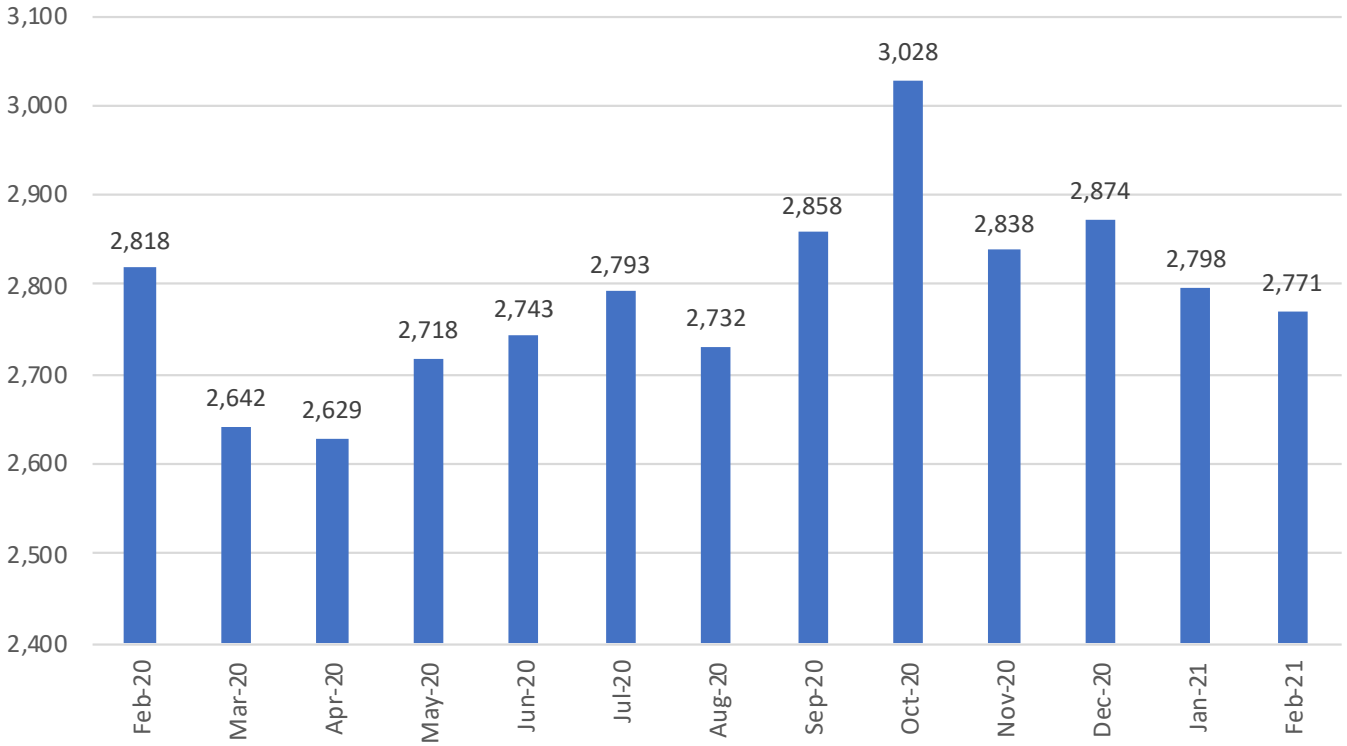

Figure 32: Rio Blanco Employment (February 2020 through February 2021)

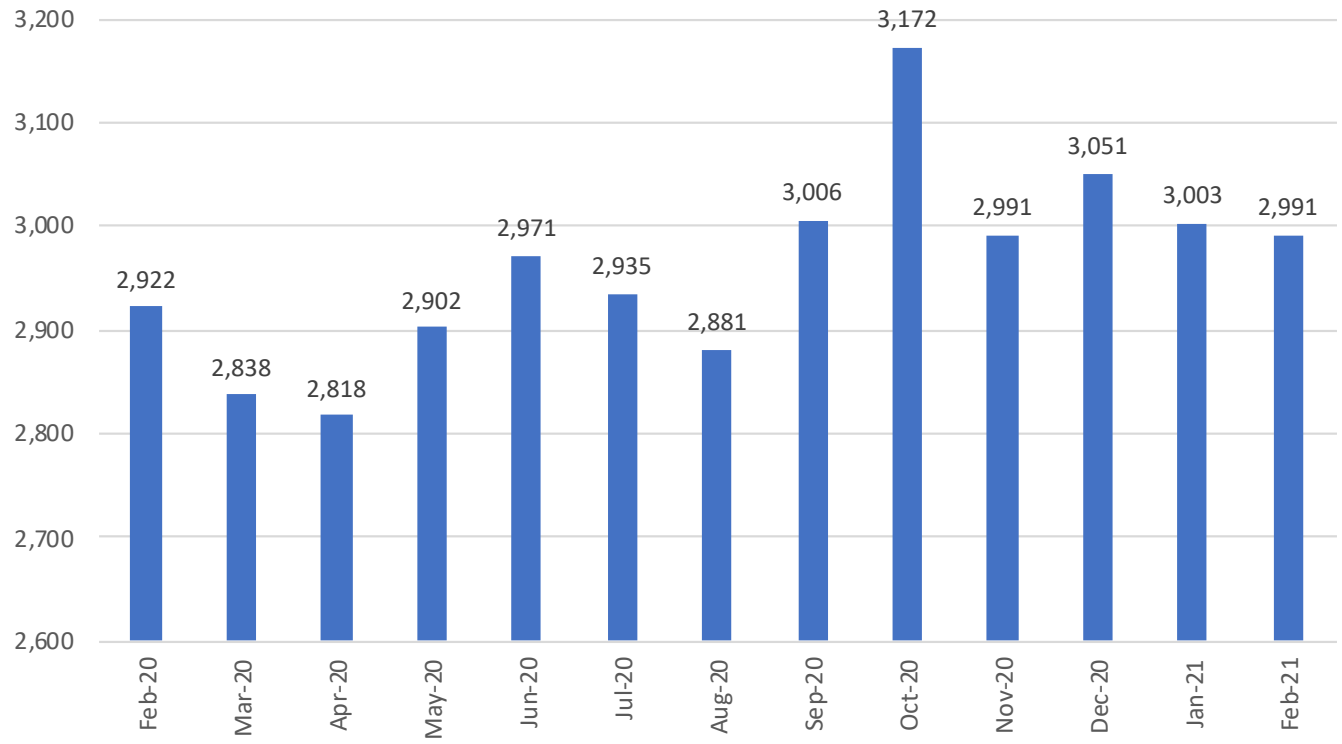

Figure 33: Rio Blanco Labor Force (February 2020 through February 2021)

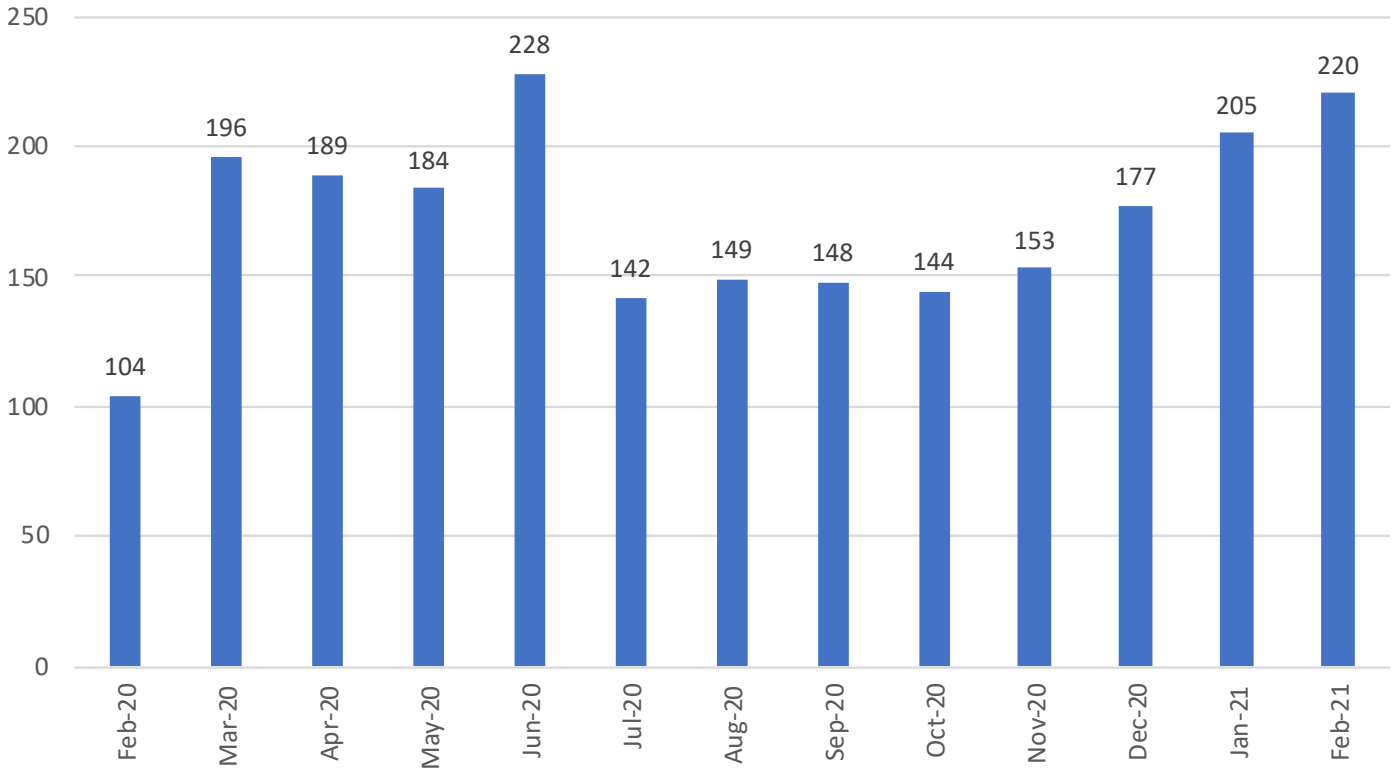

Figure 34: Rio Blanco Unemployment (February 2020 through February 2021)

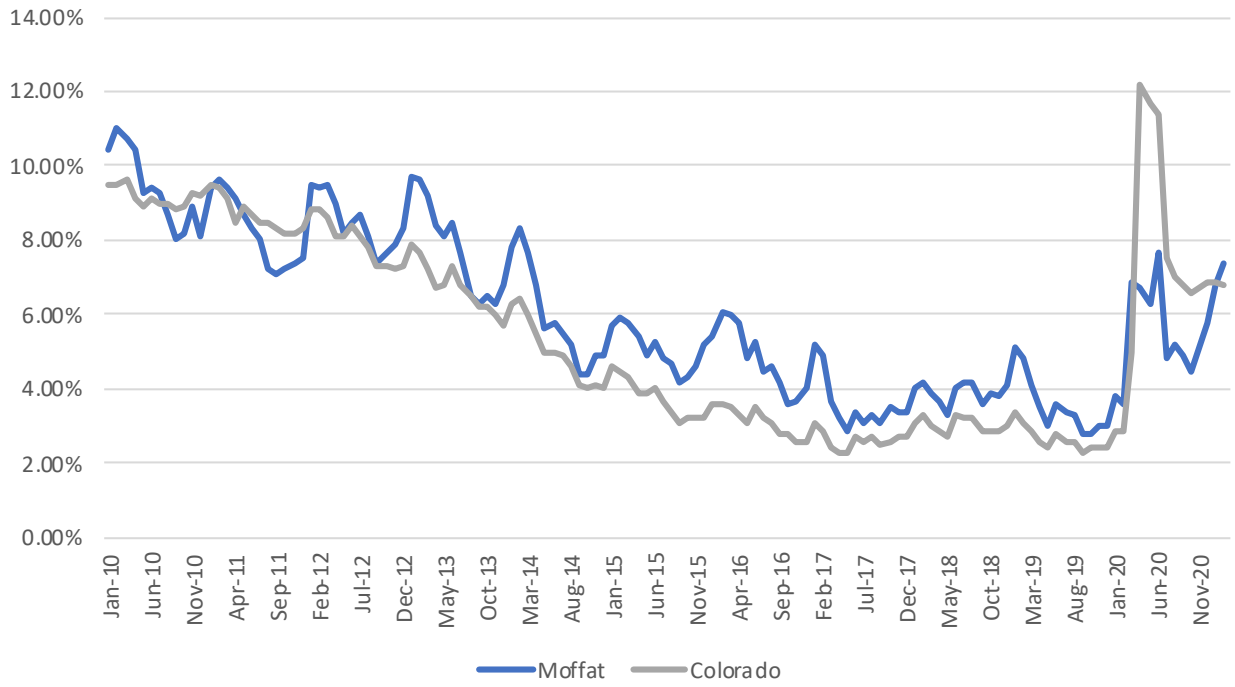

Figure 35: Rio Blanco Unemployment Rate (January 2010 through December 2020)

Industry Code	Industry Sector	Total Initial Claims 3/15/20 - 12/19/20	Share of Total Initial Claims 3/15/20 - 12/19/20	Weekly Average Initial Claims in 2019	Share of Total Initial Claims In 2019	Change in Share Post COVID-19 Period vs. 2019
72	Accommodation and Food Services	114,104	21.7%	154	8.4%	2.6
62	Health Care and Social Assistance	61,614	11.7%	161	8.8%	1.3
44	Retail Trade	60,750	11.5%	141	7.7%	1.5
56	Administrative and Waste Services	37,989	7.2%	214	11.7%	0.6
23	Construction	32,695	6.2%	317	17.3%	0.4
31	Manufacturing	27,666	5.3%	104	5.7%	0.9
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81	Other Services	26,264	5.0%	43	2.3%	2.1
71	Arts, Entertainment, and Recreation	26,250	5.0%	49	2.7%	1.9
61	Education Services	20,954	4.0%	44	2.4%	1.7
48	Transportation and Warehousing	18,878	3.6%	63	3.4%	1.0
42	Wholesale Trade	18,663	3.5%	76	4.2%	0.9

53	Real Estate, Rental, and Leasing	11,618	2.2%	37	2.0%	1.1
92	Public Administration	9,913	1.9%	90	4.9%	0.4
51	Information	9,771	1.9%	51	2.8%	0.7
52	Finance and Insurance	7,440	1.4%	62	3.4%	0.4
21	Mining	7,422	1.4%	29	1.6%	0.9
55	Management of Companies and Enterprises	4,620	0.9%	29	1.6%	0.6
11	Agriculture, Forestry, Fishing and Hunting	2,410	0.5%	17	1.0%	0.5
22	Utilities	625	0.1%	2	0.1%	0.9

Table 30: Colorado Industry Share of Initial Unemployment Claims
SOURCE: COLORADO DEPARTMENT OF LABOR AND UNEMPLOYMENT

Unfortunately, industry level unemployment claims are not available at the county level in Colorado; however, the state trends can be observed in Table 30. Accommodation and food services represent the largest share of initial claim filings (21.7%). This is followed by healthcare (11.7%) and retail trade (11.5%). The performance of these industries can be observed by their employment numbers. Figure 36 shows that retail trade in Rio Blanco County is almost even to its 2019 levels, and in fact did not experience a COVID-19 induced decline. Accommodation and food services, the industry most impacted by COVID-19, fell in Q2 2020 but started trending back up in Q3 2020. Healthcare and social assistance has increased through 2020, contrasting with Moffat County's healthcare decline.

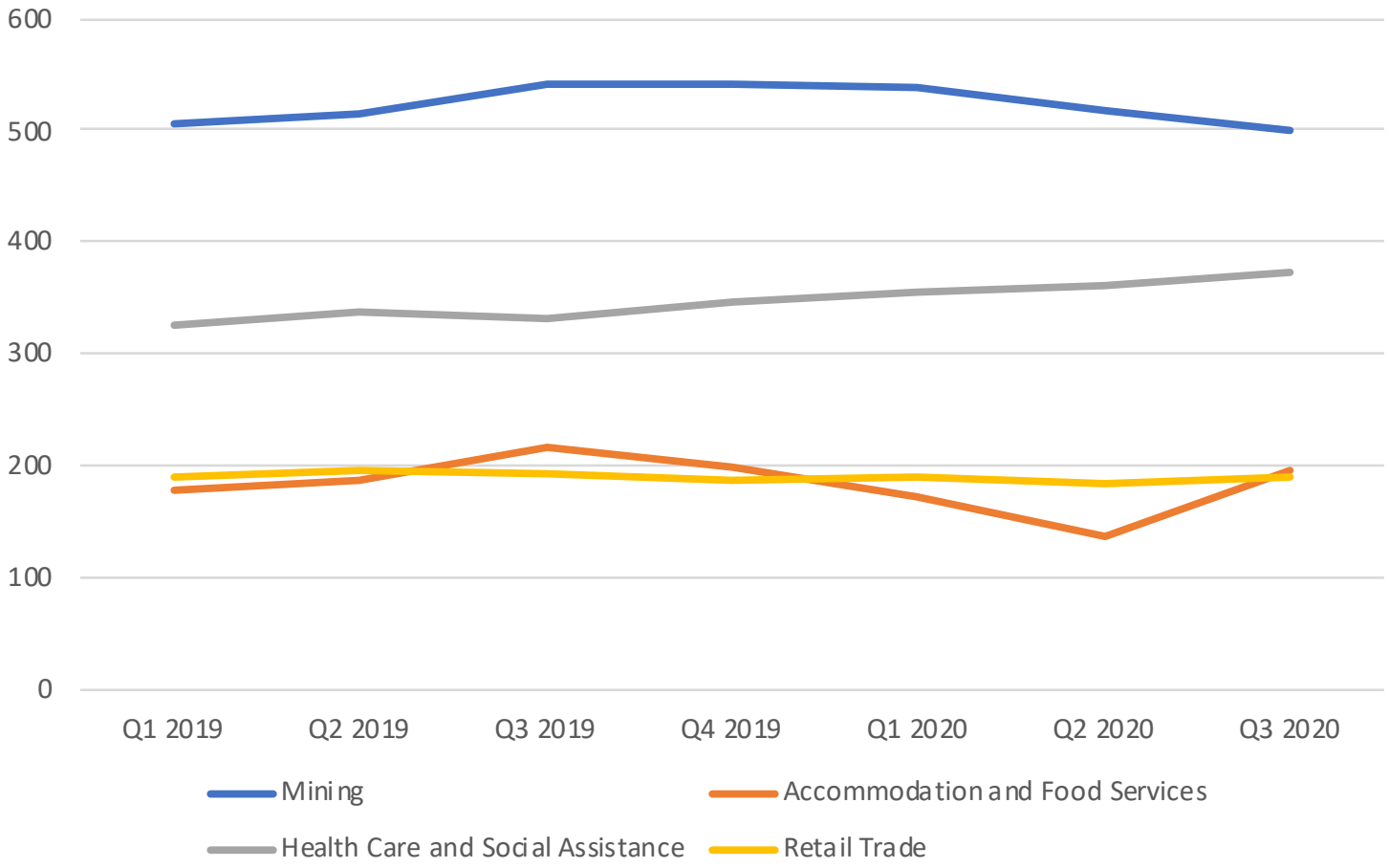

Figure 36: Employment in COVID Impacted Industries

Figure 32 illustrates the change in employment in Rio Blanco County from Q3 2019 to Q3 2020, providing insight on the industries that were most impacted in Rio Blanco County due to COVID-19. To be clear, Q2 2020 was the worst quarter of employment affected by COVID-19, due to the government induced shutdowns that occurred during April and early May. Figure 37 shows that administrative and waste services, mining, and construction have the biggest job losses year over year. Accommodation and food services was only down 20 jobs, while healthcare gained 40. Compared to other parts of the country, this was a small impact on what was supposed to be the most affected industry. In fact, year over year accommodation and food services saw wages increase. The biggest wage losses occurred in mining, construction, administrative, and waste services. The losses in mining (which includes oil and gas) are indirectly related to COVID-19. The Spring 2020 losses resulted from a demand induced plunge in oil and natural gas prices, which led to layoffs in the industry.

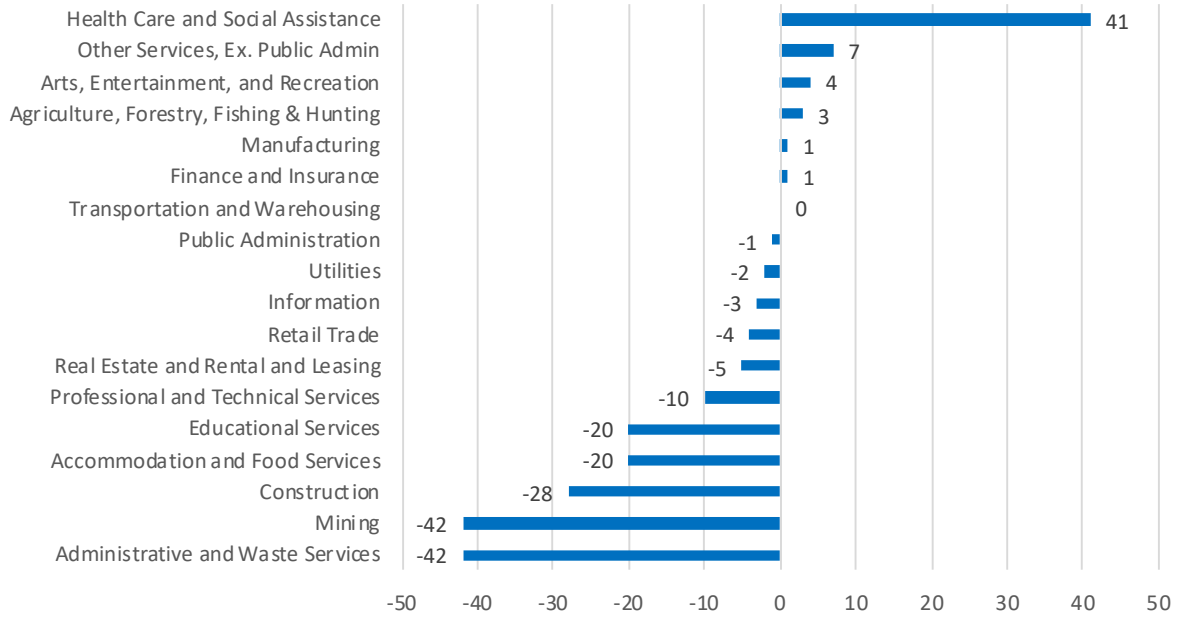

Figure 37: Change in Employment Q3 2019 to Q3 2020

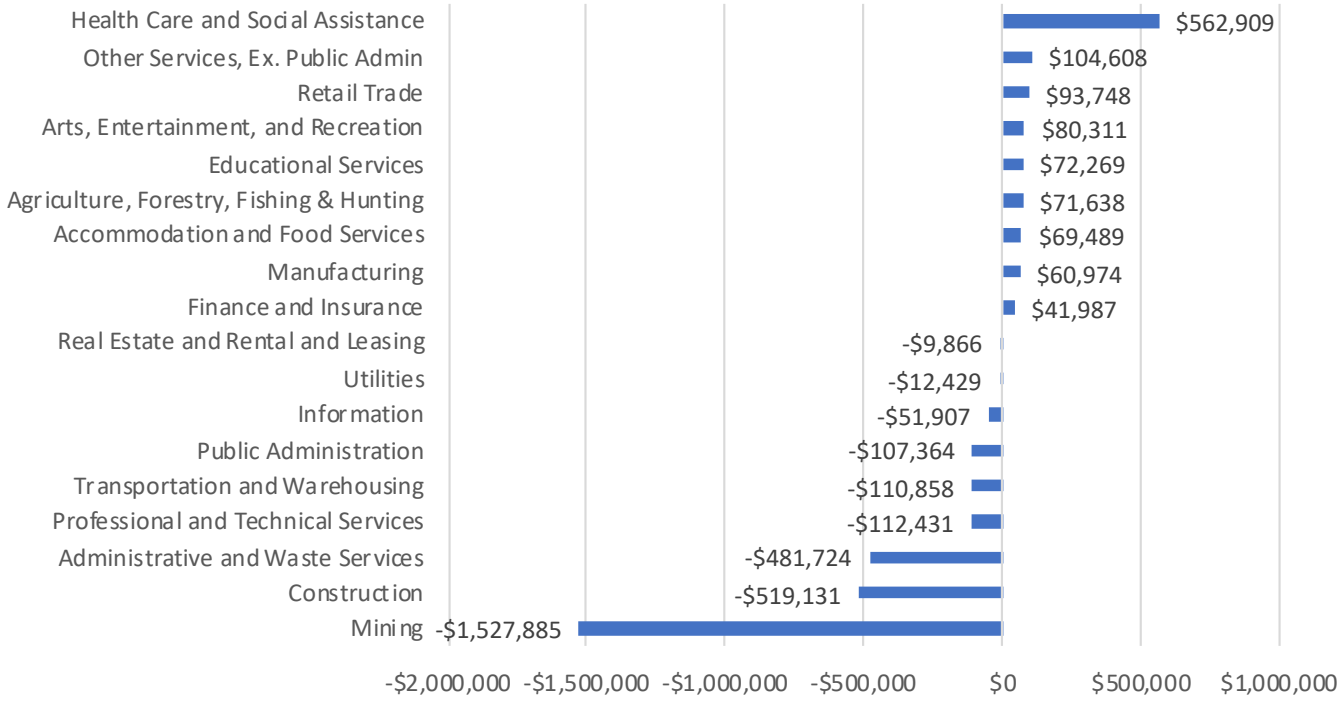

Figure 38: Wage Changes Q3 2019 to Q3 2020

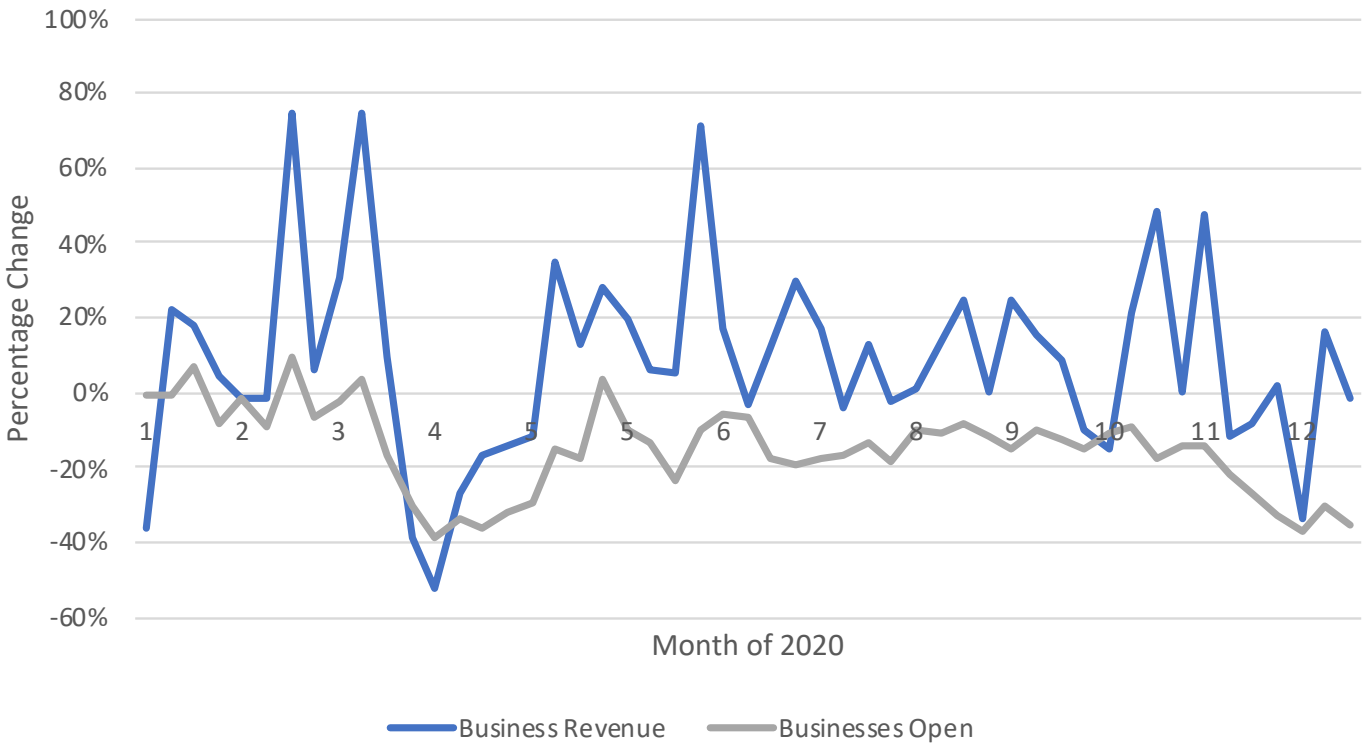

Figure 39: Small Business Revenue and number of Small Businesses Open: Jan 2020 to Jan 2021 [41]

The most noticeable impact COVID-19 has had in Rio Blanco County involved small business, which do not have the same resources to survive economic downturns as large businesses. Figure 39 illustrates small business data on jobs and revenue for Rio Blanco County. Small business revenue fell by 19.1%, while small open businesses fell by 28.4%. The small business data reflects worse economic outcomes than the standard economic data. This indicates that small businesses have taken the brunt of the economic damage in the county and may take time to recover to 2019 levels.

ROUTT COUNTY

Like the rest of the nation, Routt County's initial unemployment claims spiked during the April 2020 government induced shutdowns. Due to the large tourism industry in the Steamboat Springs area, Routt County saw initial claims spike particularly high during the first several months of COVID. Initial claims spiked as high as 838 the week of March 28th, during the first week and quickly fell until they spiked again during late November. To put this spike in initial claims in perspective, Moffat County saw 2.22% of its employment in March 2020 file initial claims, while Routt saw 6.15%. As a comparison, weekly average of initial clams during 2019 were 11 per week. Average continued claims remained higher in 2020 (measured March through December) when compared to 2019 (1,008 for 2020 and 72 for 2019).

[41] Small business data is collected by Womply and organized by the Harvard Opportunity Insights Team see https://www.tracktherecovery.org/ . For more information, see the following paper explaining the data: Chetty, R., Friedman, J., Hendren, N., Stepner, M, and the Opportunity Insights Team (2020). "The economic impacts of COVID-19: Evidence from a new public database built using private sector data". https://opportunityinsights.org/wp-content/uploads/2020/05/tracker_paper.pdf (Accessed June 2, 2021).

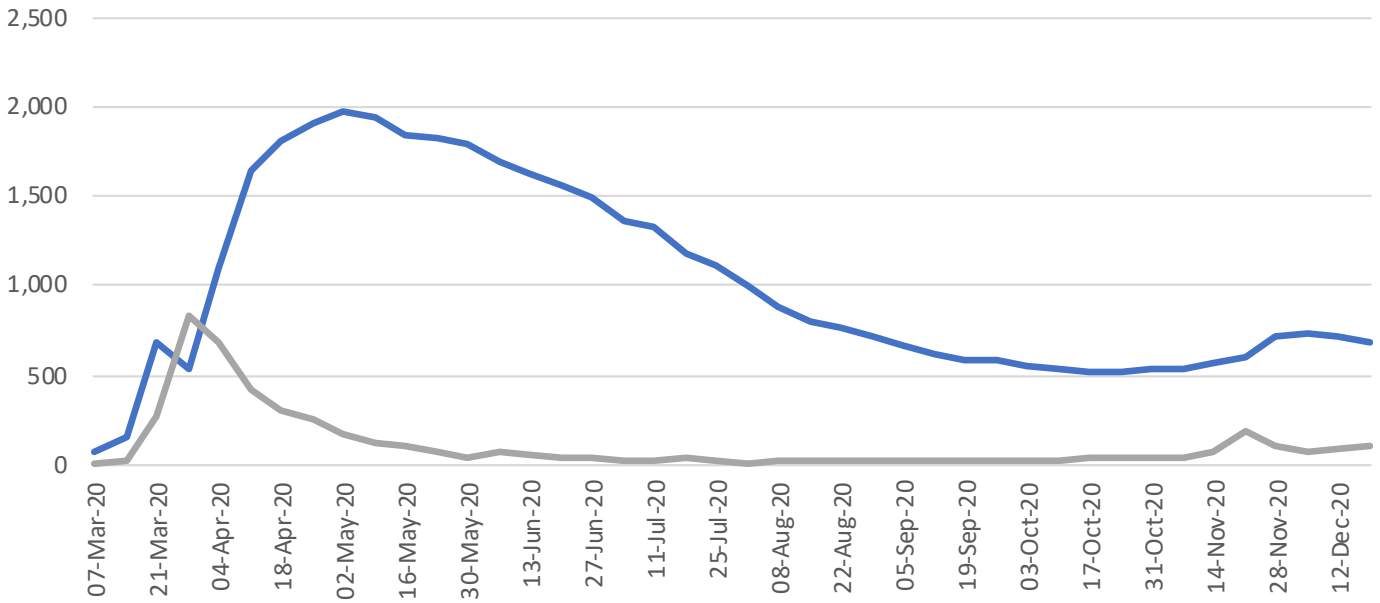

Figure 40: Routt County Initial and Continued Claims [42]

Like the rest of the state, COVID-19 cases spiked during the winter months, beginning in early November. Before October 2020, COVID-19 cases were uncommon with an average of 1.9 cases per day in October. This escalated to 14.7 cases per day from November through January. Figure 41 illustrates COVID-19 cases and the 7-day moving average of COVID cases.

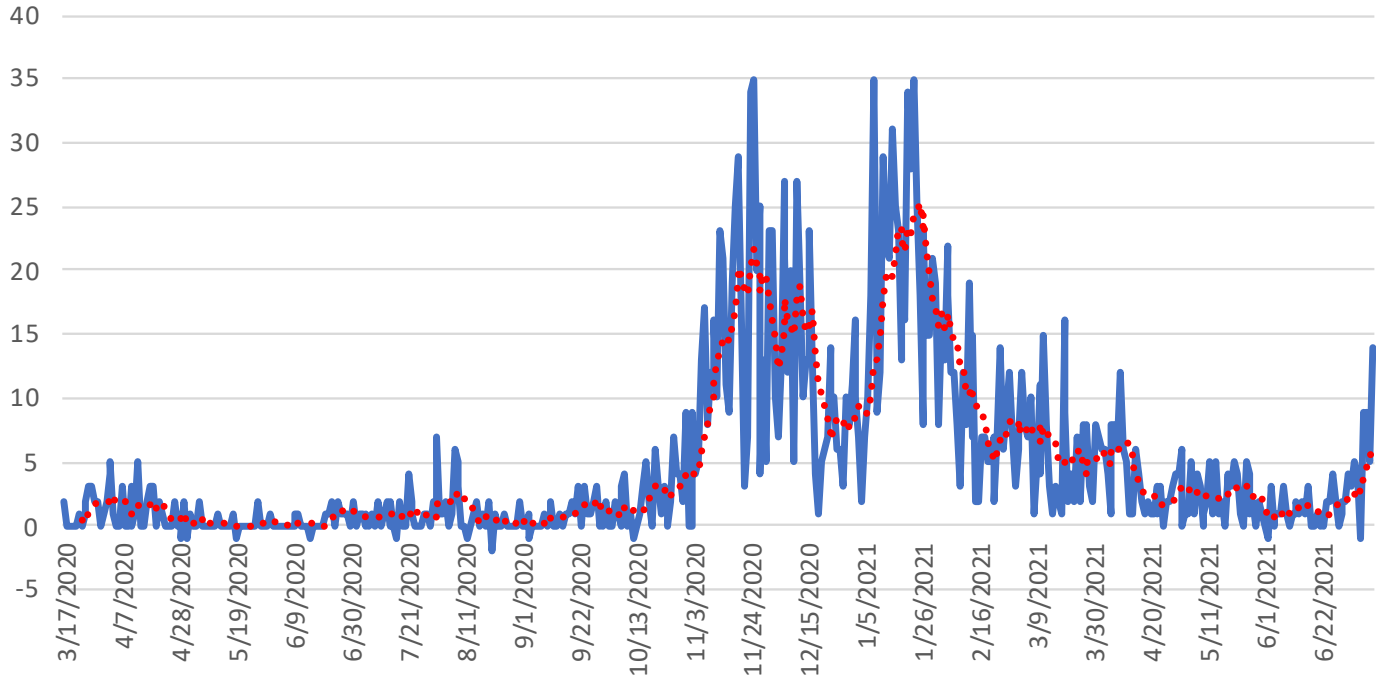

Figure 41: Routt County COVID Cases [43]

[42] In this section, Initial claims, continued claims, employment, unemployment, labor force, unemployment rates, initial unemployment claims by industry, and QCEW data from the Colorado Department of Labor and Employment.

[43] Data from the Colorado Department of Public Health and the Environment (CDPHE).

Employment during February 2020 was 16,968, and dropped in April to 11,917, with an 18.9% unemployment rate. Since April 2020, employment has risen increasing to 16,366 by February of 2021. Routt County has seasonal employment fluctuations driven by tourism, with winter months peaking (ski season), April and May falling, and summer heat tourism (July) increasing again. May and October are the trough months, with January and July being peak employment months. From October 2020 to February 2021 employment rose in Routt County which is a typical seasonal cycle. The important point is that as COVID cases spike, Routt employment rose to its highest point since February of 2020 at 16,483 and seems to have avoided the winter 2020 employment lull causes by a spike in COVID cases.

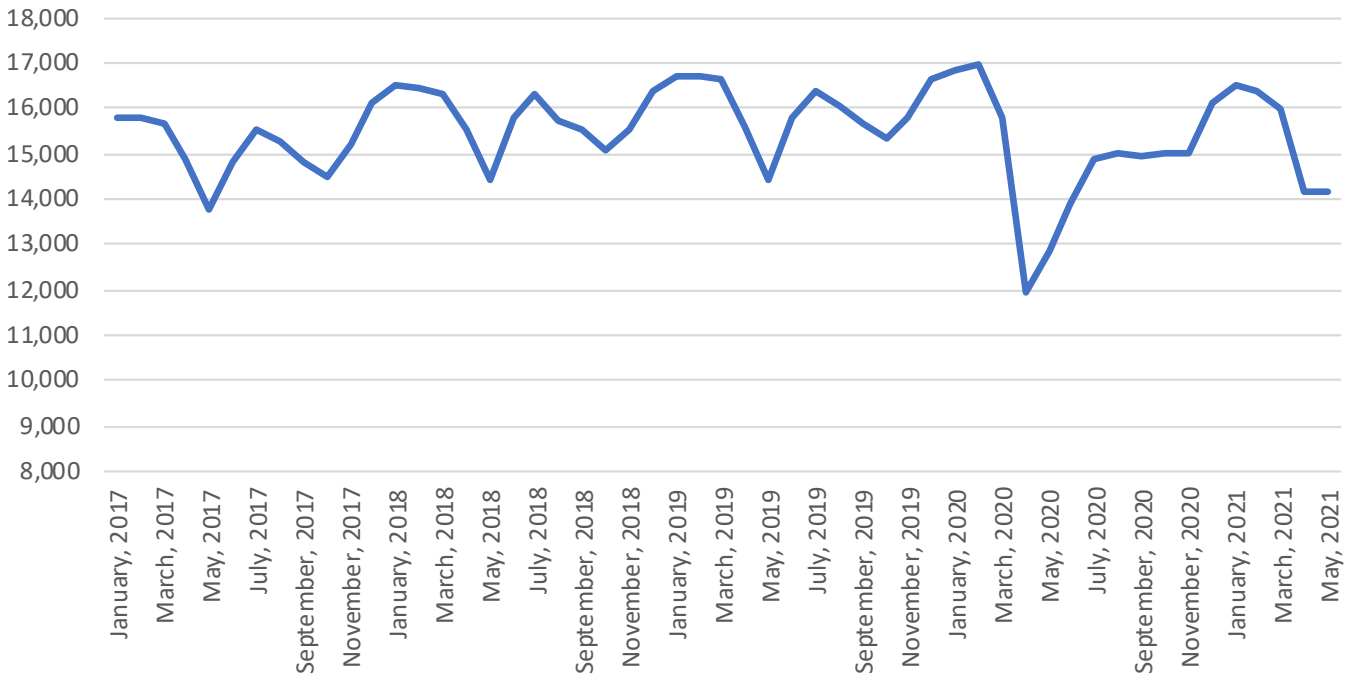

Figure 42: Seasonal Fluctuations in Employment Jan-17 through May-21

The labor force in Routt County fell by 118 from February 2020 and February 2021, in line with a national issue that exists where the labor force is falling due to such factors as baby boomers retiring early, one parent staying home due to COVID risk or schools not being in person, and an assortment of other issues. Routt' County's unemployment rate spiked significantly higher than the Colorado rate during the initial months of COVID due to the big tourism industry (figure 46). Since late summer 2020, Routt's unemployment rate has been below the Colorado rate. There is some slight concern about comparing unemployment rates during COVID, as additional COVID-19 related unemployment benefits have distorted traditional labor market incentives. Because of this, it is likely the unemployment rate would be lower under normal unemployment insurance conditions, which makes a historical comparison difficult.

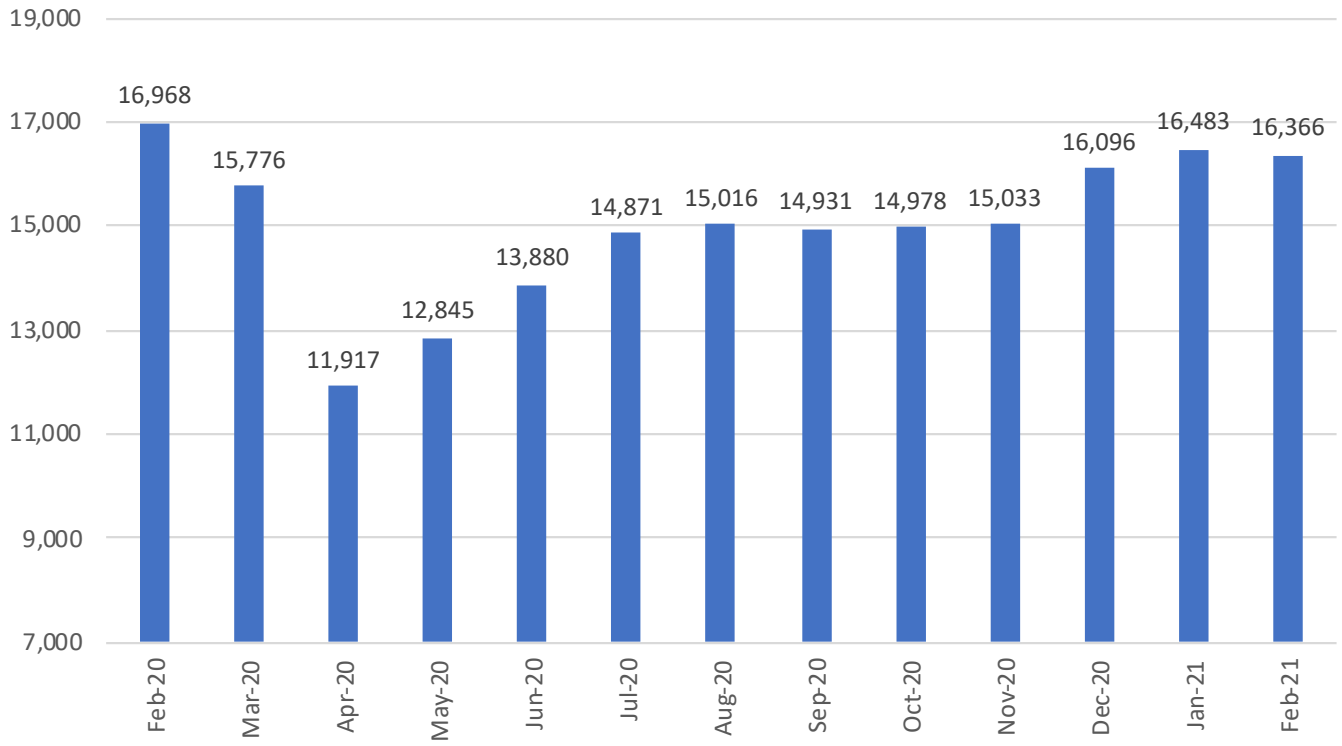

Figure 43: Routt County Employment (February 2020 through February 2021)

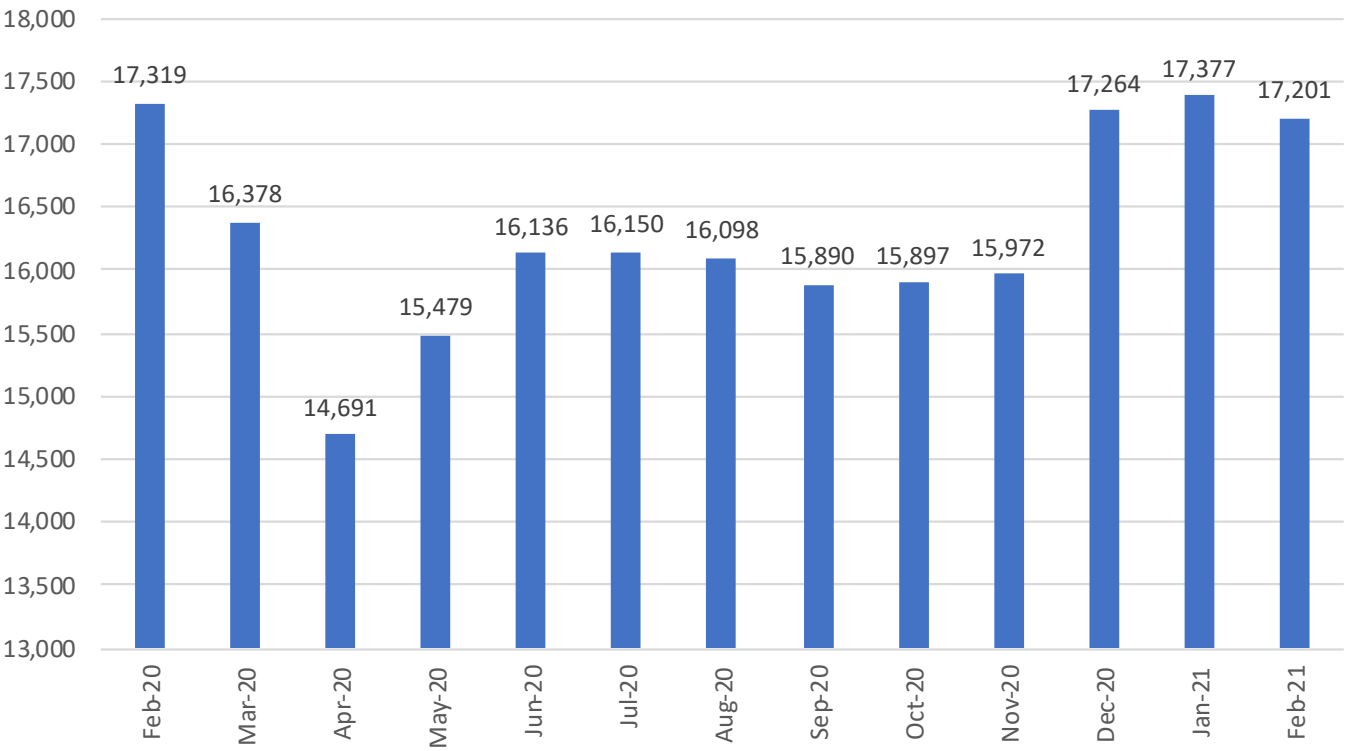

Figure 44: Routt County Labor Force (February 2020 through February 2021)

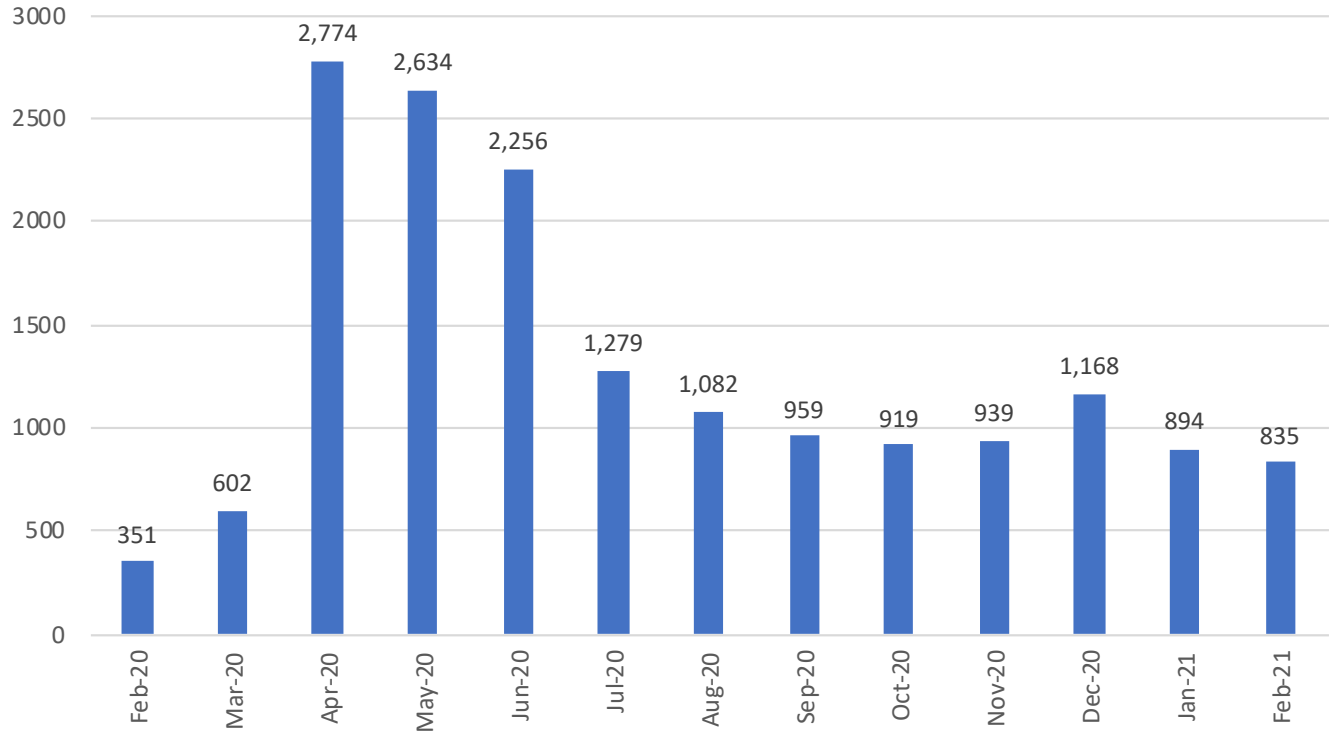

Figure 45: Routt County Unemployment (February 2020 through February 2021)

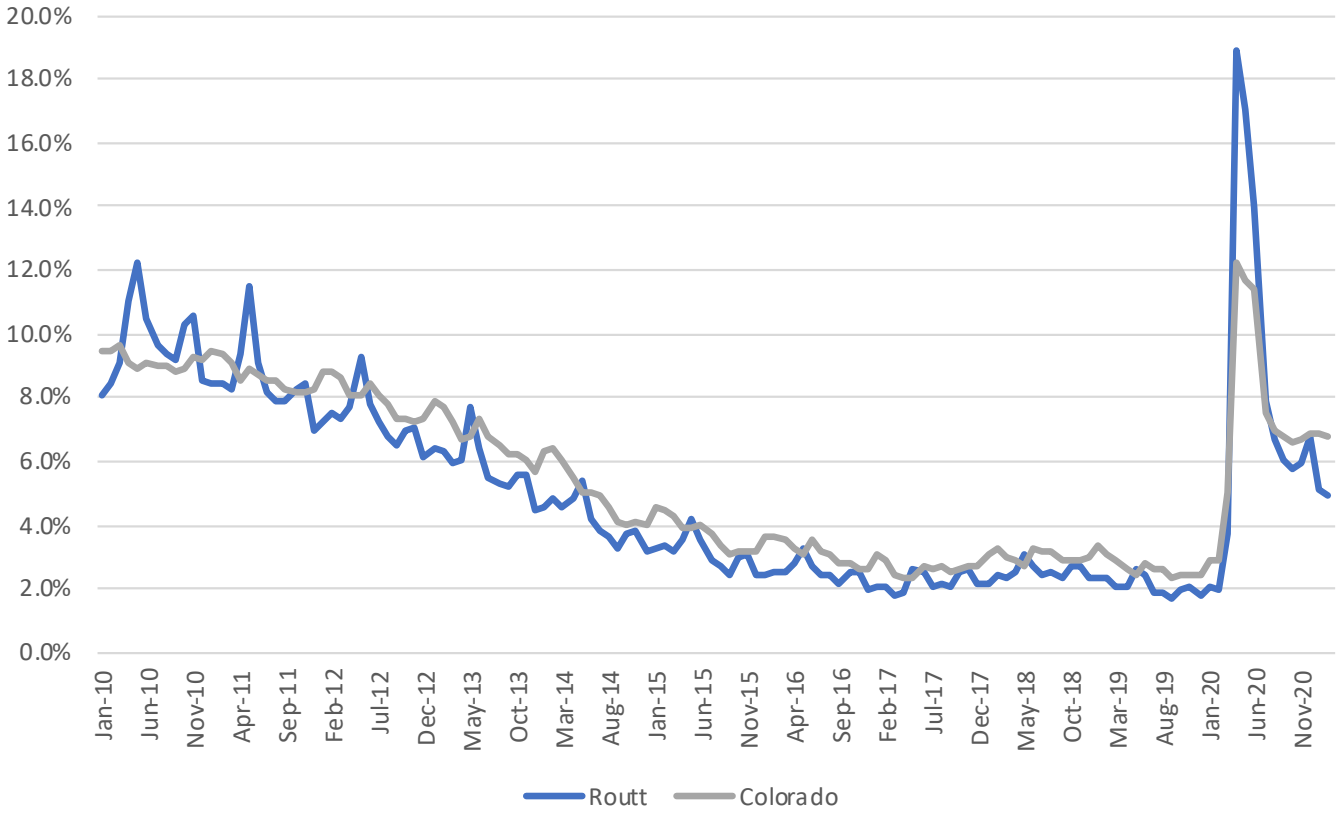

Figure 46: Routt County Unemployment Rate (January 2010 through December 2020)

Industry Code	Industry Sector	Total Initial Claims 3/15/20 - 12/19/20	Share of Total Initial Claims 3/15/20 - 12/19/20	Weekly Average Initial Claims in 2019	Share of Total Initial Claims In 2019	Change in Share Post COVID-19 Period vs. 2019
72	Accommodation and Food Services	114,104	21.7%	154	8.4%	2.6
62	Health Care and Social Assistance	61,614	11.7%	161	8.8%	1.3
44	Retail Trade	60,750	11.5%	141	7.7%	1.5
56	Administrative and Waste Services	37,989	7.2%	214	11.7%	0.6
23	Construction	32,695	6.2%	317	17.3%	0.4
31	Manufacturing	27,666	5.3%	104	5.7%	0.9
54	Professional and Technical Services	26,375	5.0%	150	8.2%	0.6
81	Other Services	26,264	5.0%	43	2.3%	2.1
71	Arts, Entertainment, and Recreation	26,250	5.0%	49	2.7%	1.9
61	Education Services	20,954	4.0%	44	2.4%	1.7
48	Transportation and Warehousing	18,878	3.6%	63	3.4%	1.0
42	Wholesale Trade	18,663	3.5%	76	4.2%	0.9
53	Real Estate, Rental, and Leasing	11,618	2.2%	37	2.0%	1.1
92	Public Administration	9,913	1.9%	90	4.9%	0.4
51	Information	9,771	1.9%	51	2.8%	0.7
52	Finance and Insurance	7,440	1.4%	62	3.4%	0.4
21	Mining	7,422	1.4%	29	1.6%	0.9
55	Management of Companies and Enterprises	4,620	0.9%	29	1.6%	0.6
11	Agriculture, Forestry, Fishing and Hunting	2,410	0.5%	17	1.0%	0.5
22	Utilities	625	0.1%	2	0.1%	0.9

Table 31: Colorado Industry Share of Initial Unemployment Claims

SOURCE: COLORADO DEPARTMENT OF LABOR AND UNEMPLOYMENT

Unfortunately, industry level unemployment claims are not available at the county level in Colorado; however, the state trends can be observed in Table 31. Accommodation and food services represent the largest share of initial claim filings (21.7%). This is followed by healthcare (11.7%) and retail trade (11.5%). The performance of these industries can be observed by their employment numbers. Figure 47 shows key industries in Routt County from Q1 2019 to Q4 2020. Accommodation and food service dropped precipitously during Q2 2020 and is still below its 2019 point. This is true for arts entertainment and recreation as well (note there is some missing data). Retail trade fell in Q2 2020 but has risen since, and healthcare has stayed relatively steady during COVID. Mining is consistently declining, which is expected in that industry due to the retirement of coal power and mines.

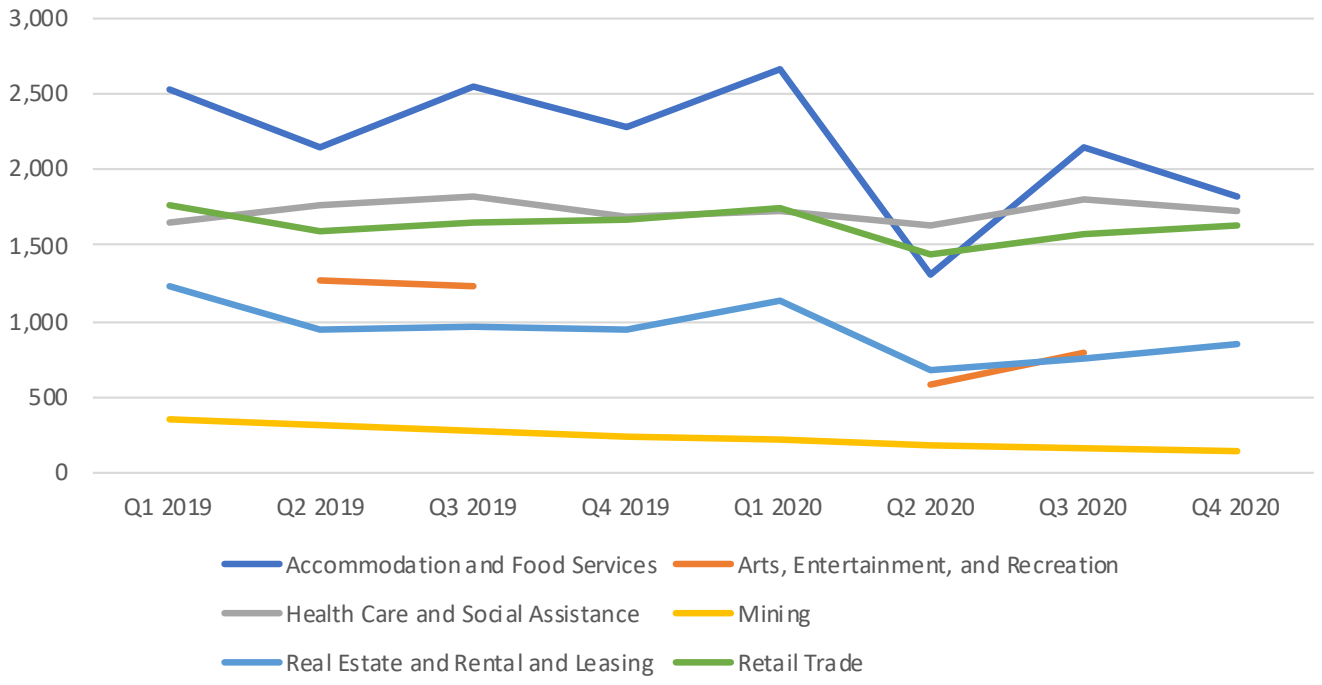

Figure 47: Employment in COVID Impacted Industries

Figure 48 illustrates the change in employment in Routt County from Q3 2019 to Q3 2020, providing insight on the industries that were most impacted in due to COVID-19. To be clear, Q2 2020 was the worst quarter of employment affected by COVID-19. Figure 48 shows that arts entertainment and recreation (447), accommodation and food service (388), real estate rental and leasing (216), and mining (132) have the biggest job losses year over year. Accommodation and food services was only down 20 jobs, while healthcare gained 40. There were some employment gains, including 62 in management of companies and enterprises and 47 in administrative waste services. Wage losses were concentrated in arts entertainment and recreation, mining, and

wholesale trade. Despite large job losses in accommodation and food services, wage losses were relatively low at ($819,932). This is due to the low weekly wage that the accommodation and food services industry has ($606 per week), whereas the job losses in mining were almost one third of accommodation and food services, but more than double the wage loss due to mining's high weekly wage ($1,742).

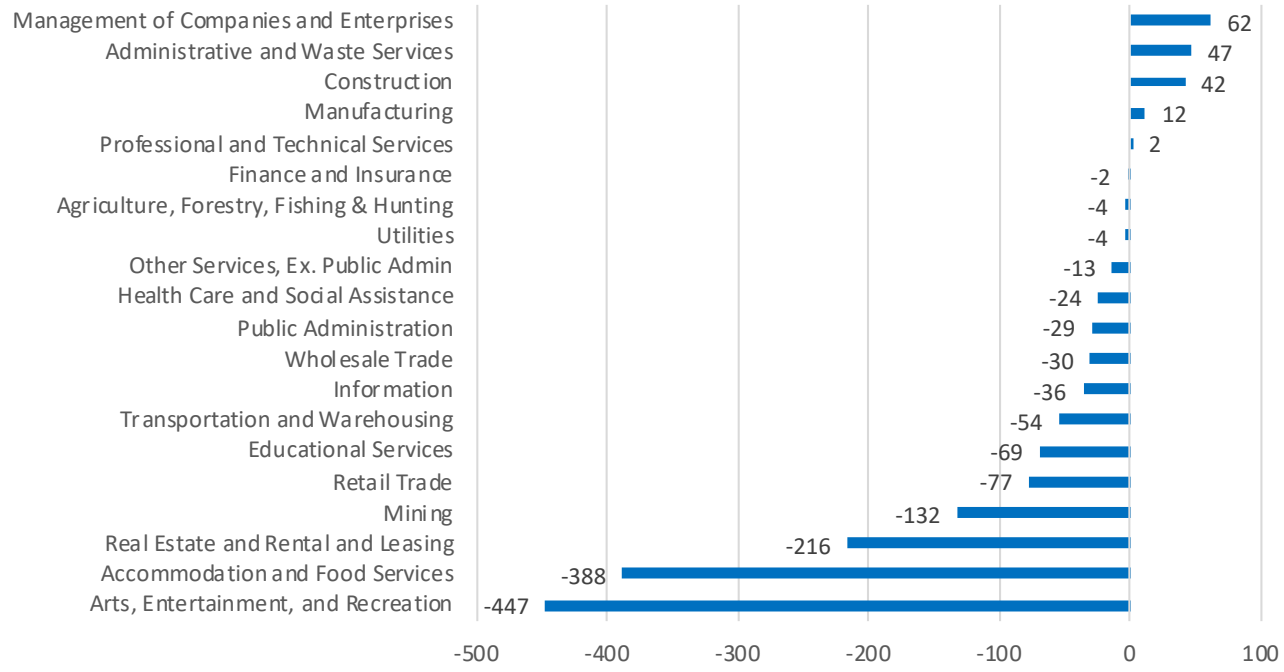

Figure 48: Change in Employment Q3 2019 to Q3 2020

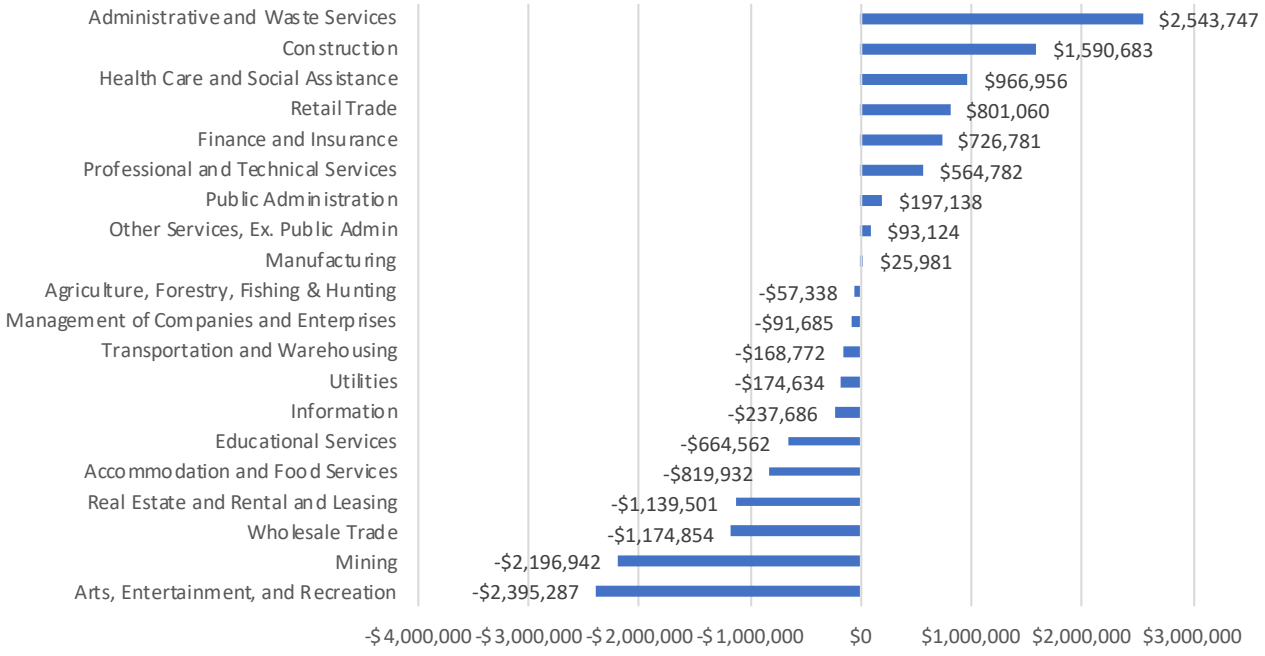

Figure 49: Wage Changes Q3 2019 to Q3 2020

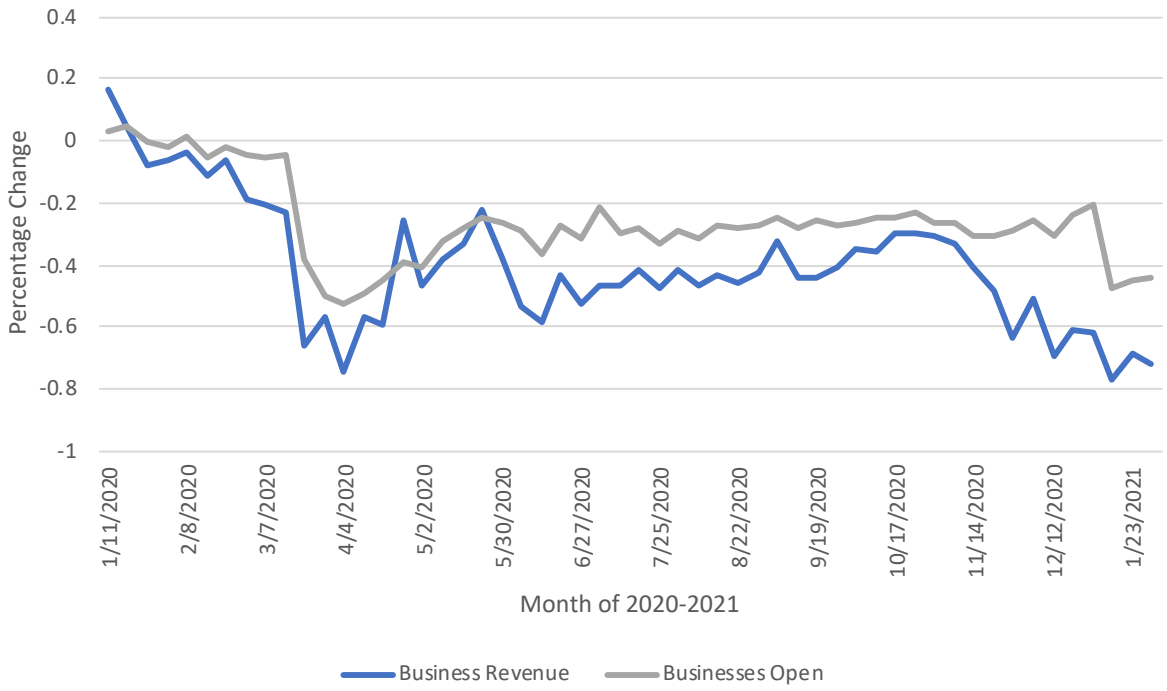

Figure 50: Small Business Revenue and number of Small Businesses Open: Jan 2020 to Jan 2021 [44]

The most noticeable impact COVID-19 has had in Routt County involved small business, which do not have the same resources to survive economic downturns as large businesses. Figure 50 illustrates small business data on jobs and revenue for Routt County. Small business revenue fell by 72.3%, while small open businesses fell by 43.8%. The small business data reflects worse economic outcomes than the standard economic data. This indicates that small businesses have taken the brunt of the economic damage in the county and may take time to recover to 2019 levels.

[44] Small business data is collected by Womply and organized by the Harvard Opportunity Insights Team see https://www.tracktherecovery.org/ . For more information, see the following paper explaining the data: Chetty, R., Friedman, J., Hendren, N., Stepner, M, and the Opportunity Insights Team (2020). "The economic impacts of COVID-19: Evidence from a new public database built using private sector data". https://opportunityinsights.org/wp-content/uploads/2020/05/tracker_paper.pdf (Accessed June 2, 2021).

2 County Economic Overview: Eastern Utah

EMERY COUNTY

DEMOGRAPHIC INFORMATION: EMERY COUNTY

Emery County is a small rural county in eastern Utah with a population of 20,476. The Emery County population peaked in 2010 during the top of the energy boom experienced by many coal producing economies. Coal demand drove intense economic activity in related industries from 2005-2010, which in turn created employment and caused a population surge. As the energy bubble burst, Emery County lost residents and its population declined between 2009 and 2017. According to 2019 data, the Real Gross Domestic Product in Emery County was just under $1 billion, at $892,903,000.

	2018	2019
Population	10,039	10,061
Real Gross Domestic Product (chained 2012 dollars)	$853,705,000	$932,010,000
Real GDP Per Capita	$85,039	$92,636
Median Household Income	$54,213	$61,893
Education (Bachelor's Degree Or Higher)	14.7%	16.3%
Education (High School or Higher)	93.9%	93.8%
% Of People Under Poverty Line	12.5%	10.9%

Table 32: Carbon County Overview [45]

Census Bureau data shows that 96.4% of Emery County is White, with 6.5% Hispanic or Latino and 1.2% American Indian and Alaskan Native. 6.1% of the population is under 5 years old, 28.4% is under 18 years old, and 17.7% is over 65 years old. Table 32 illustrates the population data from the Census department (2000-2020) with the Kem Gardner Institutes population forecast (2021-2050).[7] Note the runup in population during the energy boom from 2005 to 2010, and the precipitous decline following the energy bust. Emery County's population is expected to decline through the early 2040's and then start to increase after that.

Race/Ethnicity	Percentage
White alone	96.4%
Black	0.4%
American Indian and Alaskan Native alone	1.2%
Asian alone	0.5%
Native Hawaiian and Other Pacific Islander alone	0.1%
Two or More Races	1.4%
Hispanic or Latino	6.5%
White alone, Not Hispanic or Latino	90.6%

Table 33: Moffat County Demographics [46]

[45] Source: U.S. Census Bureau (USCB). Regional GDP is from the Bureau of Economic Analysis (BEA). Census poverty estimates are from the Small Area Income and Poverty Estimates (SAIPE).

[46] Source: United States Census Bureau.

Age/Gender	Percentage
Under 5 years old	6.1%
Under 18 years old	28.4%
Over 65 years old	17.7%
Between 18 and 65	53.9%
Female	49.1%
Male	50.9%

Table 34: Emery County Age and Gender[47]

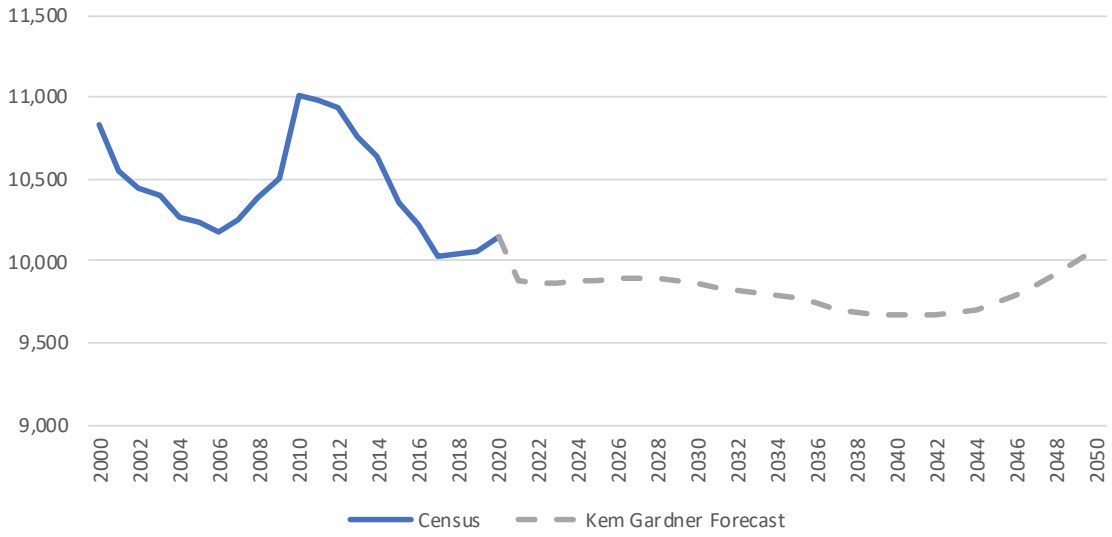

Figure 51: Emery County Population and Forecast (2000-2050) [48]

INDUSTRIAL COMPOSITION AND EMPLOYMENT: EMERY COUNTY

Emery County Gross Domestic Product (Figure 52) peaked in 2013 at $939,545,000 billion during the runup in coal prices and has been in steady decline since. Mining (the central industry of the Emery and Carbon County economic story) is graphed as a percentage of GDP in Figure 52, and has fallen from a peak of close to 37% in 2001, to 11.70% in 2017, and to 13.97% in 2020. Mining, as classified by NAICS codes, includes both coal mining, oil, and gas extraction. According to 2019 IMPLAN data, oil and gas wages made up approximately 20% of the proportion, while coal mining made up the other 80%. This proportion does not include electric power generation from coal, or support services for oil, gas, and coal. Although there is some oil and gas activity in Emery County, it is primarily located on the south end of the Uinta Basin.

[47] Source: United States Census Bureau.

[48] Source: United States Census Bureau and the Kem Gardner Institute

Table 35 illustrates the top contributions by industry to GDP. According to 2020 BEA data, utilities are the top contributor to GDP at 60.88%, with mining coming in second at 11.03%. The Sunnyside power plant is counted in Emery County by the Bureau of Economic Analysis.

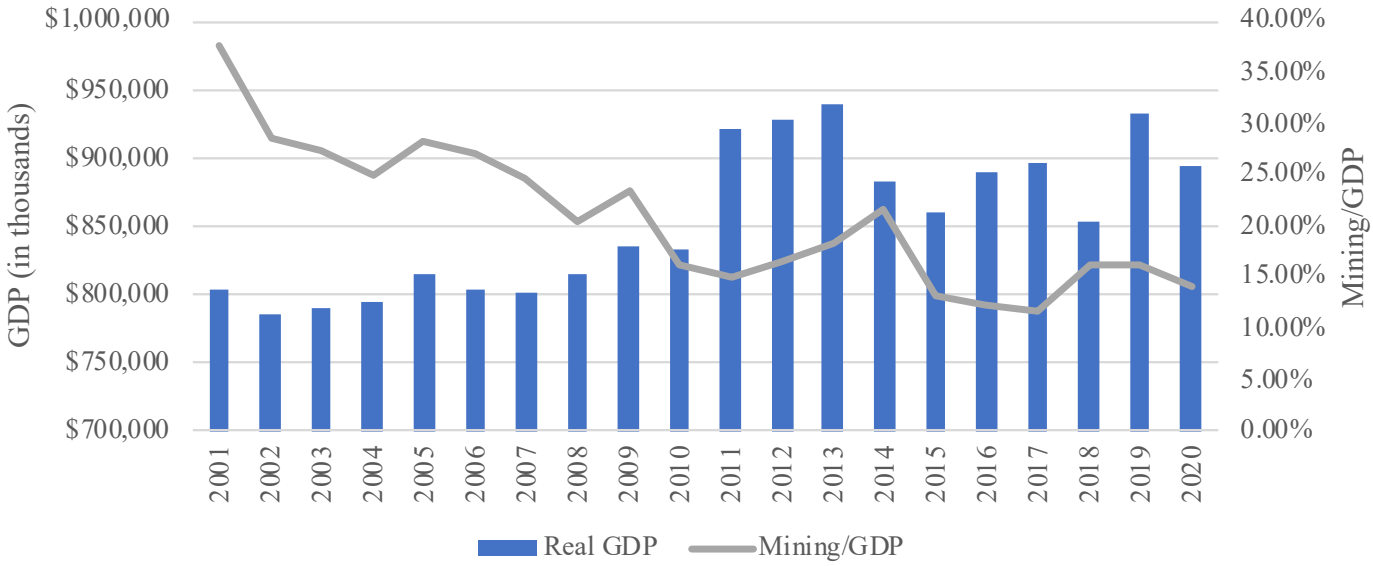

Figure 52: Emery County Real GDP [49]

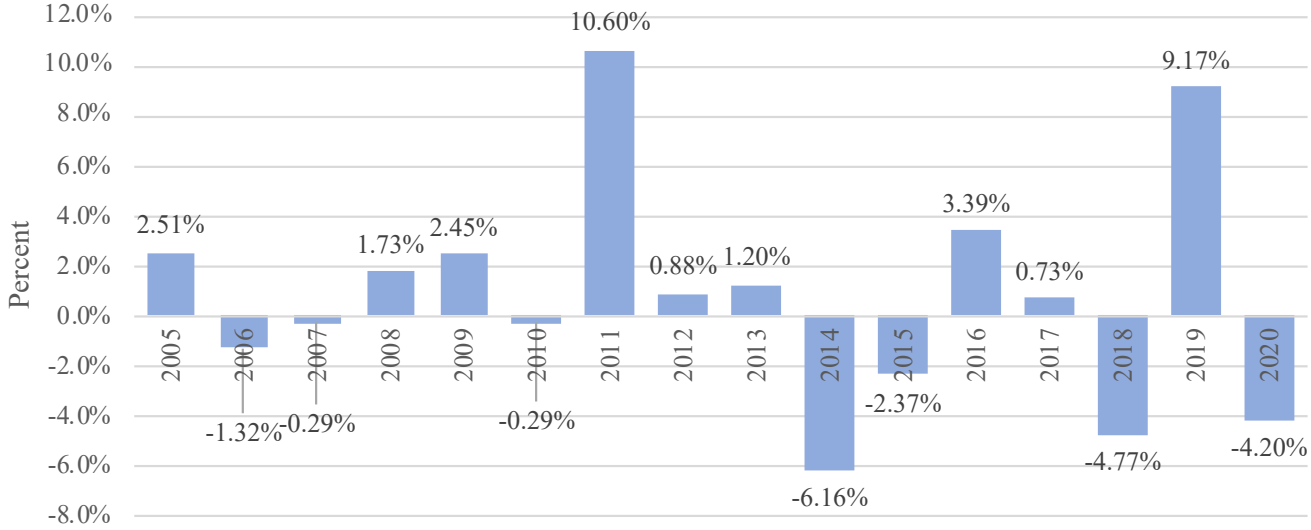

Figure 53: Emery County Real Growth Rate GDP [50]

[49] Source: Bureau of Economic Analysis. Real GDP is calculated with chained 2012 dollars.

[50] Source: Bureau of Economic Analysis. Real GDP is calculated with chained 2012 dollars.

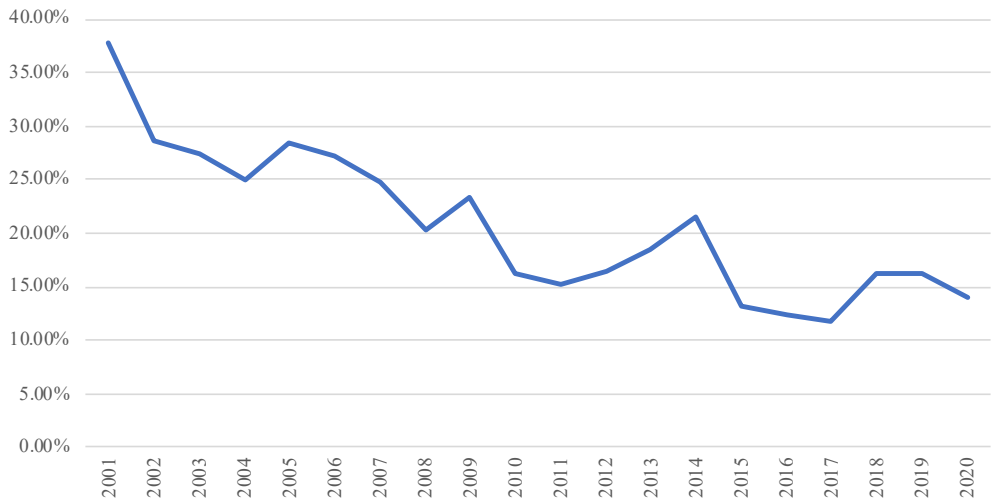

Figure 54: Mining as a Percentage of GDP

	2018	2019	2020	% Change from 2019	% of Total GDP
All industry total [51]	$853,705	$932,010	$892,903	9.17%	
Private industries	$804,547	$889,251	$852,587	-4.56%	95.48%
Agriculture, forestry, fishing and hunting	$24,981	$15,650	$25,403	39.04%	2.84%
Mining, quarrying, and oil and gas extraction	$111,790	$131,797	$98,495	-29.79%	11.03%
Utilities	$492,836	$553,578	$543,615	-2.02%	60.88%
Construction	$18,961	$18,787	$21,208	12.77%	2.38%
Manufacturing	$3,259	$3,422	$2,781	-19.67%	0.31%
Durable goods manufacturing	$1,999	$2,013	$1,675	-16.91%	0.19%
Nondurable goods manufacturing	$1,343	$1,502	$1,177	-24.20%	0.13%
Wholesale trade	N/A	N/A	N/A	N/A	N/A
Retail trade	$20,173	$21,422	$22,079	3.26%	2.47%
Transportation and warehousing	$2,084	$2,252	$2,735	23.18%	0.31%
Information	N/A	N/A	N/A	N/A	N/A

[51] Bold text indicates primary industry, non-bold text indicates a subcategory.

Finance, insurance, real estate, rental, and leasing	$51,002	$54,219	$50,814	-6.68%	5.69%
Finance and insurance	$2,752	$2,875	$3,105	8.36%	0.35%
Real estate and rental and leasing	$48,216	$51,319	$47,594	-7.73%	5.33%
Professional and business services	$16,330	$19,350	$18,413	-5.74%	2.06%
Professional, scientific, and technical services	$5,312	$6,177	$5,716	-8.68%	0.64%
Management of companies and enterprises	N/A	N/A	N/A	N/A	N/A
Administrative and support and waste management and remediation services	N/A	N/A	N/A	N/A	N/A
Educational services, health care, and social assistance	$6,941	$8,012	$8,055	0.62%	0.90%
Educational services	N/A	N/A	N/A	N/A	N/A
Health care and social assistance	N/A	N/A	N/A	N/A	N/A
Arts, entertainment, recreation, accommodation, and food services	$9,463	$10,602	$7,521	-32.56%	0.84%
Arts, entertainment, and recreation	$114	$108	$139	27.19%	0.02%
Accommodation and food services	$9,334	$10,476	$7,372	-33.25%	0.83%
Other services (except government and government enterprises)	$10,360	$9,864	$9,696	-1.62%	1.09%
Government and government enterprises	$49,038	$43,614	$41,203	-4.92%	4.61%

Table 35: Carbon County GDP by Industry [52]

[52] Source: Bureau of Economic Analysis.

EMERY COUNTY LABOR MARKET: LONG VIEW

The Emery County labor market peaked in the summer of 2006, entering a downward trend from the post energy bubble until 2016. From 2017 to 2021, there was an uptrend in employment, increasing from 3,811 in January of 2017 to 4,294 in September of 2021. Emery County's unemployment rate is generally 1-2% higher than the State of Utah's. Employment and unemployment data is shown in Figures 55 through 56 and are non-seasonally adjusted.

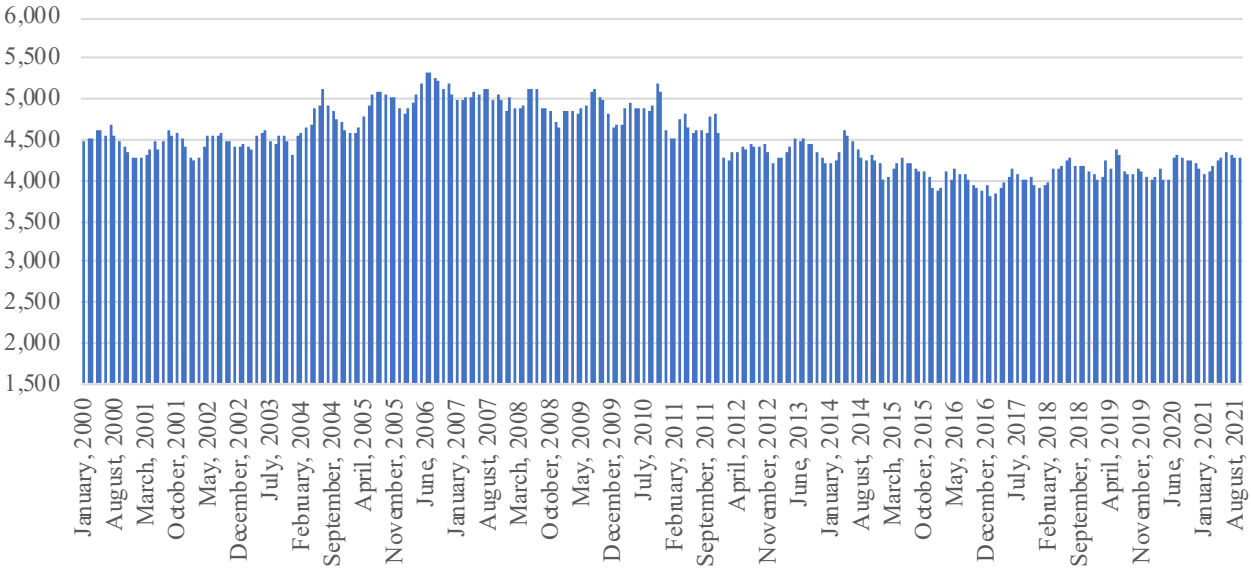

Figure 55: Emery County Employed [53]

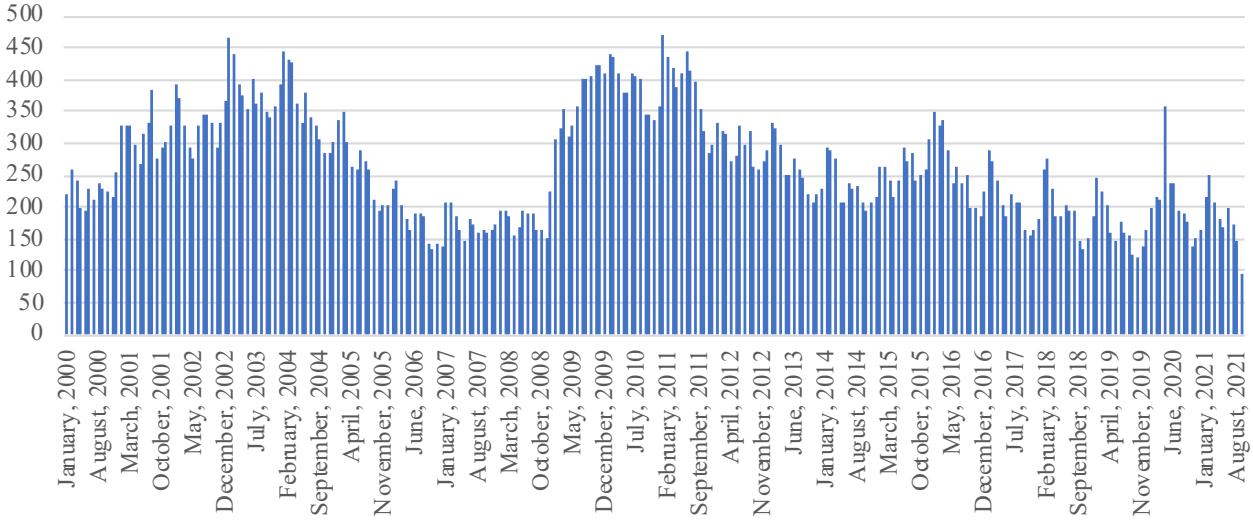

Figure 56: Emery County Unemployed [54]

[53] Bureau of Labor Statistics

[54] Bureau of Labor Statistics

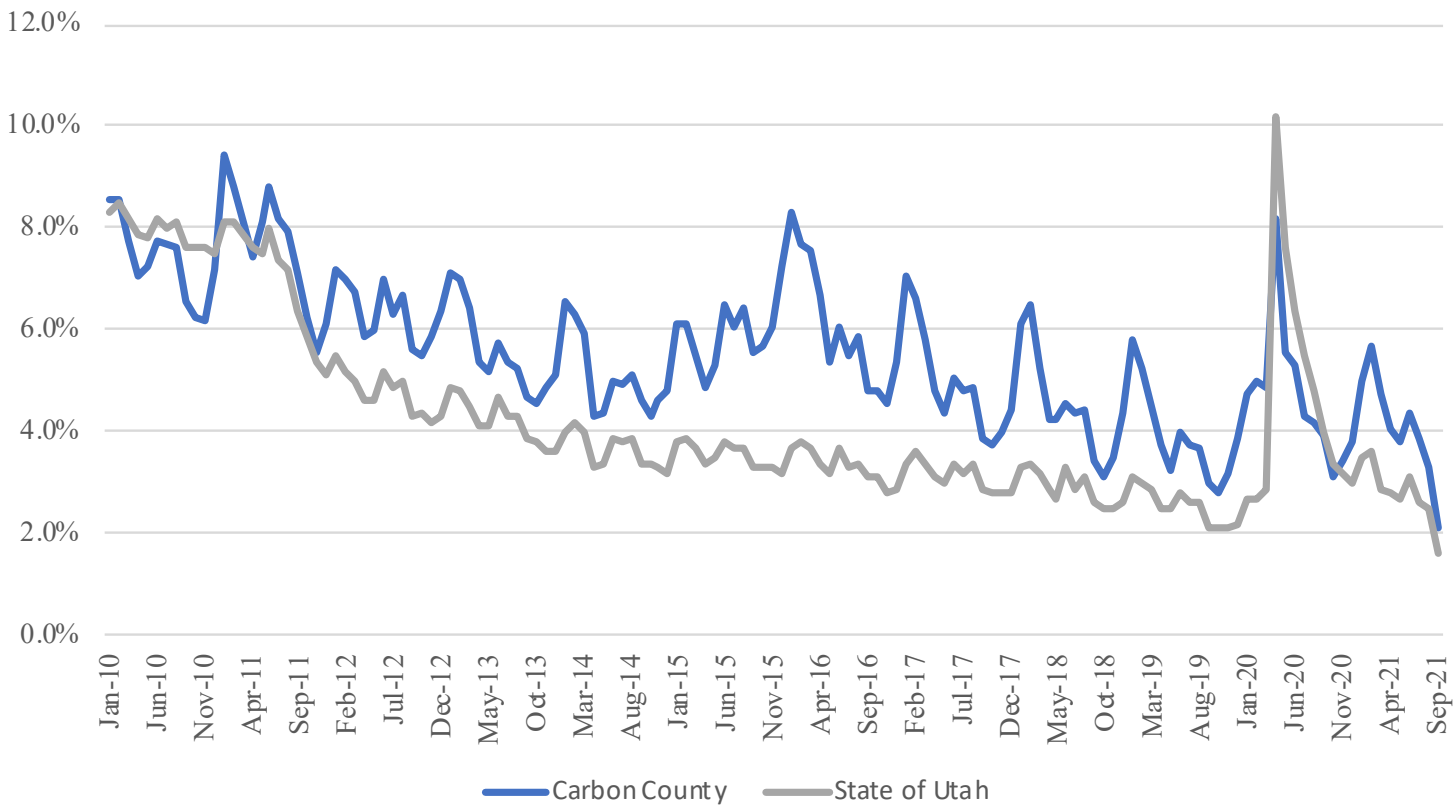

Figure 57: Emery County and State of Utah Unemployment Rate [55]

LEVEL OF ECONOMIC DIVERSITY: EMERY COUNTY

Economic diversity is an important concept and the more diversified it is, the more insulated it is from specific industry shocks. Table 36 shows that utilities, mining, and construction are the three largest wage contributors. Mining makes up 12.9% of that and utilities (including coal fired power plants) makes up 26.4%. Combined, this is a large portion of the wages earned in the county, which contributes to a lack of economic diversity. Utilities and Mining also produce the highest monthly wages at $8,228 and $6,100 respectively.

[55] Employment, unemployed, labor force, and unemployment rates for Emery, Carbon, and San Juan Counties are from the Bureau of Labor Statistics.

NAICS SECTOR	Average Employment 2019	Total Quarterly Wages 2019	Average Monthly Wage 2019
Total	261	$146,999,708	$3,765
Agriculture, Forestry, Fishing & Hunting	20	$554,682	$2,340
Mining	260	$19,014,038	$6,100
Utilities	394	$38,908,949	$8,229
Construction	389	$19,939,528	$4,269
Manufacturing	21	$1,074,743	$4,265
Retail Trade	486	$10,372,037	$1,778
Transportation and Warehousing	50	$2,056,462	$3,445
Information	126	$6,847,005	$4,546
Finance and Insurance	51	$1,753,058	$2,893
Professional Scientific & Technical Svc	89	$3,465,414	$3,254
Admin., Support, Waste Management, Remediation	12	$335,616	$2,380
Education Services	384	$14,261,087	$3,097
Health Care and Social Assistance	256	$7,876,616	$2,567
Accommodation and Food Services	280	$4,599,214	$1,369
Other Services (except Public Admin.)	102	$3,875,144	$3,174
Public Administration	324	$11,123,234	$2,861

Table 36:Emery County Quarterly Census and Employment Wages (2019) [56]

To understand what this means in terms of industrial diversification, refer to the industrial diversification index below. This was produced by measuring a Hachman Index for Emery County compared to Utah. The Hachman index is a measure of regional economic diversity and compares the target region (say a state) to the larger geographic area (say the nation). In this case, Emery County it was compared to Utah. The Hachman Index goes from 0-1, with 1 indicating the same amount of industrial diversity as the comparison region, and 0 indicating an area is completely different.

[56] Source: Utah Department of Workforce Services.

Figure 58 illustrates the Hachman Index for Emery County over the last 10 years. The most recent measurement for 2019 data is 0.541. For comparison purposes, Mesa County, Colorado has a Hachman Index of 0.8941. Therefore, 0.541 indicates that Emery County is not very diverse and has a high industry concentration when compared to the rest of the state. Although this calculation was performed using employment, it would likely show less diversification if wages were used instead.[8] However, Emery County has become significantly more diversified since 2013, rising from 0.336 in 2013 to 0.541in 2019. Although a lot of this reflects a major loss of mining jobs, gains occurred in arts, entertainment, recreation, professional services, utilities, transportation, and warehousing.

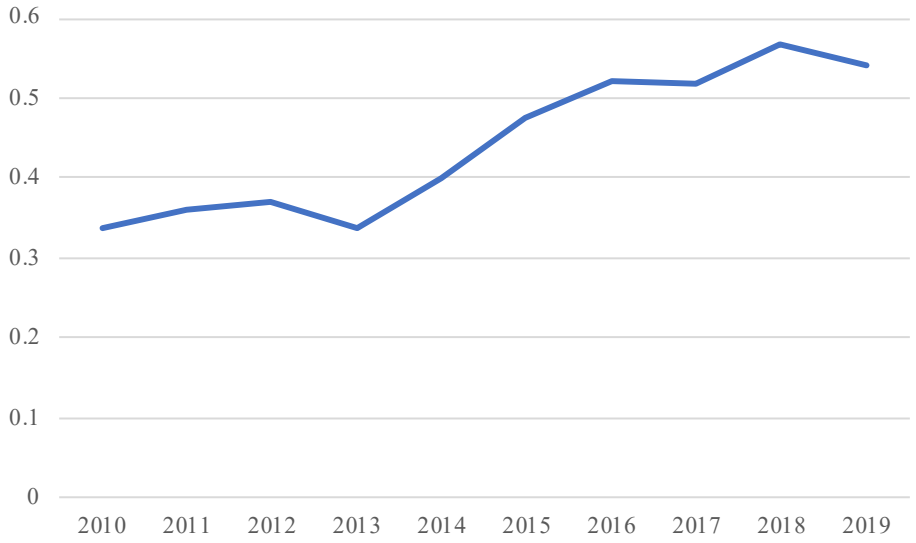

Figure 58: Hachman Index of Emery County

Coal County	Hachman Index
Colorado	
Moffat	0.445
Rio Blanco	0.364
Routt	0.755
Mesa	0.894
Montrose	0.757
Delta	0.556
Utah	
Carbon	0.585
Emery	0.541
San Juan	0.768

Table 37: Hachman Index Comparison

CARBON COUNTY

DEMOGRAPHIC INFORMATION: CARBON COUNTY

Carbon County is a small rural county in eastern Utah with a population of 20,476. The Carbon County population peaked in 2010 at the top of the energy boom experienced by many coal-producing economies. Coal demand drove intense economic activity in energy-producing regions like this from 2005-2010, creating employment and a population surge in the process. When the energy bubble burst, Carbon County lost residents and its population began to decline between 2009 and 2017. According to 2019 data, the Real Gross Domestic Product in Carbon County was just under $1 billion, at $997,957,000.

	2018	2019
Population	20,476	20,476
Real Gross Domestic Product (chained 2012 dollars)	$948,073,000	$997,957,000
Real GDP Per Capita	$46,823	$48,738
Median Household Income	$51,394	$52,110
Education (Bachelor's Degree Or Higher)	16.4%	17.1%
Education (High School or Higher)	90.8%	91.6%
% Of People Under Poverty Line	14.4%	16.4%

Table 38: Carbon County Overview [57]

Race/Ethnicity	Percentage
White alone	94.8%
Black	0.6%
American Indian and Alaskan Native alone	1.6%
Asian alone	0.7%
Native Hawaiian and Other Pacific Islander alone	0.2%
Two or More Races	2.1%
Hispanic or Latino	13.4%
White alone, Not Hispanic or Latino	82.9%

Table 39: Carbon County Demographics [58]

[57] Source: U.S. Census Bureau (USCB). Regional GDP is from the Bureau of Economic Analysis (BEA). Census poverty estimates are from the Small Area Income and Poverty Estimates (SAIPE).

[58] Source: United States Census Bureau, estimates as of July 1st, 2021.

Census Bureau data shows that 94.8% of Carbon County is White, 13.4% Hispanic or Latino, and 1.6% American Indian or Alaskan Native. 6.2% of the population is under 5 years old, 25.6% under 18 years old, and 18% over 65 years old. As forecast by the Kem Gardner Institute, Carbon County is expected to grow at a slow rate until considerable declines occur later.[9] Figure 60 illustrates census population data from 2001-2020 with Kem Gardner Institute population estimates from 2021-2050. Note the run-up in population during the energy boom from 2005 to 2010 and the precipitous decline following the energy bust.

Age/Gender	Percentage
Under 5 years old	6.2%
Under 18 years old	25.6%
Over 65 years old	18.0%
Between 18 and 65	56.4%
Female	50.3%
Male	47.7%

Table 40: Carbon County Age and Gender [59]

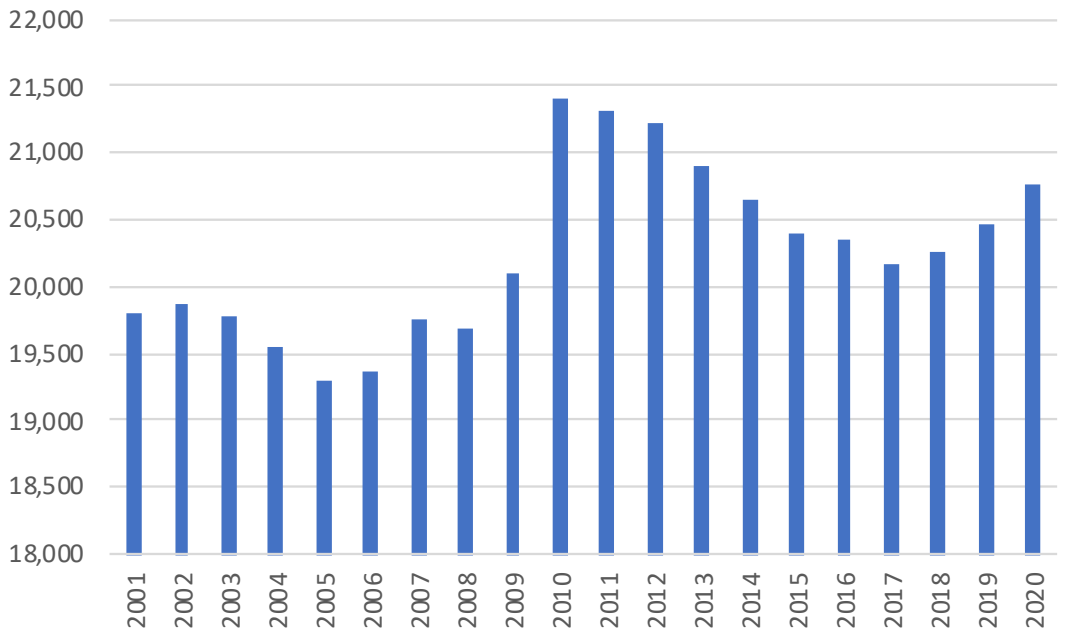

Figure 59: Carbon County Population (Census) [60]

[59] Source: United States Census Bureau.

[60] Kem Gardner Institute.

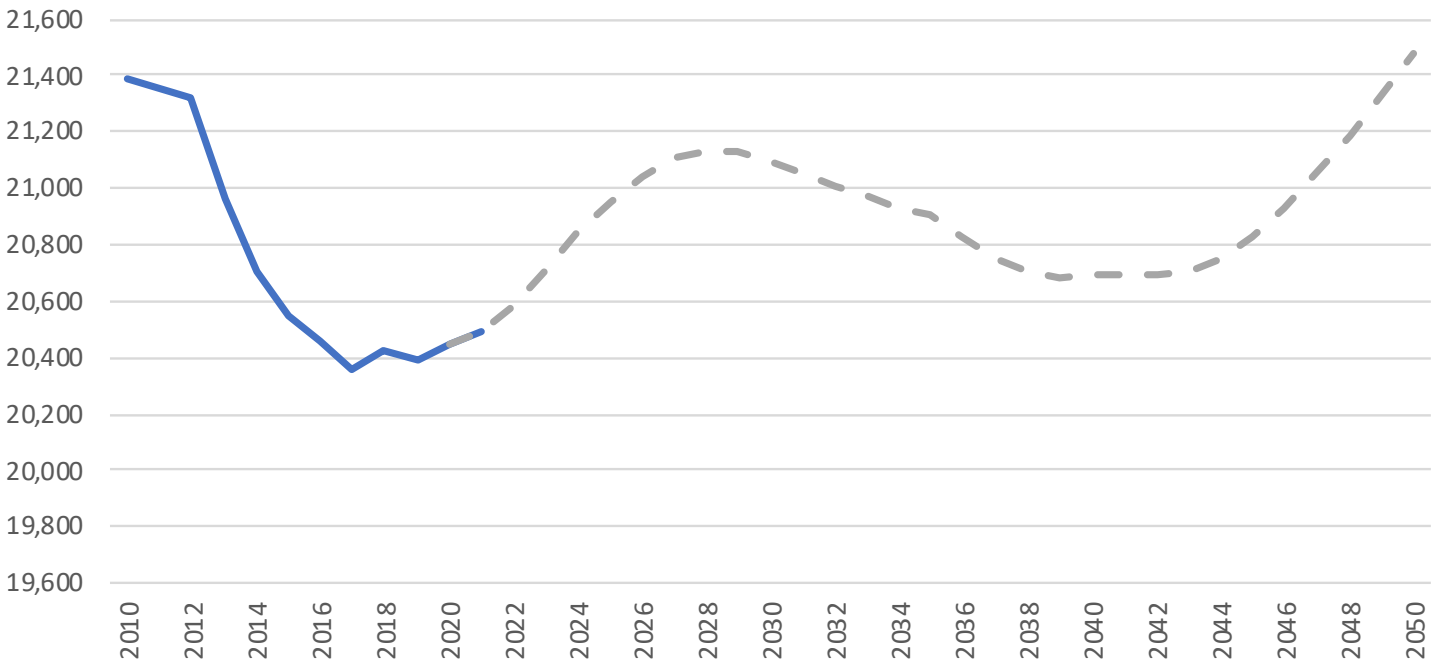

Figure 60: Carbon County Population and Forecast (2010-2050)

INDUSTRIAL COMPOSITION AND EMPLOYMENT: CARBON COUNTY

Carbon County Gross Domestic Product (Figure 61) peaked in 2008 at close to $1.3 Billion during the runup in coal prices and has been in steady decline since. Mining, the center of the Carbon County economic story, is graphed as a percentage of GDP in Figure 63. This has changed from a previous peak of close to 40% of economic activity in 2002 to a low of 27% in 2012 and rising again to 51% by 2020. Mining, as classified by NAICS codes, includes both coal mining and oil and gas extraction. According to 2019 IMPLAN data, oil and gas wages made up approximately 8% of this, while coal made up the other 92%. This proportion does not include electric power generation from coal or oil, gas, and coal support services. Although there is some oil and gas activity in Carbon County, it is primarily on the south end of the Uinta Basin.

Table 41 illustrates the top contributions by industry to GDP. According to the BEA, mining is the top contributor to GDP at 51.43% with real estate coming in second at close to 10%. The BEA GDP data does not count the Sunnyside power plant as part of Carbon County, but as Emery County instead. However, IMPLAN data does and it shows that coal power plants contribute 10.3% to GDP in Carbon County, while coal mining contributes 36.3%.

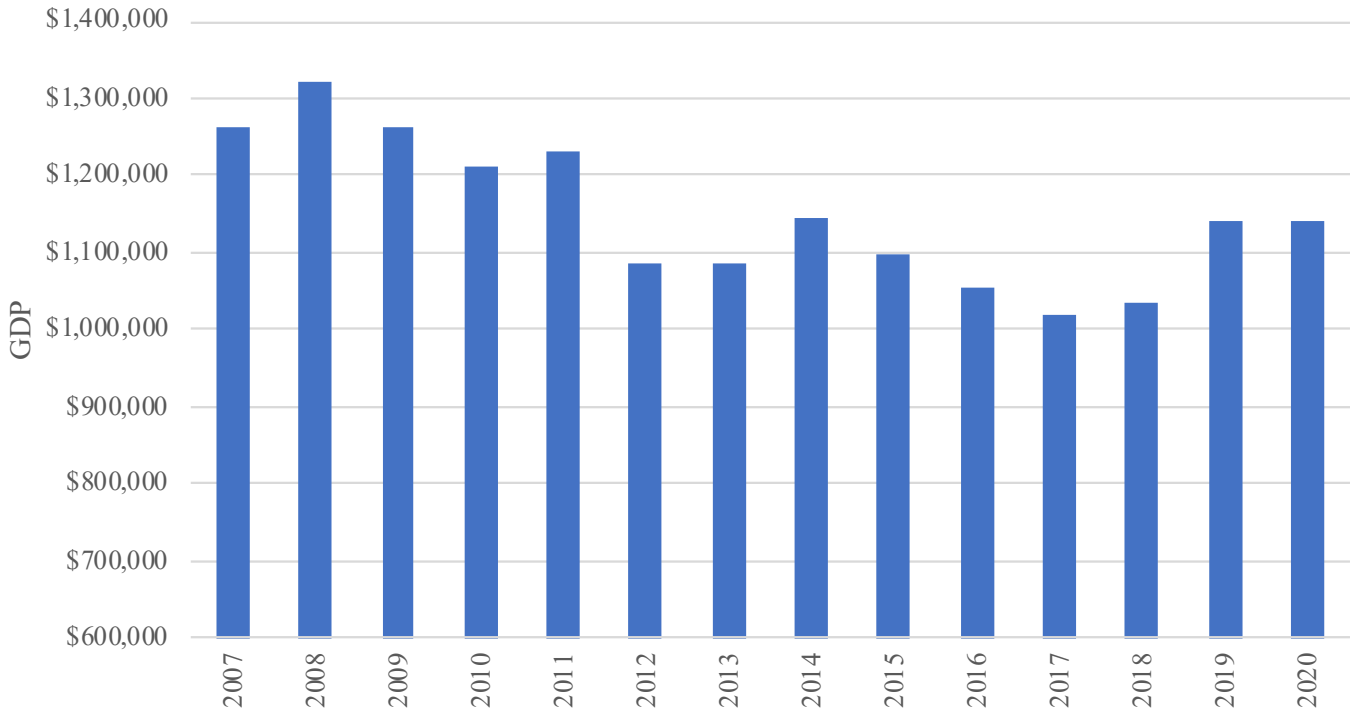

Figure 61: Carbon County Real GDP [61]

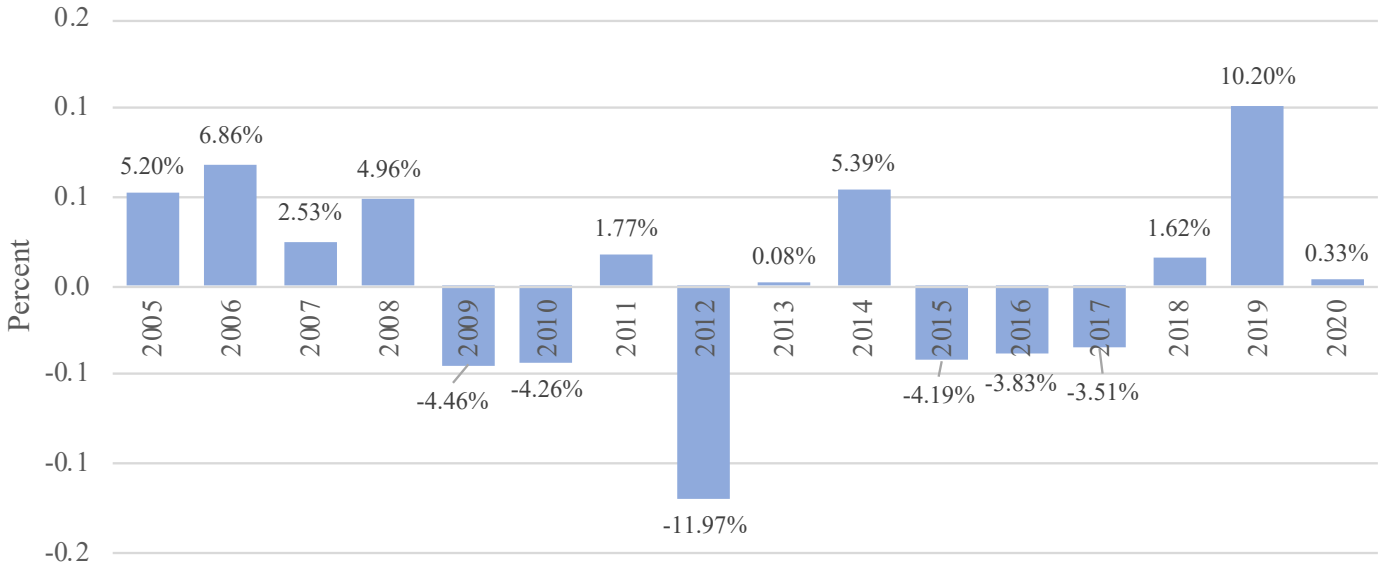

Figure 62: Carbon County Real GDP (% Change) [62]

[61] Source: Bureau of Economic Analysis. Real GDP is calculated with chained 2012 dollars.

[62] Source: Bureau of Economic Analysis. Real GDP is calculated with chained 2012 dollars.

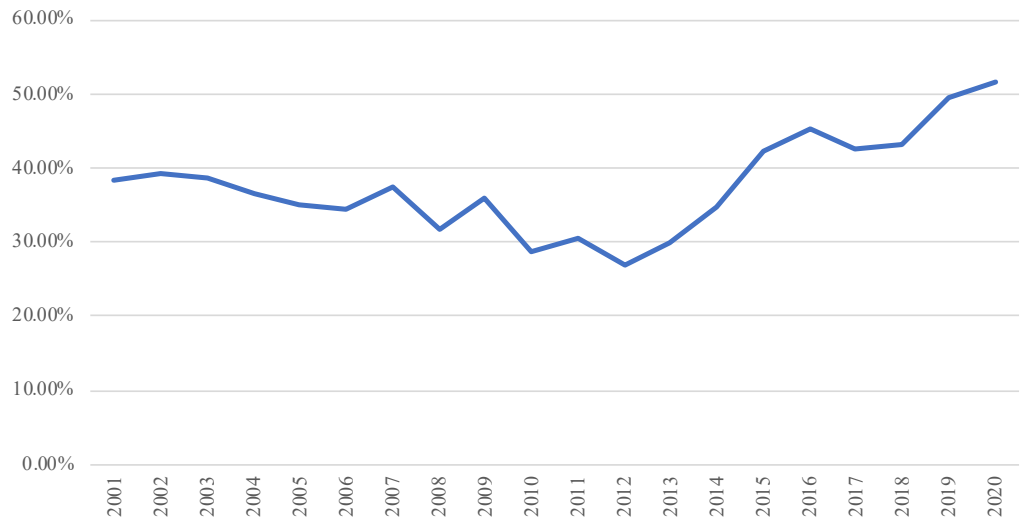

Figure 63: Mining as a Percentage of GDP, Carbon County

	2018	2019	2020	% Change Since 2019	% of Total GDP
All industry total [63]	$1,033,391	$1,138,829	$1,142,554		
Private industries	$914,451	$1,023,518	$1,029,041	0.60%	90.06%
Agriculture, forestry, fishing and hunting	$2,303	$490	$3,144	115.24%	0.28%
Mining, quarrying, and oil and gas extraction	$446,115	$564,320	$587,663	5.23%	51.43%
Utilities	$28,368	$31,747	$30,416	-4.69%	2.66%
Construction	$24,561	$22,560	$21,585	-3.97%	1.89%
Manufacturing	$38,316	$42,336	$42,959	1.63%	3.76%
Durable goods manufacturing	$31,606	$34,184	$35,041	2.71%	3.07%
Nondurable goods manufacturing	$6,711	$8,130	$7,901	-3.41%	0.69%
Wholesale trade	$36,505	$35,468	$33,984	-4.07%	2.97%
Retail trade	$55,926	$55,603	$58,202	4.65%	5.09%
Transportation and warehousing	$41,378	$39,336	$31,684	-18.49%	2.77%

[63] Bold text indicates primary industry and non-bold text a subcategory.

Information	$4,188	$6,448	$6,923	11.34%	0.61%
Finance, insurance, real estate, rental, and leasing	$119,494	$125,498	$121,019	-3.75%	10.59%
Finance and insurance	$8,827	$8,617	$9,008	4.43%	0.79%
Real estate and rental and leasing	$110,926	$117,305	$112,263	-4.55%	9.83%
Professional and business services	$36,267	$38,320	$42,912	12.66%	3.76%
Professional, scientific, and technical services	$16,629	$16,700	$15,502	-7.20%	1.36%
Management of companies and enterprises	$2,229	$5,433	$14,532	408.21%	1.27%
Administrative and support and waste management and remediation services	$16,724	$15,955	$14,200	-10.49%	1.24%
Educational services, health care, and social assistance	$68,810	$68,398	$65,920	-3.60%	5.77%
Educational services	N/A	N/A	N/A	N/A	N/A
Health care and social assistance	N/A	N/A	N/A	N/A	N/A
Arts, entertainment, recreation, accommodation, and food services	$16,000	$16,737	$14,161	-16.10%	1.24%
Arts, entertainment, and recreation	$1,587	$1,436	$1,263	-10.90%	0.11%
Accommodation and food services	$14,394	$15,266	$12,871	-16.64%	1.13%
Other services (except government and government enterprises)	$27,272	$27,710	$28,428	2.63%	2.49%
Government and government enterprises	$117,578	$115,625	$114,109	-1.29%	9.99%

Table 41: Carbon County GDP by Industry [64]

[64] Source: Bureau of Economic Analysis.

CARBON COUNTY LABOR MARKET: LONG VIEW

The Carbon County labor market has stagnated since the energy boom peak of 2009. Figure 65 illustrates employment back to the year 2000. During the 2000s there was a runup in employment, culminating with a peak in 2009 and a subsequent employment drop. Employment dropped from a peak of 10,240 in November of 2008 to a low of 7,663 in August of 2017. Additionally, since 2018, employment has stayed relatively stagnant. Figure 64 shows that Carbon County's unemployment rate is generally higher than that of the state of Utah.

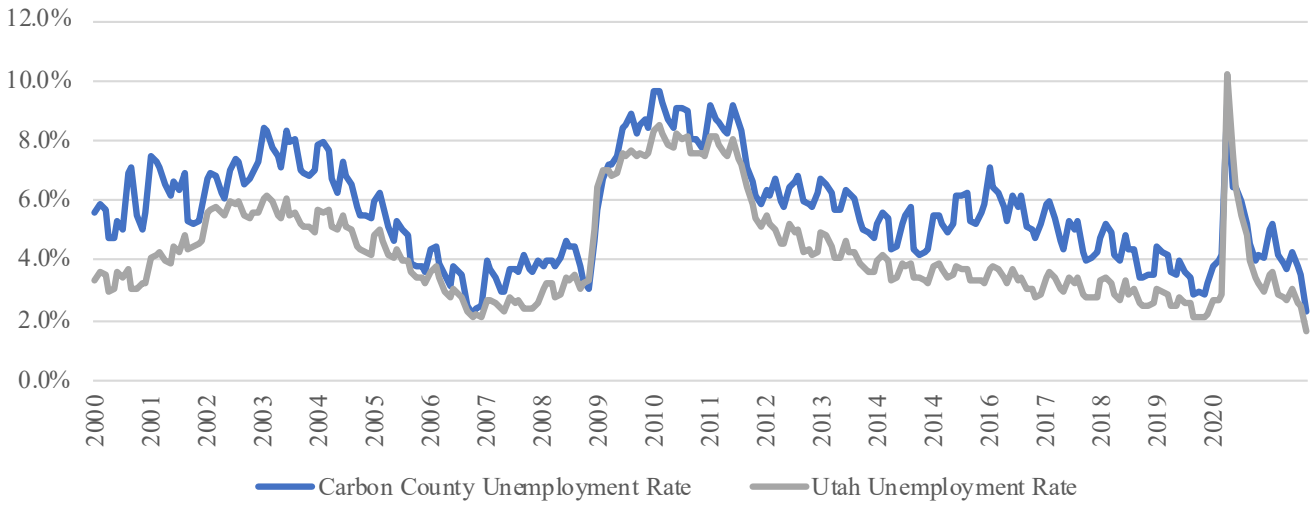

Figure 64: Carbon County Unemployment Rate (Non-Seasonally Adjusted)

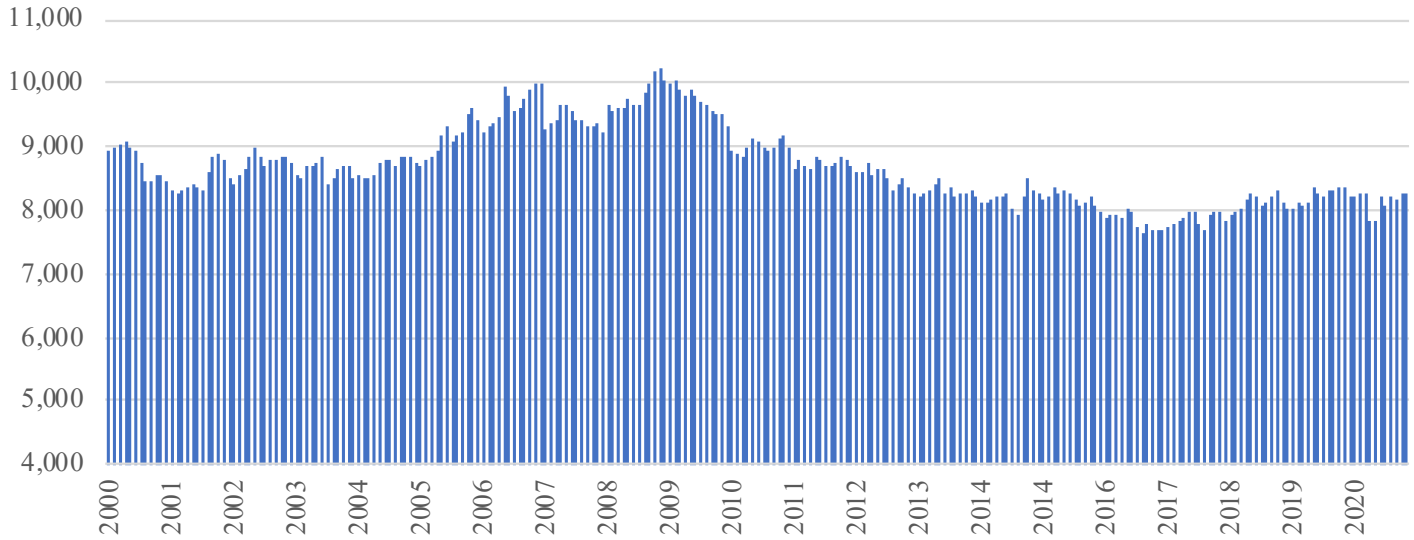

Figure 65: Carbon County Employed

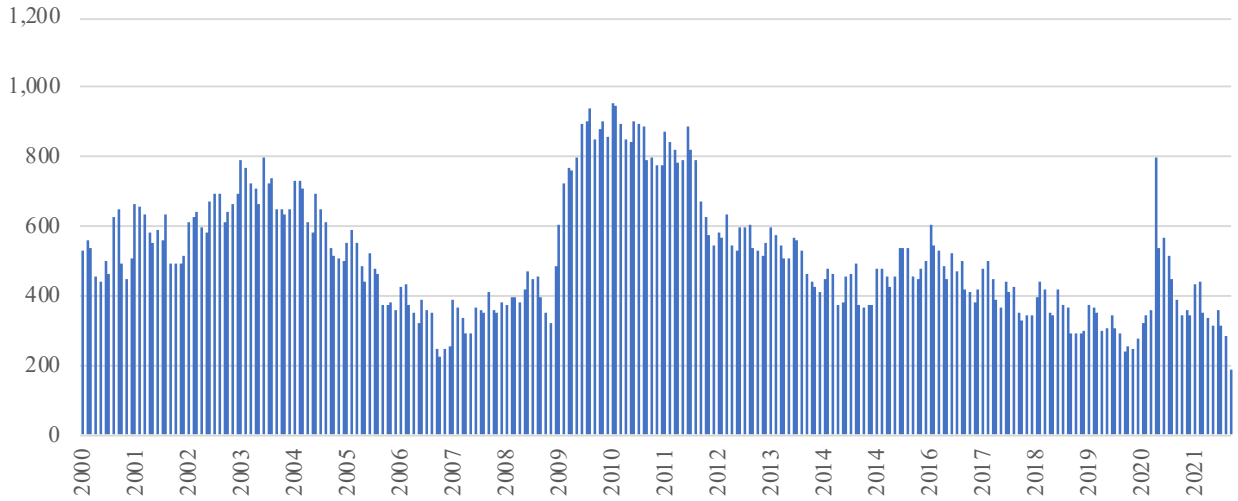

Figure 66: Carbon County Unemployed

LEVEL OF ECONOMIC DIVERSITY: CARBON COUNTY

Economic diversity is important for any economy because the more diverse it is, the more insulated it is to shocks within a given industry. Table 42 illustrates employment, wages, and average monthly wages for 2019 in Carbon County. 2019 data was used to illustrate pre-COVID-19 industry activity. According to this data, Carbon County is not diversified in terms of wages, with a large percentage coming from mining. To these ends, $61,709, 205 of the $87,823,956 total wages for the sector come from mining, while the remaining portion comes from oil and gas. According to in QCEW data, healthcare is another top economic contributor representing 23% of wages and 10.1% of jobs. Table 42 illustrates that mining has the highest monthly wage at $8,005 and is the highest contributor to wages, followed by healthcare.

NAICS SECTOR	Average Employment 2019	Total Quarterly Wages 2019	Average Monthly Wage 2019
Total	624	$380,430,291	$3,526
Agriculture, Forestry, Fishing & Hunting	15	$466,712	$2,682
Mining	914	$87,823,956	$8,005
Utilities	117	$9,565,278	$6,813
Construction	368	$17,148,978	$3,889
Manufacturing	399	$22,249,646	$4,650
Wholesale Trade	312	$18,465,478	$4,940
Retail Trade	1053	$27,590,388	$2,184

Transportation and Warehousing	534	$26,114,454	$4,073
Information	84	$2,354,497	$2,343
Finance and Insurance	136	$5,555,077	$3,416
Real Estate and Rental and Leasing	49	$1,288,866	$2,203
Professional Scientific & Technical Svc	207	$9,170,727	$3,687
Management of Companies and Enterprises	28	$4,441,696	$13,338
Admin., Support, Waste Management, Remediation	291	$9,559,989	$2,738
Education Services	1180	$30,594,207	$2,162
Health Care and Social Assistance	1264	$48,404,726	$3,192
Arts, Entertainment, and Recreation	149	$1,608,288	$903
Accommodation and Food Services	696	$9,390,765	$1,124
Other Services (except Public Admin.)	377	$14,768,059	$3,267
Public Administration	836	$34,335,216	$3,423

Table 42: Carbon County Quarterly Census and Employment Wages (2019) [65]

An industrial diversification index was created to understand what this means in terms of industrial diversification. This was produced by measuring a Hachman Index for Carbon County compared to Utah. The Hachman index is a measure of regional economic diversity and compares the target region (say a state) to the larger geographic area (say the nation). In this case, Carbon County it was compared to Utah. The Hachman Index goes from 0-1, with 1 indicating the same amount of industrial diversity as the comparison region, and 0 indicating an area is completely different. Figure 67 illustrates the Hachman Index for Carbon County over the last 10 years. The most recent measurement for 2019 data is 0.5859. For comparison purposes, Mesa County, Colorado, has a Hachman Index of 0.8941. 0.5859 indicates that Carbon County is not very diverse and has high industry concentration compared to the rest of the state. This calculation was performed using employment. If it was performed using wages instead, it would likely show even less industrial diversification.[10]

[65] Source: Utah Department of Workforce Services, QCEW data.

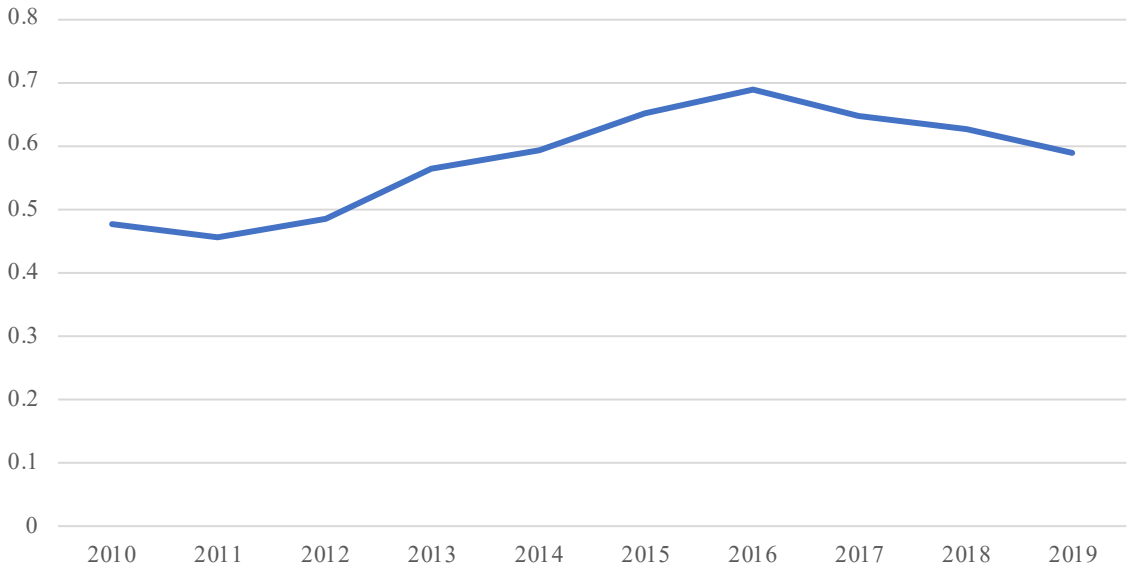

Figure 67: Hachman Index of Carbon County

Coal County	Hachman Index
Colorado	
Moffat	0.445
Rio Blanco	0.364
Routt	0.755
Mesa	0.894
Montrose	0.757
Delta	0.556
Utah	
Carbon	0.585
Emery	0.541
San Juan	0.768

Table 43: Hachman Index Comparison

SAN JUAN COUNTY

DEMOGRAPHIC INFORMATION: SAN JUAN COUNTY

San Juan County is a small rural county in eastern Utah with a population of 15,278. The population of San Juan County has steadily increased since the early 2000s. The Navajo Nation (located within the southern region of the county) contributes economic and population activity that are counted in San Juan County's data. According to 2019 data, the Real Gross Domestic Product was $506,988,000 in 2012 chained dollars in San Juan County.

	2018	2019
Population	15,228	15,278
Real Gross Domestic Product (chained 2012 dollars)	$483,379,000	$506,988,000
Real GDP Per Capita	$31,519	$33,293
Median Household Income	$42,982	$49,438
Education (Bachelor's Degree or Higher)	18.4%	18.3%
Education (High School or Higher)	83.3%	84.9%
% Of People Under Poverty Line	22.6%	21.9%

Table 44: San Juan County Overview [66]

Census Bureau data shows that 49% of San Juan County is American Indian, 47.8% White, and 5.8% Hispanic or Latino. 7.2% of the population is under 5 years old, 29.3% is under 18 years old, and 14.9% is over 65 years old. After a small population decline, San Juan is expected to grow to a population of 17,250 by 2050.[11] Figure 68 illustrates the population data graphically.

Race/Ethnicity	Percentage
White alone	47.8%
Black	0.4%
American Indian and Alaskan Native alone	49%
Asian alone	0.6%
Native Hawaiian and Other Pacific Islander alone	0.1%
Two or More Races	2.1%
Hispanic or Latino	5.8%
White alone, Not Hispanic or Latino	44.3%

Table 45: San Juan County Demographics [67]

[66] Source: U.S. Census Bureau (USCB). Regional GDP is from the Bureau of Economic Analysis (BEA). Census poverty estimates are from the Small Area Income and Poverty Estimates (SAIPE).

[67] Source: United States Census Bureau.

Age/Gender	Percentage
Under 5 years old	7.2%
Under 18 years old	29.3%
Over 65 years old	14.9%
Between 18 and 65	44.2%
Female	50.0%
Male	50.0%

Table 46: San Juan County Age and Gender [68]

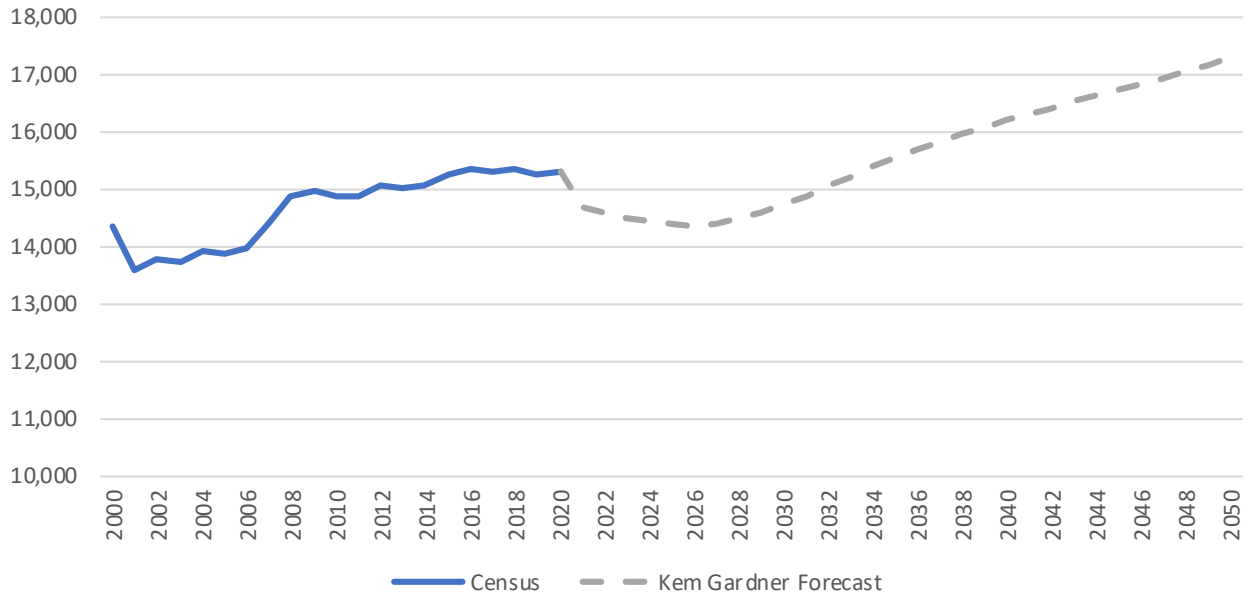

Figure 68: San Juan County Population and Forecast (2000-2050) [69]

INDUSTRIAL COMPOSITION AND EMPLOYMENT: SAN JUAN COUNTY

The San Juan economy is led by the mining industry, specifically copper and uranium. From an output perspective, copper, nickel, lead, and zinc mining makes up 8% of GDP, followed by owner occupied dwellings (5.7%) and oil and gas (4.8%). In terms of wages, the biggest wage contributors are local government education at 14.5% of total wages, outpatient care centers (9%), and other government services (7%).[12]

Table 47 illustrates the top contributions by industry to GDP in the standard industry categories. According to the BEA data, mining, oil, and gas are the top contributors to GDP at 28.4%. Government and government enterprises are the second top contributors at 19%. 2020 was a challenging year for San Juan County with GDP falling by 10.60%.

[68] Source: United States Census Bureau.

[69] Source: United States Census Bureau and the Kem Gardner Institute.

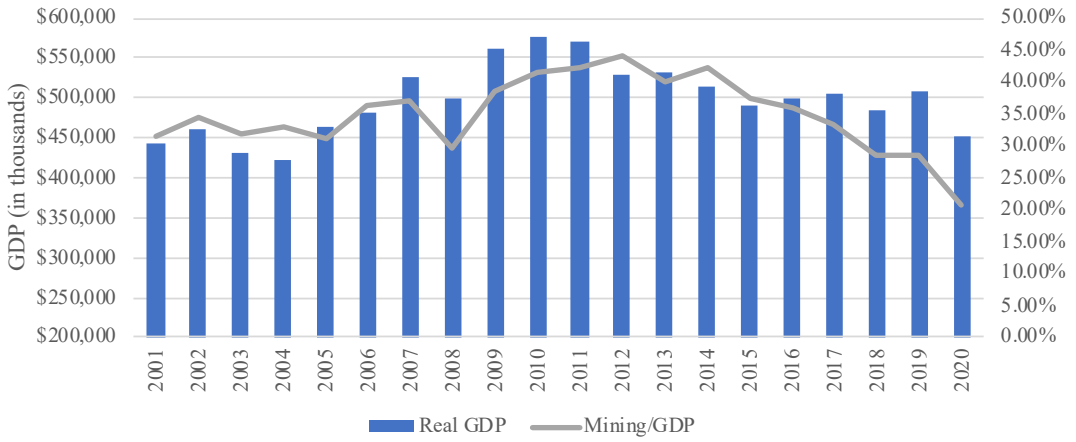

Figure 69: San Juan County Real GDP [70]

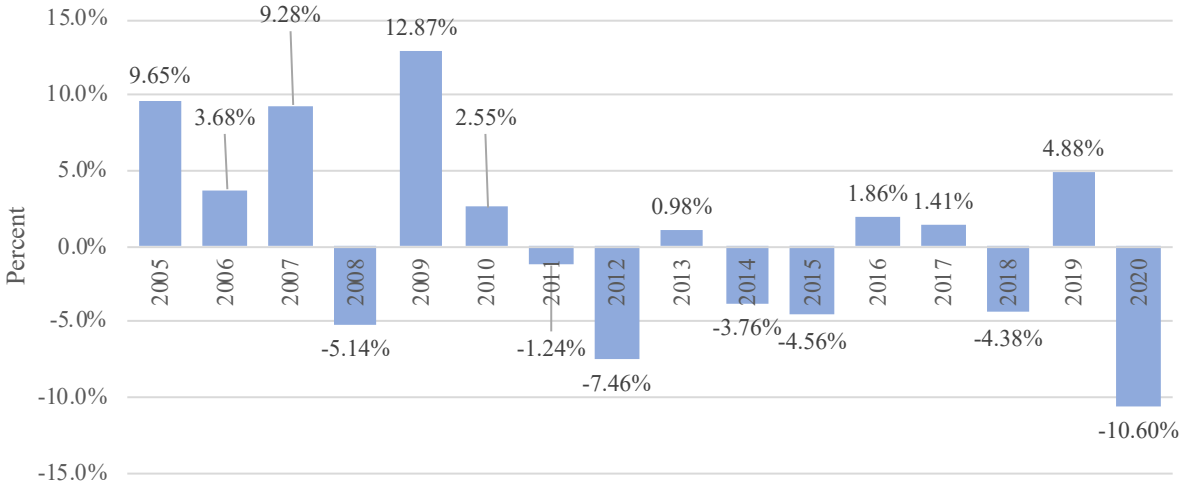

Figure 70: San Juan County Real Growth Rate GDP [71]

	2018	2019	2020	% Change from 2019	% of Total GDP
All industry total [72]	$483,379	$506,988	$453,246		
Private industries	$384,546	$411,000	$358,821	-13.57%	79.17%
Agriculture, forestry, fishing and hunting	$4,033	$5,575	$22,264	413.81%	4.91%
Mining, quarrying, and oil and gas extraction	$137,957	$144,027	$93,763	-36.43%	20.69%
Utilities	$9,162	N/A	$13,751	N/A	3.03%

[70] Source: Bureau of Economic Analysis. Real GDP is calculated with chained 2012 dollars.

[71] Source: Bureau of Economic Analysis. Real GDP is calculated with chained 2012 dollars.

[72] Bold text indicates primary industries and non-bold text indicates a subcategory.

Construction	$14,043	$14,556	$10,901	-26.03%	2.41%
Manufacturing	$7,640	$11,336	$11,623	3.76%	2.56%
Durable goods manufacturing	N/A	N/A	$2,439	N/A	0.54%
Nondurable goods manufacturing	N/A	N/A	$9,212	N/A	2.03%
Wholesale trade	N/A	$2,239	N/A	N/A	N/A
Retail trade	$11,569	$11,954	$11,586	-3.18%	2.56%
Transportation and warehousing	$4,044	$4,841	$4,986	3.59%	1.10%
Information	N/A	N/A	N/A	N/A	N/A
Finance, insurance, real estate, rental, and leasing	$63,313	$65,924	$63,536	-3.77%	14.02%
Finance and insurance	$3,221	$3,375	$3,515	4.35%	0.78%
Real estate and rental and leasing	$60,004	$62,450	$59,837	-4.35%	13.20%
Professional and business services	N/A	$9,581	$9,185	N/A	2.03%
Professional, scientific, and technical services	$4,572	N/A	N/A	N/A	N/A
Management of companies and enterprises	N/A	N/A	N/A	N/A	N/A
Administrative and support and waste management and remediation services	$2,170	$2,266	$2,111	-7.14%	0.47%
Educational services, health care, and social assistance	$49,706	$50,142	$49,068	-2.16%	10.83%
Educational services	N/A	N/A	N/A	N/A	N/A
Health care and social assistance	N/A	N/A	N/A	N/A	N/A
Arts, entertainment, recreation, accommodation, and food services	$38,308	$39,829	$23,255	-43.27%	5.13%
Arts, entertainment, and recreation	N/A	N/A	$198	N/A	0.04%

Accommodation and food services	N/A	N/A	$23,017	N/A	5.08%
Other services (except government and government enterprises)	$13,138	$13,087	N/A	N/A	N/A
Government and government enterprises	$97,711	$96,359	$92,713	-3.73%	20.46%

Table 47: San Juan County GDP by Industry [73]

SAN JUAN COUNTY LABOR MARKET: LONG VIEW

The San Juan County labor market can be characterized by three different stages. The first stage is from 2000 to 2010, which was characterized by employment growth. The second stage is from 2010 to 2019 during which employment stagnated and did not change over the nine years. The third stage is the COVID era, which saw employment fall and not recovered as of 2021. Figure 71 illustrates employment back to the year 2000. San Juan County's unemployment rate is generally higher than the state of Utah with both unemployment rates being non-seasonally adjusted.

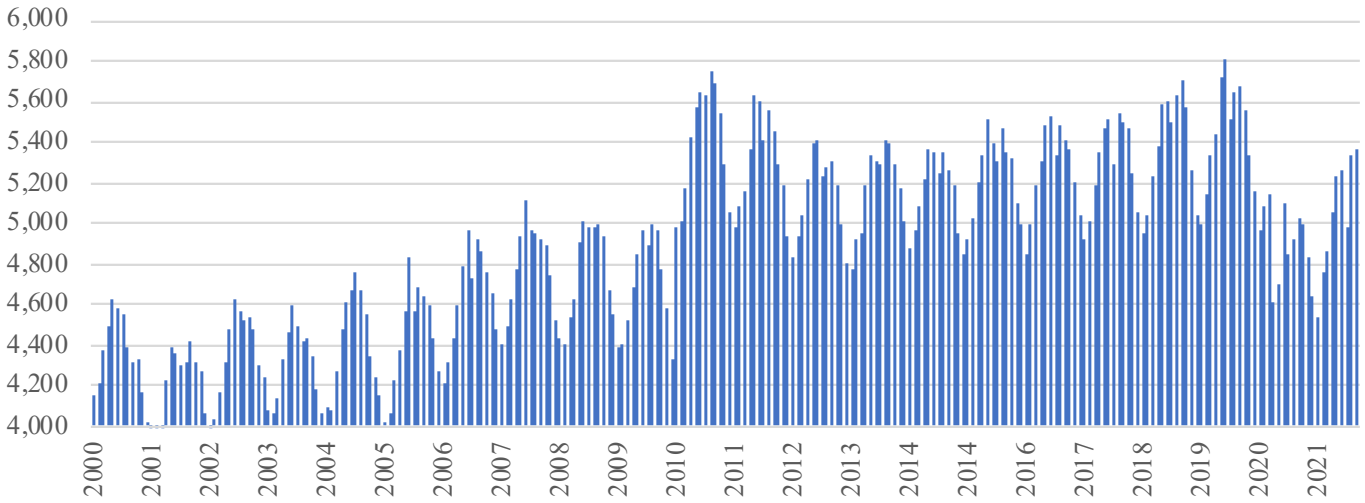

Figure 71: San Juan County Employed

[73] Source: Bureau of Economic Analysis.

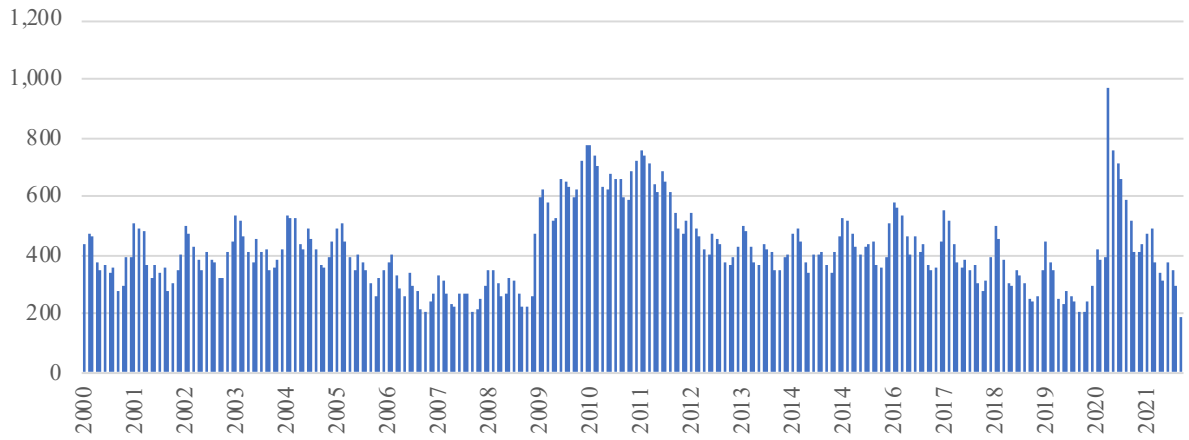

Figure 72: San Juan County Unemployed

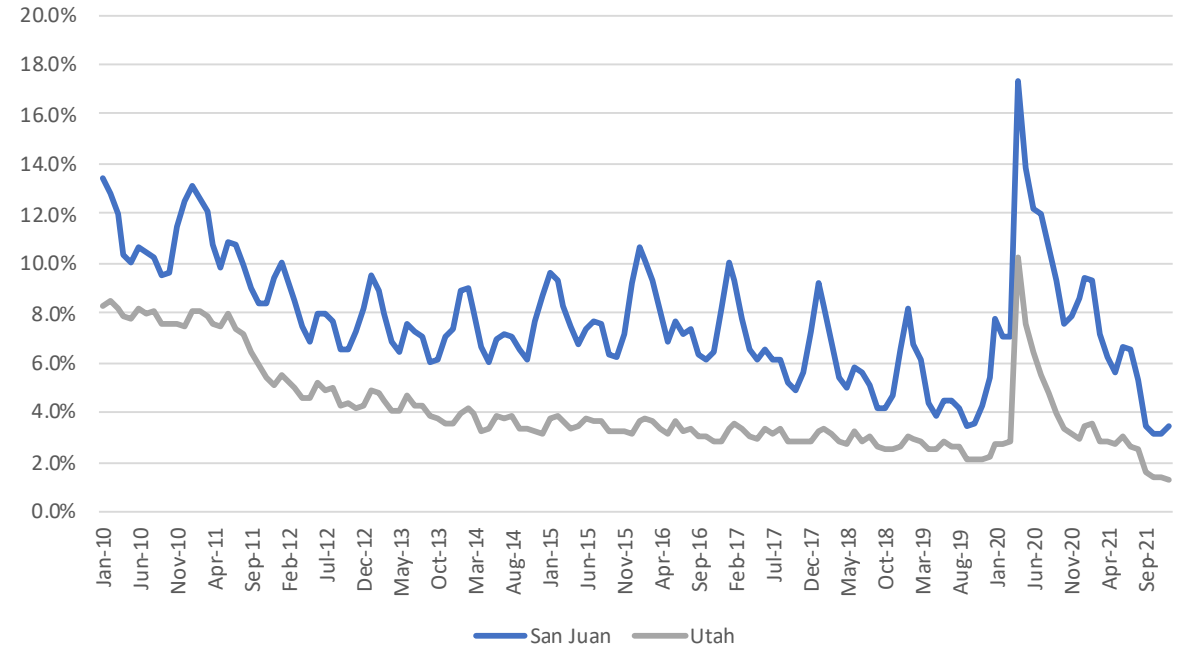

Figure 73: San Juan County Unemployment Rate

LEVEL OF ECONOMIC DIVERSITY: SAN JUAN COUNTY

Economic diversity is an important concept in an economy, as the more diversified it is the more insulated it is from shocks in a specific industry. Table 48 illustrates average employment, wages, and average monthly wage for industries in San Juan County. San Juan County is not as reliant on coal or power production as Emery, Carbon, Moffat, Rio Blanco, and Routt Counties.

Additionally, though mining makes up 10% of wages in the county, it only makes up 5.3% of employment. Health care is the largest industry by wages followed by education, public administration, and accommodation/food services. The highest monthly wages are professional services at $6,101, followed by mining ($5,864) and utilities ($5,865).

NAICS SECTOR	Average Employment 2019	Total Quarterly Wages 2019	Average Weekly Wage 2019
Total	4,428	$158,505,365	$2,983
Agriculture, Forestry, Fishing & Hunting	12	$283,970	$2,014
Mining	239	$16,836,848	$5,864
Utilities	21	$1,477,936	$5,865
Construction	271	$9,892,593	$3,048
Manufacturing (31-33)	83	$2,358,084	$2,360
Wholesale Trade	24	$844,267	$2,962
Retail Trade (44 & 45)	310	$5,516,578	$1,483
Transportation and Warehousing (48 & 49)	118	$3,553,473	$2,504
Finance and Insurance	58	$2,454,402	$3,511
Real Estate and Rental and Leasing	18	$365,567	$1,741
Professiona.l Scientific & Technical Svc	30	$2,214,565	$6,101
Admin., Support, Waste Mgmt, Remediation	60	$1,328,567	$1,861
Education Services	865	$27,769,174	$2,676
Health Care and Social Assistance	859	$38,717,367	$3,756
Arts, Entertainment, and Recreation	50	$2,439,152	$4,065
Accommodation and Food Services	778	$18,862,733	$2,021
Other Services (except Public Admin.)	110	$3,539,014	$2,693
Public Administration	517	$19,948,609	$3,215

Table 48: San Juan County Quarterly Census and Employment Wages (2019) [74]

[74] Source: Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages.

An industrial diversification index was created to understand what this means in terms of industrial diversification. This was produced by measuring a Hachman Index for San Juan County compared to Utah. The Hachman index is a measure of regional economic diversity and compares the target region (say a state) to the larger geographic area (say the nation). In this case, San Juan County it was compared to Utah. The Hachman Index goes from 0-1, with 1 indicating the same amount of industrial diversity as the comparison region, and 0 indicating an area is completely different. Figure 74 illustrates the Hachman Index for San Juan County over the last 10 years. The most recent measurement for 2019 data is 0.768. This is a high measure of diversification for a county as small as San Juan. The county saw an increase in diversification from 2010 through 2015 and has stayed at its current industrial diversification level since.[75]

REGIONAL ECONOMIC CONTRIBUTION OF COAL

To determine the regional economic contribution of coal, an analysis was conducted using IMPLAN. This model examined the economic contribution of coal extraction, power, and support industries in Carbon, Emery, and San Juan Counties. It also accounted for direct expenditure, supply chain, induced spending, and leakages effects outside of the county.

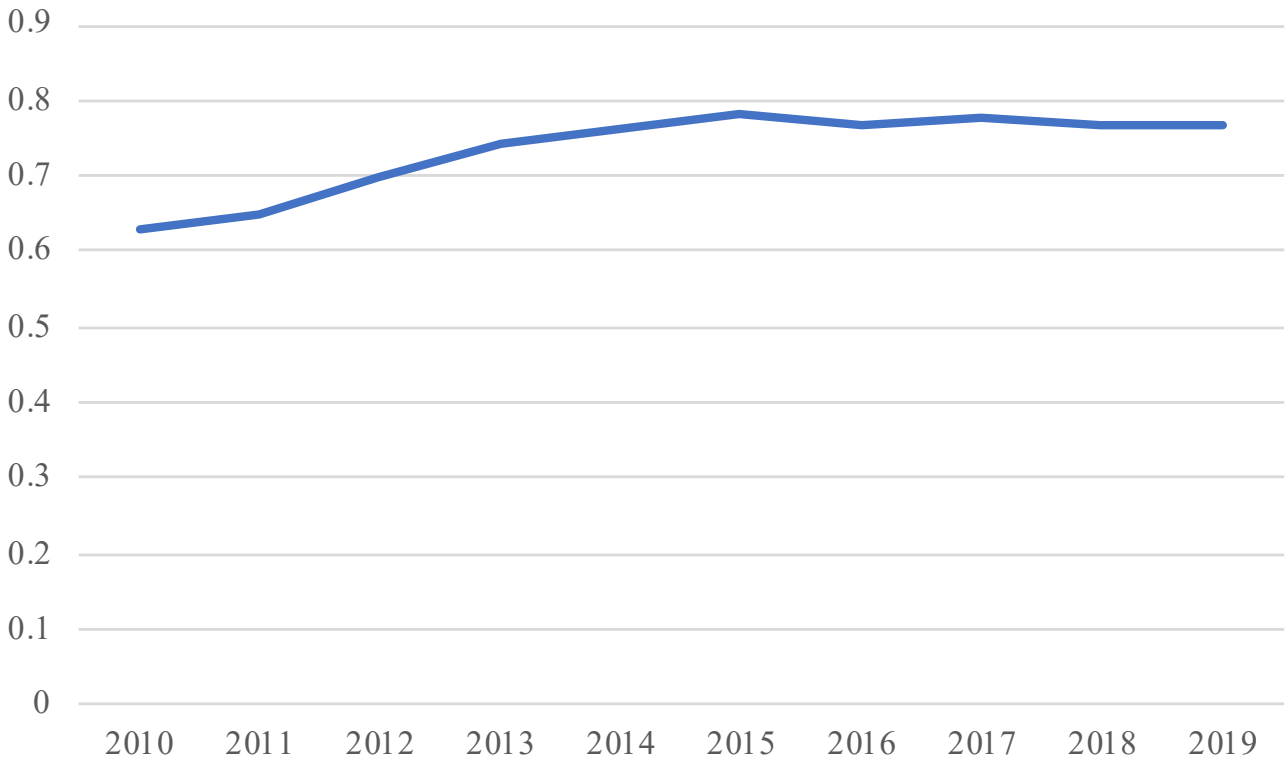

Figure 74: Hachman Index of San Juan County

Coal County	Hachman Index
Colorado	
Moffat	0.445
Rio Blanco	0.364
Routt	0.755
Mesa	0.894
Montrose	0.757
Delta	0.556
Utah	
Carbon	0.585
Emery	0.541
San Juan	0.768

Table 49: Hachman Index Comparison

Additionally, the approach was multi-regional and accounted for economic flow activity between the counties. Furthermore, the results were broken down by both the three-county region and individual county effects.

Table 50 illustrates jobs, labor income, gross regional product, and total output that results coal for the 3-county region. "Direct effects" are the direct expenditures in the region with leakages subtracted. "Indirect effects" are supply chain effects and "induced effects" are increases in expenditures that increase wages from direct and indirect spending. "Total effects" are the combination of direct, indirect, and induced effects. Each spending category has a regional multiplier that is applied in the model.

The total economic contribution of coal in the region is $623,837,035, or 30.4% of regional GDP.[14] The contribution to GDP represents final goods and services and is the proportion of total output that is paid to business and other entities in the form of employee compensation, proprietor income, taxes on production, and profits.

"Regional GDP" is the final value of goods and services. Calculating this subtracts intermediate goods from the estimation. This value considers estimated purchases from outside the county as well as other leakages.

The total output number of $1,021,131,478 represents the gross total value of all sales and production resulting from the coal industry. This is a broader measure than the standard Gross Domestic Product (GDP), or in a local economy (regional GDP). This measure also looks at the total value to each business and does not avoid the traditional "double counting" issue that arises in calculating GDP. "Total output" represents how a business sees its activity or the gross sales and production that funnel through it. This represents the gross measure of local economic activity and is more in line with how a business would account for the sales transaction from one firm to another. Therefore, total output does not subtract intermediate goods, but adds all transactions that take place through the supply chain instead. [75]

As for the coal industry, it is estimated to contribute 1,806.5 total jobs to the region, with 919.1 in direct employment from coal mining and power, 459.6 jobs created through supply chain effects, and 427.8 jobs created through the induced spending effect. The total wage contribution to the region from coal is $157,361,241.

Table 51 illustrates the top 10 industries affected by employment. Coal mining, coal power, and mining support services have the biggest contribution. Employment effects resulting from this coal activity include truck transportation (43), machinery, equipment, and supplies (36), with real estate (34) and restaurants (33) following.

Impact Type	Employment	Labor Income	Regional GDP	Total Output
Direct Effect	919.1	$114,701,601	$532,254,337	$837,057,350
Indirect Effect	459.6	$29,163,466	$63,528,064	$129,809,377
Induced Effect	427.8	$13,496,174	$28,054,634	$54,264,752
Total Effect	1,806.5	$157,361,241	$623,837,035	$1,021,131,478

Table 50: The Economic Contribution of Coal in Carbon, Emery, and San Juan Counties

[75] A good example between Total Output and GDP is automobile production: GDP only counts the final value of the car, but total output adds the steel, rubber, and parts to the total value of the car. This is known as double counting in GDP calculations.

Industry	Total Employment
21 - Coal mining	649.94
40 - Electric power generation - Fossil fuel	147.02
38 - Other nonmetallic minerals services	122.13
417 - Truck transportation	43.06
395 - Wholesale - Machinery, equipment, and supplies	35.70
447 - Other real estate	33.78
510 - Limited-service restaurants	33.51
509 - Full-service restaurants	28.71
469 - Management of companies and enterprises	27.44
490 - Hospitals	25.16

Table 51: Top 10 Industries Impacted by Employment in the Three Counties

Table 53 illustrates the economic contribution of coal by county. The table also illustrates the percentage of total employment and GDP that coal contributes to each county. Note that these numbers account for direct, indirect, and induced effects. Coal contributes 1,194.5 jobs in Carbon County, or 10.2% of the total employment. The total GDP contribution of coal to Carbon County is $433,150,549, or 39.2% of total GDP. Coal contributes $103,630,124 in labor income (20.3% of total wages).

Emery County has a similar profile to Carbon County with coal contributing 599.7 total jobs (11.7% of employment). The county's coal GDP contribution is $362,999,500, or 33.7% of total GDP. Additionally, its labor income from coal is $52,834,677 (25% of total wages).

San Juan has a completely different coal profile than Carbon and Emery Counties. There are no coal mines or coal fired power stations in San Juan County. However, the larger Navajo Nation has been impacted by the closures of the Navajo Generating Station near Page, Arizona and the Kayenta mine, which provides its coal. Furthermore, the forthcoming closures of the San Juan Generating Station in San Juan, New Mexico and the San Juan Coal Mine that provide its coal will have a large impact. These facilities are in the four corners region on the eastern portion of the Navajo Nation. Although San Juan County, Utah is in the northern part of Navajo Nation, it is centrally located

between the two power plants and exposed to the economic impact surrounding them.

In addition to effects from these power station and mine closures, San Juan County neighbors Emery County on its southeast corner and has a mining industry of its own not related to coal, which exposes it to challenges in the larger regional mining economy. Since the coal power plants mentioned above are not located in San Juan County, Utah, their economic contribution is very small to the county. However, their impact on the broader Navajo Nation is very significant and will likely have ramifications for the Navajo population in the county.

Within the county, coal contributes 12.37 jobs (5 from direct employment, 5 from indirect, and 2 from induced effects) or 0.20% of total employment. The direct jobs are from the "other non-metallic mineral services" industry and not directly from coal mines or coal power. The coal industry contributes $1,099,733 to GDP, or 0.30%. Below there is further discussion of the economic impact of the closures of the two power plants in Navajo Nation, but they are not included in this three-county model.

Table 54 illustrates the estimated tax impact. Adding all tax impacts for the region, the counties receive $39,272,865 in taxes due to the contribution of coal. The state receives $21,098,259, and the Federal Government receives $30,236,301.

Note that this analysis does not include other contributions of coal, such as the contribution of ad valorem tax, severance tax, or Federal Mineral Lease tax income that counties receive from coal. This can be considerable, specifically the ad valorem tax. In previous work, Perry (2020) found that in Moffat, Rio Blanco, and Routt counties in Colorado (which fit a similar profile to these three Utah counties) ad valorem tax revenue contributed 2.5% and 0.58% of the total contribution of coal (approximately 3% combined).

Region	Employment	Labor Income	Regional GDP	Total Output	Employment % of Total	Regional GDP % of Total
Carbon	1,194.5	$103,630,124	$433,150,549	$654,818,543	10.2%	39.2%
Emery	599.7	$52,834,677	$189,586,754	$362,999,500	11.7%	33.7%
San Juan	12.4	$896,440	$1,099,733	$3,313,435	0.2%	0.3%
Total Effect	1,806.5	$157,361,241	$623,837,035	$1,021,131,478	7.9%	30.4%

Table 52: : Coal's Economic Contribution to Individual Counties

Counties	Total Employment	Total GDP
Carbon	11,761.7	$1,103,570,504
Emery	5,122.3	$561,776,433
San Juan	6,127.8	$388,627,632
Total	23,011.8	$2,053,974,568

Table 53: IMPLAN GDP and Employment Data

Impact	Sub-County General	Sub County Special Districts	County	State	Federal
Total Tax Impact	$17,187,849	$6,784,946	$15,300,070	$21,098,259	$30,236,301

Table 54: Coal Related Tax Impact of Emery, Carbon and San Juan Counties Combined

NAVAJO NATION COAL POWER CLOSURE ECONOMIC IMPACT STUDIES

San Juan County, Utah, encompasses the northern Navajo Nation. Since the Navajo Nation plays an important role in the county, its economic health effects that of the county. Therefore, this section summarizes the impact of the coal mines and power plants near San Juan County that affect the Navajo Nation. This includes the Navajo Generating Station, Kayenta Mine, San Juan Generating Station, San Juan Mine, Four Corners Generating Station, and the Navajo Mine.

The Navajo Generating Station (NGS) is within the Navajo Nation in Northern Arizona, near Page. This facility is a 2,250 MW, coal fired power plant. Croucher, Evans, and James (2012) show that the NGS creates 538 direct jobs (on a yearly basis) plus 1,079 indirect/induced jobs, for a total contribution of 1,617 jobs.[15] Kayenta Mine creates 430 direct jobs, with 616 indirect/induced jobs, totaling 1,046 jobs. The authors also cite that 83% of the Kayenta Mine employees are Navajo.

San Juan Generating Station is an 847 MW coal fired power plant in San Juan County, New Mexico, which is accompanied by the San Juan Mine which fuels the station. Two of its stations were retired in 2017. These included unit 2 (369 MW) and unit 3 (555 MW). Although two are still active, may potentially shut down in 2022. These include unit 1 (369 MW) and unit 4 is (555 MW). Research conducted by Four Corners Economic Development shows that the average employment impacts of the San

Juan Generating Station are 657 direct jobs with $56,660,240 in wages, and $20,722,556 in benefits. The average annual salary of job loss is $86,639 for power station jobs and $85,911 for coal mine jobs. These numbers do not appear to include indirect and induced effects like the other models discussed above. Also, another study that utilized EMSI showed an average employment impact of 409, with a $91,300,000 impact on GDP.[16]

Four Corners Generating Station is a 1,540 MW coal fired power plant located in the Navajo Nation. The coal used in the plant comes from the nearby Navajo Coal Mine. As of this writing, there are no publicly available economic contribution reports for the Four Corners Generating Station. However, the Four Corners Generating Station is set to be decommissioned by 2031.[17]

REGIONAL ECONOMIC IMPACT OF COVID 19

EMERY COUNTY

COVID-19 Cases

Emery County COVID-19 cases stayed extremely low until September of 2020 when the first wave of COVID-19 occurred in the county. This wave lasted through early spring of 2021. Cases fell by late spring of 2021 and rose again due to the Delta variant spike, which started in late summer of 2021. Cases surpassed their previous high during the Delta variant surge and eventually declined by November of 2021. December brought another large spike in cases caused by the Omicron variant. Despite the COVID-19 surges, unemployment and labor force data continued to be strong. A visual inspection of the relationship between COVID-19 cases and initial/continued claims shows that only during the first wave of spring 2020 a relationship occurred between claims and cases.

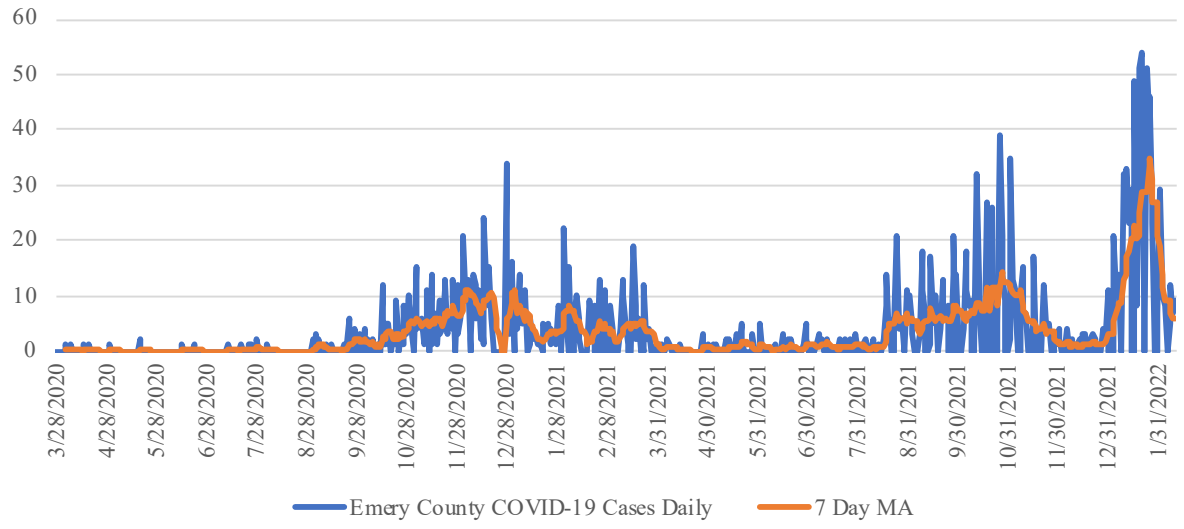

Figure 75: Emery County COVID Cases [76]

[76] Source: USAfacts.org: https://usafacts.org/visualizations/coronavirus-covid-19-spread-map/state/utah/county/carbon-county

Initial and Continued Unemployment Claims

Emery County experienced a similar surge in initial and continued claims during the first months of COVID-19. During this time, initial claims rose to 46 in week 13 (April 2020) and continued claims peaking at 171 in week 16. For context, continued claims in 2019 averaged 44.1, while initial claims averaged 5.5. As a percentage of the January 2020 labor force, the initial claims peak in April of 2020 in Emery County at 1.06% was lower than in the state of Utah at 2.03%. Continued claims started falling during late summer 2020 and spiked again during the winter of late 2020, after which they peaked in February 2021 and fell back to the 2019 levels by summer of 2021. Figure 76 illustrates Emery County initial and continued unemployment claims.

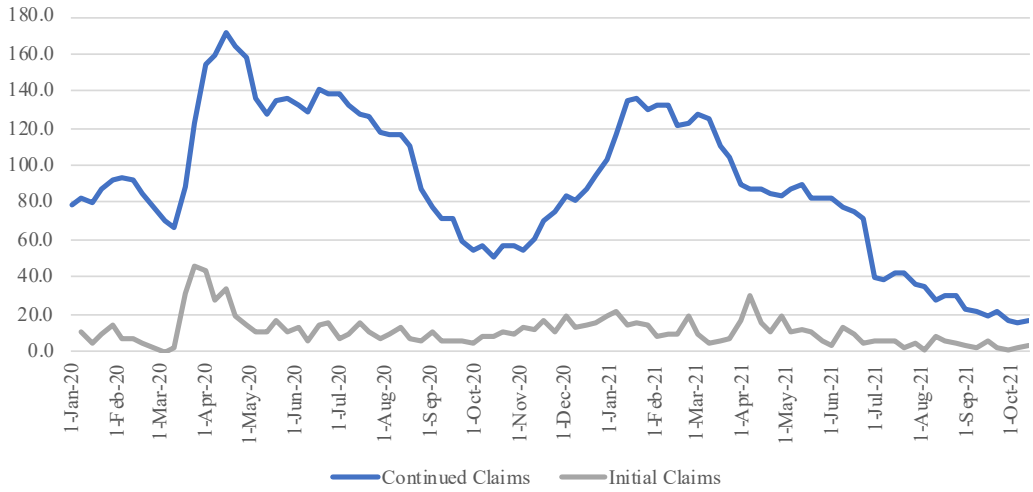

Figure 76: Emery County Initial and Continued Claims [77]

COVID-19 Labor Market

The Emery County labor force has ranged between 4,100 and 4,500, experiencing a slightly upward trend since 2017. There has also been slight employment growth in the last four years that is coupled with declining unemployment. This created a low unemployment rate at just below 2% by the end of 2021. Although neighboring Carbon County has lost labor force, Emery has maintained a slightly positive trend since 2017. Figure 82 illustrates total quarterly wages from the QCEW business survey, which shows a slightly positive trend in wages during the COVID-19 period.

Although Bureau of Economic Analysis shows negative GDP and jobs numbers for 2020, some evidence suggests that Emery may have a positive 2021 GDP due to the small amount of employment growth. 2021 data on employment and wages from the Bureau of Economic Analysis (which will be released in late 2022) will have better data on wage and job growth for 2021.

Industry Recovery from COVID-19

While many counties in the region experienced large job losses during the

[77] Initial and continued claims from the Utah Department of Workforce Services: https://jobs.utah.gov/wi/data/misstats/Unemployment_Claims/

initial wave of COVID-19 in spring 2020, these occurred mainly in accommodation/ food services, retail trade, arts, entertainment, and recreation. Emery County saw losses in only accommodation and food services and these losses were only impactful for one quarter. Figure 81 illustrates key industries that were affected by COVID-19 and their percentage changes using Q4 2019 as a baseline. Mining became positive, likely due to coal demand (not oil demand, which declined during the COVID-19 period). The only industry that was below its 2019 employment level was utilities. Table 55 illustrates GDP for 2018-2020 in yearly data. In real GDP terms, comparing 2019 to 2020 shows that COVID-19 had the biggest impact on mining (-29.79%), manufacturing (-19.67%), and accommodation and food services (-33.25%). Figure 83 illustrates the 2020 GDP losses, showing a 4.2% loss to the county.

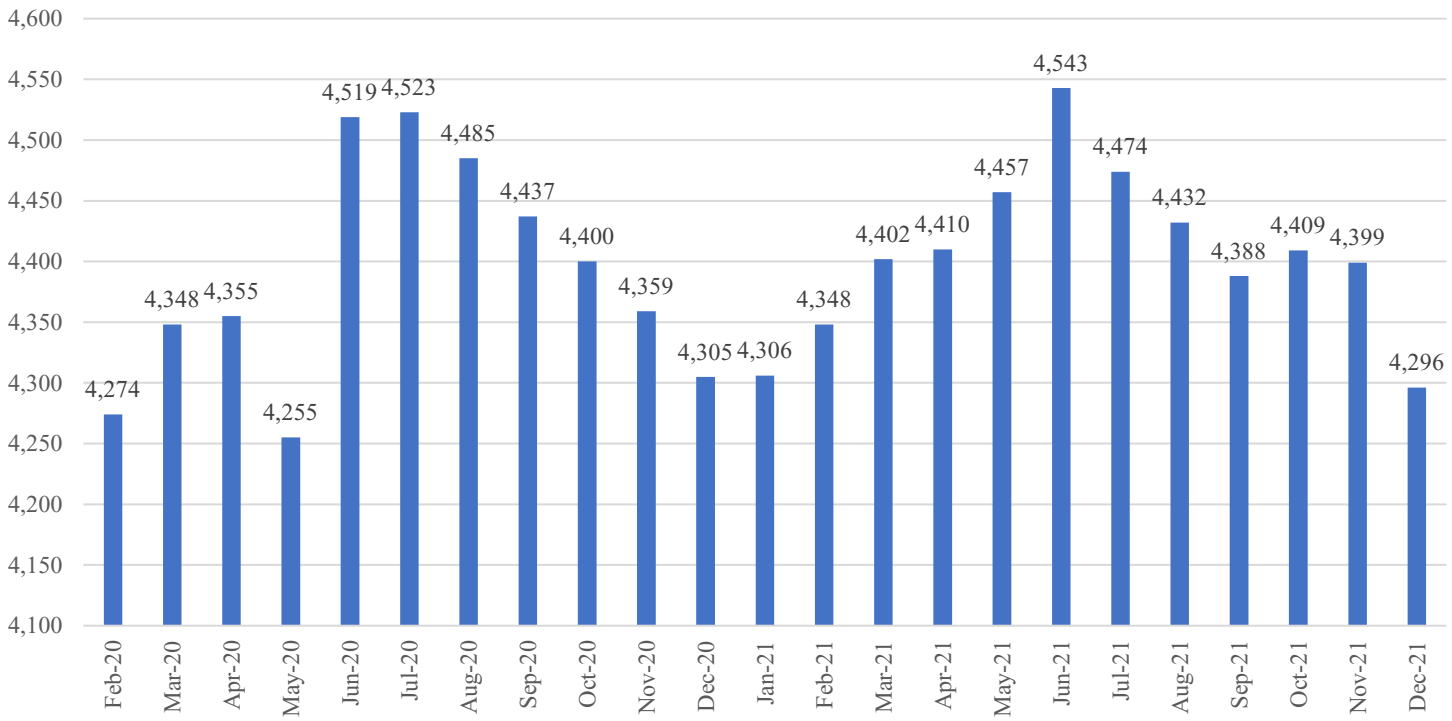

Figure 77: Emery County Labor Force [78]

[78] Data for labor force, employment, and unemployed, and unemployment rate, come from the U.S. Bureau of Labor Statistics

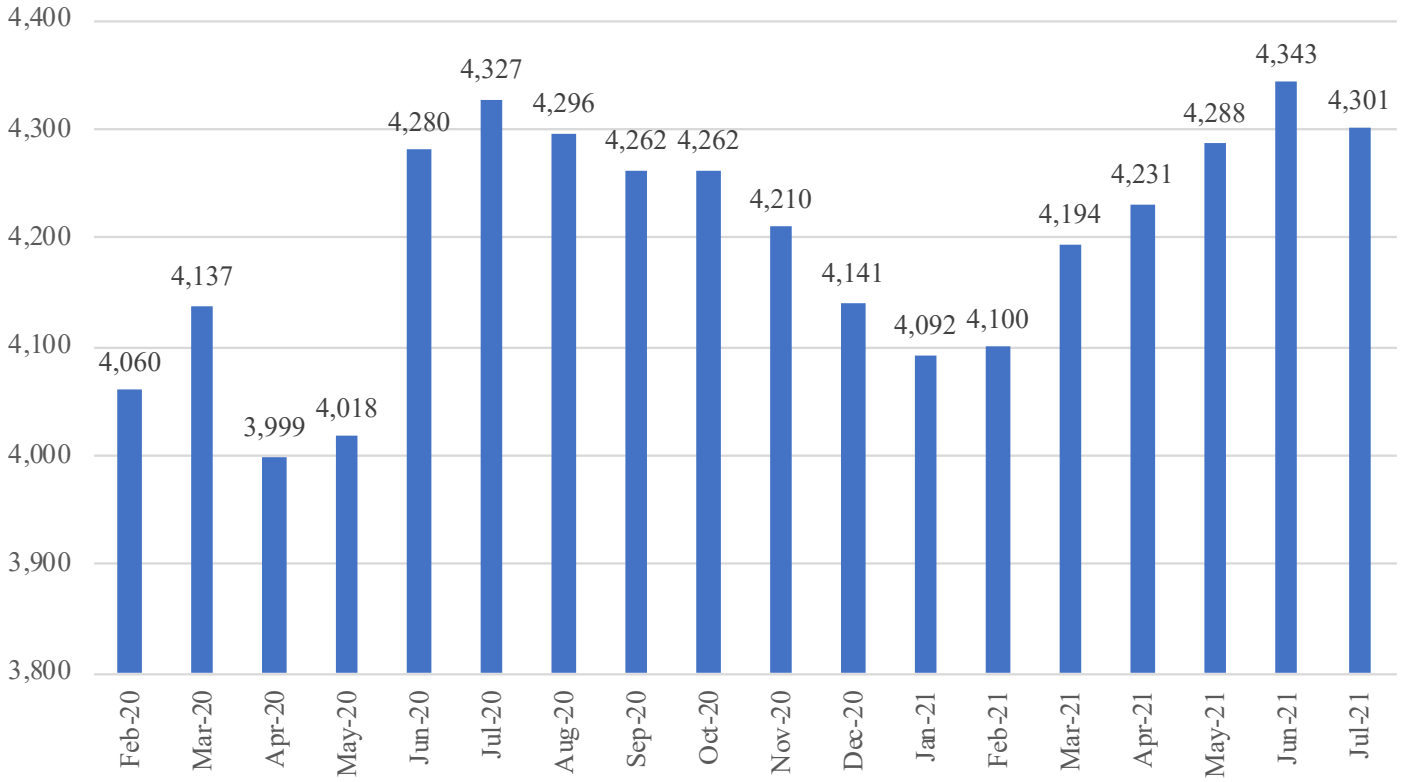

Figure 78: Emery County Employment

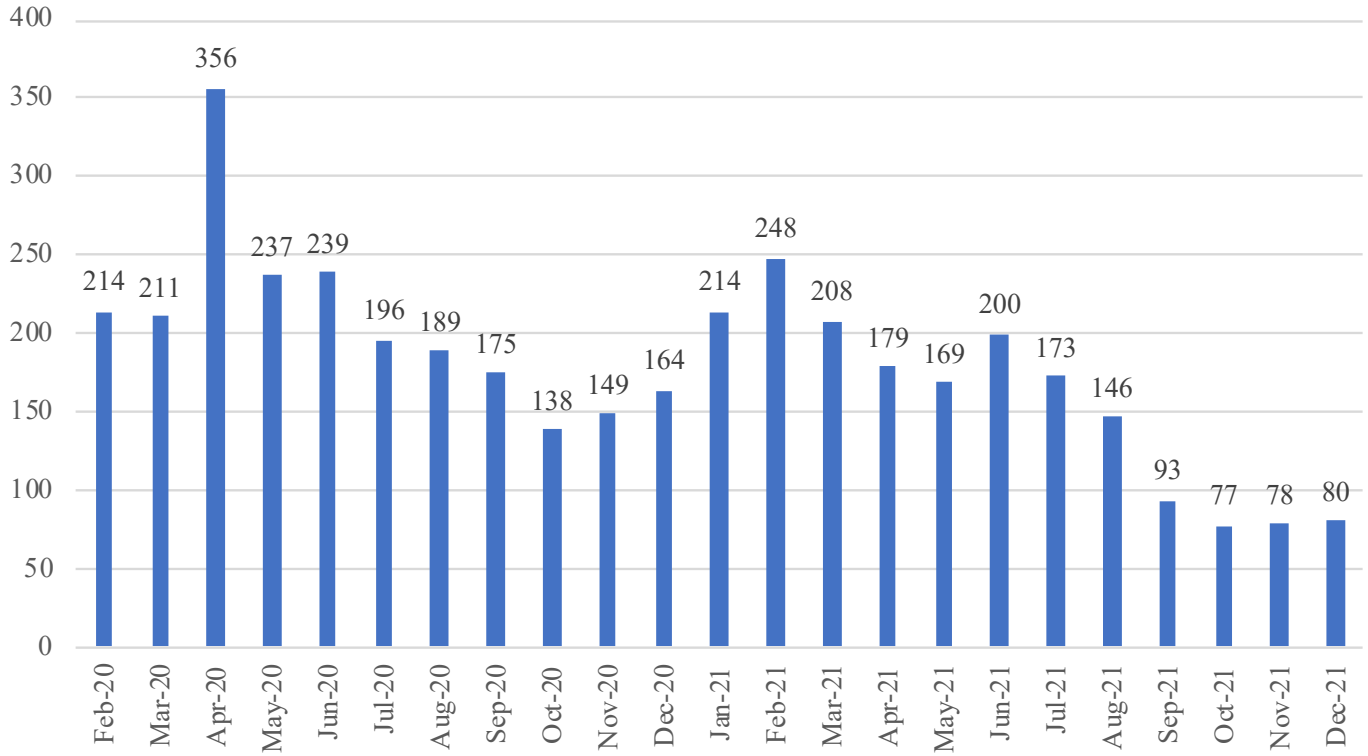

Figure 79: Emery County Unemployed

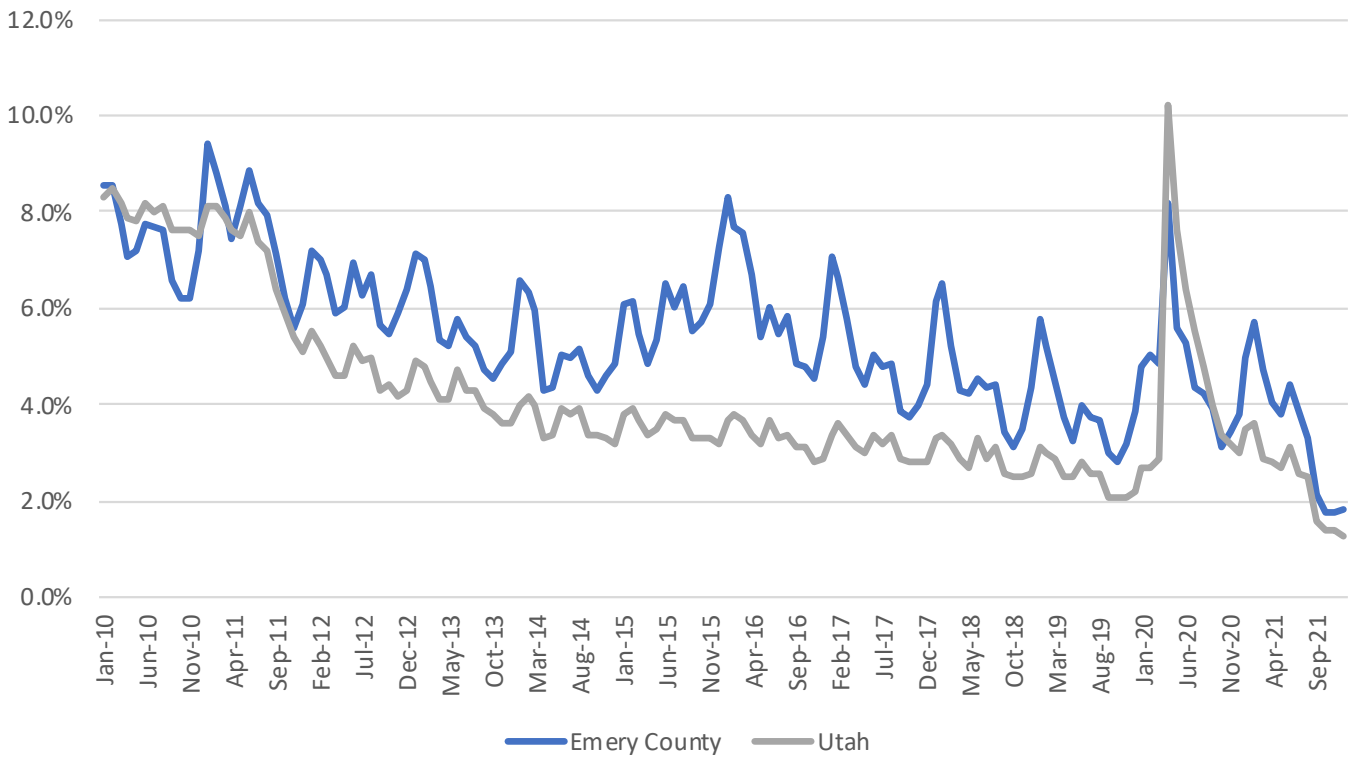

Figure 80: Emery County and State of Utah Unemployment Rates

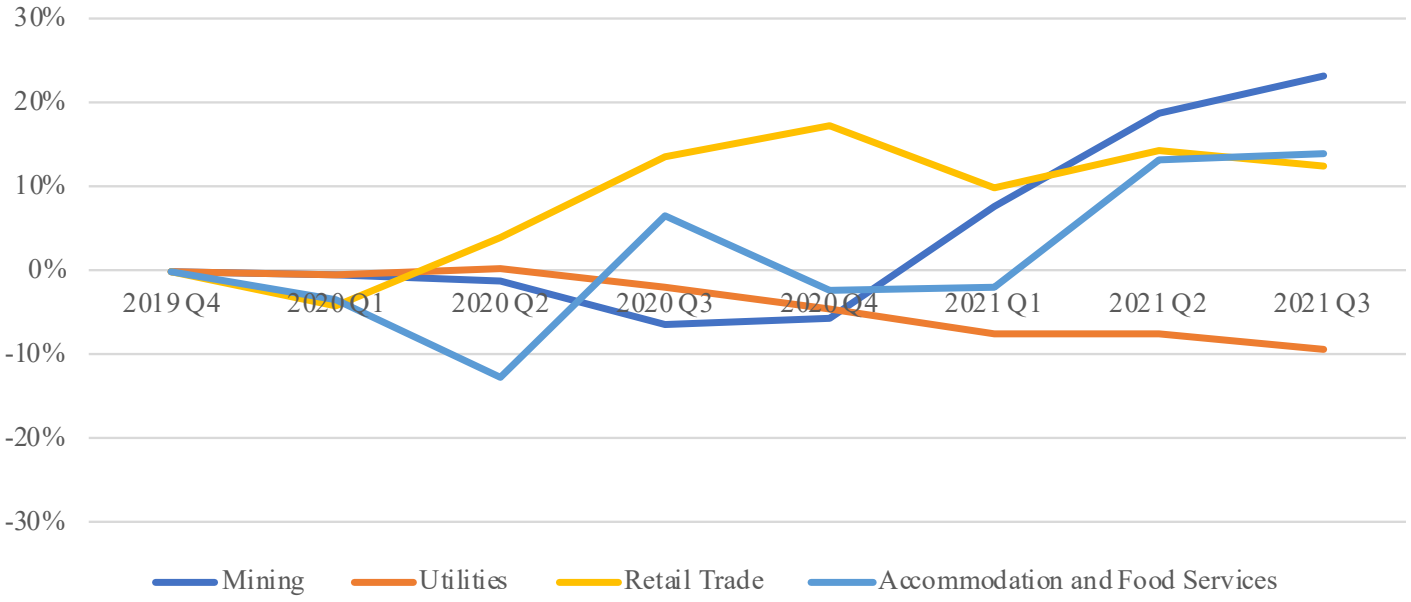

Figure 81: Emery County Industry Job Change [79]

[79] Source: QCEW data from Utah Department of Workforce Services

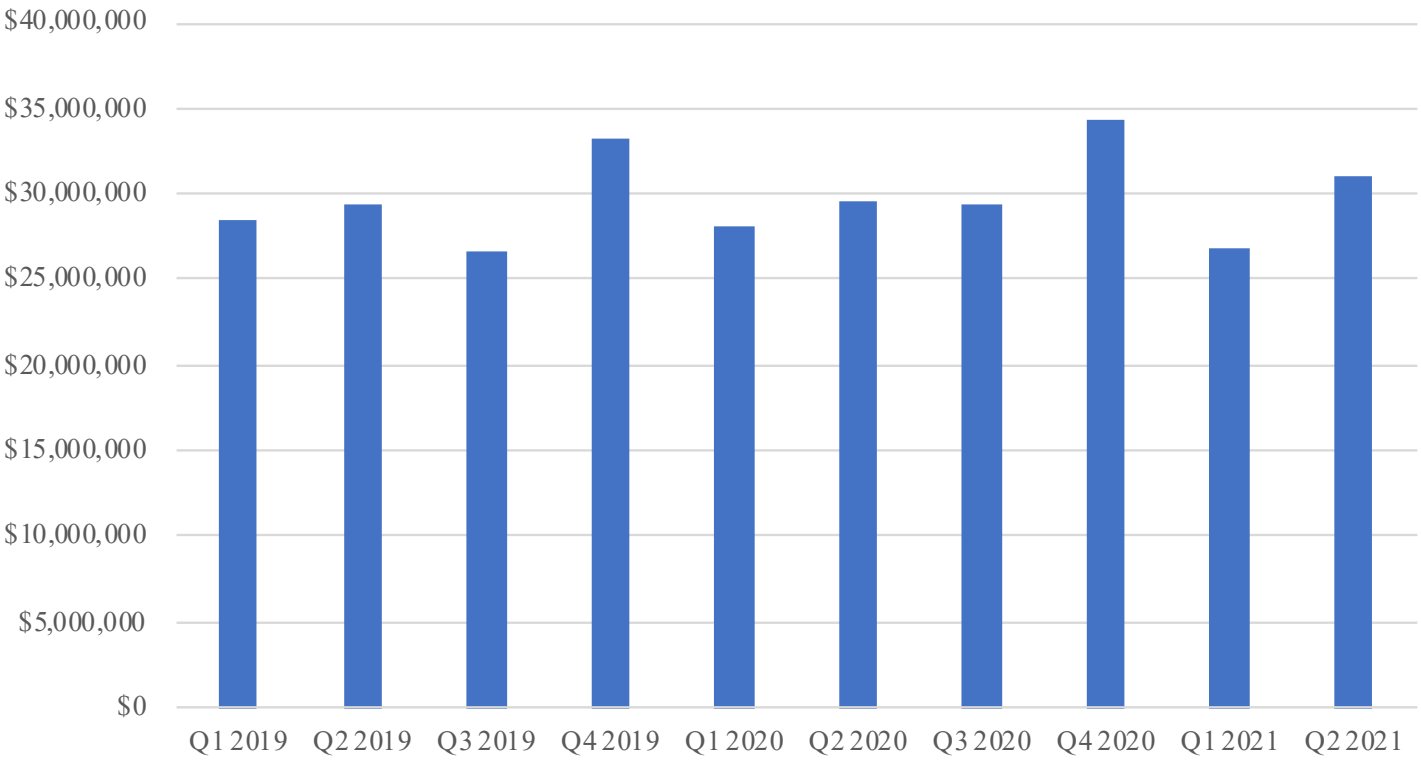

Figure 82: Emery County Total Quarterly Wages [80]

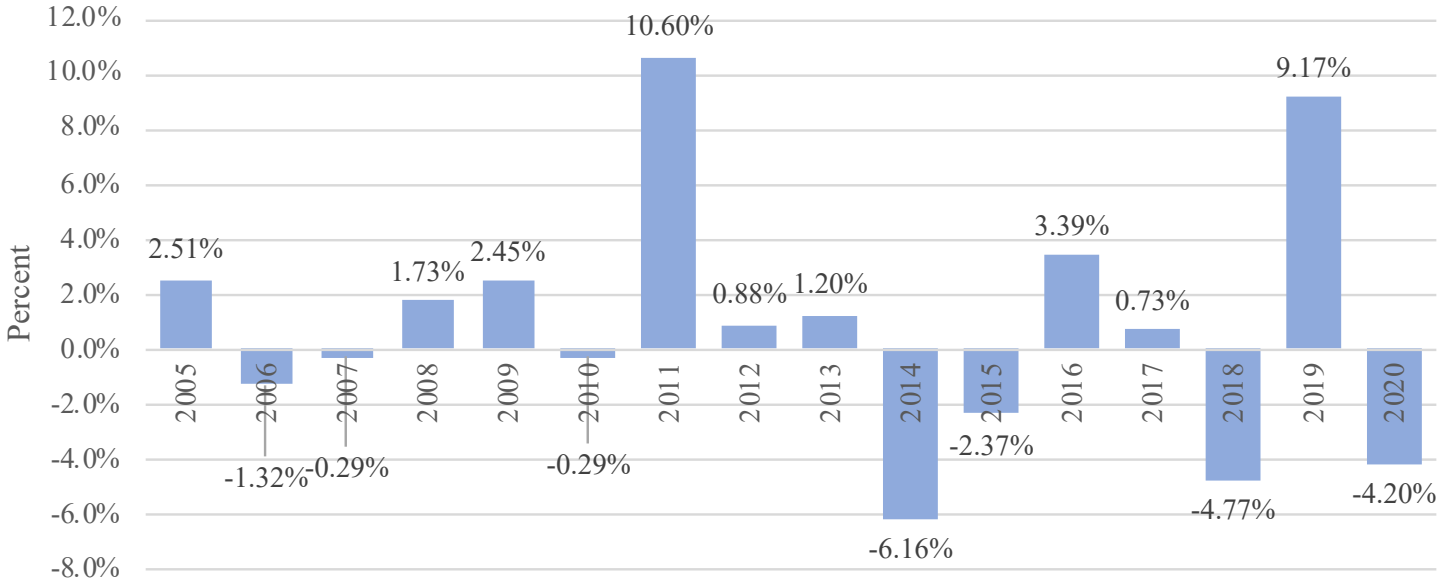

Figure 83: Emery County Real Growth Rate GDP [81]

[80] Source: QCEW data from the Bureau of Labor Statistics.

[81] Source: Bureau of Economic Analysis. Real GDP is calculated with chained 2012 dollars.

	2018	2019	2020	% Change from 2019	% of Total GDP
All industry total[82]	$853,705	$932,010	$892,903	9.17%	
Private industries	$804,547	$889,251	$852,587	-4.56%	95.48%
Agriculture, forestry, fishing and hunting	$24,981	$15,650	$25,403	39.04%	2.84%
Mining, quarrying, and oil and gas extraction	$111,790	$131,797	$98,495	-29.79%	11.03%
Utilities	$492,836	$553,578	$543,615	-2.02%	60.88%
Construction	$18,961	$18,787	$21,208	12.77%	2.38%
Manufacturing	$3,259	$3,422	$2,781	-19.67%	0.31%
Durable goods manufacturing	$1,999	$2,013	$1,675	-16.91%	0.19%
Nondurable goods manufacturing	$1,343	$1,502	$1,177	-24.20%	0.13%
Wholesale trade	N/A	N/A	N/A	N/A	N/A
Retail trade	$20,173	$21,422	$22,079	3.26%	2.47%
Transportation and warehousing	$2,084	$2,252	$2,735	23.18%	0.31%
Information	N/A	N/A	N/A	N/A	N/A
Finance, insurance, real estate, rental, and leasing	$51,002	$54,219	$50,814	-6.68%	5.69%
Finance and insurance	$2,752	$2,875	$3,105	8.36%	0.35%
Real estate and rental and leasing	$48,216	$51,319	$47,594	-7.73%	5.33%
Professional and business services	$16,330	$19,350	$18,413	-5.74%	2.06%
Professional, scientific, and technical services	$5,312	$6,177	$5,716	-8.68%	0.64%
Management of companies and enterprises	N/A	N/A	N/A	N/A	N/A
Administrative and support and waste management and remediation services	N/A	N/A	N/A	N/A	N/A

[82] Bolded indicates primary industry, not bolded indicates subcategory.

Educational services, health care, and social assistance	$6,941	$8,012	$8,055	0.62%	0.90%
Educational services	N/A	N/A	N/A	N/A	N/A
Health care and social assistance	N/A	N/A	N/A	N/A	N/A
Arts, entertainment, recreation, accommodation, and food services	$9,463	$10,602	$7,521	-32.56%	0.84%
Arts, entertainment, and recreation	$114	$108	$139	27.19%	0.02%
Accommodation and food services	$9,334	$10,476	$7,372	-33.25%	0.83%
Other services (except government and government enterprises)	$10,360	$9,864	$9,696	-1.62%	1.09%
Government and government enterprises	$49,038	$43,614	$41,203	-4.92%	4.61%

Table 55: Emery County GDP by Industry [83]

CARBON COUNTY

COVID-19 Cases

COVID-19 cases in Carbon County stayed extremely low until late October of 2020. Cases fell by Spring of 2021 and rose again during the Delta variant spike, which started in Summer of 2021. During this time, cases surpassed their previous high and eventually declined in November of 2021.

December 2021 saw a large spike of cases caused by the Omicron variant. However, unemployment and labor force data continued to be strong. A visual inspection of the relationship between COVID-19 cases and initial/continued claims shows that only during the first wave of spring 2020 a relationship between unemployment claims and COVID-19 occurred.

[83] Source: Bureau of Economic Analysis.

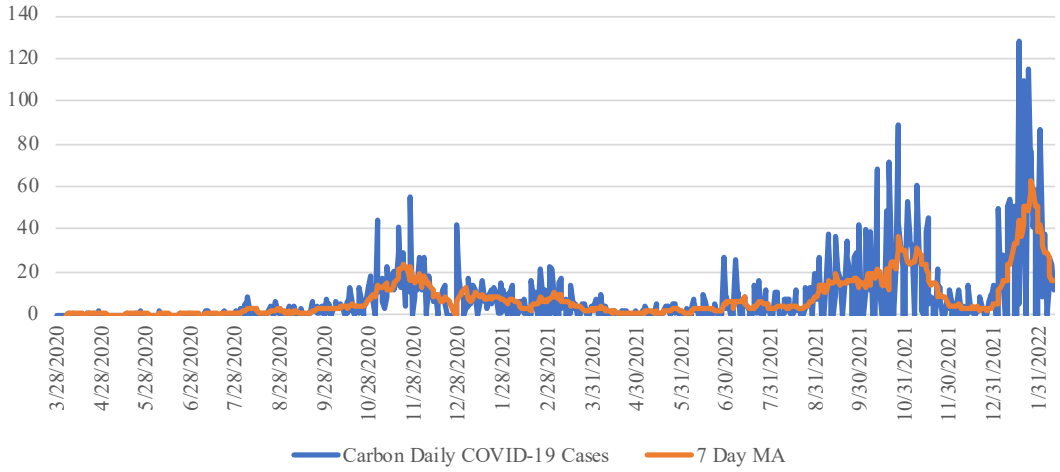

Figure 84: Carbon County COVID Cases [84]

Initial and Continued Unemployment Claims

Carbon County experienced a similar surge in initial and continued claims during the first months of COVID-19 with claims rising to 131 in week 14 (April 2020). For context, continued claims in 2019 averaged 60.9, while initial claims averaged 9.11. As a percentage of the January 2020 labor force, the initial claims peak in April of 2020 in Carbon County (1.54%) was lower than that of the state of Utah (2.03%). Continued claims started falling by late summer 2020 and spiked during the winter months of late 2020. After this, they continued their decline and fell back to their 2019 levels by summer of 2021. Figure 85 illustrates Carbon County initial and continued unemployment claims.

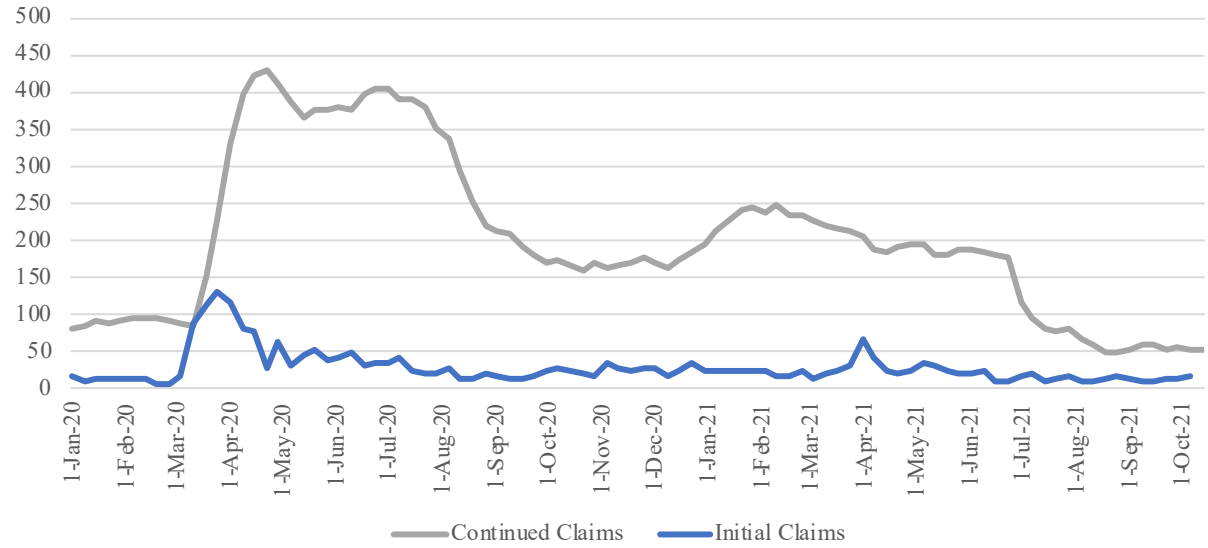

Figure 85: Carbon County Initial and Continued Claims [85]

[84] Source: USAfacts.org: https://usafacts.org/visualizations/coronavirus-covid-19-spread-map/state/utah/county/carbon-county

[85] Initial and continued claims from the Utah Department of Workforce Services: https://jobs.utah.gov/wi/data/misstats/Unemployment_Claims/

COVID-19 Labor Market

Carbon County has seen a distinctive decline in their labor force since early 2020. For context, in 2019 the labor force averaged 8,536, employment averaged 8,230, and unemployment averaged 307. However, by December of 2021, the labor force fell by approximately 300 people to 8,224 (Figure 86). Despite being slightly down since early 2020, employment has maintained a horizontal trend (Figure 87).

Unemployment also has fallen since spring of 2020 from its 2019 average from 307 to 166 (Figure 88). During this time, Carbon County's unemployment rate fell from 9.2% in April 2020 to 2% by the end of 2021. This was well below the 2019 average of 3.6%. Taken in context, Carbon County's unemployment rate has fallen not because of job growth, but because of labor force declines, while employment has remained relatively steady. Figure 90 illustrates total quarterly wages from the QCEW business survey, which shows a trend that supports this analysis. Although the unemployment rate is low, there has not been quarterly wage growth. 2021 data on employment and wages from the Bureau of Economic Analysis (which will be released in late 2022) will have better data on wage and job growth for 2021.

Industry Recovery from COVID-19

While many counties in the region experienced large job losses, these occurred mainly in accommodation/food services, retail trade, arts, entertainment, and recreation. However, Carbon County saw comparably smaller losses in these industries during the initial wave of COVID-19 in spring of 2020. Figure 91 illustrates key industries that were affected by COVID-19 and their percentage change using Q4 2019 as a baseline. These three industries only saw losses in Q2 of 2020 and bounced back almost immediately. The industries that were hit during this time were mining industries (which includes oil and gas) and the utilities sector (coal powerplants). The mining industry is still down from Q4 2019 and utilities have been in a small but steady decline since Q4 2019 as well. Table 56 illustrates GDP for 2018-2020 in yearly data. In real GDP terms, comparing 2019 to 2020 shows that COVID-19 had the biggest impact on transportation and warehousing (-18.49%), accommodation and food services (-16.64%), and arts, entertainment, and recreation (-10.90%). Figure 92 illustrates the percentage change in GDP. Carbon County avoided the fate of other counties and ended with a positive GDP number at 0.33%.

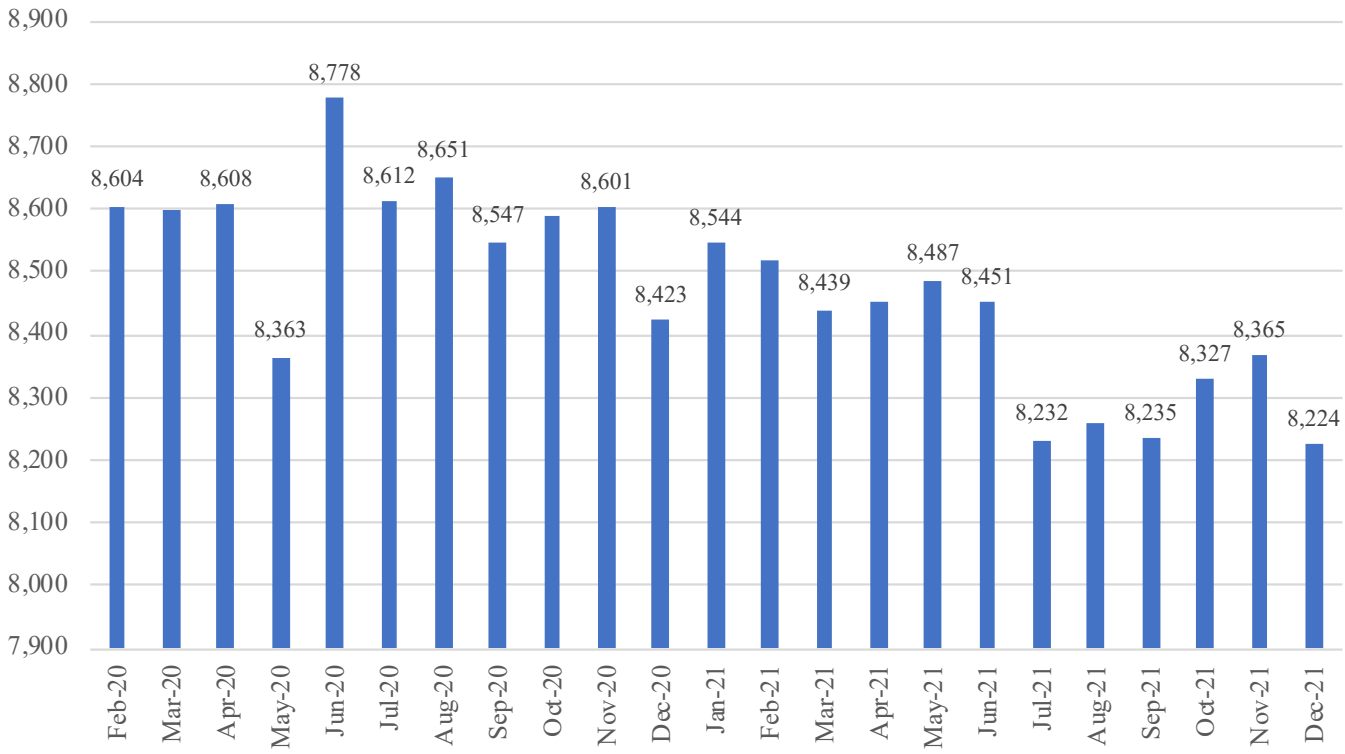

Figure 86: Carbon County Labor Force [86]

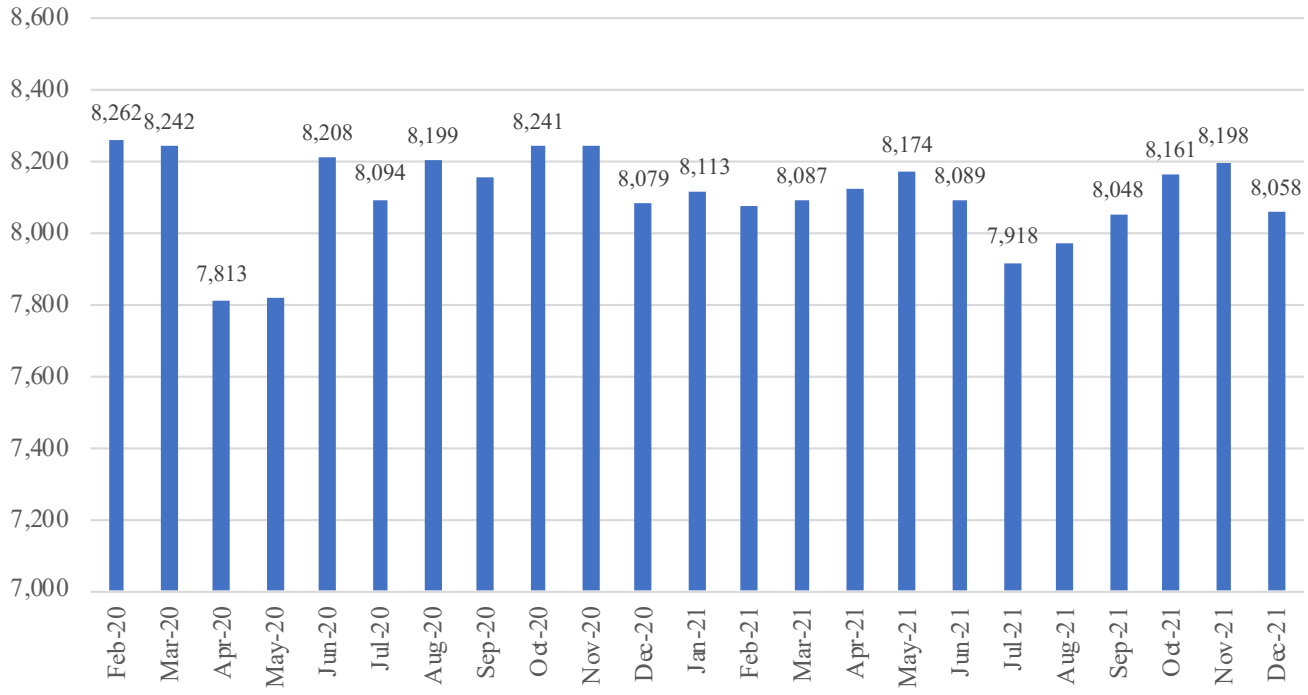

Figure 87: Carbon County Employment

[86] Data for labor force, employment, and unemployed, and unemployment rate, come from the U.S. Bureau of Labor Statistics

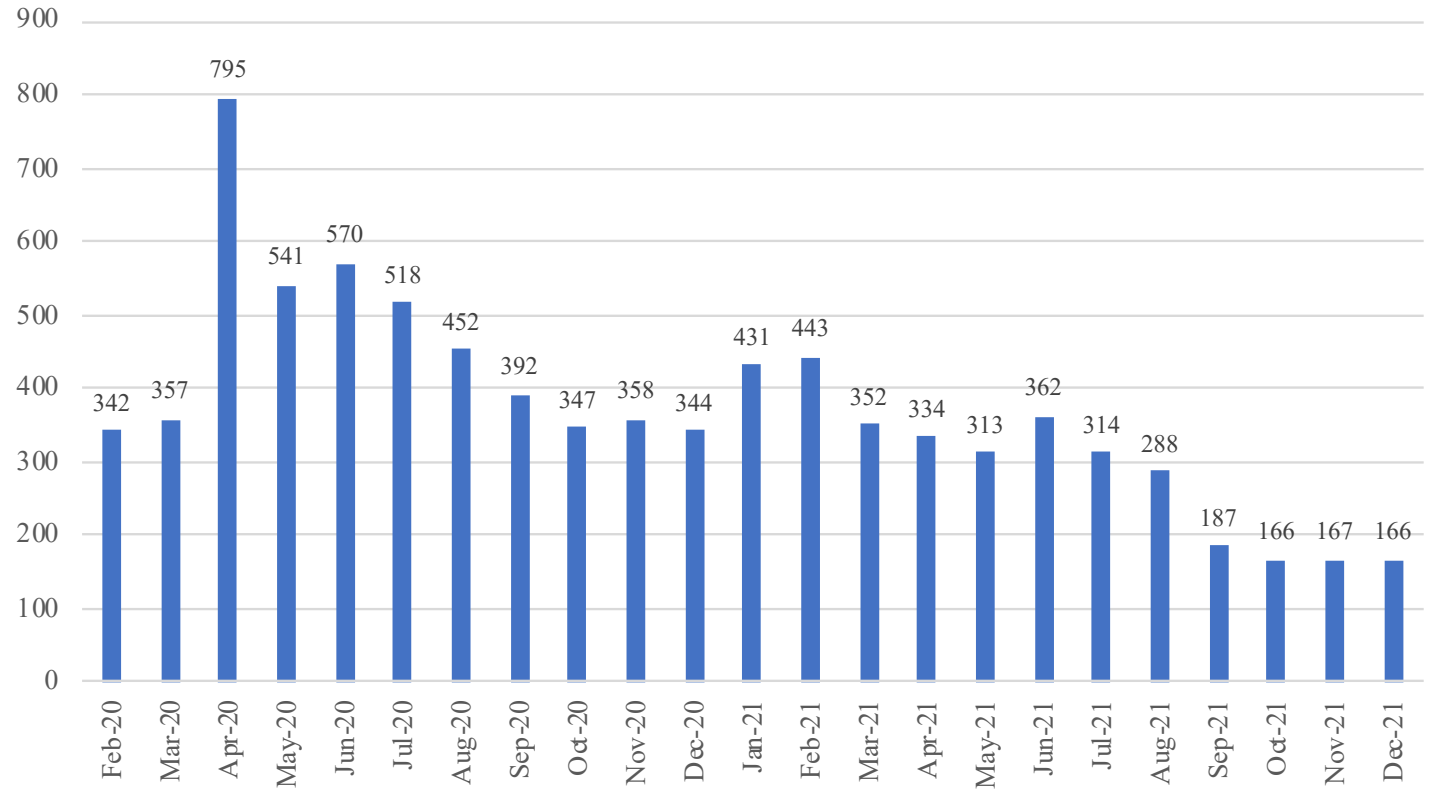

Figure 88: Carbon County Unemployed

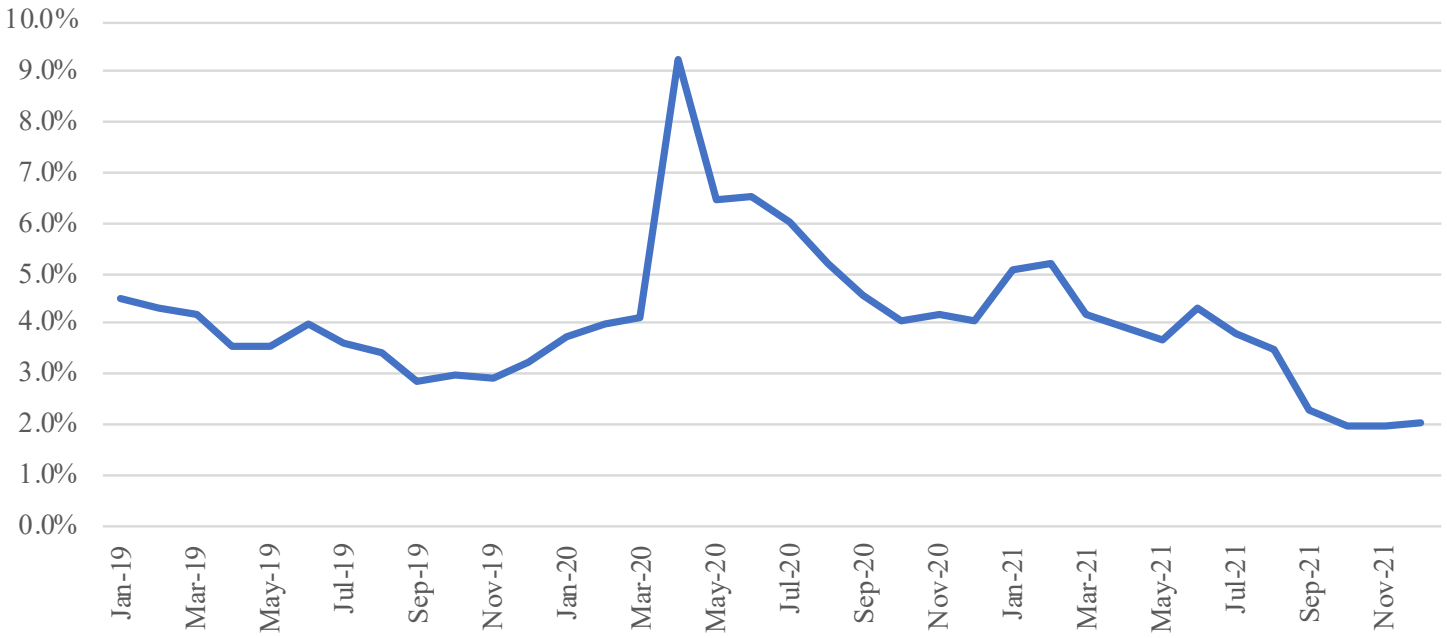

Figure 89: Carbon County Unemployment Rate

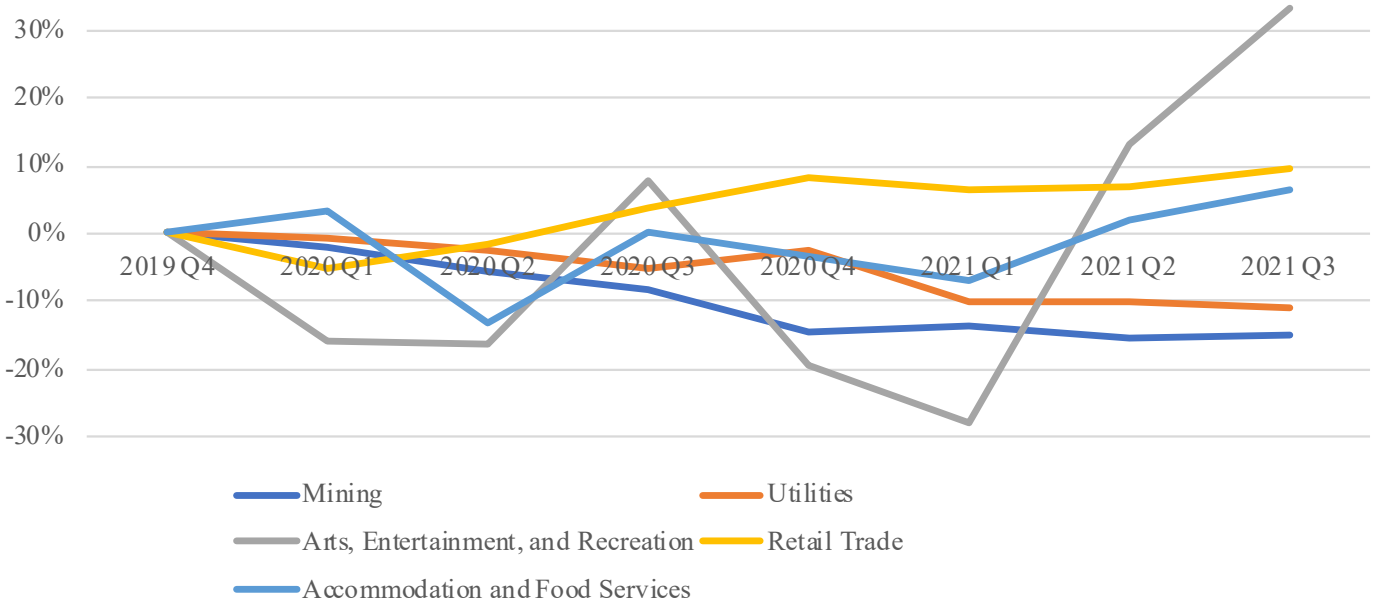

Figure 90: Carbon County Industry Job Change [87]

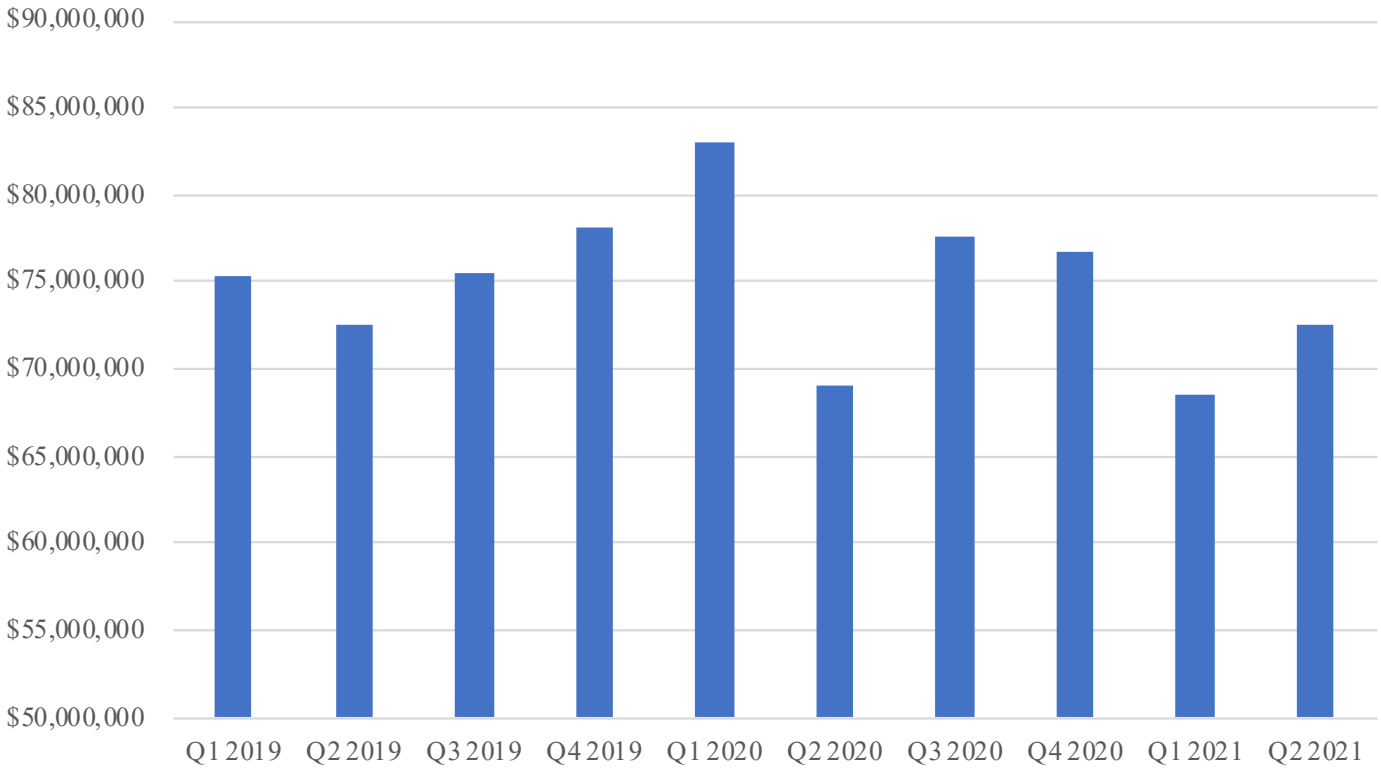

Figure 91: Carbon County Total Quarterly Wages [88]

[87] Source: QCEW data from Utah Department of Workforce Services

[88] Source: QCEW data from the Bureau of Labor Statistics.

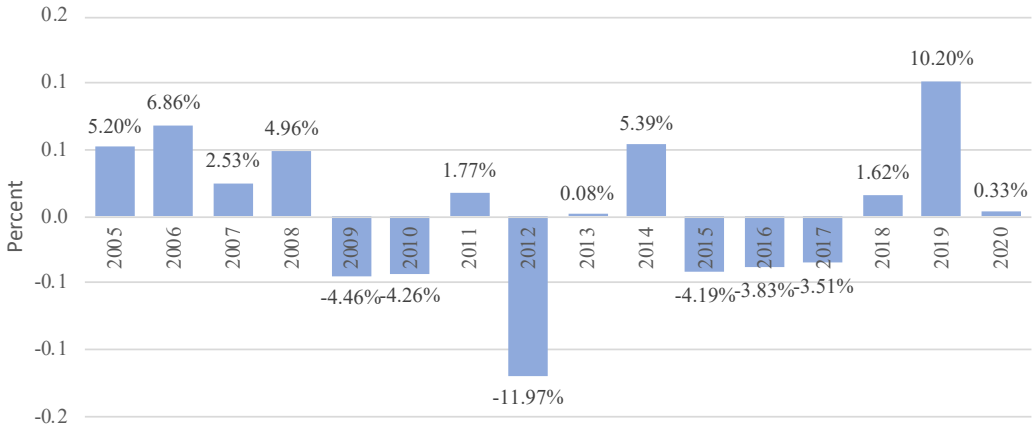

Figure 92: Carbon County Real GDP (% Change) [89]

	2018	2019	2020	% Change since 2019	% of Total GDP
All industry total [90]	$1,033,391	$1,138,829	$1,142,554		
Private industries	$914,451	$1,023,518	$1,029,041	0.60%	90.06%
Agriculture, forestry, fishing and hunting	$2,303	$490	$3,144	115.24%	0.28%
Mining, quarrying, and oil and gas extraction	$446,115	$564,320	$587,663	5.23%	51.43%
Utilities	$28,368	$31,747	$30,416	-4.69%	2.66%
Construction	$24,561	$22,560	$21,585	-3.97%	1.89%
Manufacturing	$38,316	$42,336	$42,959	1.63%	3.76%
Durable goods manufacturing	$31,606	$34,184	$35,041	2.71%	3.07%
Nondurable goods manufacturing	$6,711	$8,130	$7,901	-3.41%	0.69%
Wholesale trade	$36,505	$35,468	$33,984	-4.07%	2.97%
Retail trade	$55,926	$55,603	$58,202	4.65%	5.09%
Transportation and warehousing	$41,378	$39,336	$31,684	-18.49%	2.77%
Information	$4,188	$6,448	$6,923	11.34%	0.61%

[89] Source: Bureau of Economic Analysis. Real GDP is calculated with chained 2012 dollars.

[90] Bolded indicates primary industry, not bolded indicates subcategory.

Finance, insurance, real estate, rental, and leasing	$119,494	$125,498	$121,019	-3.75%	10.59%
Finance and insurance	$8,827	$8,617	$9,008	4.43%	0.79%
Real estate and rental and leasing	$110,926	$117,305	$112,263	-4.55%	9.83%
Professional and business services	$36,267	$38,320	$42,912	12.66%	3.76%
Professional, scientific, and technical services	$16,629	$16,700	$15,502	-7.20%	1.36%
Management of companies and enterprises	$2,229	$5,433	$14,532	408.21%	1.27%
Administrative and support and waste management and remediation services	$16,724	$15,955	$14,200	-10.49%	1.24%
Educational services, health care, and social assistance	$68,810	$68,398	$65,920	-3.60%	5.77%
Educational services	N/A	N/A	N/A	N/A	N/A
Health care and social assistance	N/A	N/A	N/A	N/A	N/A
Arts, entertainment, recreation, accommodation, and food services	$16,000	$16,737	$14,161	-16.10%	1.24%
Arts, entertainment, and recreation	$1,587	$1,436	$1,263	-10.90%	0.11%
Accommodation and food services	$14,394	$15,266	$12,871	-16.64%	1.13%
Other services (except government and government enterprises)	$27,272	$27,710	$28,428	2.63%	2.49%
Government and government enterprises	$117,578	$115,625	$114,109	-1.29%	9.99%

Table 56: Carbon County GDP by Industry [91]

[91] Source: Bureau of Economic Analysis.

SAN JUAN COUNTY

COVID-19 Cases Data

San Juan County COVID-19 cases began earlier than Carbon and Emery Counties with case increases occurring in April of 2020. Cases spiked again in late October of 2020 and fell by early January 2021. San Juan also experienced a spike in cases in August 2021, which fell by early December and rose again later that month during the Omicron surge. However, unemployment and labor force data continued to be strong. A visual inspection of the relationship between COVID-19 cases and initial/continued claims shows that only in the first wave of spring 2020 was there a relationship between claims and COVID-19.

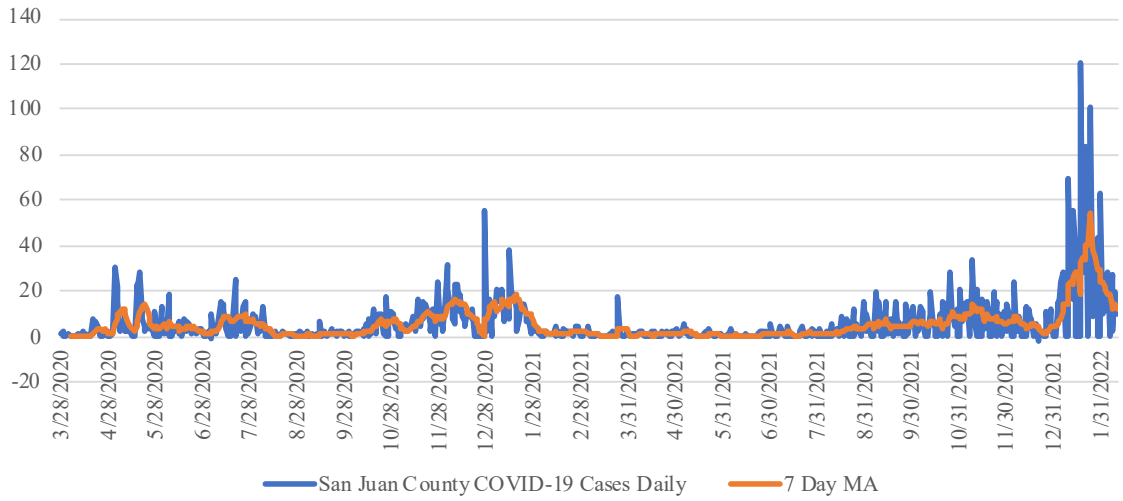

Figure 93: San Juan County COVID Cases [92]

San Juan County experienced a similar surge compared to the rest of the nation in initial and continued claims during the first months of COVID-19. During this time, initial claims rose to 108 in week 13 (April 2020) and continued claims peaked at 399 during week 18. San Juan County experienced a second surge in initial and continued claims in July 2020 during which time they peaked at 118 and 413 respectively. For context, continued claims in 2019 averaged 61.7. As a percentage of the January 2020 labor force, the initial claims peak in April 2020 in the county at 2.15%, which was slightly higher than in the state of Utah at 2.03%. Continued claims started falling in late summer 2020 and spiked again in January 2021, after which they peaked during February 2021. Since February 2021, initial and continued claims have been on a downward trend closer to levels of 2019. Figure 94 illustrates San Juan County initial and continued unemployment claims.

[92] Source: USAfacts.org: https://usafacts.org/visualizations/coronavirus-covid-19-spread-map/state/utah/county/carbon-county

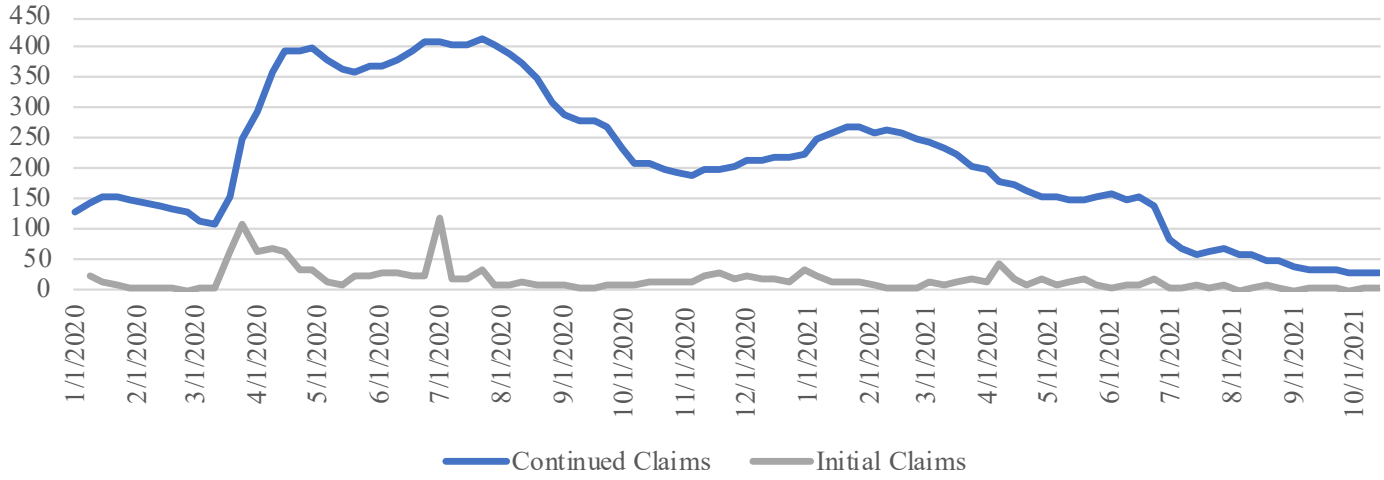

Figure 94: San Juan County Initial and Continued Claims [93]

Before 2020, San Juan County employment pushed towards 6,000, peaking at 5,808 in June 2019. During the winter months of late 2019, the county experienced the normal fluctuations in seasonal employment that that have occurred over the last several years. The main difference here was the fact that employment did not pick back up during late Spring 2020. Similarly, employment did not return to normal levels in late Spring 2021. As an example, employment in January 2019 was 4,009 and rose to 5,804 in June of the same year. However, during January 2020 employment was 4,962 and only rose to 5,091 by June 2020. Also, during January 2021, employment was much lower at 4,537 and increased to 5,267 by June 2021. This indicates that although employment is still in place on the downside, it is still not swinging up on the upside.

The lack of seasonal recovery in the labor market is partly due to a labor force reduction in the San Juan County. In 2018, the labor force was 5,708 and in 2019 it was 5,723. However, in 2020 it was 5,457 and in 2021 it was 5,375. This indicates a distinctive downtrend in labor force, which has capped the upside in employment. The downward trend in labor force appeared during early 2020. This shows strong evidence that COVID-19 policies and labor market choices have impacted the San Juan County economy. This is not surprising given the GDP data discussed earlier showed a 10.6% GDP loss.

The business survey shows which industries have been most impacted during the 2020-2021 employment losses. Figure 100 illustrates key industries that were affected by COVID-19 and their percentage change using Q4 2019 as a baseline. Accommodation/food services has been hit the hardest and is still down 23.8% as of Q3 2021. This sector has not recovered in San Juan County like it has in other counties as of 2021. Another industry that has not recovered is manufacturing, which is still down 15.67%. Arts, entertainment, and recreation are all up dramatically from 47 employed in Q4 of 2019 to 254 in Q3 2021 (a 440% increase). Mining also fully recovered

[93] Initial and continued claims from the Utah Department of Workforce Services: https://jobs.utah.gov/wi/data/misstats/Unemployment_Claims/

by Q1 2021. However, mining data is missing due to privacy restrictions. Table 57 illustrates GDP for 2018-2020 in yearly data. In real GDP terms, comparing 2019 to 2020 shows that COVID-19 had the biggest impact on mining (-36.43%), construction (-26.03%), and accommodation/food services (-43.27%). Figure 101 illustrates the 2020 GDP losses, showing a 10.6% loss to the county.

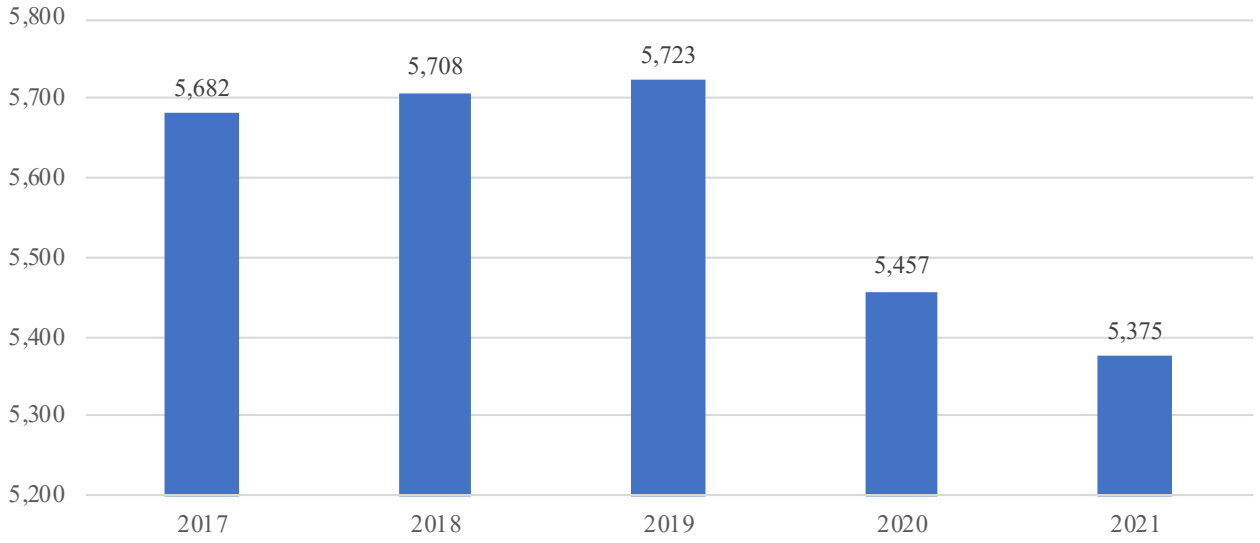

Figure 95: San Juan Yearly Average of Labor Force [94]

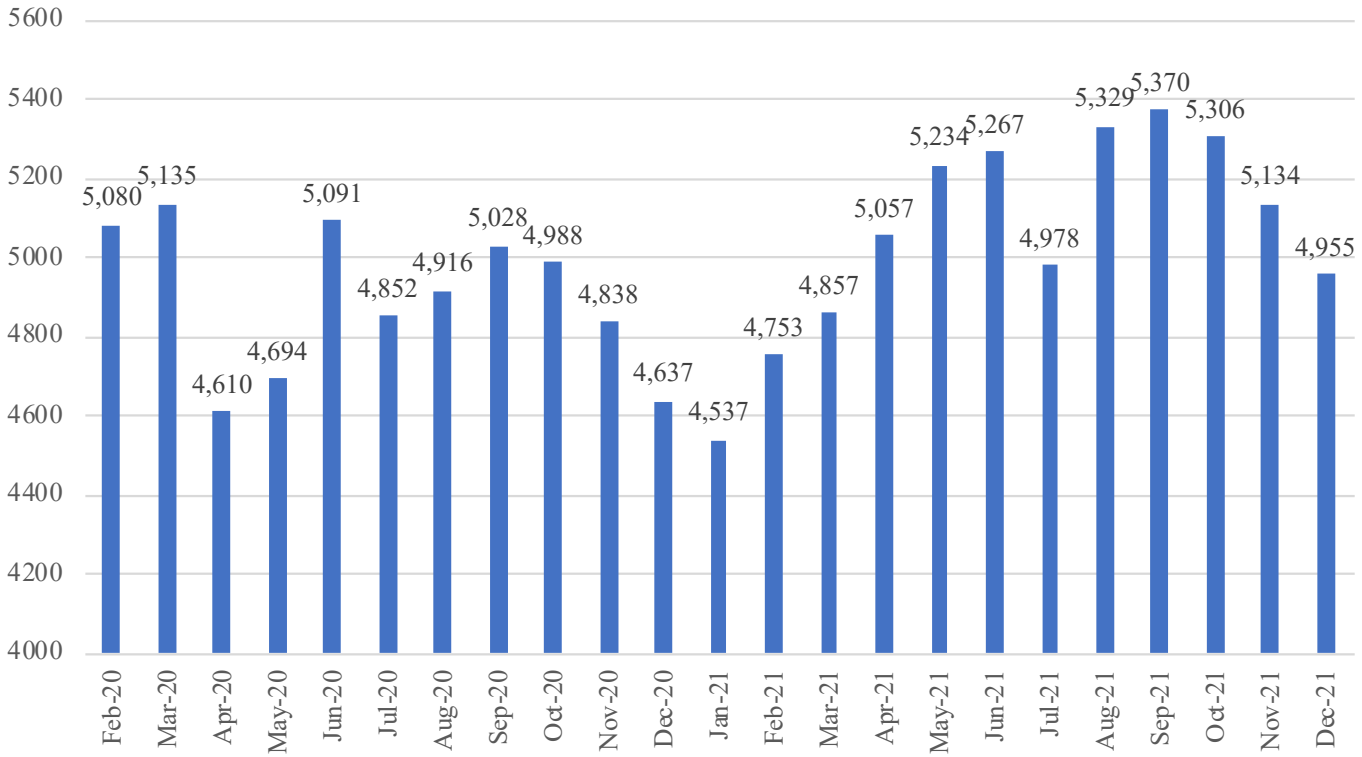

Figure 96: San Juan County Labor Force [95]

[94] Data for labor force, employment, and unemployed, and unemployment rate, come from the U.S. Bureau of Labor Statistics

[95] Data for labor force, employment, and unemployed, and unemployment rate, come from the U.S. Bureau of Labor Statistics

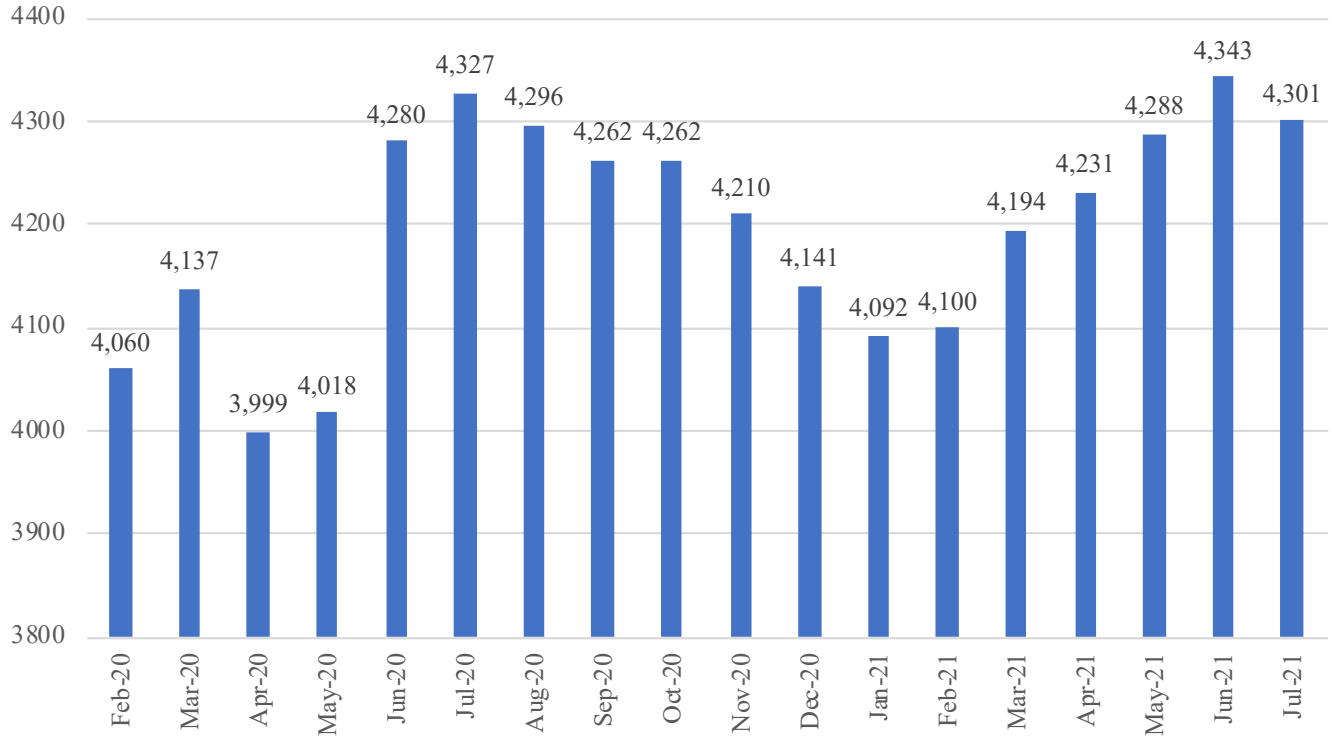

Figure 97: San Juan County Employment

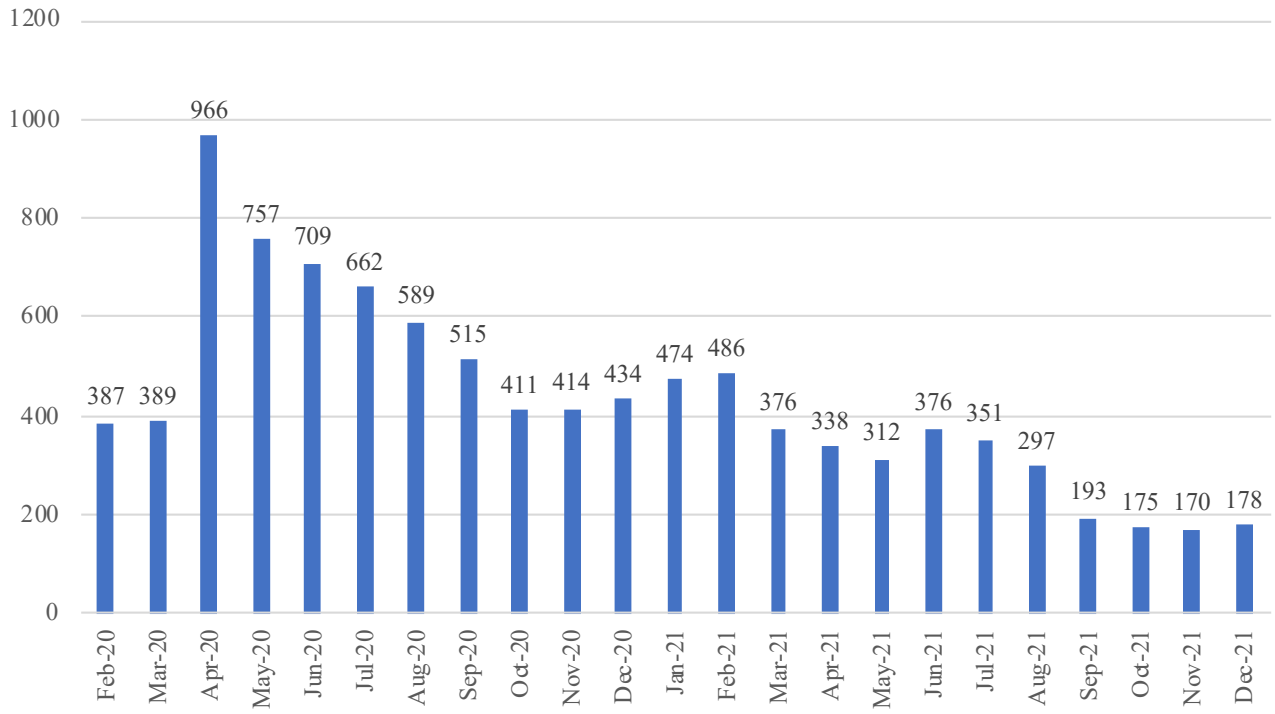

Figure 98: San Juan County Unemployed

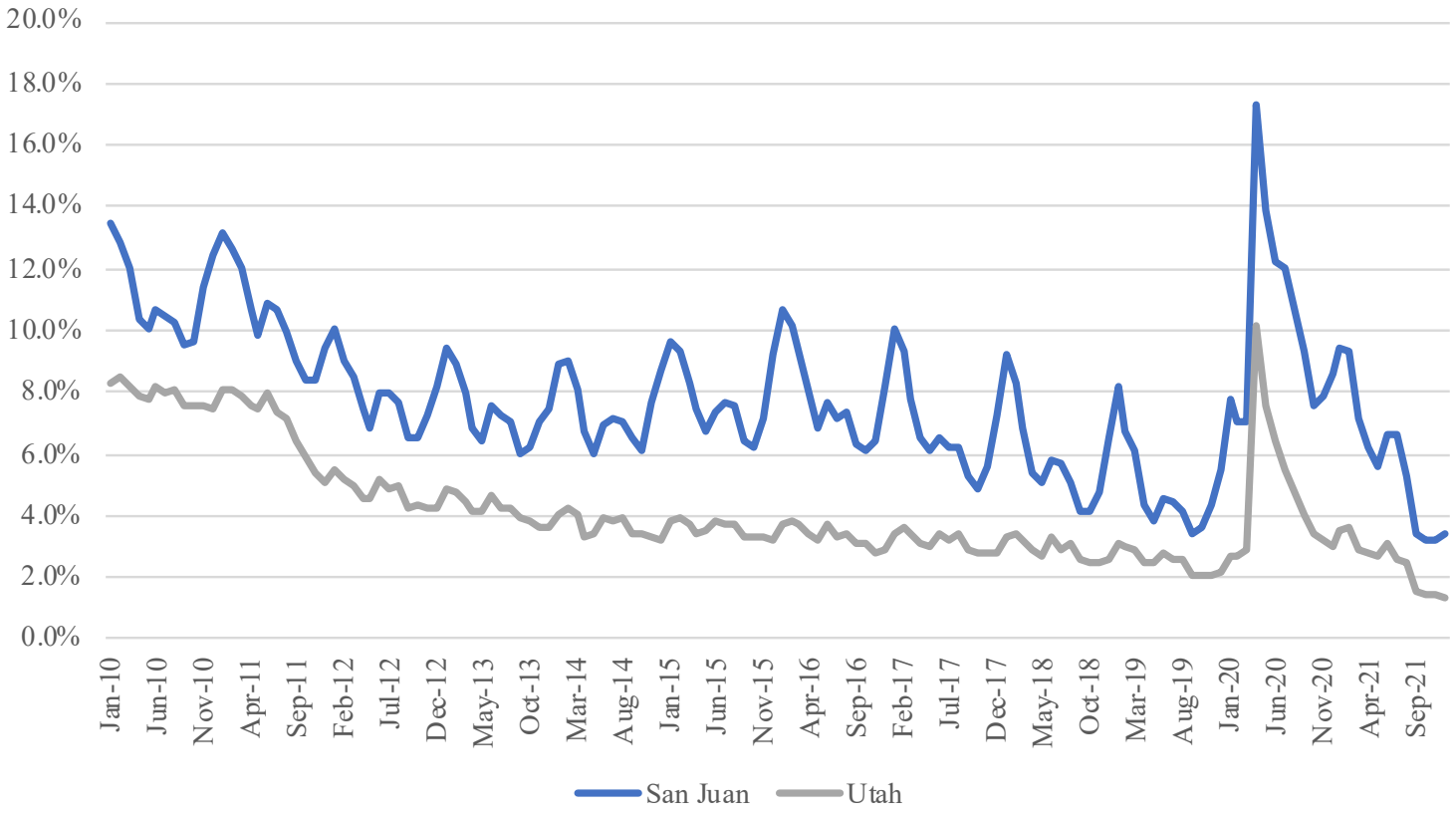

Figure 99: San Juan County and State of Utah Unemployment Rates

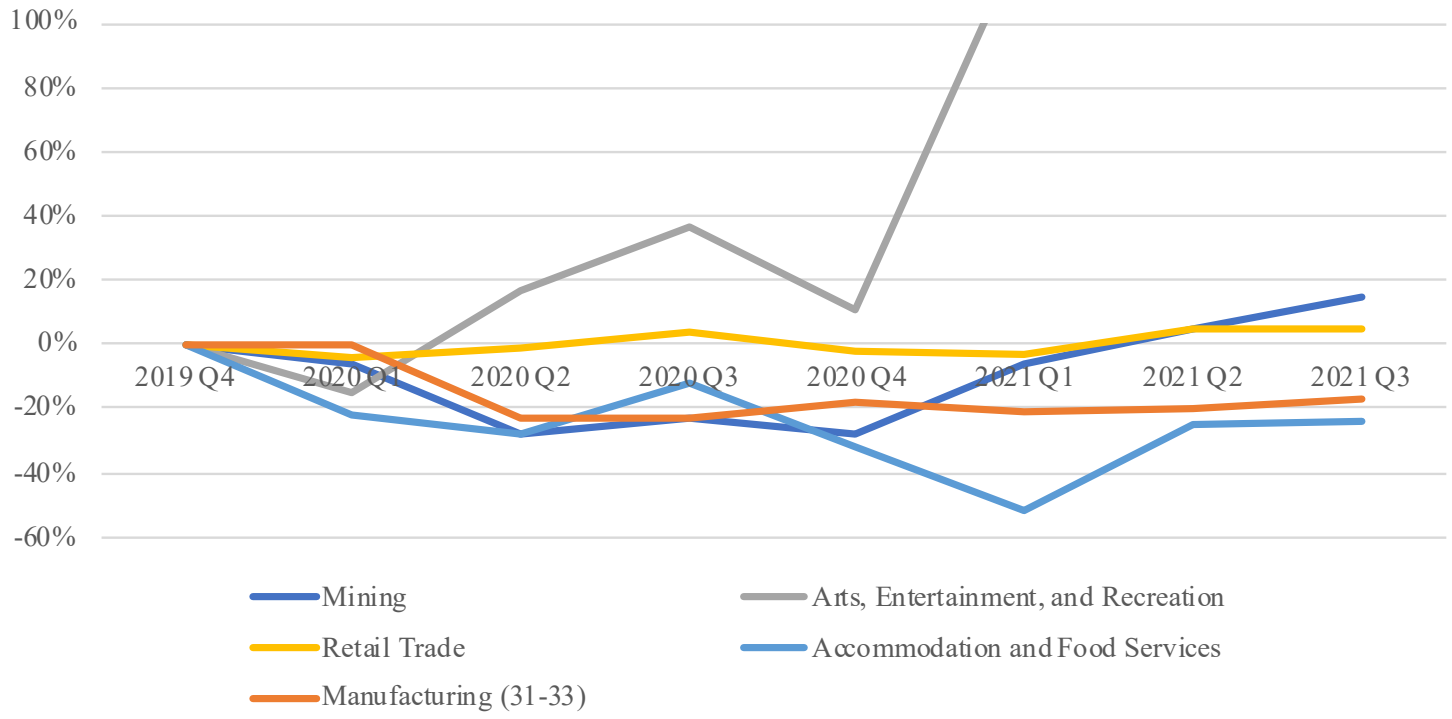

Figure 100: San Juan County Industry Job Change [96]

[96] Source: QCEW data from Utah Department of Workforce Services

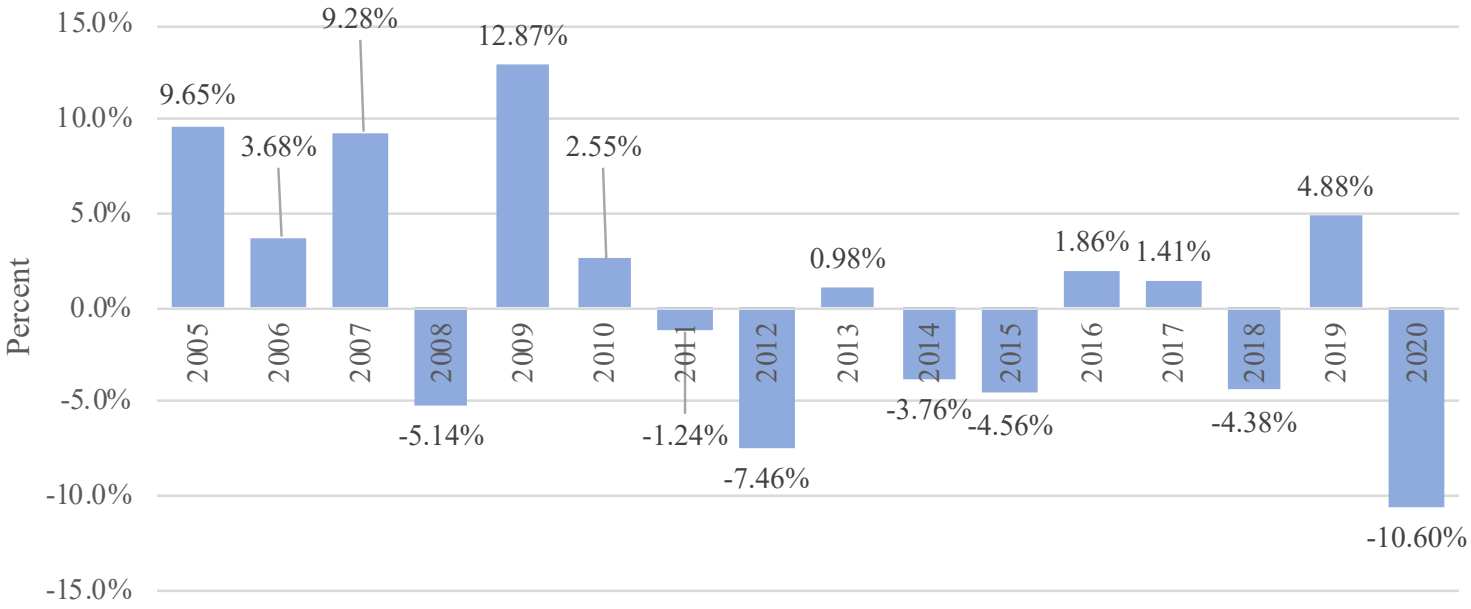

Figure 101: San Juan County Real Growth Rate GDP[97]

	2018	2019	2020	% Change from 2019	% of Total GDP
All industry total[98]	$483,379	$506,988	$453,246		
Private industries	$384,546	$411,000	$358,821	-13.57%	79.17%
Agriculture, forestry, fishing and hunting	$4,033	$5,575	$22,264	413.81%	4.91%
Mining, quarrying, and oil and gas extraction	$137,957	$144,027	$93,763	-36.43%	20.69%
Utilities	$9,162	N/A	$13,751	N/A	3.03%
Construction	$14,043	$14,556	$10,901	-26.03%	2.41%
Manufacturing	$7,640	$11,336	$11,623	3.76%	2.56%
Durable goods manufacturing	N/A	N/A	$2,439	N/A	0.54%
Nondurable goods manufacturing	N/A	N/A	$9,212	N/A	2.03%
Wholesale trade	N/A	$2,239	N/A	N/A	N/A
Retail trade	$11,569	$11,954	$11,586	-3.18%	2.56%

[97] Source: Bureau of Economic Analysis. Real GDP is calculated with chained 2012 dollars.

[98] Bolded indicates primary industry, not bolded indicates subcategory.

Transportation and warehousing	$4,044	$4,841	$4,986	3.59%	1.10%
Information	N/A	N/A	N/A	N/A	N/A
Finance, insurance, real estate, rental, and leasing	$63,313	$65,924	$63,536	-3.77%	14.02%
Finance and insurance	$3,221	$3,375	$3,515	4.35%	0.78%
Real estate and rental and leasing	$60,004	$62,450	$59,837	-4.35%	13.20%
Professional and business services	N/A	$9,581	$9,185	N/A	2.03%
Professional, scientific, and technical services	$4,572	N/A	N/A	N/A	N/A
Management of companies and enterprises	N/A	N/A	N/A	N/A	N/A
Administrative and support and waste management and remediation services	$2,170	$2,266	$2,111	-7.14%	0.47%
Educational services, health care, and social assistance	$49,706	$50,142	$49,068	-2.16%	10.83%
Educational services	N/A	N/A	N/A	N/A	N/A
Health care and social assistance	N/A	N/A	N/A	N/A	N/A
Arts, entertainment, recreation, accommodation, and food services	$38,308	$39,829	$23,255	-43.27%	5.13%
Arts, entertainment, and recreation	N/A	N/A	$198	N/A	0.04%
Accommodation and food services	N/A	N/A	$23,017	N/A	5.08%
Other services (except government and government enterprises)	$13,138	$13,087	N/A	N/A	N/A
Government and government enterprises	$97,711	$96,359	$92,713	-3.73%	20.46%

Table 57: San Juan County GDP by Industry [99]

[99] Source: Bureau of Economic Analysis.

3 Infrastructure and Resources

NORTHWESTERN COLORADO

Available Infrastructure

POWER STATIONS

Power stations provide access to industrial grade utilities and infrastructure that could support advanced manufacturing and other initiatives. The AGNC region is home to two coal fired power plants that are set to retire in 7-14 years. Therefore, opportunity exists to utilize these facilities in local innovation programs like the following:

- Coal-to-products
- Advanced/light manufacturing
- Workforce development
- Remote work support
- Physical innovation spaces

AGNC Coal-Fired Power Stations

CRAIG POWER STATION: this facility is a coal-fired 1,427.6 MW power station located in Moffat County, which consists of three units. Unit 1 is scheduled for shutdown in 2025, while Units 2 and 3 will be shut down by the end of 2029. This facility contains land and buildings with access to industrial grade power infrastructure, security infrastructure, and coal feedstock sources.

HAYDEN POWER STATION: this facility is a 446 MW power station located in Routt County. Hayden consists of two units, the first of which will be shut down in 2030 and the second in 2036. Like Craig, it possesses industrial infrastructure and access to coal feedstock, all of which could serve a local coal-to-products industry.

RAILROAD RESOURCES

Railroad resources provide the region with a cost-effective method for transporting raw materials and finished goods. The AGNC region is home to one major railroad and a short line railway. Both have potential to support innovation programs such as the following:

- Coal-to-products
- Advanced/light manufacturing

RAILROADS

Northwest Colorado's rail infrastructure is primarily used for transporting freight. In 2019, coal was the number one commodity shipped by volume, while it was the number two received by volume.[18]

Top 5 Commodities Shipped by Volume	Top 5 Commodities Received
Coal	Assembled Autos
Intermodal-Wholesale	Coal
Petroleum Products	Intermodal-Wholesale
Stone and Gravel	Sand
Wheat and Flour	Stone and Gravel

Table 58: Top 5 Commodities Shipped Via Rail in Colorado

The primary rail artery in northwestern Colorado is a Union Pacific line that follows I-70 from Kansas to Utah. This line has a class 1 rail offshoot that deviates north into southern Routt County. This line is for freight transportation and connects near the Trapper, Colowyo, and 20 Mile mines to the main line that follows I-70, allowing for long haul transportation. The primary use for this line is coal transportation.

The Deseret Power Railway is a smaller line that is not connected to the Union Pacific line. This line is a class 3 short line railroad and crosses the Utah border from Uintah County into Rio Blanco and Moffat Counties. This line was built to supply coal from the Deserado coal mine in Rio Blanco County to a coal fired power station in Uintah County called the Bonanza Power Plant (400 MW). The length of the railway is about 35 miles with 17 miles of it being in Utah. The Bonanza Power Plant is set to retire in 2030, eliminating the need for the railway after that point.[19]

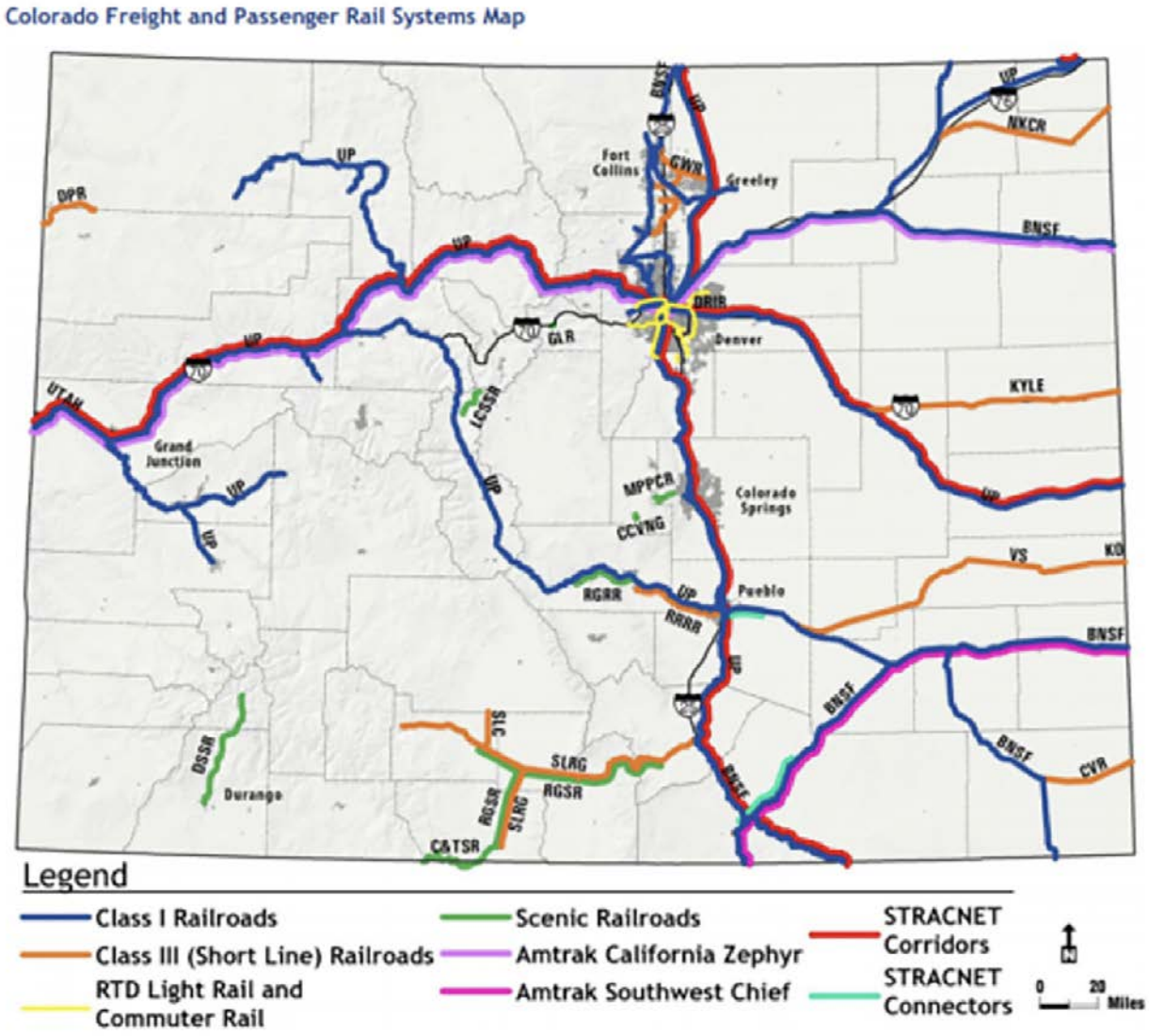

Figure 102: Colorado Freight and Passenger Rail Systems

COAL MINES

The AGNC region has four active coal mines. Most of these mines produce low-sulfur subbituminous coal that is used for power generation. Additionally, two active mines exist in Colorado outside of the AGNC region, which produce bituminous coal. For further information on coal types (ranks) and the materials that can be made from them refer to Chapter 4. Coal mines like these could be used to help support the following:

- Coal-to-products
- Advanced/light manufacturing

AGNC Mines

COLOWYO MINE (Moffat County): This mine produces 1.7 million tons of subbituminous coal per year, which is primarily used for power generation. The mine is owned by Tri-State and scheduled to close in 2029.

TRAPPER MINE (Moffat County): This mine produces 2 million tons of subbituminous coal annually, which is primarily used for power generation. This mine is owned by Tri State and supplies coal to Craig Station, which is adjacent to it. The mine is scheduled to close in 2029.

DESERADO MINE (Rio Blanco County): This mine produces 1.8 million tons of subbituminous coal per year, which is primarily used for power generation. This mine is owned by Blue Mountain Energy and does not have a set closing date.

TWENTYMILE MINE (Routt): This mine produces 1.1 million tons of bituminous coal annually, which is used for power generation and export. This mine is owned by Peabody Energy and does not have a set closing date.

Other Colorado Mines

KING COAL II MINE (La Plata County): This mine produces 592,000 tons of bituminous coal annually and is owned by GCC Energy. Coal from the mine is used for cement production, heating, and historic railroad fuel.

WEST ELK MINE (Gunnison County): This mine produces 2.5 million tons of bituminous coal annually. This mine is owned by Mountain Coal Company, LLC and its coal is primarily used for power generation.

BROADBAND

Compared to other parts of Colorado, Northwest Colorado has a slightly higher percentage of residents with access to broadband in rural areas. The average percentage of rural Colorado households with access to broadband is 90.32%. However, access in Moffat County is 92.01%, in Routt County it is 95.36%, and in Rio Blanco County 90.32%. Non-rural access to broadband for Colorado is 97.32%. Therefore, when compared to non-rural areas Northwest Colorado still lags behind in terms of broadband access. Table 59 lists rural and total broadband access by county. The Colorado Broadband Office collects this data from local internet service providers twice a year and they translate it into GIS format.[20]

County Name	RURAL Households with Broadband Access	Total RURAL Households	Percent RURAL Households With Broadband Access	Households with Broadband Access	Total Households	Percent Households With Broadband Access
Adams	5,526	6,097	90.64%	162,477	163,136	99.60%
Alamosa	6,552	6,554	99.97%	6,552	6,554	99.97%
Arapahoe	3,233	3,437	94.07%	238,097	238,301	99.91%
Archuleta	7,334	8,762	83.70%	7,334	8,762	83.70%
Baca	2,095	2,248	93.21%	2,095	2,248	93.21%
Bent	2,178	2,242	97.15%	2,178	2,242	97.15%
Boulder	10,041	13,742	73.07%	123,349	127,071	97.07%
Broomfield	125	129	96.99%	22,642	22,646	99.98%
Chaffee	9,270	10,020	92.51%	9,270	10,020	92.51%
Cheyenne	914	975	93.71%	914	975	93.71%
Clear Creek	4,124	5,685	72.55%	4,124	5,685	72.55%
Conejos	3,820	4,285	89.16%	3,820	4,285	89.16%
Costilla	2,473	2,613	94.65%	2,473	2,613	94.65%
Crowley	1,508	1,559	96.70%	1,508	1,559	96.70%
Custer	3,430	3,956	86.70%	3,430	3,956	86.70%
Delta	12,950	14,572	88.87%	12,950	14,572	88.87%
Denver	0	0	0.00%	285,797	285,797	100.00%
Dolores	790	1,468	53.82%	790	1,468	53.82%
Douglas	14,798	14,982	98.77%	106,675	106,859	99.83%
Eagle	29,309	31,312	93.60%	29,309	31,312	93.60%
Elbert	8,638	8,939	96.63%	8,638	8,939	96.63%
El Paso	22,661	23,163	97.83%	252,350	252,852	99.80%
Fremont	18,681	19,249	97.05%	18,681	19,249	97.05%
Garfield	23,105	23,309	99.12%	23,105	23,309	99.12%
Gilpin	2,577	3,560	72.37%	2,577	3,560	72.37%

Grand	15,776	16,061	98.22%	15,776	16,061	98.22%
Gunnison	9,377	11,412	82.17%	9,377	11,412	82.17%
Hinsdale	666	1,388	47.99%	666	1,388	47.99%
Huerfano	4,652	5,073	91.69%	4,652	5,073	91.69%
Jackson	769	1,286	59.80%	769	1,286	59.80%
Jefferson	17,946	23,025	77.94%	224,819	229,967	97.76%
Kiowa	726	805	90.23%	726	805	90.23%
Kit Carson	3,457	3,527	98.02%	3,457	3,527	98.02%
Lake	4,137	4,271	96.87%	4,137	4,271	96.87%
La Plata	25,222	25,860	97.53%	25,222	25,860	97.53%
Larimer	20,767	27,305	76.06%	126,151	132,722	95.05%
Las Animas	5,394	8,217	65.65%	5,394	8,217	65.65%
Lincoln	2,061	2,420	85.17%	2,061	2,420	85.17%
Logan	8,854	8,981	98.58%	8,854	8,981	98.58%
Mesa	7,106	8,254	86.10%	61,467	62,642	98.13%
Mineral	760	1,201	63.30%	760	1,201	63.30%
Moffat	5,700	6,196	92.01%	5,700	6,196	92.01%
Montezuma	10,849	12,094	89.71%	10,849	12,094	89.71%
Montrose	17,805	18,250	97.56%	17,805	18,250	97.56%
Morgan	11,460	11,490	99.74%	11,460	11,490	99.74%
Otero	8,918	8,969	99.43%	8,918	8,969	99.43%
Ouray	3,017	3,083	97.85%	3,017	3,083	97.85%
Park	8,938	13,949	64.08%	8,938	13,949	64.08%
Phillips	2,064	2,087	98.90%	2,064	2,087	98.90%
Pitkin	12,652	12,953	97.68%	12,652	12,953	97.68%
Prowers	5,894	5,942	99.20%	5,894	5,942	99.20%
Pueblo	8,338	9,988	83.48%	67,646	69,526	97.30%
Rio Blanco	2,989	3,309	90.32%	2,989	3,309	90.32%
Rio Grande	6,233	6,630	94.01%	6,233	6,630	94.01%

Routt	15,546	16,303	95.36%	15,546	16,303	95.36%
Saguache	3,488	3,843	90.76%	3,488	3,843	90.76%
San Juan	95	756	12.63%	95	756	12.63%
San Miguel	6,417	6,638	96.66%	6,417	6,638	96.66%
Sedgwick	1,384	1,414	97.86%	1,384	1,414	97.86%
Summit	27,526	29,843	92.24%	27,526	29,843	92.24%
Teller	12,152	12,643	96.12%	12,152	12,643	96.12%
Washington	2,101	2,434	86.32%	2,101	2,434	86.32%
Weld	36,226	40,103	90.33%	92,232	96,281	95.79%
Yuma	4,088	4,466	91.55%	4,088	4,466	91.55%
Statewide Totals	537,683	595,326	90.32%	2,154,620	2,212,901	97.37%

Table 59: Colorado County Broadband Access [100]

Figures 103 and 105 illustrate broadband coverage by speed. Figure 106 shows both residential wireline and wireless coverage for NW Colorado. Dark blue indicates download speeds greater than or equal to 100 Mbps and less than 1 Gbps, while light blue indicates speeds greater than or equal to 25mbps and less than 100 Mbps. Figure 104 is the color key for these maps and shows each color and corresponding download speed.

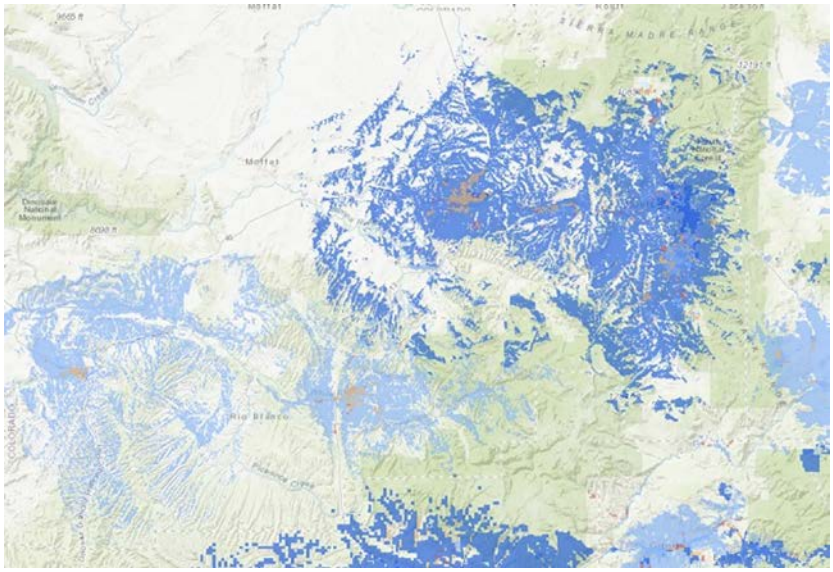

Figure 103: Moffat, Routt, and Rio Blanco County Wireline and Wireless Broadband Coverage [101]

[100] Data provided by Antonio Martinez and Megan Gernert of the Colorado Broadband Office.

[101] Colorado Broadband Office, "Colorado Broadband Map."

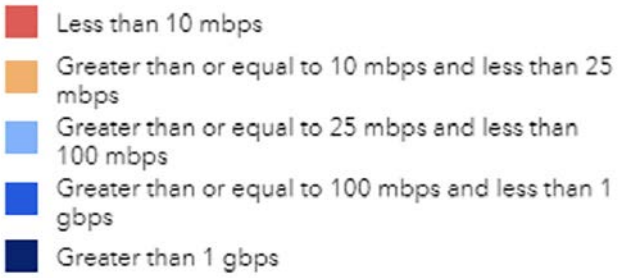

Figure 104: Key for Download Speeds

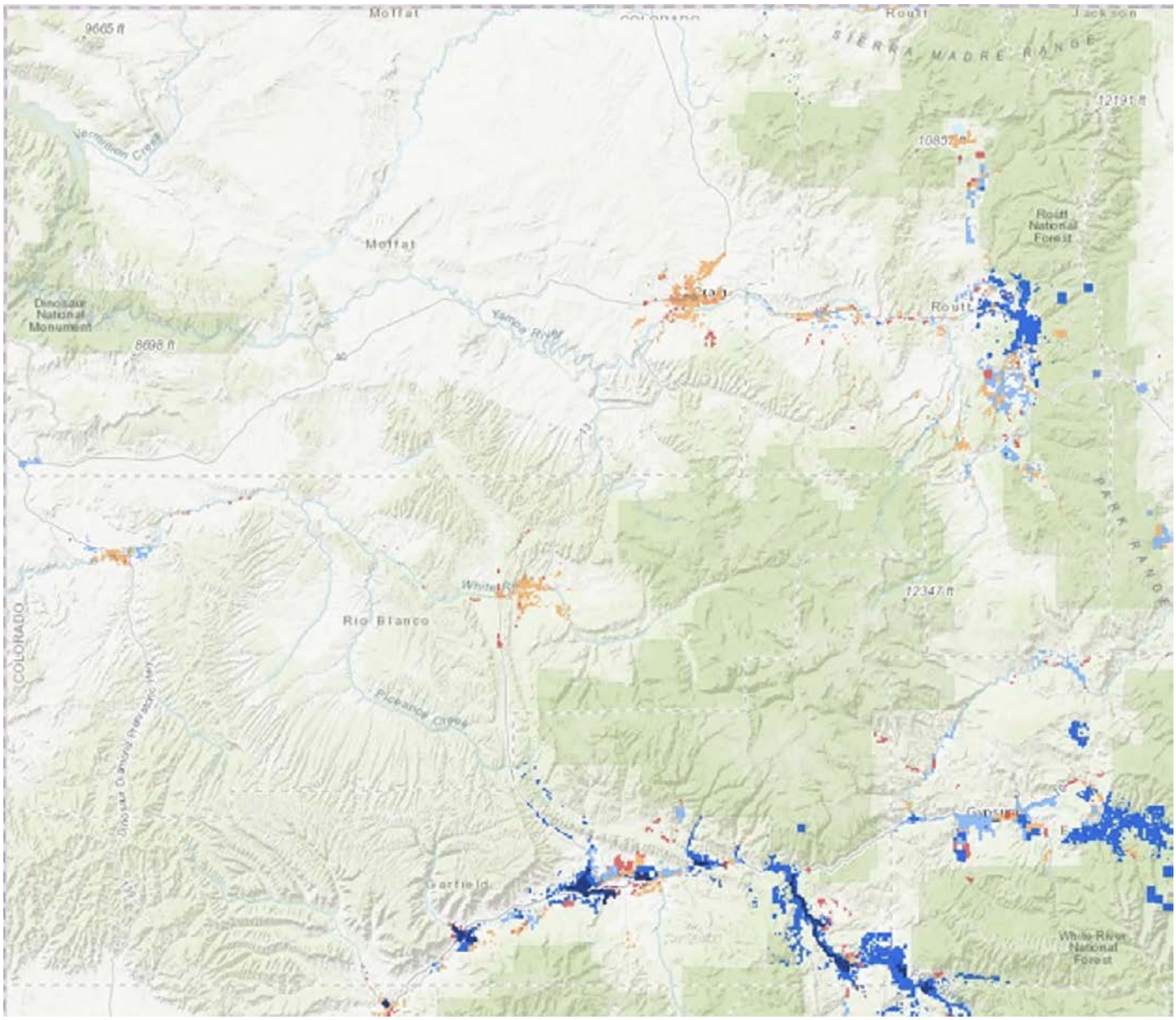

Figure 105: Moffat, Routt, and Rio Blanco Wireline Coverage by Speed [102]

[102] Ibid.

Figure 106 illustrates Moffat, Rio Blanco, and Routt County broadband service levels. These figures use the same information from the previous dataset. However, the Colorado Broadband Office's GIS team applies the data to every address or structure to get a more precise view of service per area. With this map it is easier to see where coverage deficiencies occur. The Colorado Broadband Office defines the green area as "served" with a 25/3 Mbps (25 Mbps download and 3 Mbps upload speed). Yellow indicates "unserved" areas, where reported service does not meet the 25/3 Mbps standard, and red is a "priority unserved" area, where reported service is 10/1 Mbps or less.

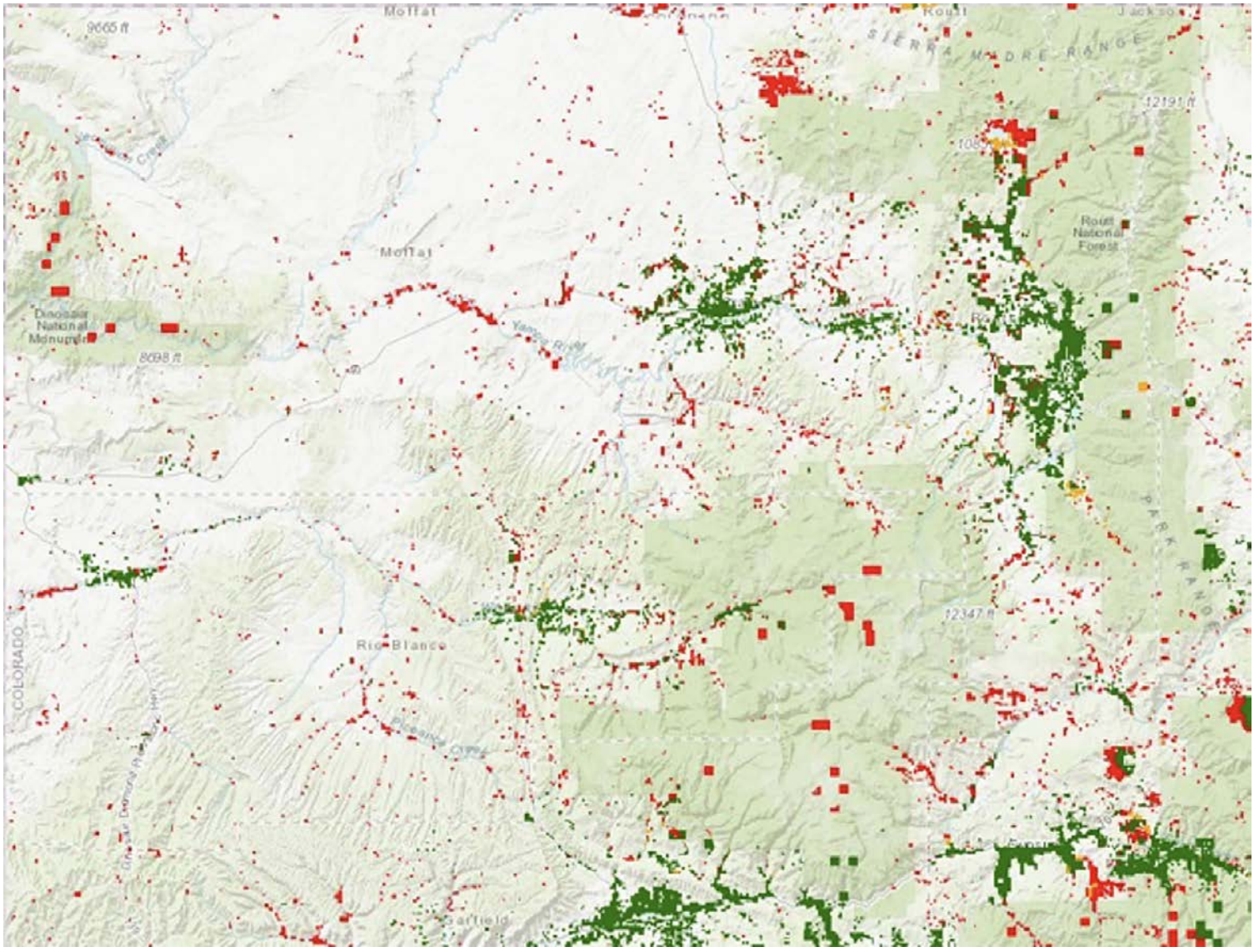

Figure 106: Broadband Service Levels for Moffat, Routt, and Rio Blanco Counties [103]

[103] Ibid.

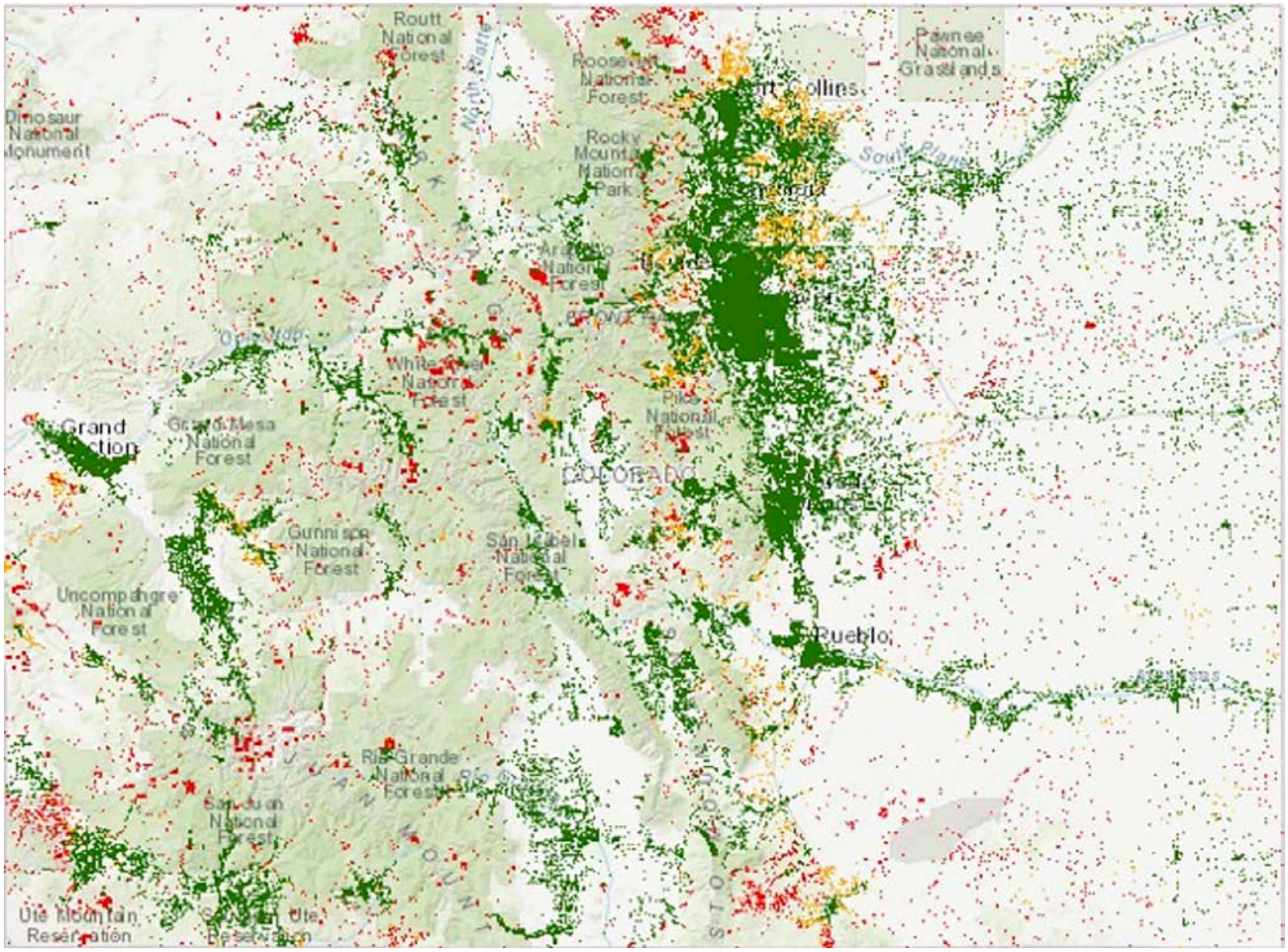

Figure 107: Colorado Broadband Service Levels [104]

BROADBAND RECOMMENDATIONS

Although the maps above illustrate broadband availability in northwestern Colorado, below are some recommendations that policy makers should consider:

- Moffat County needs wireless and wired broadband development. The expansion of broadband into this area would help facilitate remote work, both from existing residents and new ones moving into the area with existing jobs. To accomplish this, there is need of detailed assessment and mapping involving the local utilities that serve the area. Such a map should contain priority areas for broadband infrastructure projects that could be carried out over a specified number of years. This planning phase could then be followed by physical work to expand coverage.

- There is a need to expand wireline coverage in both Moffat and Rio Blanco Counties. Wireline coverage could serve as the backbone for more reliable connections via cellular tower and satellite. The wireless connections that this backhaul network supports could then better serve rural residents, enabling remote working to take place in more areas throughout the counties.

[104] Ibid.

- It is not clear if the wireless broadband coverage shown in Figure 2 only includes connections for cellular phones or reliable for computers as well. Options to connect computers wirelessly should be explored. These could include router connections through cellular broadband, satellite, and blanket wireless networks like 5G. Wireless options like these would require less infrastructure and are a good option for rural residents. In cases where such connections exist, they should be improved as needed to support reliable connectivity and download/upload speeds.

Potential Domestic Partners

ACADEMIC

Academic institution involvement is necessary for certain innovation programs like coal-to-products and workforce development. However, it can benefit other programs as well. Academic partners can provide expertise, exposure to other partnerships, and access to potential funding opportunities. Academic partnerships can benefit the following programs:

- Coal-to-products
- Advanced/light manufacturing
- Workforce development
- Remote work support
- Physical innovation spaces

In-State Academic Institutions

COLORADO SCHOOL OF MINES: Located in Golden, Colorado, Colorado School of Mines specializes in engineering, science, and mathematics with an emphasis on issues related to the earth, energy, and the environment.

COLORADO NORTHWEST COMMUNITY COLLEGE (CNCC): Located in Craig and Rangeley, CNCC serves nearly 1,800 students. The Craig campus building was recently built in 2010 and is close to a technical career center where courses and certificates are offered in several programs. These include mine safety, automotive/diesel technology, nursing, and cybersecurity.

COLORADO MESA UNIVERSITY CMU: CMU is a public university serving close to 11,000 students in Grand Junction, Co. CMU houses the Western Colorado Community College, and a university campus in Montrose. It also has an engineering degree partnership with University of Colorado, Boulder.

Out-of-State Academic Institutions

MONTANA TECHNOLOGICAL UNIVERSITY: Located in Butte, Montana, this institution is a STEM university with a strong mining engineering program. It is also a favorable partner due to Montana's strong Congressional position, which may increase the likelihood of developing funding for a program.

UNIVERSITY OF WYOMING: The College of Engineering and Applied Sciences at this institution offers undergraduate and graduate degrees in energy systems engineering, chemical engineering, and traditional engineering fields. This program devotes focus to energy conversion systems, petroleum science, and advanced material

research. UW is also home to the Center for Carbon Capture and Conversion (CCCC), which explores alternate uses of coal and ways to make it cleaner.[21]

DEPARTMENT OF ENERGY (DOE) LABORATORIES

DOE laboratories are actively involved in coal material, sustainable power technologies, and energy development. DOE laboratory partnerships can benefit the following:

- Coal-to-products
- Advanced/light manufacturing

DOE Laboratories in Colorado

National Renewal Energy Laboratory (NREL)
Website: https://www.nrel.gov
NREL supports programs that advance the science and engineering of energy efficiency, sustainable transportation, and renewable power technologies. This also includes energy storage and battery technologies, as well as material science technologies that involve energy retention, transmission, and capture.

DOE Laboratories Outside of Colorado

NETL
Website: https://www.netl.doe.gov
NETL supports a wide range of energy and materials research. This includes and advanced energy systems, carbon management, and advanced coal processing.

Oak Ridge National Laboratory (ORNL)
Website: https://www.ornl.gov
ORNL supports research in coal carbon materials and carbon fiber. ORNL's main campus is in Oak Ridge, TN where it supports a 42,000 sq. ft. facility dedicated to carbon fiber research known as the Carbon Fiber Technology Facility (CFRF). ORNL also supports research into nanomaterials, Rare Earth Elements (REEs) and other coal materials related research.

COAL SECTOR COMPANIES

Companies in the coal sector provide opportunities for partnership and are sources for personnel that could participate in multiple innovation programs. They could also help support programs like workforce development, help provide feedstock for coal to products, and help test power technologies. The following initiatives could benefit from their involvement:

- Coal-to-products
- Advanced/light manufacturing
- Workforce development
- Physical innovation spaces

Power Companies

TRI STATE: Tri-State is a non-profit cooperative power supplier that provides power to nearly 1 million people, covering several states in the west.

Coal Mine Operators

- Tri-State and its subsidiaries Elk Ridge Mining and Reclamation, LLC, and Colowyo Coal Company: Colowyo Mine

- Platte River, Tri-State Generation & Transmission, Inc., Xcel Energy, the Salt River Project, and Pacificorp: Trapper Mine

- Deseret Generation & Transmission Co-operative and Blue Mountain Energy (operator): Deserado Mine
- Peabody Energy: Twenty Mile Mine

DEFENSE INDUSTRIES ON THE FRONT RANGE [105]

A strong defense industry is one of Colorado's main innovation assets. Defense firms on the front range are potential users of products derived from coal. They also have potential to support advanced/light manufacturing in the AGNC region by locating manufacturing facilities and subcontracting with local firms to produce goods. The following initiatives could benefit from their involvement:

- Coal-to-products
- Advanced/light manufacturing

COLORADO DEFENSE FIRMS

- Lockheed Martin (Colorado Springs and Littleton): Lockheed Martin is a global security and aerospace company that employs approximately 114,000 people worldwide. The firm is principally engaged in the research, development, manufacture, integration, and sustainment of advanced technology systems, products, and services.

- Northrop Grumman (Colorado Springs): Northrop Grumman is a global aerospace, defense, and security company. Most of this firm's business is with the U.S. Department of Defense and intelligence community. However, they also deliver solutions to global and commercial customers.

- Raytheon Technologies (Colorado Springs): Raytheon Technologies is an aerospace and defense company that provides advanced systems and services for commercial, military and government customers worldwide. It includes four industry-leading businesses: Collins Aerospace, Pratt & Whitney, Raytheon Intelligence & Space and Raytheon Missiles & Defense.

- Ball Aerospace (Broomfield): Ball Aerospace is a company that manufactures spacecraft, components, and instruments for national defense, civil space, and commercial space applications. The company produces satellites, spacecraft, space-based instruments and sensors, tactical instruments and sensors, antennas, microwave systems, and other forms of aerospace technology. Ball also provides engineering services such as prototyping, system design, and software development for ground, air, and space systems. The company serves both government and commercial aerospace markets.

- Sierra Nevada Corporation (Centennial and Broomfield): Sierra Nevada Corporation (SNC) is national security firm that specializes in aircraft modification and integration, space systems, cybersecurity, and health technology. The company contracts with the Department of Defense, NASA, and private spaceflight companies.

- United Launch Alliance (Denver): The United Launch Alliance (ULA) is a

[105] For a detailed view of all aerospace and defense companies in Colorado Springs, see https://coloradospringschamberedc.com/wp-content/uploads/2016/10/Aerospace_Defense_Map_April_2020.pdf

joint venture between private space companies Lockheed Martin and Boeing that provides launch vehicles to NASA, the Department of Defense and other organizations. Headquartered in Denver, Colorado, ULA's rockets are among the largest and most powerful in the industry. ULA was formed in 2006 and has since successfully delivered more than 100 satellites to orbit using the Atlas and Delta families of rockets, according to Boeing.

- Leidos (Denver): Leidos Holdings, Inc. is a holding company that engages in scientific, engineering, and information technology services and solutions. Their areas of focus are defense, intelligence, civil and health markets. These are carried out through three corporate segments: Defense Solutions, Civil, and Health.

- Ball Corporation (Broomfield): Ball Corporation is a provider of metal packaging for beverages, foods, and household products. They also provide products for aerospace and other technologies for commercial and governmental customers.

- Boeing (Colorado Springs): Boeing is the world's largest aerospace company and leading manufacturer of commercial jetliners, defense, space, and security systems. They are also a service provider for aftermarket support of their products. As America's biggest manufacturing exporter, the company supports airlines, the U.S., and allied government customers in more than 150 countries. Boeing products and services include commercial and military aircraft, satellites, weapons, electronic and defense systems, launch systems, advanced information and communication systems, performance-based logistics, and training.

- General Atomics (Englewood): General Atomics is a defense and diversified technologies company that was founded in 1955 as a Division of General Dynamics. In 1986, Neil Blue acquired the firm. Today the firm and its affiliated companies (which include GA Aeronautical Systems, Inc.) operate on five continents.

- GA-ASI (Centennial): GA-ASI produces a series of unmanned aircraft and provides electro-optical, radar, signals intelligence, and automated airborne surveillance systems. GA's Electromagnetic Systems Division also produces electro-magnetic aircraft launch and recovery systems for the US Navy, satellite surveillance systems, an electro-magnetic rail gun, high power lasers, hypervelocity projectiles, and power conversion systems.

- Barber Nichols, Inc. (Arvada): Barber-Nichols Inc. (BNI) designs and manufactures specialty turbo machinery. The company also provides products such as blowers, compressors, fans, pumps, turbines. Additionally, they provide systems for cryogenic, national defense, power generation, and space flight applications.

- Boom Supersonic (Englewood): Boom Supersonic is a commercial airplane manufacturer that builds a 65-88 seat

supersonic airliner that are affordable for business travel. Their goal is to make routine supersonic flights available for everyone.

Potential Foreign Partners

Carbon fiber is useful to a variety of industries such as aerospace, automobile manufacturing, sporting goods, and energy production. It is also used in aerospace where it replaces alloys such as aluminum and titanium. In sporting goods, it is used for tennis rackets, golf clubs, hockey sticks, bats, bows, and arrows. In energy production, it is used as a lightweight material for wind turbine blades. And, in the automotive industry it is used to reduce vehicle weight, increase energy efficiency, and reduce material cost. Below are foreign countries with coal-to-products interests that could help support a program of this type:

SOUTH KOREA

South Korea has invested significantly in carbon fiber research and recognizes a potential need for less expensive caron fiber from coal. Therefore, they designated Jeonju City and Jenbuk Province as their "Carbon Valley." This region is where South Korea intends to create infrastructure and research support for advanced carbon materials. Although South Korea has low offshore wind potential, it has high automobile manufacturing demand. This is due to an active automotive industry that produced over 3.5 million cars in 2020 and a national requirement to reduce carbon emissions. This provides an opportunity to innovate with lightweight materials like coal-carbon products for automobile manufacturing.

JAPAN

Japan is the second largest automobile manufacturer in the world. Demand for coal materials primarily exists in the automotive sector, which includes major manufactures such as Toyota, Honda, Nissan, and others. During 2020, Japan produced just over 8 million cars and is the third largest automobile producer in the world. As more stringent fuel economy standards take hold, demand for lighter vehicles that contain carbon fiber will likely increase. Additionally, Japan's energy needs and high potential for offshore wind power generation also create an opportunity to utilize carbon fiber for wind turbines.

MEXICO

In 2020, Mexico produced 3.1 million vehicles, making the country the seventh largest producer of vehicles in the world. Mexico also has 1,600 GW of offshore wind power. However, no policies exist that would force Mexico to expand this at the present time.

TAIWAN

Taiwan has taken steps to implement land based and offshore wind energy. One program that may increase carbon fiber use is their Thousand Wind Turbines program. Although Taiwan does not have a specific vehicle manufacturing industry, they are the second largest producer for sporting goods, which utilize carbon fiber in many products.

INDIA

India is the sixth largest automobile manufacturer in the world, producing 3.3 million automobiles. Additionally, they

have 7,600 km of coastline that can be used for offshore wind power. Therefore, India's Ministry of New and Renewable Energy has established the goals of 5 GW of offshore wind power by 2022 and 30 GW of power by 2030. This may increase the need of carbon fiber and other products that can be derived from coal in India.

THE EUROZONE

Europe's commitment to reducing greenhouse gasses have led to aggressive emission reduction targets, increasing demand for low weight vehicles in the process. Additionally, NATO countries within the Eurozone like France produce military goods, some of which require carbon fiber in their construction. France alone produces 8.2% of the international arms in the world. Therefore, materials derived from coal could be used by their aerospace and defense industries. Another potential market for coal-carbon materials is Germany. Currently, Germany is the largest manufacturer of automobiles in Europe, producing 3.7 million vehicles in 2020 alone.

EASTERN UTAH

Available Infrastructure

POWER STATIONS

Power stations provide access to industrial grade utilities and infrastructure that could support advanced manufacturing and other initiatives. The Carbon and Emery Counties are home to three coal fired power plants, two of which are set to retire in 14-18 years. Therefore, opportunity exists to utilize these facilities in local innovation programs like the following:

- Coal-to-products
- Advanced/light manufacturing
- Workforce development
- Remote work support
- Physical innovation spaces

Emery, Carbon, and San Juan County Power Stations

HUNTER: this facility is a coal-fired 1,455 MW power station located in Emery County near Castle Dale, Utah. The power plant is owned by Pacificorp and operated by MidAmerican Energy. It consists of three units and is set to be retired in 2042. Units 1 and 2 provide 480 MW of power each, while unit 3 baseload capacity is 495 MW.[22] This facility contains land and buildings with access to industrial grade power infrastructure, security infrastructure, and coal feedstock sources.

HUNTINGTON: this facility is a 1,037 MW power station located in Emery County, Utah that is owned by Pacificorp. Huntington consists of two units and is scheduled to shut down in 2036.[23] Like Craig, it possesses industrial infrastructure and access to coal feedstock, all of which could serve a local coal-to-products industry.

SUNNYSIDE: Sunnyside is a qualified cogeneration facility that burns waste coal and generates 58 MW of power. The facility is operated by Colmac Sunnyside and is located within Carbon County, Utah.[24]

COAL MINES

The Emery, Carbon, and San Juan County region have five active coal mines and seven exist in the entire state of Utah. The two

mines outside of the project region are in Sevier and Kane Counties. Most of these mines produce low-sulfur subbituminous coal that is used for power generation. Figure 108 illustrates total coal production in the state of Utah from 2002 to 2020. At its peak, Utah produced just above 26,131 thousand short tons of coal and by 2020 that was reduced to 13,324 thousand short tons. Table 60 is taken directly from the Utah Geological Survey and shows the amount of coal production per mine in Utah. Coal mines like these could be used to help support the following:

- Coal-to-products
- Advanced/light manufacturing

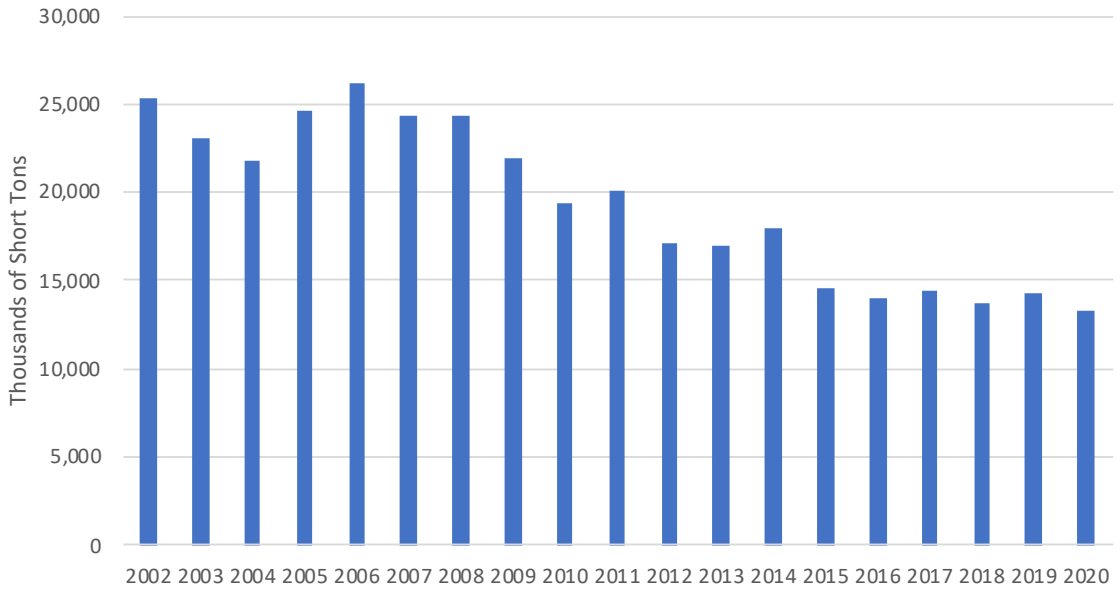

Figure 108: Total coal production in Utah, 2002-2020 [106]

Emery, Carbon, and San Juan County Coal Mines

LILA CANYON (Emery County): Lila Canyon is just south of Sunnyside power plant and in 2020 ranked third in production among Utah coal mines.

DUGOUT CANYON (Carbon County): Located North of Lila Canyon mine and East of Wellington, Dugout Canyon mine has been inactive since 2019.

SKYLINE #3 (Emery/Sanpete County): Skyline Mine is a coal mine located between Fairview, Utah, and Price Utah, bordering Emery County and Sanpete County. Skyline #3 had the second most coal output of Utah coal mines in 2020, producing 3,713 thousand short tons of coal.

SUFCO (Sevier County): SUFCO Mine is located near the town of Emery, south of Castledale and East of Salina, Utah. SUFCO is technically in Sevier County, located to the west near the border of Emery County.

[106] Data from the Utah Geological Survey

SUFCO mine was the top producing mine at 4,601 thousand short tons of coal in 2020.

EMERY MINE (Emery County): Emery Mine is located 4 miles south of the town of Emery, Utah, in Emery County. Emery Mine produced 474 thousand short tons of coal in 2020.

GENTRY (Emery County): Gentry Mines number 3, and 4 are located north of the Huntington coal power plant and produced 660 and 11 thousand short tons of coal, respectively, in 2020.

Coal Production in Utah by Coal Mine, 2002-2020. Reproduced exactly from the Utah Geological Survey
Thousand short tons

Company	Mine	County	Coalfield	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Utah Land Resources, Inc. - ACNR Holdings, Inc.	Aberdeen[1]	Carbon	Book Cliffs	37	444	1,984	1,519	2,103	1,044	242	--	--	--	--	--	--	--	--	--	--	--	--
	Pinnacle[1]	Carbon	Book Cliffs	662	584	419	189	8	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Emery County Coal Resources - ACNR Holdings, Inc.	Lila Canyon	Emery	Book Cliffs	--	--	--	--	--	--	--	--	72	157	304	257	335	350	1,587	1,638	2,816	3,664	3,296
Canyon Fuel, LLC - Wolverine Fuels[2]	Dugout Canyon	Carbon	Book Cliffs	2,080	2,941	3,811	4,592	4,335	3,816	4,135	3,291	2,307	2,395	1,588	561	676	763	650	626	557	430	--
	Skyline #3	Emery/Carbon /Sanpete[3]	Wasatch Plateau	3,477	2,771	551	405	1,759	2,558	3,120	2,910	3,050	2,950	1,954	3,135	4,170	4,409	4,767	4,389	3,614	3,896	3,713
	SUFCO	Sevier	Wasatch Plateau	7,600	7,126	7,568	7,567	7,908	6,712	6,946	6,748	6,398	6,498	5,651	5,959	6,539	6,095	5,375	5,947	4,842	4,374	4,601
Bronco Utah Operations[4]	Emery	Emery	Emery	26	243	256	1,187	1,054	1,026	1,050	1,238	999	--	--	4	--	--	--	135	442	694	474
Gentry Mountain Mining, LLC[5] - COP Coal Development Co.	Castle Valley #1	Emery	Wasatch Plateau	953	403	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Gentry #3	Emery	Wasatch Plateau	4	310	227	304	27	--	--	--	--	--	--	--	--	218	170	205	102	562	660
	Gentry #4	Emery	Wasatch Plateau	--	--	112	151	462	653	868	651	--	592	1,004	875	1,061	757	724	754	893	488	11
East Mountain Energy	Deer Creek[6]	Emery	Wasatch Plateau	3,984	3,938	3,356	3,910	3,748	3,685	3,878	3,833	2,954	3,143	3,295	2,785	2,083	15	--	--	--	--	--
Utah Land Resources, Inc. - ACNR Holdings, Inc.	Crandall Canyon[7]	Emery	Wasatch Plateau	3,248	1,161	872	1,593	613	400	--	--	--	--	--	--	--	--	--	--	--	--	--
	South Crandall Canyon[7]	Emery	Wasatch Plateau	--	26	103	225	759	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hidden Splendor Resources, Inc. - America West Resources, Inc.	Horizon	Carbon	Wasatch Plateau	110	108	293	286	257	233	229	194	270	370	210	--	--	--	--	--	--	--	--
Lodestar Energy, Inc.	Whisky Creek #1	Carbon	Wasatch Plateau	278	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Utah Land Resources, Inc. - ACNR Holdings, Inc.	West Ridge	Carbon	Book Cliffs	2,840	2,989	2,265	2,627	3,098	4,160	3,807	3,063	3,355	3,566	2,579	2,629	2,514	1,580	--	--	--	--	--
Alton Coal Development	Coal Hollow (surface)	Kane	Alton	--	--	--	--	--	--	--	--	--	403	570	747	555	316	671	724	488	240	569
	Burton #1 (underground)	Kane	Alton	--	--	--	--	--	--	--	--	--	--	--	--	--	11	34	--	--	--	--
Total				**25,299**	**23,069**	**21,818**	**24,556**	**26,131**	**24,288**	**24,275**	**21,927**	**19,406**	**20,073**	**17,155**	**16,953**	**17,933**	**14,513**	**13,978**	**14,417**	**13,753**	**14,347**	**13,325**

[1]Owned by Andalex Resources, Inc. until fall 2006.
[2]Bowie Resources bought Canyon Fuel from Arch Coal in summer 2013. In late 2018, Bowie changed their name to Wolverine Fuels.
[3]2020 production by county = Sanpete = 3,00,319 tons; Emery = 712,681 tons. 2019 production by county: Sanpete = 3,645,133 tons; Emery = 250,695 tons. 2018 production by county: Sanpete = 906,716 tons; Emery = 1,765,410 tons; Carbon = 941,447 tons. 2017 production by county: Sanpete = 43,949 tons; Emery = 136,203 tons; Carbon = 4,208,538 tons. 2005-2016: all production in Carbon. 2004 and before: all production in Emery.
[4]Bronco bought the Emery mine from CONSOL Energy in 2015.
[5]COP bought the Castle Valley mines when Rhino went into bankruptcy in late 2020, mines were renamed Gentry. In summer 2010, Rhino bought the Castle Valley mines from C.W. Mining (Co-op); mines were formerly called Bear Canyon.
[6]Deer Creek changed ownership in 2015, it was formally owned by Energy West Mining - PacifiCorp.
[7]Partially owned by Andalex Resources, Inc. until fall 2006. South Cradall now called the Princess Mine.

Note: ACNR Holdings, Inc. was previously Murray Energy

Source: UGS coal company questionnaires, MSHA

Table 60: Coal Production in Utah 2002-2020 [107]

RAILROAD RESOURCES

Railroad resources provide the region with a cost-effective method for transporting raw materials and finished goods. Carbon and Emery Counties are home to one major Union Pacific Railroad line that cuts through the major coal hubs in the region with connections to both Salt Lake and Denver.

Rail lines currently support the coal mining industry and other industries. These could also support innovation programs such as the following:

- Coal-to-products
- Advanced/light manufacturing

[107] Reproduced exactly from the Utah Geological Survey: https://geology.utah.gov/docs/statistics/coal2o/pdf/T2.8.pdf

RAILROADS

Utah's rail infrastructure is primarily used for transporting freight. In 2019, coal was the number one commodity shipped by volume, while it was the number two received by volume. Table 61 illustrates the top commodities exported from Utah and imported from Utah via freight rail.

Top 5 Commodities Shipped	Tons (mil)	Top 5 Commodities Received	Tons (mil)
Coal	6.3	Chemicals	2.1
Chemicals	3.8	Coal	2.1
Intermodal	1.4	Intermodal	1.8
Petroleum Products	1.0	Petroleum Products	1.0
Glass and Stone	0.6	Waste and Scrap	0.9
Other	2.1	Other	3.7

Table 61: Top Commodities Shipped Via Freight Rail in Utah [108]

The primary rail artery in northwestern Colorado continues through into Utah, traveling West through Green River, Utah, and then following I-191 North to Emery and Carbon Counties. From there it continues through to the Provo and the Salt Lake area. This rail line is a Union Pacific line that connects to other major parts of the nation. The rail line travels near Emery and Carbon County coal mines and power plants with offshoot lines serving these facilities. San Juan County has no rail lines that serves the county. Figure 109 illustrates Utah's railroad infrastructure.

[108] https://www.aar.org/wp-content/uploads/2021/02/AAR-Utah-State-Fact-Sheet.pdf

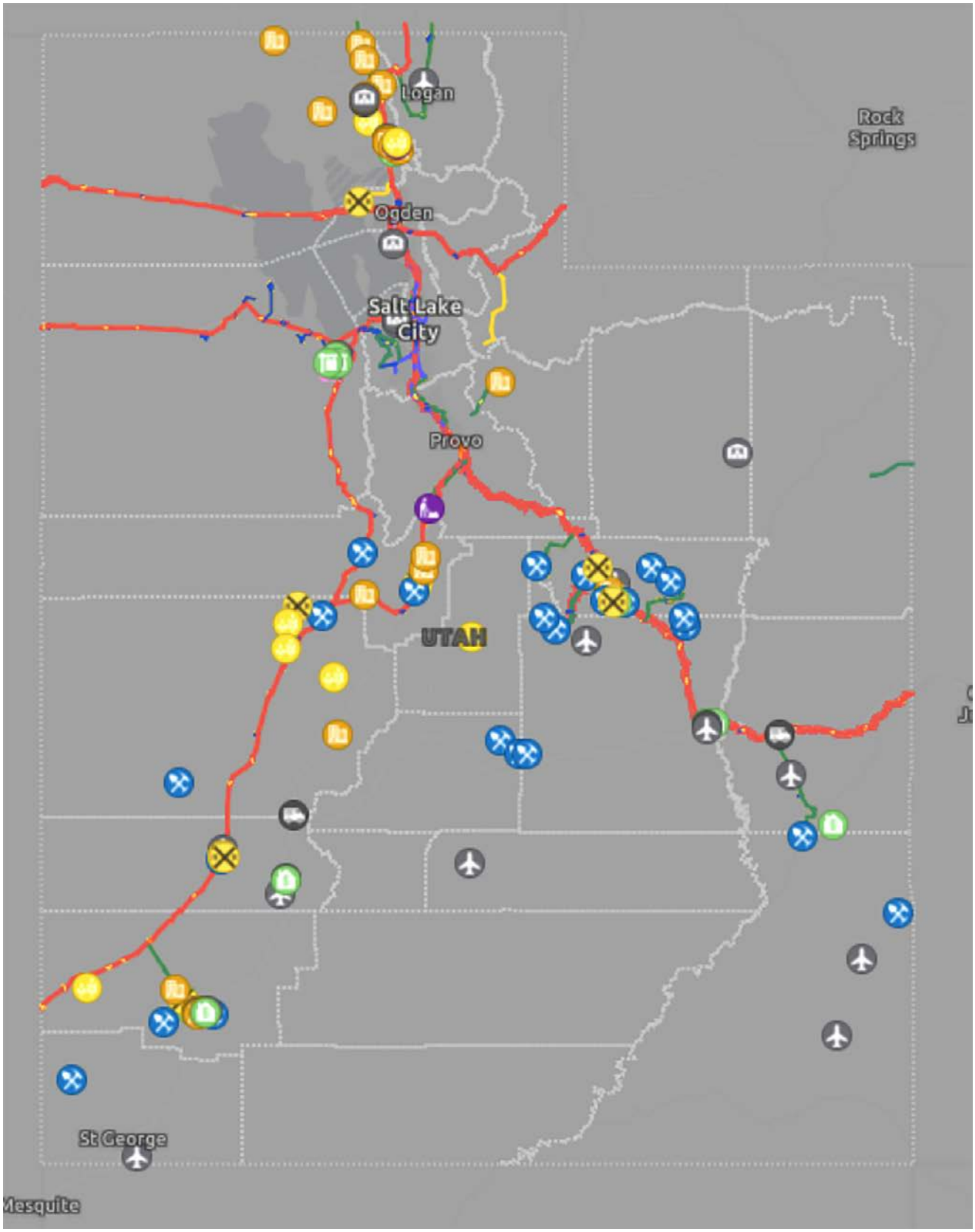

Figure 109: Utah Freight and Passenger Rail [109]

[109] https://www.arcgis.com/apps/webappviewer/index.html?id=f38f27504e7840b3a13f40fa24856607

BROADBAND

According to Broadband Now, broadband coverage reaches 94.8% of Carbon County's residents, 95.10% of Emery County's residents, and 39.10% San Juan County's residents.[110] San Juan County has the lowest percentage of residential coverage in Utah. Table 62 illustrates residential broadband coverage by county in Utah.

County	% Broadband Coverage
Beaver	99.30%
Box Elder	87.40%
Cache	93.90%
Carbon	94.80%
Daggett	91.80%
Davis	99.60%
Duchesne	86.40%
Emery	95.10%
Garfield	98.00%
Grand	93.30%
Iron	94.90%
Juab	81.80%
Kane	88.60%
Millard	59.40%
Morgan	94.50%
Piute	100.00%
Rich	62.40%
Salt Lake	99.70%
San Juan	39.10%
Sanpete	88.80%
Sevier	93.80%
Summit	91.70%
Tooele	94.70%
Uintah	84.00%
Utah	98.60%
Wasatch	91.00%
Washington	95.70%
Wayne	89.50%
Weber	97.20%

Table 62: Utah County Broadband Access [111]

Figures 110 shows residential internet coverage via map with a minimum download speed of 6 Mbps and upload speed of 1.5 Mbps. Note the lack of service areas in San Juan County. Figure 111 shows Utah residential broadband map with a minimum download speed of 25 Mbps and upload speed of 3 Mbps. There is a distinctive difference in coverage by speed for fixed wireless (green) and wireline coverage (red) for Carbon, Emery, and San Juan Counties.

[110] https://broadbandnow.com/Utah

[111] https://broadbandnow.com/Utah.

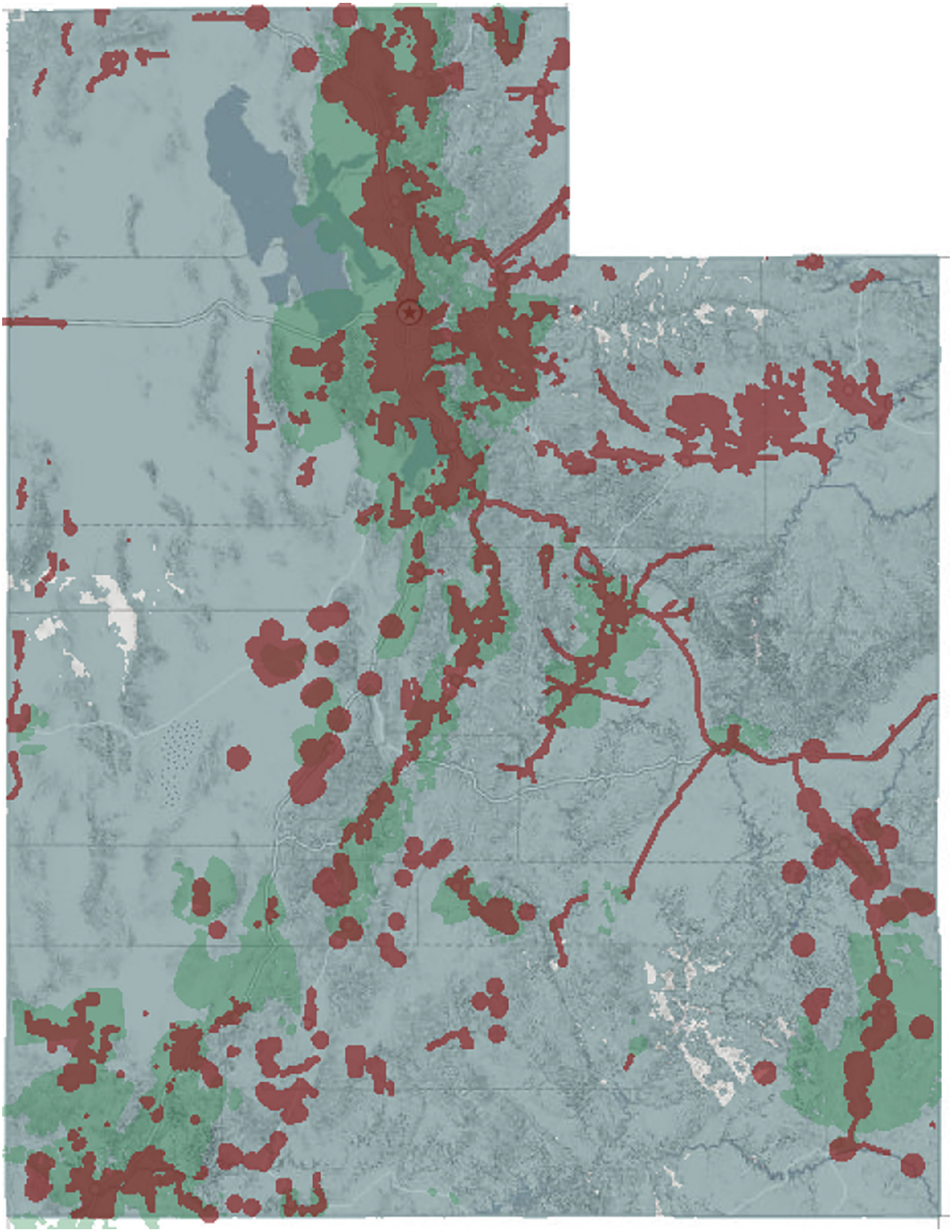

Figure 110: Utah Residential Broadband Map, Minimum 6 Mbps download and 1.5 Mbps upload [112]

[112] https://broadband.ugrc.utah.gov/#/route/extent=-12361542|4783764|4622324

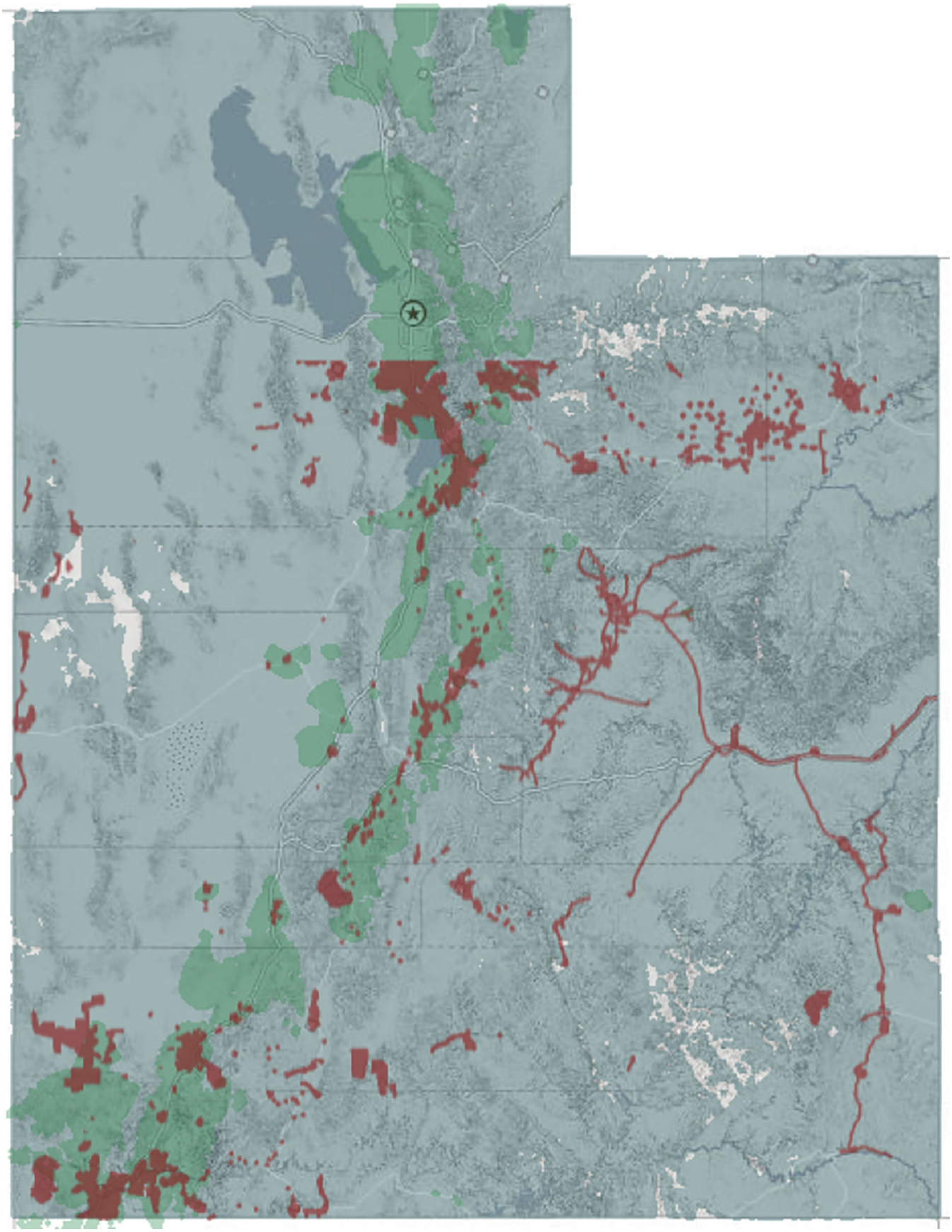

Figure 111: Utah Broadband Service, 25MBPS download and 3MBPS upload speed

County	% Access to 25+ mbps	% Access to 100+ mbps	% Access to 1 Gbit
Carbon	94.8%	63.5%	21.6%
Emery	95.1%	94.2%	0.87%
San Juan	39.1%	9%	0.30%

Table 63: Internet Speed Access by County [113]

BROADBAND RECOMMENDATIONS

Although the maps above illustrate broadband availability in Carbon, Emery, and San Juan Counties, below are some recommendations that policy makers should consider:

- San Juan County needs wireless and wired broadband development. The expansion of broadband into this area would help facilitate remote work, both from existing residents and new ones moving into the area with existing jobs. To accomplish this, there is need of detailed assessment and mapping involving the local utilities that serve the area. Such a map should contain priority areas for broadband infrastructure projects that could be carried out over a specified number of years. This planning phase could then be followed by physical work to expand coverage. There is a project currently to bring broadband to the Navajo Nation. During this project fiber will be laid from Blanding to Bluff, east to Montezuma Creek, west of Bluff through Kayenta, and back north to Navajo Mountain.[26]

- All three counties need access to higher speed internet to attract business. When using 25 mbps as the threshold for business internet speeds and 3 Mbps as the cutoff, Carbon, Emery, and San Juan Counties all decline in coverage as can be observed in figures 110 to 111. This is most apparent in San Juan County. 25 Mbps is a low threshold and would only support a small business. Businesses with several employees that all actively use internet would need much higher download speeds to function properly, increasing the need for higher broadband performance in certain areas.

Potential Domestic Partners

ACADEMIC

Academic institution involvement is necessary for certain innovation programs like coal-to-products and workforce development. However, it can benefit other programs as well. Academic partners can provide expertise, exposure to other partnerships, and access to potential funding opportunities. Academic partnerships can benefit the following programs:

- Coal-to-products
- Advanced/light manufacturing
- Workforce development
- Remote work support
- Physical innovation spaces

[113] https://broadbandnow.com/Utah

In-State Academic Institutions

UNIVERSITY OF UTAH, Industrial Combustion and Gasification Research Facility, Salt Lake City, UT

The Gasification Research Facility supports energy related research in partnership with government agencies, national labs, other universities, and private industry. Among their areas of focus are coal combustion and coal material technologies. This includes active work with the Department of Energy to study transforming coal pitch into carbon fiber.

Out-of-State Academic Institutions

MONTANA TECHNOLOGICAL UNIVERSITY: Located in Butte, Montana, this institution is a STEM university with a strong mining engineering program. It is also a favorable partner due to Montana's strong Congressional position, which may increase the likelihood of developing funding for a program.

UNIVERSITY OF WYOMING: The College of Engineering and Applied Sciences at this institution offers undergraduate and graduate degrees in energy systems engineering, chemical engineering, and traditional engineering fields. This program devotes focus to energy conversion systems, petroleum science, and advanced material research. UW is also home to the Center for Carbon Capture and Conversion (CCCC), which explores alternate uses of coal and ways to make it cleaner.[27]

DEPARTMENT OF ENERGY (DOE) LABORATORIES

DOE laboratories are actively involved in coal material, sustainable power technologies, and energy development. DOE laboratory partnerships can benefit the following:

- Coal-to-products
- Advanced/light manufacturing

DOE Laboratories in Utah

None

DOE Laboratories Outside of Utah

National Renewal Energy Laboratory (NREL)
Website: https://www.nrel.gov
NREL supports programs that advance the science and engineering of energy efficiency, sustainable transportation, and renewable power technologies. This also includes energy storage and battery technologies, as well as material science technologies that involve energy retention, transmission, and capture.

NETL
Website: https://www.netl.doe.gov
NETL supports a wide range of energy and materials research. This includes and advanced energy systems, carbon management, and advanced coal processing.

Oak Ridge National Laboratory (ORNL)
Website: https://www.ornl.gov
ORNL supports research in coal carbon materials and carbon fiber. ORNL's main campus is in Oak Ridge, TN where it supports a 42,000 sq. ft. facility dedicated to

carbon fiber research known as the Carbon Fiber Technology Facility (CFRF). ORNL also supports research into nanomaterials, Rare Earth Elements (REEs) and other coal materials related research.

COAL SECTOR COMPANIES

Companies in the coal sector provide opportunities for partnership and are sources for personnel that could participate in multiple innovation programs. They could also help support programs like workforce development, help provide feedstock for coal to products, and help test power technologies. The following initiatives could benefit from their involvement:

- Coal-to-products
- Advanced/light manufacturing
- Workforce development
- Physical innovation spaces

Power Companies

SUNNYSIDE COGENERATION ASSOCIATES: Sunnyside Cogeneration Associates owns the Sunnyside Cogeneration Plant. The parent companies of this organization are ACI Energy Inc. and Colmac Utah Inc.

PACIFICORP: PacifiCorp owns the Huntington and Hunter coal power stations. The parent company of PacifiCorp is MidAmerican Energy.

Coal Mine Operators

- Wolverine Fuels: Skyline #3, Dugout Canyon, and SUFCO
- Gentry Mountain Mining, LLC: Castle Valley #1
- COP Coal Development Co.: Gentry #3 and #4
- Bronco Utah Operations: Emery Mine
- Emery County Coal Resources: Lila Canyon

4 Coal Innovation

INTRODUCTION TO COAL MATERIALS

Advanced coal-carbon materials have several advantages. One of these is a low weight-high strength ratio. This results from the chaotic displacement of carbon atoms, which is due to numerous three-dimensional molecular connections. This structural characteristic enables these materials to resist shearing apart, while remaining light weight. The result is a low density, high strength material that compares favorably to the diamonds and boron nitrides utilized in aerospace.[28]

Although many advanced carbon materials can be produced from graphite and oil, the former is typically imported from abroad and both feedstock sources are costly. Currently the United States has no active graphite mines and imports about 70% of the resource from China. However, coal is widely abundant in the United States and is an effective feedstock for carbon products.[29]

In addition to domestic availability, carbon materials produced from coal are cost-effective. This is because coal only costs between $12-$54 per short ton, depending on grade. However, graphite (the traditional

carbon feedstock) is much more costly, ranging from $600 to $1,700 per short ton, depending on grade. As for oil, prices have climbed significantly, reaching over $90 a barrel.[30]

Coal-carbon materials are also environmentally friendly. Their inherent lightness reduces fuel consumption associated with transportation. Additionally, their strength and durability mean that they have longer duty cycles than many traditional materials, reducing waste associated with demolition and construction. Also, light weight insulation produced from these materials can increase the energy efficiency.[31]

A SAMPLING OF COAL MATERIALS

The main base materials produced from coal that are used to create end products include:

- Graphene
- Graphite
- Carbon fiber
- Polypropylene
- Activated carbon

The main end products produced from coal and its base products are:

- Building materials
- Coal-carbon foam
- Coal-carbon fiber fabric
- 3D printer filament
- Fertilizers
- Rare Earth Elements (REEs).

Below are descriptions of these materials, the main production technologies being developed to produce them, and key entities involved in developing them:

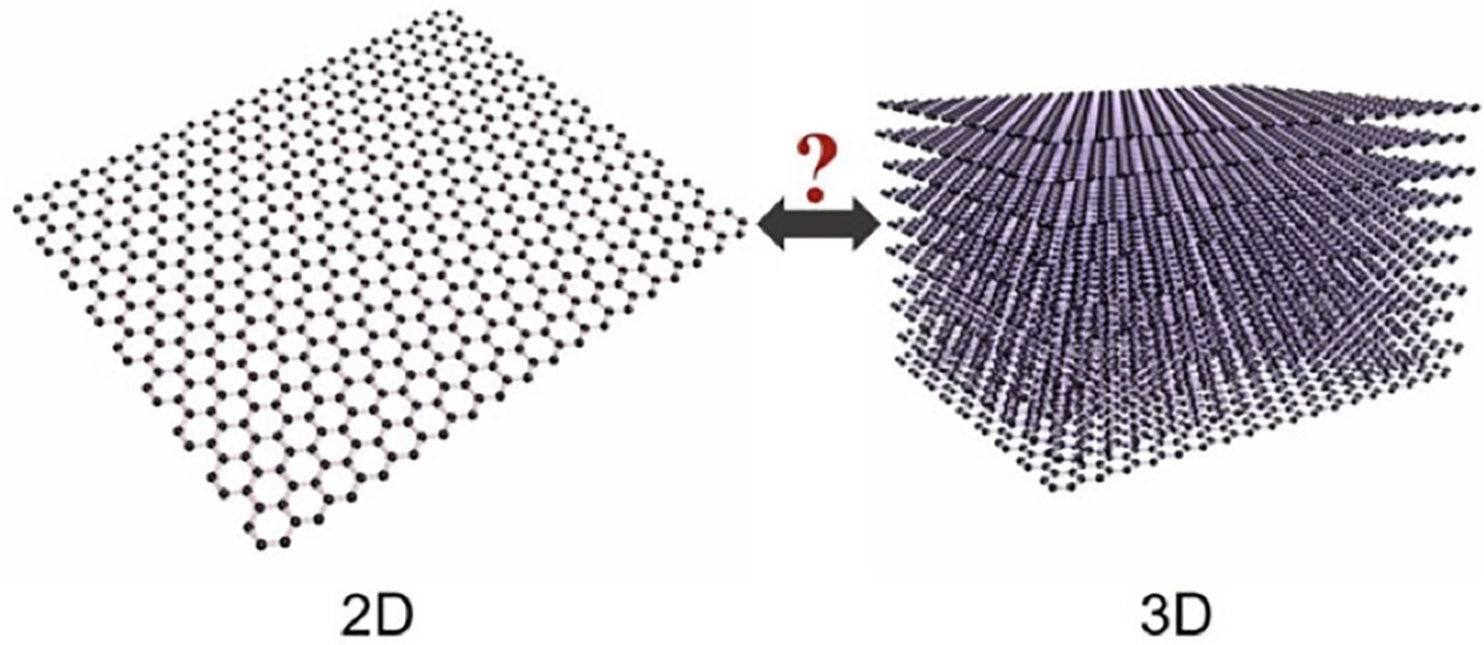

Figure 112: The Two and Three-Dimensional Qualities of Graphene
COURTESY OF QUEEN MARY UNIVERSITY OF LONDON

Base Materials

GRAPHENE

Graphene is one of the most promising materials derived from coal. First isolated in 2004, it is the most robust material known to modern science. Graphene is 200 times stronger than steel and only weighs 0.77 milligrams per square meter. It is also highly flexible and can be stretched to 25% of its original length without breaking.[32]

Graphene owes its unique qualities to its unusual construction, which consists of a two-dimensional crystalline structure with three dimensional properties. This flat construction is made up of hexagonal rings of carbon tightly bonded to each other, forming a honeycomb pattern. Before the discovery of graphene, two dimensional molecules were not thought to exist, due to their thermal instability. However, this unique structure enables graphene to act both as an effective conductor and insulator of heat and electricity, depending on how it is utilized. This makes it useful for high-capacity battery cores and solar panels.[33]

Industrial Uses of Graphene

- Electronics and sensor production
- Automotive parts, tires, and lubricant additives
- Household products (LED light bulbs, cookware coating, and furnishings)

Figure 113: Graphite
COURTESY OF GEOLOGY SCIENCE

GRAPHITE

Graphite currently ranges in price from $600 to $1,750 per short ton (depending on grade) and no graphite mines exist in the United States. Therefore, most of what the country uses is imported from China. However, coal is an inexpensive carbon source that can be processed into graphite. Producing graphite from coal would reduce its overall cost, as well as the items made from it, while contributing to domestic supply security.[34]

Graphite is used in many products. As a material, it is a good conductor of electricity. It also has high refractory capabilities, which enable it to stand up to high temperatures and wear. Some advanced industrial uses of graphite include lubricants and refractories, anodes for lithium-ion batteries, and nuclear graphite. Another application of graphite is for solar panels where it is crucial to silicon production in traditional panels and a key material in lower cost graphite-based panels.[35]

Industrial Uses of Graphite

- Battery technology
- Electronics
- Automotive (lubricants, brake linings, and parts)
- Solar panel production
- Nuclear reactors
- Refractory materials for steelmaking
- Composite materials

Figure 114: Carbon Fiber
COURTESY OF OAK RIDGE NATIONAL LABORATORY

CARBON FIBER

Carbon fiber weighs half as much as aluminum and is four times as strong. It is also a quarter of the weight of steel, but twice as strong. However, when produced from petroleum feedstock, it costs around $15 per pound, making it difficult to compete with traditional metals. At only $12-$54 per short ton, the use of coal as a feedstock would reduce production costs, thereby enabling carbon fiber to better compete with steel and aluminum. This is important because carbon fiber is not just light and strong, it is corrosion resistance and heat tolerant as well, making it ideal for many structural needs.[36]

Industrial Uses of Graphite

- Aerospace
- Automotive (light-weight structural materials)
- Sporting goods
- Medical materials (prosthetics and surgical materials)
- Building materials (rebar and structural supports)
- Wind turbines

Figure 115: Polypropylene Molecular Structure (Left) and Pellets (Right)
COURTESY OF PETROCUYO

POLYPROPYLENE FROM COAL

Currently, China is the world's largest producer of polypropylene, accounting for over 20% of its production, while North America only accounts for a little over 8%. Additionally, the traditional feedstock used for polypropylene is oil, causing its price to fluctuate based on the price of oil. Polypropylene is used in many items that the United States relies on each day for economic, health, and national security. However, it is possible to use coal as a lower cost feedstock for its production. Additionally, it would be beneficial to rural coal communities, because it could build off local raw materials and utilize displaced workers with existing skills related to the energy sector.[37]

Industrial Uses of Polypropylene

- Packaging
- Household items
- Medical supplies
- Low friction gears
- Piping and electrical components
- Automotive applications

Figure 116:Activated Carbon Pellets from Coal
COURTESY OF XINGSHI ACTIVATED CARBON

ACTIVATED CARBON

Activated carbon is a valuable material for water and air filtration. However, it also has other uses. Medically, it serves as treatment for poisoning. For automotive applications, it is used to control evaporative fuel emissions. Furthermore, it has other uses ranging from chemical spill cleanup to filtration systems in spacesuits.[38]

Activated carbon is produced from a variety of carbonaceous materials. However, coal is an ideal feedstock due to its low cost and high carbon content. All four ranks of coal (lignite, subbituminous, bituminous, and anthracite) can be used to make activated carbon. The product can be granular, extruded (pelletized), or powder, depending on the application it is used for.[39]

Industrial Uses of Activated Carbon

- Water and air filtration
- Precious metal extraction
- Medical applications (poisoning treatment)
- Automotive applications (emissions control)
- Nuclear applications (filtration)

Figure 117: Carbon Fiber I-Beam (Left) and Rebar (Right)
COURTESY OF ALIBABA.COM (I-BEAM) AND THYSSENKRUPP (REBAR)

End Products

BUILDING MATERIALS FROM COAL

Coal can produce low weight/high strength building materials that are not subject to corrosion like steel and aluminum. This is particularly advantageous for structural support members used in concrete such as rebar. A major failing point of traditional rebar is moisture related corrosion, which expands metal, leading to cracking and spalling. Because coal-carbon materials are resistant to corrosion, have high tensile strength, and rigidity, they are ideal for concrete reinforcement.[40]

In addition to concrete reinforcement, coal-carbon materials have promising potential for other construction and aircraft applications. This is because they are lighter than steel and aluminum, while being significantly stronger. This translates into less energy requirements for transportation, constructing buildings, and aircraft operation. Materials like these can also be fabricated into custom parts for a wide variety of applications and are more heat resistant than traditional metals.[41]

Coal-carbon building materials also have the potential to provide a longer lasting alternative to wood building materials. Coal can be transformed into a plastic composite that is like wood in terms of structure and strength. This process involves grinding coal and subjecting it to a simple chemical process. This is advantageous from a cost perspective considering coal is a cheaper than sawdust, which is often used in traditional wood composites.[42]

<u>Industrial Uses of Carbon Fiber Building Materials</u>

- General building construction
- Road surface construction
- High performance concrete structures (bridges and dams)

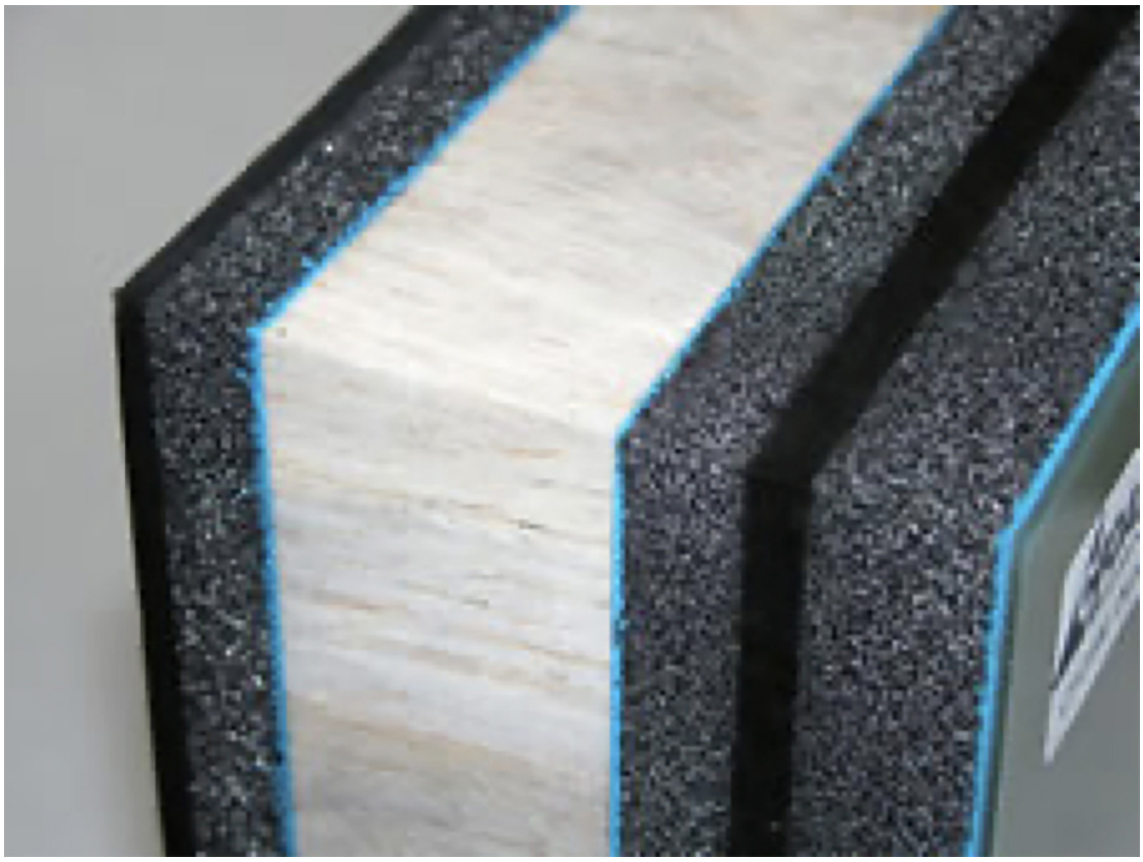

Figure 118: CFOAM Coal-Carbon Foam
COURTESY OF CFOAM

COAL-CARBON FOAM

Coal-carbon foams offers properties such as heat resistance, tailorable electrical/thermal conductivity, and chemical inertness. This type of foam can be produced inexpensively from coal and is ideal for larger projects that involve fire and thermal protection, electrical magnetic shielding, and radar absorption. Additionally, it can insulate or conducting depending on how it is configured and can be easily cut and milled to suit a variety of uses.[43]

Coal foam is excellent for insulating structures that require fire resistance. Furthermore, the pumice-like microstructure of coal foam and the ability to precisely control its strength make it ideal for strengthening structures.[44]

For components that require composite tooling, carbon foam has CTE values like carbon fiber with a much lower density than traditional materials. It Is also much easier to machine to precision specifications at a faster rate with lower curing times. Therefore, intricate shapes can be machined in little time with standard machinery, making it ideal for applications that require specialized parts.[45]

Industrial Uses of Coal-Carbon Foam

- General building construction
- Aerospace applications (aircraft insulation and radar absorption)
- Automotive (vehicle insulation)

Figure 119: Carbon Fiber Fabric

COAL-CARBON FIBER FABRIC

High performance fabrics composed of carbon fiber have several uses and can be inexpensively derived from coal. These materials are used in aerospace, automotive, and marine applications where its strength and thermal properties are highly valued. A good example of a well-known carbon fiber fabric is Kevlar, which is used for armor and as a flame retardant material.[46]

Industrial Uses of Coal-Carbon-Fiber Fabric

- Aerospace
- Automotive and marine applications
- Electronics
- Photography equipment
- Sporting goods

Figure 120: 3D Carbon Fiber Solid Lattice that Could be Made from Coal
COURTESY OF RAMACO CARBON

COAL-CARBON FIBER FILAMENTS FOR 3D PRINTING

3D printers hold a lot of promise for advanced manufacturing by allowing components to be easily fabricated based on software designs to precise specifications. However, the carbon-based filaments utilized for printing are typically imported from China and are petroleum based.[47]

One disadvantage of petroleum-based carbon filaments is cost. However, cheaper feedstocks like coal could greatly reduce cost. Lower cost filaments would make it possible to expand 3D printing technology into more industries, which would encourage more customization and less waste in the supply chain. Additionally, coal's domestic abundance would contribute to supply chain security.[48]

Industrial Uses of Carbon Fiber 3D Printing Filaments

- Additive manufacturing
- Automotive (parts fabricationo
- Aerospace
- Electronics (batteries and parts)

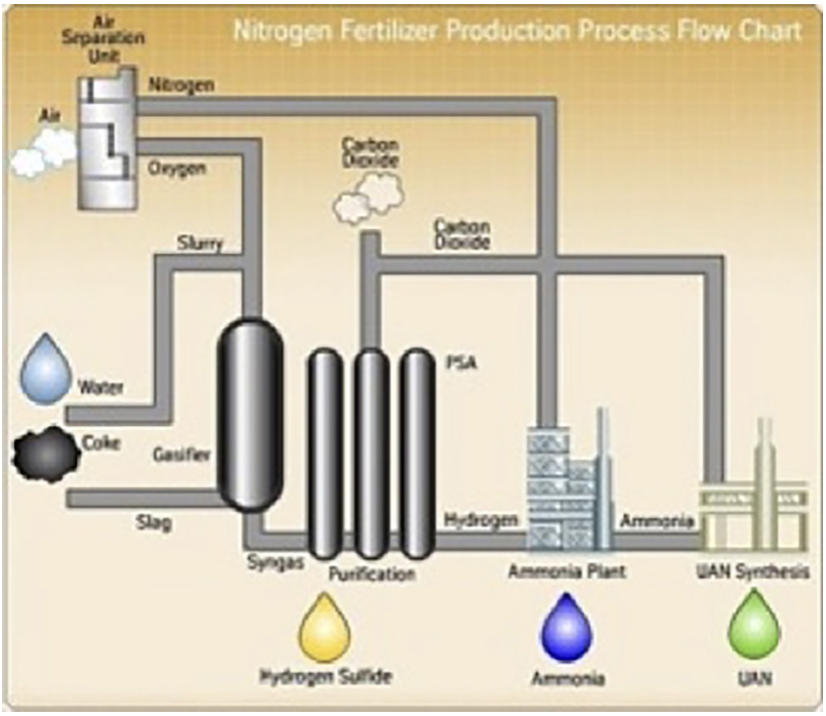

Figure 121: Nitrogen Fertilizer Production from Coal
COURTESY OF NETL

FERTILIZERS

About 70% of the world's arable farmland requires nitrogen amendments to remain fertile. Commercial nitrogen amendments are produced from urea, which is typically derived from natural gas by burning or reforming it. An alternative urea feedstock is coal. Coal has the advantage of being less expensive than natural gas. Additionally, processing it takes place through coal gasification. This process is cleaner and allows the capture of other products such as methanol and industrially pure CO2, both of which have commercial value.[49]

Other fertilizers that can be produced from coal include potassium, magnesium, and calcium amendments from fly ash. They also include using gypsum as a source for calcium and sulfur amendments. Coal fly ash is a widely abundant waste product from power stations. Although, it would need to be processed to remove impurities for agricultural use, this could potentially take place in tandem with REE harvesting. As for gypsum, it is a byproduct from removing sulfur from coal in power generation. Therefore, potential exists to clean up coal waste products and use them for something beneficial.[50]

In addition to conventional soil amendments, coal can be used to produce organic amendments as well. One example of an organic soil amendment produced from coal is under development from Pure-Gro. This amendment is produced from crushed coal mixed with other ingredients and provides similar benefits to an NPK or 19-19-19 amendment without the runoff issues associated with conventional examples.

<u>Industrial Use of Coal-Based Fertilizers</u>

- Agriculture industry (soil amendments)

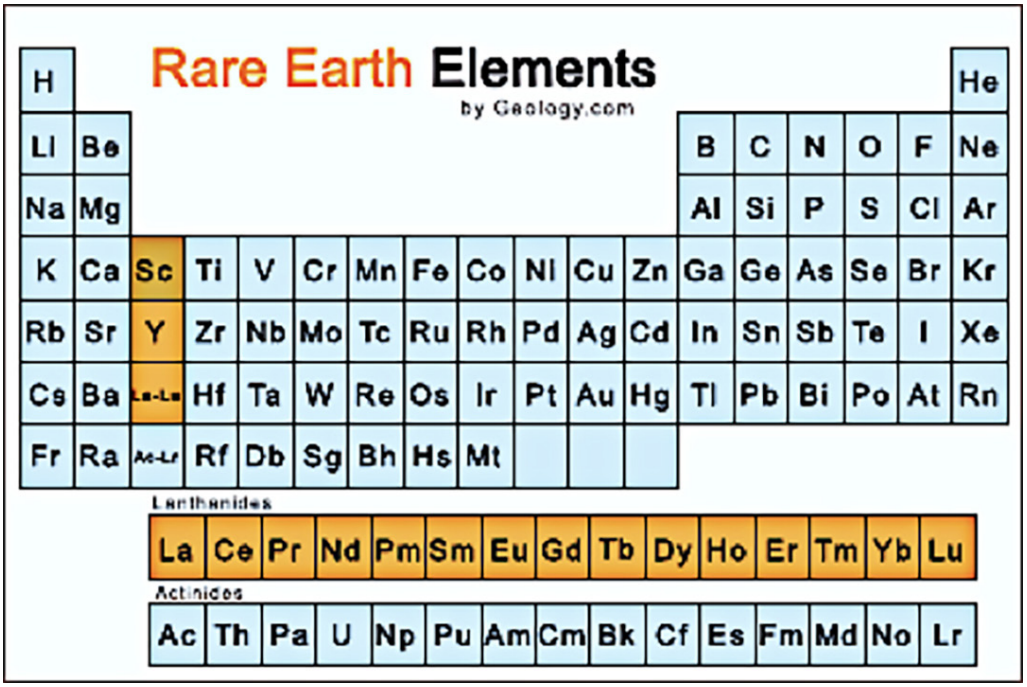

Figure 122: Rare Earth Elements (REEs)
COURTESY OF GEOLOGY.COM

RARE EARTH ELEMENTS

Rare Earth Elements (REEs) are naturally occurring minerals that many modern technologies depend on to function. Although referred to as rare, they occur frequently in very low concentrations. However, commercial grade concentrations mainly exist in China where 80% of the world supply is produced. REEs are typically mined in large scale operations that involve drilling, blasting, hauling, and open pits. The resulting ore is then refined through fractural crystallization, ion exchange, liquid extraction, and solvent extraction.[51]

Due to the costs associated with this type of mining/refining, environmental drawbacks, and lack of high concentration deposits, few mines exist in the United States. Currently, Molycorp's mine in Mountain Pass, California is the only active REE mine in the country. This makes the United States heavily dependent on foreign REE sources. A total of 17 REEs are known to exist, which are used in a variety of modern devices. Below are some of these and examples of their uses:[52]

- Neodymium: powerful magnets for loudspeakers, hard drives, and hybrid cars.
- Lanthanum: camera and telescopic lenses, studio lighting, and cinema projection.
- Cerium: catalytic converters for cars and refining crude oil.
- Praseodymium: strong metal alloys for defense aircraft engines and visors for welders.
- Gadolinium: x-ray and MRI scanning systems, as well as television screens.
- Yttrium, Terbium, and Europium: television and computer screens, as well as other devices with visual displays such as smart phones.

Although commercial grade REE deposits occur infrequently, similar grade levels can be found in coal and coal fly ash. Unlike natural ore deposits, these REE sources are common. Extracting REEs from raw coal could take place in conjunction with the production of other products. As for extraction from fly ash, as of 2001, Colorado alone produced an estimated 1.6 million tons of this material with similar production occurring in Utah. Therefore, millions of tons of coal ash exist between the two states, which could be refined for REEs. Utilizing coal ash for this purpose would also have environmental benefits by helping clean up waste sites.[53]

Industrial Uses of Rare Earth Elements

- Industrial magnets
- Automotive applications (electric vehicle batters and catalytic convertors)
- Medical applications (imaging systems)
- Computers (screens, displays, and electronic components)
- Sustainable power technologies (wind turbines and solar panels)

COAL TYPES AND USES AS FEEDSTOCK

The Four Coal Types (Ranks)

There are four major types of coal known as "ranks." Each of these are part of the process of coalification, which is the process plant matter undergoes as it transforms into more mature states of coal.[167] This section describes the four major coal ranks and discusses the coal materials that can be created from them. It should be noted that manufacturing processes of coal derived products could be carried out in conjunction with each other. Such an approach would streamline manufacturing, while it maximizes the value of coal in the process.

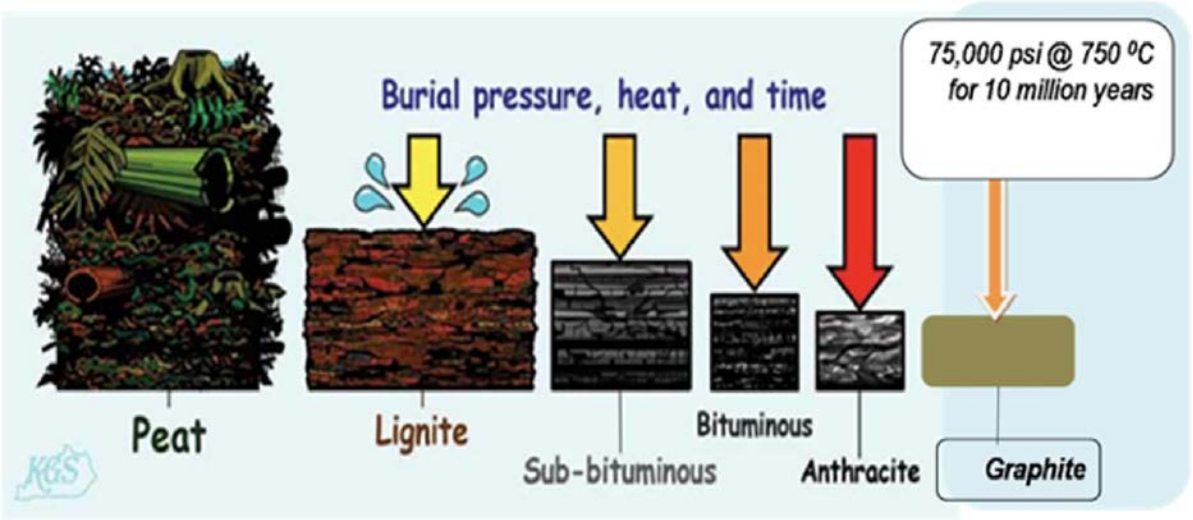

Figure 123: The Four Ranks of Coal and Graphite
COURTESY OF THE KENTUCKY GEOLOGICAL SURVEY

[167] USGS, "What are the Types of Coal," USGS Website, https://www.usgs.gov/faqs/what-are-types-coal?qt-news_science_products=0#qt-news_science_products (Accessed March 29, 2021).

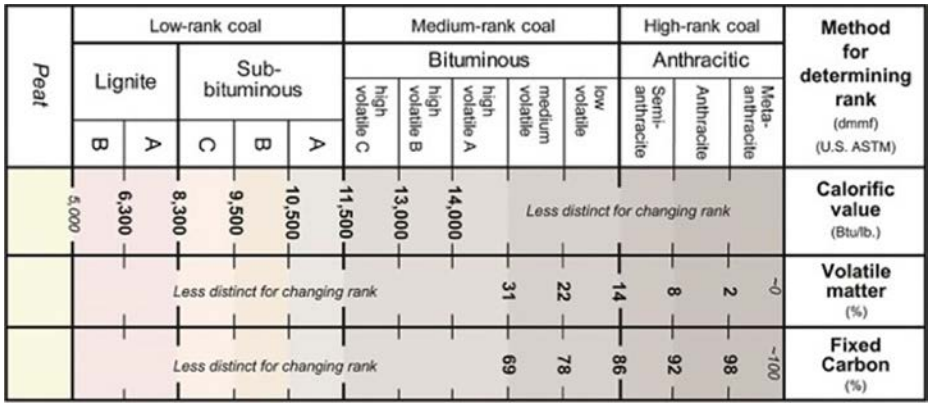

Figure 124: Coal Grades Within the Four Ranks
COURTESY OF THE KENTUCKY GEOLOGICAL SURVEY

ANTHRACITE

Coal Material Uses: graphite, graphene, activated carbon, and rare earth elements (REEs)

Anthracite is the highest rank of coal. It is dense, brittle, black, and often referred to as hard coal. This rank of coal contains a high percentage of fixed carbon and a low concentration of volatile matter. Due to its high carbon content and maturity, it is the closest rank of coal to graphite. Therefore, less processing is required to refine it into graphite, graphene, or activated carbon. However, this rank is the least abundant and mostly concentrated in Pennsylvania, making lower-ranked coals a viable option for these materials. It should also be noted that the superiority of anthracite depends on its ash to value, making certain types better than others.[168]

In addition to graphite, graphene, and activated carbon, anthracite can contain high concentrations of REEs. This has to do with the contents of the volatile matter in the coal. Although anthracite contains less volatile matter than lower ranks of coal, what it contains has high concentrations of heavier elements like REEs.[169]

BITUMINOUS

Coal Material Uses: graphite, graphene, carbon fiber, base material for polypropylene, activated carbon, and rare earth elements.

Bituminous coal is the middle rank between anthracite and subbituminous coal. This rank usually has a high heating value and is used for power generation and steel making. Bituminous coal appears blocky and shiny but has thin alternating layers that are shiny and dull. Like anthracite, bituminous coal has high levels of fixed carbon and is an ideal candidate for graphite production.[170]

Due to its high level of fixed carbon and ability to form ashless coal when processed, bituminous coal is also favorable for carbon

[168] USGS, "What are the Types of Coal," USGS Website, https://www.usgs.gov/faqs/what-are-types-coal?qt-news_science_products=0#qt-news_science_products (Accessed April 6, 2021); Melissa Pistilli, "Coal 101," Investigating News Network, June 23, 2020, https://investingnews.com/daily/resource-investing/industrial-metals-investing/coal-investing/types-of-coal/ (Accessed April 6, 2021); Schobert, "Graphitization of Pennsylvania Anthracites," https://thecoalguy.com/files/2214/4131/0037/Graphite_from_anthracite_Pretoria_-_2006.pdf (Accessed April 6, 2021), 4, 6-7, 24, 32, 38.

[169] Peiravi, Ackah, Guru, Mohanty, and Lui, "Chemical Extraction of Rare Earth Elements from Coal Ash,", https://www.researchgate.net/publication/320775802_Chemical_extraction_of_rare_earth_elements_from_coal_ash (Accessed April 9, 2021)., 171, 177.

[170] USGS, "What are the Types of Coal," USGS Website, https://www.usgs.gov/faqs/what-are-types-coal?qt-news_science_products=0#qt-news_science_products (Accessed April 6, 2021); Ian Reid, "Non-Energy Uses of Coal," https://www.ramacocarbon.com/wp-content/uploads/2019/01/2018_Reid_IEA_Non-energy-uses-of-coal-CCC291.pdf (Accessed April 7, 2021)., 60-61.

fiber production. To accomplish this, ashless coal is produced by extracting the soluble components of the coal with a solvent. Then this is processed into slurry, which can be spun into carbon fiber. Additionally, carbon fiber can be produced from coal tar, which is a byproduct of coking bituminous coal.

In addition to carbon fiber, bituminous coal is a viable feedstock for activated carbon and REEs. Its inherent porosity (which carbonization and activation increases) makes it well suited for the former. And for the latter, it contains higher concentrations of REEs in its volatile matter like other mature forms of coal.[171]

SUBBITUMINOUS

Coal Material Uses: graphene, graphite, carbon fiber, rare earth elements, ammonia-based fertilizers, base material for polypropylene, and activated carbon

Subbituminous coal is black in color, but mainly dull. It has a low to moderate heating value and is mainly used for power generation. However, it also holds promise as a feedstock for several advanced materials and is the most abundant rank of coal in the United States.

One promising product that can be produced from subbituminous coal is carbon fiber. Although lower grade coals do not produce the level of tar that bituminous coal does, carbon fiber can be produced via metaplast formation, which is the tarlike material that forms when coal is heated up.[172]

In addition to carbon fiber, certain types of subbituminous coal are potential REE sources. Although REE concentration is highest in ranks including and above high volatile bituminous coal, subbituminous C coal generally contains relatively high concentrations of REEs. Therefore, ash from this coal rank is a potential source for REEs. Other uses for subbituminous coal include ammonia-based fertilizers and feedstock for polypropylene production.[173]

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[171] Lorene-Grabowska, Ewa, Grazyna Gryplewicz, Jacek Machnikowski, Maria-Antonia Diez and Carmen Barriocanal. "Suitability of Coal/Pitch—PET Mixture for Activated Carbon Production." Wroclaw University of Technology. Wroclaw, Poland. Institute Nacional del Carbon. Oviedo, Spain. https://core.ac.uk/download/pdf/36017204.pdf (Accessed April 8, 2021)., 1.

[172] Edwin S. Olson, "Subtask 5.2 – Development of Carbon Products from Low-Rank Coals," Final Report, Prepared for AAD Document Control, U.S. Department of Energy, National Energy Technology Laboratory, Pittsburg, PA, https://www.osti.gov/servlets/purl/786841 (Accessed April 12, 2021)., 4,-5 7-8.

[173] Peiravi, Ackah, Guru, Mohanty, and Lui, "Chemical Extraction of Rare Earth Elements from Coal Ash,", https://www.researchgate.net/publication/320775802_Chemical_extraction_of_rare_earth_elements_from_coal_ash (Accessed April 12, 2021)., 171; Transgas, "Why Nitrogen Fertilizers," Fertilizers, http://www.transgasdevelopment.com/about/fertilizers.php (Accessed April 12, 2021); Deutsche Bank, "China's Coal to Olefins Industry," Duetsche Bank Markets Research, July 2, 2014, http://www.fullertreacymoney.com/system/data/files/PDFs/2014/July/3rd/0900b8c088667819.pdf (Accessed April 12, 2021)., 26, 71.

LIGNITE

Coal Material Uses: Rare earth elements, carbon fiber, and ammonia-based fertilizers

This rank of coal is sometimes referred to as brown coal. Of the four types, it is the least mature and contains the lowest concentration of carbon. Additionally, it has a low heating value, high moisture content, and is generally used in power generation.[174]

As for carbon fiber, it can be produced from lignite via metaplast formation. However, the metaplasts should be chemical cross-linked with gasification tars to generate a suitable fiber-forming pitch. Once this takes place, the material can be spun into carbon fiber.[175]

In addition to carbon fiber, lignite is a potential feedstock for REEs. Although concentrations can vary depending on deposits, certain lignite contains higher concentrations than others. This is the case with lignite from Freedom Mine in North Dakota, which contains very high levels of REEs.[176]

A NATIONAL CONTEXT OF COAL-TO-PRODUCTS FEEDSTOCK POTENTIAL

The United States is home to 22% of the world's coal supply and has the largest reserves of any single country.[177] As a feedstock material, it has tremendous potential for supply security, cost reduction, and performance. Although coal is found throughout the United States, it is concentrated into three major regions: Western, Central, and Appalachian. Currently fifteen states have active coal mines that produce coal, which have coal products potential. However, this potential varies depending on coal type (rank) and the characteristics of individual deposits.

This section documents the major mines in each of the coal producing states that produce 100,000 tons or more annually. The production figures used were taken from the Mine Safety and Health Administration (MSHA) Mine Data Retrieval System. These figures reflect production during all four quarters of 2020 and the first two quarters of 2021. It should be noted that some figures may be lower than usual due to pandemic related power consumption patterns in 2020. This national picture of coal production serves as a point of reference for potential coal-to-products initiatives in northwestern Colorado and eastern Utah.

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[174] USGS. "What are the Types of Coal." USGS Website. https://www.usgs.gov/faqs/what-are-types-coal?qt-news_science_products=0#qt-news_science_products (Accessed April 13, 2021).

[175] Olson, "Development of Carbon Products from Low-Rank Coals," https://www.osti.gov/servlets/purl/786841 (Accessed April 13, 2021)., 5, 7-8.

[176] Learn, "Lignite Coal Full of Easily Extracted Rare Earth Elements, Research Finds," https://www.spglobal.com/marketintelligence/en/news-insights/trending/_mjh_7ftrifse6p6iagpwa2 (Accessed April 13, 2021).

[177] EIA, "How Much Coal is Left," Coal Explained, U.S. Energy Administration, https://www.eia.gov/energyexplained/coal/how-much-coal-is-left.php (Accessed July 2, 2021).

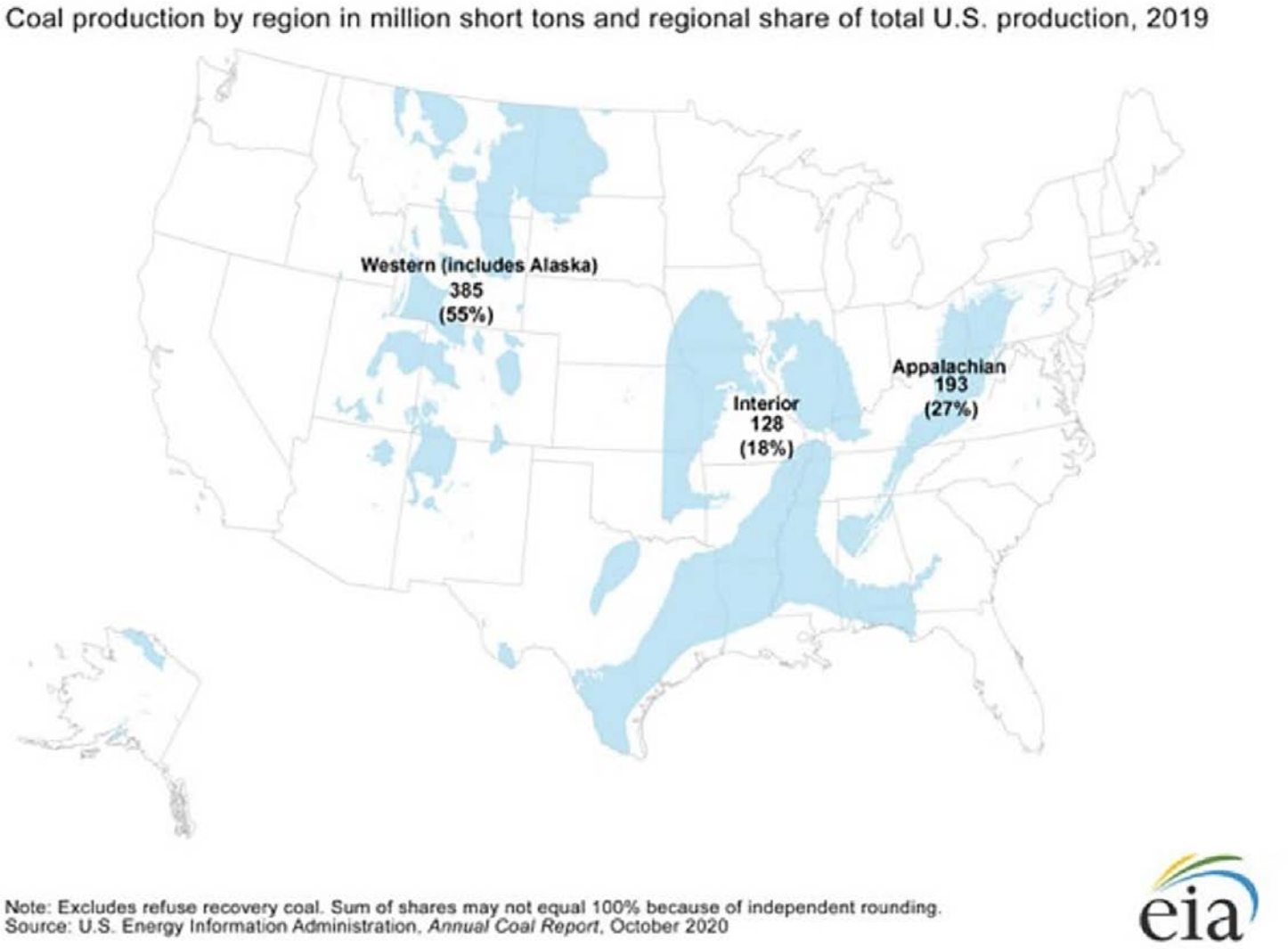

Figure 125: Major U.S. Cola Producing Regions

COURTESY OF EIA

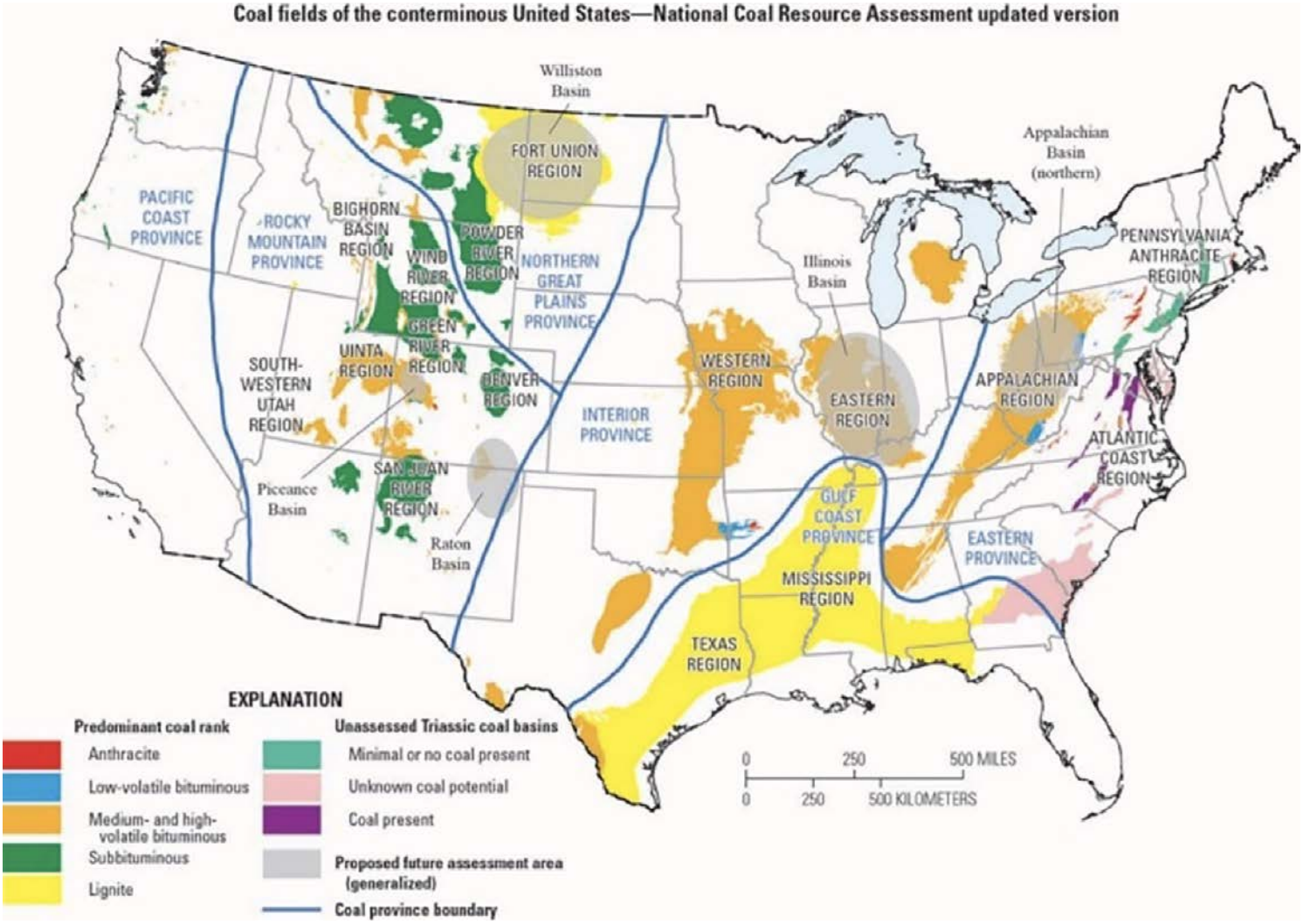

Figure 126:Coalfields of the Conterminous United States
COURTESY OF USGS

Western Region

ALASKA

Coal Rank	*Field/Region*	*Borough*	*Mine*	*Ownership*	*Yearly Productions Estimate*	*Main Use*
Sub-Bituminous	Nenana	Denali	Usibelli Mine[178]	Usibelli coal Mine, Inc.	1 Million Tons	Power Generation and Export

[178] U.S. Department of Labor, Mine Data Retrieval System, Mine Information: Usibelli Coal Mine, Denali Borough, AK, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); Usibelli Coal Mine, "Mining the Nenana Coal Field," Usibelli Coal Mine Website, http://www.usibelli.com/mining/mining-sites/the-nenana-coal-field (Accessed June 8, 2021).

COLORADO

Coal Rank	*Field/Region*	*County*	*Mine*	*Ownership*	*Yearly Productions Estimate*	*Main Use*
Subbituminous B	Uinta	Moffat	Colowyo Mine[179]	Tri-State Generation and Transportation Association	1.7 Million Tons	Power Generation
Subbituminous B	Greene River	Moffat	Trapper Mine[180]	Tri-State	2 Million Tons	Power Generation
Subbituminous A	Unita	Rio Blanco	Deserado Mine[181]	Blue Mountain Energy	1.8 Million Tons	Power Generation
Bituminous (High Volatile C)	Greene River	Routt	Foidel Creek (Twentymile) Mine[182]	Peabody Energy	1.1 Million Tons	Power Production and Export
Bituminous (High Volitile C)	San Juan River	La Plata	King Coal II Mine[183]	GCC Energy	592,000 Tons	Cement Production, Heating Fuel, and Historic Railroad Fuel
Bituminous	Uinta	Gunnison	West Elk Mine[184]	Mountain Coal Company, LLC	2.5 Million Tons	Power Generation
Subbituminous B	Greene River	Moffat	ADDCAR System 16[185]	Mega Highwall Mining, LLC	349,000 Tons	Power Generation

[179] Global Energy Monitor. "Colowyo Mine." https://www.gem.wiki/Colowyo_Mine (Accessed April 1, 2021); Denis Webb, "State Coal Production Dips in 2019," The Daily Sentinel, February 9, 2020. https://www.gjsentinel.com/news/western_colorado/state-coal-production-dips-in-2019/article_78f7a0ae-49f1-11ea-878d-3fbcac9cd769.html (Accessed April 1, 2021); Christopher J. Carroll and Beth L. Widmann, "Colorado Coal Directory 2000," Information Series 55, Colorado Geological Division of Minerals and Geology," Denver: 2000. 13.

[180] Ibid., 65; Webb, "State Coal Production Dips in 2019." https://www.gjsentinel.com/news/western_colorado/state-coal-production-dips-in-2019/article_78f7a0ae-49f1-11ea-878d-3fbcac9cd769.html (Accessed April 1, 2021).

[181] Ibid., Carroll and Widmann, "Colorado Coal Directory 2000," 17.

[182] Ibid., 25; Webb, "State Coal Production Dips in 2019." https://www.gjsentinel.com/news/western_colorado/state-coal-production-dips-in-2019/article_78f7a0ae-49f1-11ea-878d-3fbcac9cd769.html (Accessed April 1, 2021).

[183] GCC Energy, "Building a Bright Future," Energy, https://www.gcc.com/business-segments/energy/ (Accessed April 14, 2021); Horizon Laboratories, Certificate of Analysis Submitted to GCC Energy, LLC, August 18, 2020, https://www.gcc.com/wp-content/uploads/2020/08/Quality-Composite-1.pdf (Accessed April, 14, 2021); Jonathan Romeo County, "Life of King Coal Mine Extended by 20 Years," The Durango Herald, October 17, 2019, https://durangoherald.com/articles/298542 (Accessed April 14, 2021).

[184] Department of Labor, Mine Data Retrieval System, West Elk Mine, Gunnison County, CO MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 15, 2021); EIA, State Profile and Energy Estimates: Colorado: "Coal," https://www.eia.gov/state/analysis.php?sid=CO (Accessed June 15, 2021); Carroll and Widmann, "Colorado Coal Directory 2000," 68.

[185] Department of Labor, Mine Data Retrieval System, ADDCAR System 16, Moffat, CO MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 15, 2021); EIA, State Profile and Energy Estimates: Colorado: "Coal," https://www.eia.gov/state/analysis.php?sid=CO (Accessed June 15, 2021).

MONTANA

Coal Rank	*Field/ Region*	*County*	*Mine*	*Ownership*	*Yearly Productions Estimate*	*Main Use*
Sub-Bituminous	Powder River Basin	Big Horn	Decker Mine[186]	Decker Coal Company	3.2 Million Tons	Power Generation and Export
Sub-Bituminous	Powder River Basin	Big Horn	Absaloka Mine[187]	Westmoreland Absaloka Mining, LLC	2 Million Tons	Power Generation and Export
Sub-Bituminous	Powder River Basin	Big Horn	Spring Creek Coal Company[188]	Navajo Transitional Energy Company	9.5 Million Tons	Power Generation and Export
Sub-Bituminous	Powder River Basin	Rosebud	Rosebud Mine & Crusher/ Conveyor[189]	Westmoreland Rosebud Mining, LLC	5.3 Million Tons	Power Generation and Export
Sub-Bituminous	Bull Mountains Basin	Musselshell	Bull Mountain Mine No. 1[190]	Signal Peak Energy, LLC	6 Million Tons	Power Generation and Export
Lignite	Williston Basin	Richland	Savage Mine[191]	Westmoreland Savage Mining, LLC	345,000 Tons	Power Generation and Export

[186] Department of Labor, Mine Data Retrieval System, Decker Mine, Big Horn County, MT, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); Montana State Legislature, "Coal in Montana," https://leg.mt.gov/content/publications/Environmental/2004deq_energy_report/coal_text.pdf (Accessed June 8, 2021)., IV-1,IV-4.

[187] Department of Labor, Mine Data Retrieval System, Absaloka Mine, Big Horn County, MT, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); Montana State Legislature, "Coal in Montana," https://leg.mt.gov/content/publications/Environmental/2004deq_energy_report/coal_text.pdf (Accessed June 8, 2021)., IV-1,IV-4.

[188] Ibid., IV-1,IV-4; Department of Labor, Mine Data Retrieval System, "Spring Creek Coal Company, Big Horn County, MT, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021);

[189] Department of Labor, Mine Data Retrieval System, Rosebud Mine & Crusher/Conveyor, Rosebud County, MT, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); Montana State Legislature, "Coal in Montana," https://leg.mt.gov/content/publications/Environmental/2004deq_energy_report/coal_text.pdf (Accessed June 8, 2021)., IV-1,IV-4.

[190] Ibid., IV-1,IV-4; Department of Labor, Mine Data Retrieval System, Bull Mountain Mine No. 1, Musselshell County, MT, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021).

[191] Department of Labor, Mine Data Retrieval System, "Savage Mine, Musselshell County, MT, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); Montana State Legislature, "Coal in Montana," https://leg.mt.gov/content/publications/Environmental/2004deq_energy_report/coal_text.pdf (Accessed June 8, 2021)., IV-1,IV-4.

NEW MEXICO

Coal Rank	*Field/Region*	*County*	*Mine*	*Ownership*	*Yearly Productions Estimate*	*Main Use*
Sub-Bituminous	San Juan Basin	San Juan	Navajo Mine[192]	Bisti Fuels Company, LLC	4.4 Million Tons	Power Generation
Sub-Bituminous	San Juan Basin	San Juan	San Juan Mine 1[193]	Westmoreland San Juan Mining, LLC	1.2 Million Tons	Power Generation
Sub-Bituminous	San Juan Basin	McKinley	El Segundo[194]	El Segundo	4.5 Million Tons	Power Generation

NORTH DAKOTA

Coal Rank	*Field/Region*	*County*	*Mine*	*Ownership*	*Yearly Productions Estimate*	*Main Use*
Lignite	Williston Basin	Mercer	Freedom Mine[195]	The Coteau Properties Company	12.5 Million Tons	Power Generation
Lignite	Williston Basin	Mercer	Beulah Mine[196]	Westmoreland Beulah Mining, LLC	435,000 Tons	Power Generation
Lignite	Williston Basin	Oliver	Center Mine[197]	BNI Coal, Ltd	4.1 Million Tons	Power Generation
Lignite	Williston Basin	Mclean	Falkirk[198]	Falkirk Mining Company	7.2 Million Tons	Power Generation
Lignite	Williston Basin	Mercer	Coyote Creek Mine	Coyote Creek Mining Company, LLC	1.9 Million Tons	Power Generation

[192] Department of Labor, Mine Data Retrieval System, Navajo Mine, San Juan County, NM, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); Megan O'Reilly, "The Water-Energy Nexus in New Mexico, Amigos Bravos, 2016, https://www.amigosbravos.org/wp-content/uploads/2020/07/Water-Energy-Nexus-Report_Amigos-Bravos.pdf (Accessed June 8, 2021)., 7; EIA, State Profile and Energy Estimates: New Mexico, "Coal," U.S. Energy Information Administration, https://www.eia.gov/state/analysis.php?sid=NM (Accessed June 8, 2021).

[193] Ibid.; Department of Labor, Mine Data Retrieval System, San Juan Mine 1, San Juan County, NM, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); O'Reilly, "The Water-Energy Nexus in New Mexico, https://www.amigosbravos.org/wp-content/uploads/2020/07/Water-Energy-Nexus-Report_Amigos-Bravos.pdf (Accessed June 8, 2021)., 7.

[194] Ibid., 7; Department of Labor, Mine Data Retrieval System, El Segundo, McKinley County, NM, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); EIA, State Profile and Energy Estimates: New Mexico, "Coal," U.S. Energy Information Administration, https://www.eia.gov/state/analysis.php?sid=NM (Accessed June 8, 2021).

[195] Department of Labor, Mine Data Retrieval System, Freedom Mine, Mercer, ND, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); MDO, "Freedom Mine," Mining Data Solutions, 2020, https://miningdataonline.com/property/708/Freedom-Mine.aspx (Accessed March 29, 2021); Lignite Energy Council, "Freedom Mine, KAT Marketing, 2018-2021, https://lignite.com/mines-plants/mines/freedom-mine/ (Accessed March 29, 2021); EIA, State Profile and Energy Estimates: North Dakota, "Coal," U.S. Energy Information Administration, https://www.eia.gov/state/print.php?sid=ND (Accessed June 8, 2021).

[196] Ibid.; Department of Labor, Mine Data Retrieval System, Beulah Mine, Mercer County, ND, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021).

[197] Department of Labor, Mine Data Retrieval System, Center Mine, Oliver County, ND, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); EIA, State Profile and Energy Estimates: North Dakota, "Coal," https://www.eia.gov/state/print.php?sid=ND (Accessed June 8, 2021).

[198] Ibid.; Department of Labor, Mine Data Retrieval System, Falkirk Mine, Falkirk County, ND, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021).

UTAH

Coal Rank	*Field/Region*	*County*	*Mine*	*Ownership*	*Yearly Productions Estimate*	*Main Use*
Bituminous	Uinta	Emery	Lila Canyon Mine[199]	Emery County Coal Resources	3.3 Million Tons	Power Generation
Subbituminous	Wasatch Plateau	Sevier	Sufco Mine[200]	Wolverine Fuels	4.4 Million Tons	Power Generation
Subbituminous	Wasatch Plateau	Carbon/ Emery	Skyline #3[201]	Wolverine Fuels	3.6 Million Tons	Power Generation
Bituminous	Emery	Emery	Emery[202]	Bronco Operations	474,000 Tons	Thermal and Metallurgic
Bituminous	Wasatch Plateau	Emery	Gentry #3[203]	Gentry Mountain Mining, LLC-COP Coal Development Co	659,000 Tons	Power Generation
Bituminous	Alton	Kane	Coal Hollow Mine[204]	Alton Coal Development Co	569,000 Tons	Power Generation

[199] Brian Maffly, "Utah's Most Productive Coal Mine Gets a Life Line from Trump's Federal Land Managers," Salt Lake Tribune, January 25, 2021, https://www.sltrib.com/news/environment/2021/01/25/utahs-most-productive/ (Accessed April 28, 2021); Global Energy Monitor, "Utah and Coal," https://www.gem.wiki/Utah_and_coal (Accessed April 28, 2021); H.H. Doelling, "Coal Fields of Utah," Utah Geological and Mineral Survey, Relief Map of Utah, May 1982, https://ugspub.nr.utah.gov/publications/energy_maps/M-66.pdf (Accessed April 28, 2021); MSHA, USGS, "Coal Production in Utah by Mine, 2002-2020, https://geology.utah.gov/docs/statistics/coal2.0/pdf/T2.8.pdf (Accessed May 26, 2021).

[200] Ibid.; Wolverine Fuels, "Sufco," Mines and Coal Quality, http://wolverinefuels.com/sufco/ (Accessed May 26, 2021); Brian Maffly, "Utah's Oldest Coal Mine Aims to Expand into an Uncertain Future, Salt Lake Tribune, March 18, 2014, https://archive.sltrib.com/article.php?id=57666963&itype=cmsid (Accessed May 26, 2021).

[201] Wolverine Fuels, "Skyline," Mines and Coal Quality, http://wolverinefuels.com/skyline/ (Accessed May 26, 2021); MSHA, USGS, Coal Production in Utah by Mine, 2002-2020, https://geology.utah.gov/docs/statistics/coal2.0/pdf/T2.8.pdf (Accessed May 26, 2021).

[202] MSHA, USGS, "Coal Production in Utah by Mine, 2002-2020, https://geology.utah.gov/docs/statistics/coal2.0/pdf/T2.8.pdf (Accessed May 26, 2021).

[203] Department of Labor, Mine Data Retrieval System, Gentry Mine #3, Emery County, UT MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 15, 2021); EIA, State Profile and Energy Estimates: Utah: "Coal" https://www.eia.gov/state/analysis.php?sid=UT (Accessed June 15, 2021).

[204] Ibid.; Department of Labor, Mine Data Retrieval System, Coal Hollow Mine, Kane County, UT MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 15, 2021);

WYOMING

Coal Rank	*Field/Region*	*County*	*Mine*	*Ownership*	*Yearly Production Estimate*	*Main Use*
Sub-Bituminous	Powder River	Campbell	Wyodak Mine[205]	Black Hills Energy	3.5 Million Tons	Power Generation/ Industrial
Sub-Bituminous	Hams Fork	Lincoln	Kemmerer Mine[206]	Kemmerer Operations , LLC	2.4 Million Tons	Power Generation/ Industrial
Bituminous	Green River	Sweetwater	Jim Bridger Mine[207]	Bridger Coal Company	1.4 Million Tons	Power Generation/ Industrial
Sub-Bituminous	Powder River	Campbell	Belle Ayr Mine[208]	Eagle Specialty Materials, LLC	11.1 Million Tons	Power Generation/ Industrial
Sub-Bituminous	Powder River	Campbell	Black Thunder[209]	Thunder Basin Coal Company, LLC	50.1 Million Tons	Power Generation/ Industrial
Sub-Bituminous	Powder River	Campbell	Cordero Rojo Mine[210]	Navajo Transitiona l Energy Company, LLC	9.7 Million Tons	Power Generation/ Industrial

[205] Department of Labor, Mine Data Retrieval System, Wyodak Mine, Campbell County, WY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); Wyoming State Geological Survey, "Wyoming Coal," State of Wyoming, https://www.wsgs.wyo.gov/energy/coal (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Wyoming, "Coal," https://www.eia.gov/state/print.php?sid=WY (Accessed June 9, 2021).

[206] Ibid.; Department of Labor, Mine Data Retrieval System, Kemmerer, WY, Lincoln County, WY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); Wyoming Geological Survey, "Wyoming Coal," https://www.wsgs.wyo.gov/energy/coal (Accessed June 9, 2021).

[207] Ibid.; Department of Labor, Mine Data Retrieval System, Jim Bridger Mine, Sweetwater County, WY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Wyoming, "Coal," https://www.eia.gov/state/print.php?sid=WY (Accessed June 9, 2021).

[208] Ibid.; Department of Labor, Mine Data Retrieval System, Belle Ayr Mine, Campbell County, WY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); Wyoming Geological Survey, "Wyoming Coal," https://www.wsgs.wyo.gov/energy/coal (Accessed June 9, 2021).

[209] Ibid.; Department of Labor, Mine Data Retrieval System, Black Thunder Mine, Campbell County, WY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Wyoming, "Coal," https://www.eia.gov/state/print.php?sid=WY (Accessed June 9, 2021).

[210] Ibid.; Department of Labor, Mine Data Retrieval System, Cordero Rojo Mine, Campbell County, WY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); Wyoming Geological Survey, "Wyoming Coal," https://www.wsgs.wyo.gov/energy/coal (Accessed June 9, 2021).

Sub-Bituminous	Powder River	Campbell	Rawhide Mine[211]	Peabody Coballo Mining, LLC	9.4 Million Tons	Power Generation/ Industrial
Sub-Bituminous	Powder River	Campbell	Caballo Mine[212]	Peabody Coballo Mining, LLC	11.6 Million Tons	Power Generation/ Industrial
Sub-Bituminous	Powder River	Campbell	Eagle Butte Mine[213]	Eagle Specialty Materials, LLC	12.3 Million Tons	Power Generation/ Industrial
Bituminous	Green River	Sweetwater	Black Butte and Leucite Hills Mines[214]	Black Butte Coal Company	2.2 Million Tons	Power Generation/ Industrial
Sub-Bituminous	Powder River	Campbell	Buckskin Mine[215]	Buckskin Mining Company	9.6 Million Tons	Power Generation/ Industrial
Sub-Bituminous	Powder River	Campbell	Coal Creek Mine[216]	Thunder Basin Coal Company, LLC	2.1 Million Tons	Power Generation/ Industrial
Sub-Bituminous	Powder River	Converse	Antelope Coal Mine[217]	Navajo Transitional Energy Company, LLC	19.8 Million Tons	Power Generation/ Industrial

[211] Ibid.; Department of Labor, Mine Data Retrieval System, Rawhide Mine, Campbell County, WY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Wyoming, "Coal," https://www.eia.gov/state/print.php?sid=WY (Accessed June 9, 2021).

[212] Ibid.; Department of Labor, Mine Data Retrieval System, Cabollo Mine Mine, Campbell County, WY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); Wyoming Geological Survey, "Wyoming Coal," https://www.wsgs.wyo.gov/energy/coal (Accessed June 9, 2021).

[213] Ibid.; Department of Labor, Mine Data Retrieval System, Eagle Butte Mine, Campbell County, WY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Wyoming, "Coal," https://www.eia.gov/state/print.php?sid=WY (Accessed June 9, 2021).

[214] Ibid.; Department of Labor, Mine Data Retrieval System, Black Butte and Leucite Hills Mine, Sweetwater County, WY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); Wyoming Geological Survey, "Wyoming Coal," https://www.wsgs.wyo.gov/energy/coal (Accessed June 9, 2021).

[215] Ibid.; Department of Labor, Mine Data Retrieval System, Buckskin Mine, Campbell County, WY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Wyoming, "Coal," https://www.eia.gov/state/print.php?sid=WY (Accessed June 9, 2021).

[216] Ibid.; Department of Labor, Mine Data Retrieval System, Coal Creek Mine, Campbell County, WY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); Wyoming Geological Survey, "Wyoming Coal," https://www.wsgs.wyo.gov/energy/coal (Accessed June 9, 2021).

[217] Ibid.; Department of Labor, Mine Data Retrieval System, Antelope Mine, Converse County, WY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Wyoming, "Coal," https://www.eia.gov/state/print.php?sid=WY (Accessed June 9, 2021).

Sub-Bituminous	Powder River	Campbell	North Antelope Rochelle Mine[218]	Peabody Powder River Mining, LLC	66.1 Million Tons	Power Generation/ Industrial
Sub-Bituminous	Powder River	Campbell	Dry Fork Mine[219]	Western Fuels-Wyoming, Inc.	3.9 Million Tons	Power Generation/ Industrial
Bituminous	Green River	Sweetwater	Bridger Underground Coal Mine[220]	Bridger Coal Company	2.4 Million Tons	Power Generation/ Industrial

[218] Ibid.; Department of Labor, Mine Data Retrieval System, North Antelope Rochelle Mine, Campbell County, WY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); Wyoming Geological Survey, "Wyoming Coal," https://www.wsgs.wyo.gov/energy/coal (Accessed June 9, 2021).

[219] Ibid.; Department of Labor, Mine Data Retrieval System, Dry Fork Mine, Campbell County, WY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Wyoming, "Coal," https://www.eia.gov/state/print.php?sid=WY (Accessed June 9, 2021).

[220] Ibid.; Department of Labor, Mine Data Retrieval System, Bridger Underground Coal Mine, Sweetwater County, WY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); Wyoming Geological Survey, "Wyoming Coal," https://www.wsgs.wyo.gov/energy/coal (Accessed June 9, 2021).

Interior Region

ALABAMA

Coal Rank	*Field/Region*	*County*	*Mine*	*Ownership*	*Yearly Production Estimate*	*Main Use*
Bituminous	Warrior Coalfield	Walker	Choctaw Mine[221]	Best Coal, Inc.	217,000 Tons	Export/ Industrial/ Coking/ Power Generation
Bituminous	Warrior Coalfield	Jefferson	Flat Top Mine[222]	Best Coal, Inc.	239,000 Tons	Export/ Industrial/ Coking/ Power Generation
Bituminous	Warrior Coalfield	Jefferson	Oak Grove Mine[223]	Crimson Oak Grove Resources, LLC	1.6 Million Tons	Export/ Industrial/ Coking/ Power Generation
Bituminous	Warrior Coalfield	Jefferson	No 7 Mine[224]	Warrior Met Coal Mining, LLC	5.7 Million Tons	Export/ Industrial/ Coking/ Power Generation
Bituminous	Warrior Coalfield	Walker	Carbon Hill Mine[225]	Clas Coal Company, Inc.	107,000 Tons	Export/ Industrial/ Coking/ Power Generation

[221] Department of Labor, Mine Data Retrieval System, Choctaw Mine, Walker County, AL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Alabama, "Coal," https://www.eia.gov/state/print.php?sid=AL (Accessed June 9, 2021); Coal Fields of the Appalachian Mountains, "Northern Alabama Coalfields (Including Georgia)," http://www.coalcampusa.com/alabama-coal-mines/alabama-coal-mines.htm (Accessed June 9, 2021).

[222] Ibid., Department of Labor, Mine Data Retrieval System, Flat Top Mine, Jefferson County, AL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Alabama, "Coal," https://www.eia.gov/state/print.php?sid=AL (Accessed June 9, 2021).

[223] Ibid., Department of Labor, Mine Data Retrieval System, Oak Grove Mine, Jefferson County, AL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); Coal Fields of the Appalachian Mountains, "Northern Alabama Coalfields (Including Georgia)," http://www.coalcampusa.com/alabama-coal-mines/alabama-coal-mines.htm (Accessed June 9, 2021).

[224] Ibid., Department of Labor, Mine Data Retrieval System, No 7 Mine, Jefferson County, AL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Alabama, "Coal," https://www.eia.gov/state/print.php?sid=AL (Accessed June 9, 2021).

[225] Ibid., Department of Labor, Mine Data Retrieval System, Carbon Hill Mine, Walker County, AL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); Coal Fields of the Appalachian Mountains, "Northern Alabama Coalfields (Including Georgia)," http://www.coalcampusa.com/alabama-coal-mines/alabama-coal-mines.htm (Accessed June 9, 2021).

Bituminous	Warrior Coalfield	Jefferson	Maxine-Pratt Mine[226]	Alaco LLC	159,000 Tons	Export/ Industrial/ Coking/ Power Generation
Bituminous	Warrior Coalfield	Jefferson	Black Warrior Mine No 1[227]	Black Warrior Minerals, Inc.	222,000 Tons	Export/ Industrial/ Coking/ Power Generation
Bituminous	Warrior Coalfield	Jefferson	Shannon Mine No. 3[228]	RJR Mining Company, Inc.	148,000 Tons	Export/ Industrial/ Coking/ Power Generation
Bituminous	Warrior Coalfield	Jefferson	Sloan Mtn. No. 3[229]	Best Coal, Inc.	152,000 Tons	Export/ Industrial/ Coking/ Power Generation
Bituminous	Warrior Coalfield	Walker	SHM-82[230]	Mega Highwall Mining, LLC	274,000 Tons	Export/ Industrial/ Coking/ Power Generation

[226] Ibid., Department of Labor, Mine Data Retrieval System, Maxine-Pratt Mine, Jefferson County, AL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Alabama, "Coal," https://www.eia.gov/state/print.php?sid=AL (Accessed June 9, 2021).

[227] Ibid., Department of Labor, Mine Data Retrieval System, Black Warrior Mine No 1, Jefferson County, AL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); Coal Fields of the Appalachian Mountains, "Northern Alabama Coalfields (Including Georgia)," http://www.coalcampusa.com/alabama-coal-mines/alabama-coal-mines.htm (Accessed June 9, 2021).

[228] Ibid., Department of Labor, Mine Data Retrieval System, Shannon Mine No 3, Jefferson County, AL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); Coal Fields of the Appalachian Mountains, "Northern Alabama Coalfields (Including Georgia)," http://www.coalcampusa.com/alabama-coal-mines/alabama-coal-mines.htm (Accessed June 9, 2021).

[229] Ibid., Department of Labor, Mine Data Retrieval System, Sloan Mountain No. 3, Jefferson County, AL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Alabama, "Coal," https://www.eia.gov/state/print.php?sid=AL (Accessed June 9, 2021).

[230] Ibid., Department of Labor, Mine Data Retrieval System, SHM-82, Walker County, AL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); Coal Fields of the Appalachian Mountains, "Northern Alabama Coalfields (Including Georgia)," http://www.coalcampusa.com/alabama-coal-mines/alabama-coal-mines.htm (Accessed June 9, 2021).

ILLINOIS

Coal Rank	*Field/Region*	*County*	*Mine*	*Ownership*	*Yearly Production Estimate*	*Main Use*
Bituminous	Illinois Basin	Sangamon	Viper Mine[231]	ICG-Illinois, LLC	766,000 Tons	Export/ Industrial/ Coking/ Power Generation
Bituminous	Illinois Basin	Perry	BCR Mine #1[232]	BC Recovery, LLC	191,000 Tons	Export/ Industrial/ Coking/ Power Generation
Bituminous	Illinois Basin	Williamson	Mach #1 Mine[233]	Mach Mining, LLC	3.8 Million Tons	Export/ Industrial/ Coking/ Power Generation
Bituminous	Illinois Basin	Perry	Prairie Eagle-Underground [234]	Knight Hawk Coal, LLC	3.7 Million Tons	Export/ Industrial/ Coking/ Power Generation
Bituminous	Illinois Basin	Montgomery	Deer Run Mine[235]	Patton Mining, LLC	2.8 Million Tons	Export/ Industrial/ Coking/ Power Generation
Bituminous	Illinois Basin	Franklin	MC#1 Mine[236]	M-Class Mining, LLC	7.1 Million Tons	Export/ Industrial/ Coking/ Power Generation

[231] Department of Labor, Mine Data Retrieval System, Viper Mine, Sangamon County, IL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Illinois, "Coal," https://www.eia.gov/state/analysis.php?sid=IL (Accessed June 9, 2021).

[232] Ibid.; Department of Labor, Mine Data Retrieval System, BCR Mine #1, Perry County, IL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021).

[233] Department of Labor, Mine Data Retrieval System, Mach #1 Mine, Williamson County, IL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Illinois, "Coal," https://www.eia.gov/state/analysis.php?sid=IL (Accessed June 9, 2021).

[234] Ibid.; Department of Labor, Mine Data Retrieval System, Prairie Eagle Underground, Perry County, IL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021).

[235] Department of Labor, Mine Data Retrieval System, Deer Run Mine, Montgomery County, IL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Illinois, "Coal," https://www.eia.gov/state/analysis.php?sid=IL (Accessed June 9, 2021).

[236] Ibid.; Department of Labor, Mine Data Retrieval System, MC#1 Mine, Franklin County, IL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021).

Bituminous	Illinois Basin	Washington	Lively Grove Mine[237]	Prairie State Generating	6.4 Million Tons	Export/ Industrial/ Coking/ Power Generation
Bituminous	Illinois Basin	Hamilton	Mine No 1[238]	Hamilton County Coal, LLC	2.6 Million Tons	Export/ Industrial/ Coking/ Power Generation
Bituminous	Illinois Basin	Randolph	Gateway North Mine[239]	Peabody Gateway North Mining, LLC	1.8 Million Tons	Export/ Industrial/ Coking/ Power Generation
Bituminous	Illinois Basin	Perry	Golden Eagle Mine[240]	Knight Hawk Coal, LLC	388,000 Tons	Export/ Industrial/ Coking/ Power Generation

INDIANA

Coal Rank	*Field/Region*	*County*	*Mine*	*Ownership*	*Yearly Production Estimate*	*Main Use*
Bituminous	Illinois Basin	Daviess	Craney Mine[241]	Solar Sources Mining, LLC	1 Million Tons	Power Generation/ Industrial/ Coking

[237] Department of Labor, Mine Data Retrieval System, Lively Grove Mine, Washington County, IL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Illinois, "Coal," https://www.eia.gov/state/analysis.php?sid=IL (Accessed June 9, 2021).

[238] Ibid.; Department of Labor, Mine Data Retrieval System, Mine No. 1, Hamilton County, IL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021).

[239] Department of Labor, Mine Data Retrieval System, Gateway North Mine, Randolph County, IL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021); EIA, State Profile and Energy Estimates: Illinois, "Coal," https://www.eia.gov/state/analysis.php?sid=IL (Accessed June 9, 2021).

[240] Ibid.; Department of Labor, Mine Data Retrieval System, Golden Eagle Mine, Perry County, IL, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 9, 2021).

[241] Department of Labor, Mine Data Retrieval System, Craney Mine, Daviess County, IN MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); EIA, State Profile and Energy Estimates: Indiana, "Coal," https://www.eia.gov/state/analysis.php?sid=IN (Accessed June 10, 2021); Indiana University, "Hymera Coal Member," Indiana Geological & Water Survey, Indiana University, https://igws.indiana.edu/IGNIS/GeoNamesDetails.cfm?ID=152B6FC4-2EC4-4D72-8D11-5DE01ED3FCE9 (Accessed June 10, 2021).

Bituminous	Illinois Basin	Gibson	Francisco Underground Pit[242]	Peabody Midwest Mining, LLC	1.5 Million Tons	Power Generation/ Industrial/ Coking
Bituminous	Illinois Basin	Daviess	Antioch Mine[243]	Solar Sources Mining, LLC	1 Million Tons	Power Generation/ Industrial/ Coking
Bituminous	Illinois Basin	Gibson	Gibson South[244]	Gibson County Coal, LLC	2 Million Tons	Power Generation/ Industrial/ Coking
Bituminous	Illinois Basin	Knox	Oaktown Fuels Mine No. 1[245]	Sunrise Coal, LLC	3.4 Million Tons	Power Generation/ Industrial/ Coking
Bituminous	Illinois Basin	Sullivan	Bear Run Mine[246]	Peabody Bear Run Mining, LLC	5.1 Million Tons	Power Generation/ Industrial/ Coking
Bituminous	Illinois Basin	Warrick	Wild Boar Mine[247]	Peabody Wild Boar Mining, LLC	2.1 Million Tons	Power Generation/ Industrial/ Coking

[242] Ibid., Department of Labor, Mine Data Retrieval System, Francisco Underground Pit, Gibson County, IN MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); EIA, State Profile and Energy Estimates: Indiana, "Coal," https://www.eia.gov/state/analysis.php?sid=IN (Accessed June 10, 2021).

[243] Ibid.; Department of Labor, Mine Data Retrieval System, Antioch Mine, Daviess County, IN MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); Hymera Coal Member," Indiana Geological & Water Survey, Indiana University, https://igws.indiana.edu/IGNIS/GeoNamesDetails.cfm?ID=152B6FC4-2EC4-4D72-8D11-5DE01ED3FCE9 (Accessed June 10, 2021).

[244] Ibid., Department of Labor, Mine Data Retrieval System, Gibson South, Gibson County, IN MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); EIA, State Profile and Energy Estimates: Indiana, "Coal," https://www.eia.gov/state/analysis.php?sid=IN (Accessed June 10, 2021).

[245] Ibid.; Department of Labor, Mine Data Retrieval System, Oaktown Fuels No. 1, Knox County, IN MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); Hymera Coal Member," Indiana Geological & Water Survey, Indiana University, https://igws.indiana.edu/IGNIS/GeoNamesDetails.cfm?ID=152B6FC4-2EC4-4D72-8D11-5DE01ED3FCE9 (Accessed June 10, 2021).

[246] Ibid., Department of Labor, Mine Data Retrieval System, Bear Run Mine, Sullivan County, IN MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); EIA, State Profile and Energy Estimates: Indiana, "Coal," https://www.eia.gov/state/analysis.php?sid=IN (Accessed June 10, 2021).

[247] Ibid.; Department of Labor, Mine Data Retrieval System, Wild Boar Mine, Warrick County, IN MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); Hymera Coal Member," Indiana Geological & Water Survey, Indiana University, https://igws.indiana.edu/IGNIS/GeoNamesDetails.cfm?ID=152B6FC4-2EC4-4D72-8D11-5DE01ED3FCE9 (Accessed June 10, 2021).

Bituminous	Illinois Basin	Clay	Ace in the Hole[248]	Sunrise Coal, LLC	235,000 Tons	Power Generation/ Industrial/ Coking
Bituminous	Illinois Basin	Warrick	Addcar Systems 03[249]	Mega Highwall Mining, LLC	111,000 Tons	Power Generation/ Industrial/ Coking

TEXAS

Coal Rank	*Field/Region*	*County*	*Mine*	*Ownership*	*Yearly Production Estimate*	*Main Use*
Lignite	Gulf Coal Province	Atascosa	San Miguel Lignite[250]	NACG Texas, Inc.	2.6 Million Tons	Power Generation
Lignite	Gulf Coal Province	Harrison	South Hallsville No 1 Mine[251]	The Sabine Mining Company	1.6 Million Tons	Power Generation
Lignite	Gulf Coal Province	Robertson	Calvert Mine[252]	Black Walnut Management Company, LLC	1.9 Million Tons	Power Generation

[248] Ibid., Department of Labor, Mine Data Retrieval System, Ace in the Hole, Clay County, IN MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); EIA, State Profile and Energy Estimates: Indiana, "Coal," https://www.eia.gov/state/analysis.php?sid=IN (Accessed June 10, 2021).

[249] Ibid.; Department of Labor, Mine Data Retrieval System, Addcar Systems 03, Warrick County, IN MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); Hymera Coal Member," Indiana Geological & Water Survey, Indiana University, https://igws.indiana.edu/IGNIS/GeoNamesDetails.cfm?ID=152B6FC4-2EC4-4D72-8D11-5DE01ED3FCE9 (Accessed June 10, 2021).

[250] Department of Labor, Mine Data Retrieval System, San Miguel Lignite Mine, Atascosa County, TX MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); EIA, State Profile and Energy Estimates: Texas, "Coal," https://www.eia.gov/state/analysis.php?sid=TX (Accessed June 10, 2021); RRC, "Historical Coal Mining-Coal Regions/Fields in Texas," https://www.rrc.state.tx.us/media/3zhd5ptk/feb2015_lgmap3.jpg (Accessed June 10, 2021).

[251] Ibid.; Department of Labor, Mine Data Retrieval System, South Hallsville No 1 Mine, Harrison County, TX MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); EIA, State Profile and Energy Estimates: Texas, "Coal," https://www.eia.gov/state/analysis.php?sid=TX (Accessed June 10, 2021).

[252] Ibid.; Department of Labor, Mine Data Retrieval System, Calvert Mine, Robertson County, TX MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); RRC, "Historical Coal Mining-Coal Regions/Fields in Texas," https://www.rrc.state.tx.us/media/3zhd5ptk/feb2015_lgmap3.jpg (Accessed June 10, 2021).

Lignite	Gulf Coal Province	Limestone	Kosse Strip[253]	Luminant Mining Company, LLC	10.1 Million Tons	Power Generation
Lignite	Gulf Coal Province	Rusk	Liberty Mine[254]	Luminant Mining Company, LLC	2.9 Million Tons	Power Generation

Appalachian Region

OHIO

Coal Rank	*Field/Region*	*County*	*Mine*	*Ownership*	*Yearly Production Estimate*	*Main Use*
Bituminous	Pittsburgh No. 8 Coalfield	Belmont	CCU Belmont Strip[255]	CCU Coal and Construction, LLC	217,000 Tons	Power Generation and Coking
Bituminous	Pittsburgh No. 8 Coalfield	Monroe	Century Mine[256]	Belmont County Coal Resources, Inc.	1.6 Million Tons	Power Generation and Coking
Bituminous	Cambridge Coalfield	Noble	Orange Strip[257]	B&N Coal, Inc.	460,000 Tons	Power Generation and Coking
Bituminous	Pittsburgh No. 8 Coalfield	Harrison	CCU Harrison Strip[258]	CCU Coal and Construction, LLC	193,000 Tons	Power Generation and Coking

[253] Ibid.; Department of Labor, Mine Data Retrieval System, Kosse Strip, Limestone County, TX MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); EIA, State Profile and Energy Estimates: Texas, "Coal," https://www.eia.gov/state/analysis.php?sid=TX (Accessed June 10, 2021).

[254] Ibid.; Department of Labor, Mine Data Retrieval System, Liberty Mine, Rusk County, TX MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); RRC, "Historical Coal Mining-Coal Regions/Fields in Texas," https://www.rrc.state.tx.us/media/3zhd5ptk/feb2015_lgmap3.jpg (Accessed June 10, 2021).

[255] Department of Labor, Mine Data Retrieval System, CCU Belmont Strip, Belmont County, OH, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); EIA, State Profile and Energy Estimates: Ohio, "Coal," https://www.eia.gov/state/analysis.php?sid=OH (Accessed June 10, 2021); Coal Fields of the Appalachian Mountains, "Bituminous Coal Fields of Northern and Central Appalachia," http://coalcampusa.com (Accessed June 10, 2021).

[256] Ibid.; Department of Labor, Mine Data Retrieval System, Century Mine, Monroe County, OH, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); EIA, State Profile and Energy Estimates: Ohio, "Coal," https://www.eia.gov/state/analysis.php?sid=OH (Accessed June 10, 2021).

[257] Ibid.; Department of Labor, Mine Data Retrieval System, Orange Strip, Noble County, OH, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); Coal Fields of the Appalachian Mountains, "Bituminous Coal Fields of Northern and Central Appalachia," http://coalcampusa.com (Accessed June 10, 2021).

[258] Ibid.; Department of Labor, Mine Data Retrieval System, CCU Harrison Strip, Harrison County, OH, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); EIA, State Profile and Energy Estimates: Ohio, "Coal," https://www.eia.gov/state/analysis.php?sid=OH (Accessed June 10, 2021).

Bituminous	Pittsburgh No. 8 Coalfield	Harrison	CCU Sexton Strip[259]	CCU Coal and Construction, LLC	165,000 Tons	Power Generation and Coking
Bituminous	Pittsburgh No. 8 Coalfield	Harrison	Vail Mine[260]	Rosebud Mining Company	360,000 Tons	Power Generation and Coking

PENNSYLVANIA

Coal Rank	*Field/Region*	*County*	*Mine*	*Ownership*	*Yearly Production Estimate*	*Main Use*
Anthracite	Southern Anthracite Field	Schuylkill	Tamaqua Mine[261]	Lehigh Anthracite, LLC	229,000 Tons	Heating/ Steel/ Industrial/ Export
Anthracite	Southern Anthracite Field	Schuylkill	Buck Run P-8 P-10[262]	Reading Anthracite Company	129,000 Tons	Heating/ Steel/ Industrial/ Export
Anthracite	Southern Anthracite Field	Schuylkill	Wadesville P-33[263]	Reading Anthracite Company	186,000 Tons	Heating/ Steel/ Industrial/ Export

[259] Ibid.; Department of Labor, Mine Data Retrieval System, Vail Mine, Harrison County, OH, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); Coal Fields of the Appalachian Mountains, "Bituminous Coal Fields of Northern and Central Appalachia," http://coalcampusa.com (Accessed June 10, 2021).

[260] Ibid.; Department of Labor, Mine Data Retrieval System, CCU Harrison Strip, Harrison County, OH, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 10, 2021); EIA, State Profile and Energy Estimates: Ohio, "Coal," https://www.eia.gov/state/analysis.php?sid=OH (Accessed June 10, 2021).

[261] Department of Labor, Mine Data Retrieval System, Tamaqua Mine, Schuylkill County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," Pennsylvania Department of Environmental Protection, http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

[262] Ibid, 9.; Department of Labor, Mine Data Retrieval System, Buck Run P-8 P-10, Schuylkill County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

[263] Ibid., Department of Labor, Mine Data Retrieval System, Wadesville P-33, Schuylkill County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

Anthracite	Western Middle Anthracite Field	Northumberland	West Spring Energy[264]	West Spring Energy, LLC	115,000 Tons	Heating/ Steel/ Industrial/ Export
Anthracite	Eastern Middle Anthracite Field	Luzerne	Hazelton Shaft South[265]	Atlantic Carbon Group, Inc.	604,000 Tons	Heating/ Steel/ Industrial/ Export
Anthracite	Southern Anthracite Field	Schuylkill	Ellangowan Stripping[266]	Reading Anthracite Company	192,000 Tons	Heating/ Steel/ Industrial/ Export
Anthracite	Southern Anthracite Field	Schuylkill	Primrose Operation[267]	Blaschak Coal Corp	140,000 Tons	Heating/ Steel/ Industrial/ Export
Bituminous	North Central Coal Fields	Lycoming	Fisher Mining Company[268]	Fisher Mining Company	180,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Somerset	Mine No 1[269]	PBS Coals, Inc.	167,000 Tons	Power Generation/ Coking

[264] Ibid, 9.; Department of Labor, Mine Data Retrieval System, West Spring Energy, Northumberland County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

[265] Ibid., Department of Labor, Mine Data Retrieval System, Hazelton Shaft South, Luzerne County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

[266] Ibid, 9.; Department of Labor, Mine Data Retrieval System, Ellangowan Stripping, Schuylkill County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

[267] Ibid., Department of Labor, Mine Data Retrieval System, Primrose Operation, Schuylkill County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

[268] Ibid, 9.; Department of Labor, Mine Data Retrieval System, Fisher Mining Company, Lycoming County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

[269] Ibid., Department of Labor, Mine Data Retrieval System, Mine No. 1, Somerset County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

Bituminous	Main Bituminous Field	Greene	Cumberland Mine[270]	Iron Cumberland LLC	5.6 Million Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Greene	Bailey Mine[271]	Consol Pennsylvania Coal Company, LLC	8.6 Million Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Washington	Enlow Fork Mine[272]	Consol Pennsylvania Coal Company, LLC	5.6 Million Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Armstrong	Darmac No. 2 Mine[273]	Rosebud Mining Company	286,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Armstrong	Dutch Run[274]	Rosebud Mining Company	201,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Armstrong	Parkwood Mine[275]	Rosebud Mining Company	118,000 Tons	Power Generation/ Coking

[270] Ibid, 9.; Department of Labor, Mine Data Retrieval System, Cumberland Mine, Greene County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

271 Ibid., Department of Labor, Mine Data Retrieval System, Bailey Mine, Greene County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

[272] Ibid, 9.; Department of Labor, Mine Data Retrieval System, Enlow Fork Mine, Washington County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

[273] Ibid., Department of Labor, Mine Data Retrieval System, Darmac No 2 Mine, Armstrong County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

[274] Ibid, 9.; Department of Labor, Mine Data Retrieval System, Parkwood Mine, Armstrong County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

[275] Ibid., Department of Labor, Mine Data Retrieval System, Darmac No 2 Mine, Armstrong County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

Bituminous	Main Bituminous Field	Cambria	Madison Mine[276]	Rosebud Mining Company	548,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Cambria	Cresson Mine[277]	Rosebud Mining Company	199,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Indiana	Barrett Mine[278]	Rosebud Mining Company	371,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Somerset	Mine 78[279]	Rosebud Mining Company	611,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Indiana	Knob Creek[280]	Rosebud Mining Company	165,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Indiana	Heilwood Mine[281]	Rosebud Mining Company	165,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Jefferson	Kocjancic Mine[282]	Rosebud Mining Company	154,000 Tons	Power Generation/ Coking

[276] Ibid, 9.; Department of Labor, Mine Data Retrieval System, Madison Mine, Cambria County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

[277] Ibid., Department of Labor, Mine Data Retrieval System, Cresson Mine, Cambria County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

[278] Ibid, 9.; Department of Labor, Mine Data Retrieval System, Barret Mine, Indiana County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

[279] Ibid., Department of Labor, Mine Data Retrieval System, Mine 78, Somerset County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

[280] Ibid, 9.; Department of Labor, Mine Data Retrieval System, Knob Creek, Indiana County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

[281] Ibid., Department of Labor, Mine Data Retrieval System, Heilwood Mine, Indiana County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

[282] Ibid, 9.; Department of Labor, Mine Data Retrieval System, Kocjancic Mine, Jefferson County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

Bituminous	Main Bituminous Field	Indiana	Brush Valley[283]	Rosebud Mining Company	573,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Clearfield	Harmony Mine[284]	Rosebud Mining Company	219,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Indiana	Coral-Graceton[285]	Rosebud Mining Company	135,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Clearfield	RES Shawville[286]	RES Coal LLC	119,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Clearfield	RES Morrisdale[287]	RES Coal LLC	247,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Somerset	Horning Deep Mine[288]	RoxCoal, Inc.	160,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Somerset	Acosta Deep Mine[289]	Wilson Creek Energy, LLC	362,000 Tons	Power Generation/ Coking

[283] Ibid., Department of Labor, Mine Data Retrieval System, Brush Valley, Indiana County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

[284] Ibid, 9.; Department of Labor, Mine Data Retrieval System, Harmony Mine, Clearfield County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

[285] Ibid., Department of Labor, Mine Data Retrieval System, Coral-Graceton, Indiana County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

[286] Ibid, 9.; Department of Labor, Mine Data Retrieval System, RES Shawville, Clearfield County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

[287] Ibid., Department of Labor, Mine Data Retrieval System, RES Morrisdale, Clearfield County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

[288] Ibid, 9.; Department of Labor, Mine Data Retrieval System, Horning Deep Mine, Somerset County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

[289] Ibid., Department of Labor, Mine Data Retrieval System, Acosta Deep Mine, Somerset County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

Bituminous	Main Bituminous Field	Bedford	Tarsa Strips[290]	J & J Svonavec Excavating, Inc.	186,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Indiana	Crooked Creek Mine[291]	Rosebud Mining Company	516,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Greene	Harvey Mine[292]	Consol Pennsylvania Coal Company, LLC	4.4 Million Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Westmoreland	Rustic Ridge #1 Mine[293]	LCT Energy LP	362,000 Tons	Power Generation/ Coking
Bituminous	Main Bituminous Field	Somerset	Mast Mine[294]	Heritage Coal & Natural Resources, LLC	178,000 Tons	Power Generation/ Coking

[290] Ibid, 9.; Department of Labor, Mine Data Retrieval System, Tarsa Strip, Bedford County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

[291] Ibid., Department of Labor, Mine Data Retrieval System, Crooked Creek Mine, Indiana County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

[292] Ibid, 9.; Department of Labor, Mine Data Retrieval System, Harvey Mine, Greene County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

[293] Ibid., Department of Labor, Mine Data Retrieval System, Rustic Ridge #1 Mine, Westmoreland County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EPCAMR, "Mine Water Resources of the Anthracite Coal Fields of Eastern Pennsylvania," http://www.epcamr.org/storage/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf (Accessed June 11, 2021).,9.

[294] Ibid, 9.; Department of Labor, Mine Data Retrieval System, Mast Mine, Somerset County, PA, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: Pennsylvania, "Coal," https://www.eia.gov/state/analysis.php?sid=PA (Accessed June 11, 2021).

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Bituminous	Panhandle Coal Field	Marshall	Marshall County Mine[295]	Marshall County Coal Company	8.8 Million Tons	Power Generation and Export
Bituminous	Panhandle Coal Field	Ohio	Tunnel Ridge Mine[296]	Tunnel Ridge, LLC	7.4 Million Tons	Power Generation and Export
Bituminous	Panhandle Coal Field	Marshall	Ohio County Mine[297]	Ohio County Coal Company	4.9 Million Tons	Power Generation and Export
Bituminous	Fairmont Coal Field	Marion	Harrison County Mine[298]	Harrison County Mining Company	4.8 Million Tons	Power Generation and Export
Bituminous	Fairmont Coal Field	Marion	Marion County Mine[299]	Marion County Mining Company	3.8 Million Tons	Coking
Bituminous	Fairmont Coal Field	Taylor	Leer Mine[300]	ACI Tygart Valley	4.1 Million Tons	Coking
Bituminous	Fairmont Coal Field	Monongalia	Monongalia County Mine[301]	Monongalia County Coal County	2.2 Million Tons	Power Generation and Export
Bituminous	Kanawha Coal Field	Raleigh	Affinity Mine[302]	Pocahontas Coal Company, LLC	2.9 Million Tons	Coking
Bituminous	Randolph Barbour Coal Field	Barbour	Sentinel[303]	Wolf Run Mining LLC	2.4 Million Tons	Power Generation and Export
Bituminous	Winding Gulf	Raleigh	Workman Creek[304]	Republic Energy, LLC	1.6 Million Tons	Coking

[295] Eugene White, "2019 Statistical Report and Directory of Mines," West Virginia Office of Miners' Health, Safety, and Training, West Virginia Department of Commerce, 2019, https://6b4qh3zxvlh6iz2u49uukv15-wpengine.netdna-ssl.com/wp-content/uploads/2020/12/CY-2019-Annual-Report-1.pdf (Accessed May 27, 2021)., 75.

[296] Ibid., 75.

[297] Ibid., 75.

[298] Ibid., 75.

[299] Ibid., 75.

[300] Ibid., 75.

[301] Ibid., 75.

[302] Ibid., 75.

[303] Ibid., 75.

[304] Ibid., 76.

Bituminous	Webster Gualy Coal Field	Nicholas	HWM 58[305]	South Fork Coal Co., LLC	113,000 Tons	Power Generation and Export
Bituminous	Logan Coal Field	Logan	AHM Coal Mac Mine #1[306]	Appalachian Highwall Mining, LLC	101,000 Tons	Power Generation and Export
Bituminous	Randolph Barbour Coal Field	Barbour	Leer South Mine[307]	Wolf Run Mining, LLC	756,000 Tons	Power Generation and Export
Bituminous	Winding Gulf Coal Field	Raleigh	Beckley Pocahontas Mine[308]	ICG Beckley, LLC	1 Million Tons	Power Generation and Export
Bituminous	Kanawha Coal Field	Kanawha	American Eagle Mine[309]	Panther Creek Mining, LLC	750,000 Tons	Power Generation and Export
Bituminous	Kanawha Coal Field	Boone	Gateway Eagle Mine[310]	Rockwell Mining, LLC	217,000 Tons	Power Generation and Export
Bituminous	Kanawha Coal Field	Kanawha	Sample Surface Mine[311]	Panther Creek Mining, LLC	229,000 Tons	Power Generation and Export

[305] Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021); Department of Labor, Mine Data Retrieval System, HWM 58, Nicholas County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[306] Ibid.; Department of Labor, Mine Data Retrieval System, AHM Coal Mac, Logan County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[307] Ibid.; Department of Labor, Mine Data Retrieval System, Leer South Mine, Barbour County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[308] Ibid.; Department of Labor, Mine Data Retrieval System, Beckley Pocahontas Mine, Raleigh County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[309] Ibid.; Department of Labor, Mine Data Retrieval System, American Eagle Mine, Kanawha County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[310] Ibid.; Department of Labor, Mine Data Retrieval System, Gateway Eagle Mine, Boone County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[311] Ibid.; Department of Labor, Mine Data Retrieval System, Sample Surface Mine, Kanawha County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

Bituminous	Kanawha Coal Field	Boone	Twilight Mt Surface Mine[312]	Lexington Coal Company, LLC	270,000 Tons	Power Generation and Export
Bituminous	Pocahontas Tug River Coal Field	McDowell	Eckman Surface Mine[313]	Extra Energy, Inc.	270,000 Tons	Power Generation and Export
Bituminous	Randolph Barbour Coal Field	Randolph	Morgan Camp Mine[314]	Carter Roag Coal Company	578,000 Tons	Power Generation and Export
Bituminous	Logan Coal Field	Logan	Stonecoal Branch Mine No. 2[315]	Ramaco Resources, LLC	374,000 Tons	Power Generation and Export
Bituminous	Kanawha Coal Field	Boone	Kanawha Eagle Mining, LLC[316]	North Eagle Mine	812,000 Tons	Power Generation and Export
Bituminous	Webster Gualy Coal Field	Nicholas	Jerry Fork Eagle[317]	Nicholas Contura, LLC	827,000 Tons	Power Generation and Export
Bituminous	Williamson Coal Field	Mingo	Grapevine South Surface Mine[318]	Appalachian Resources West Virginia, LLC	396,000 Tons	Power Generation and Export

[312] Ibid.; Department of Labor, Mine Data Retrieval System, Twilight Mt Surface Mine, Boone County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[313] Ibid.; Department of Labor, Mine Data Retrieval System, Eckman Surface Mine, McDowell County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[314] Ibid.; Department of Labor, Mine Data Retrieval System, Morgan Camp Mine, Randolph County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[315] Ibid.; Department of Labor, Mine Data Retrieval System, Stonecoal Branch Mine No. 2, Logan County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[316] Ibid.; Department of Labor, Mine Data Retrieval System, Kanawha Eagle Mining, LLC, Boone County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[317] Ibid.; Department of Labor, Mine Data Retrieval System, Jerry Fork Eagle, Nicholas County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[318] Ibid.; Department of Labor, Mine Data Retrieval System, Grapevine South Surface Mine, Mingo County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

Bituminous	Kanawha Coal Field	Fayette	Kingston No. 2[319]	Kingston Mining, Inc.	398,000 Tons	Power Generation and Export
Bituminous	Logan Coal Field	Logan	Holden #22 Surface[320]	Coal-Mac LLC	1.4 Million Tons	Power Generation and Export
Bituminous	Winding Gulf	Raleigh	Ewing Fork No. 1 Surface Mine[321]	Republic Energy	791,000 Tons	Power Generation and Export
Bituminous	Upper Potomac Coal Field	Tucker	Mountain View Mine[322]	Mettiki Coal WV, LLC	1.8 Million Tons	Power Generation and Export
Bituminous	Logan Coal Field	Logan	Mountaineer II Mine [323]	Mingo Logan Coal, LLC	891,000 Tons	Power Generation and Export
Bituminous	Webster Gauley Coal Field	Webster	Seven Pines[324]	Brooks Run Mining Company, LLC	142,000 Tons	Power Generation and Export
Bituminous	Fairmont Coal Field	Marion	Barackville Refuse Pile[325]	LP Mineral, LLC	170,000 Tons	Power Generation and Export
Bituminous	Kanawha Coal Field	Fayette	Republic Energy[326]	Republic Energy, LLC	799,000 Tons	Coking

[319] Ibid.; Department of Labor, Mine Data Retrieval System, Kingston No. 2, Fayette County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[320] Ibid.; Department of Labor, Mine Data Retrieval System, Holden #22 Surface, Logan County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[321] Ibid.; Department of Labor, Mine Data Retrieval System, Ewing Fork No. 1 Surface Mine, Raleigh County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[322] Ibid.; Department of Labor, Mine Data Retrieval System, Mountain View Mine, Tucker County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[323] Ibid.; Department of Labor, Mine Data Retrieval System, Mountaineer II Mine, Logan County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[324] Ibid.; Department of Labor, Mine Data Retrieval System, Seven Pines, Webster County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[325] Ibid.; Department of Labor, Mine Data Retrieval System, Barackville Refuse Pile, Marion County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[326] Ibid.; Department of Labor, Mine Data Retrieval System, Republic Energy, Fayette County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

Bituminous	Winding Gulf	Wyoming	Coal Mountain No. 1[327]	CM Energy Operations LP	484,000 Tons	Power Generation and Export
Bituminous	Williamson Coal Field	Mingo	Twin Branch No. 1 Surface[328]	Coal-Mac, LLC	337,000 Tons	Power Generation and Export
Bituminous	Winding Gulf	Raleigh	Horse Creek Eagle[329]	Marfork Coal Company, LLC	412,000 Tons	Power Generation and Export
Bituminous	Winding Gulf	Raleigh	Panther Eagle Mine[330]	Marfork Coal Company, LLC	304,000 Tons	Power Generation and Export
Bituminous	Logan Coal Field	Logan	Powelton #1 Mine[331]	Greenbrier Minerals, LLC	577,000 Tons	Power Generation and Export
Bituminous	Logan Coal Field	Logan	Highwall Miner No. 1[332]	Ramaco Resources, LLC	207,000 Tons	Power Generation and Export
Bituminous	Kanawha Coal Field	Kanawha	Slabcamp[333]	Mammoth Coal Co.	1.3 Million Tons	Power Generation and Export

[327] Ibid.; Department of Labor, Mine Data Retrieval System, Coal Mountain No. 1, Wyoming County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[328] Ibid.; Department of Labor, Mine Data Retrieval System, Twin Branch No. 1 Surface, Mingo County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[329] Ibid.; Department of Labor, Mine Data Retrieval System, Horse Creek Eagle, Raleigh County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[330] Ibid.; Department of Labor, Mine Data Retrieval System, Panther Eagle Mine, Raleigh County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[331] Ibid.; Department of Labor, Mine Data Retrieval System, Powelton #1 Mine, Logan County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[332] Ibid.; Department of Labor, Mine Data Retrieval System, Highwall Miner No. 1, Logan County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[333] Ibid.; Department of Labor, Mine Data Retrieval System, Slabcamp, Kanawha County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

Bituminous	Winding Gulf	Wyoming	Ranger Fuel No. 1 Mine[334]	Bluestone Oil Corporation	491,000 Tons	Power Generation and Export
Bituminous	Kanawha Coal Field	Boone	Winchester Peerless Rachel Mine[335]	Kanawha Eagle Mining, LLC	713,000 Tons	Power Generation and Export
Bituminous	Pocahontas Tug River Coal Field	McDowell	Mine No. 39[336]	XMV, Inc.	358,000 Tons	Power Generation and Export
Bituminous	Kanawha Coal Field	Kanawha	Blue Creek No. 1 UG Mine[337]	Blue Creek Mining, LLC	946,000 Tons	Power Generation and Export
Bituminous	Pocahontas Tug River Coal Field	Mercer	Mine No. 1[338]	Onyx Energy, LLC	340,000 Tons	Power Generation and Export
Bituminous	Winding Gulf	Wyoming	Lower War Eagle[339]	Greenbrier Minerals, LLC	503,000 Tons	Power Generation and Export
Bituminous	Kanawha Coal Field	Kanawha	Witcher Creek Surface Mine[340]	Investment Management Group, LLC	276,000 Tons	Power Generation and Export

[334] Ibid.; Department of Labor, Mine Data Retrieval System, Ranger No. 1 Mine, Wyoming County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[335] Ibid.; Department of Labor, Mine Data Retrieval System, Winchester Peerless Rachel Mine, Boone County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[336] Ibid.; Department of Labor, Mine Data Retrieval System, Mine No. 39, McDowell County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[337] Ibid.; Department of Labor, Mine Data Retrieval System, Blue Creek No. 1 UG Mine, Kanawha County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[338] Ibid.; Department of Labor, Mine Data Retrieval System, Mine No. 1, Mercer County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[339] Ibid.; Department of Labor, Mine Data Retrieval System, Lower War Eagle Mine, Wyoming County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[340] Ibid.; Department of Labor, Mine Data Retrieval System, Witcher Creek Surface Mine, Kanawha County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

Bituminous	Logan Coal Field	Logan	Cedar Grove #2 Mine[341]	Aracoma Coal Company, LLC	444,000 Tons	Power Generation and Export
Bituminous	Pocahontas Tug River Coal Field	McDowell	SHM #67[342]	Onyx Energy, LLC	169,000 Tons	Power Generation and Export
Bituminous	Winding Gulf	Wyoming	Glancy Surface Mine[343]	Rockwell Mining, LLC	806,000 Tons	Power Generation and Export
Bituminous	Pocahontas Tug River Coal Field	McDowell	Dry Branch Surface Mine[344]	Extra Energy, Inc.	564,000 Tons	Power Generation and Export
Bituminous	Winding Gulf	Wyoming	Eagle #3 Mine[345]	Rockwell Mining, LLC	292,000 Tons	Power Generation and Export
Bituminous	Winding Gulf	Wyoming	Flying Eagle[346]	Rockwell Mining, LLC	289,000 Tons	Power Generation and Export
Bituminous	Greenbrier	Greenbrier	Blue Knob Surface Mine[347]	South Fork Coal Co., LLC	160,000 Tons	Power Generation and Export

[341] Ibid.; Department of Labor, Mine Data Retrieval System, Cedar Grove #2 Mine, Logan County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[342] Ibid.; Department of Labor, Mine Data Retrieval System, SHM #67, McDowell County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[343] Ibid.; Department of Labor, Mine Data Retrieval System, Glancey Surface Mine, Wyoming County WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[344] Ibid.; Department of Labor, Mine Data Retrieval System, Dry Branch Surface Mine, McDowell County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[345] Ibid.; Department of Labor, Mine Data Retrieval System, Eagle #3 Mine, Wyoming County WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[346] Ibid.; Department of Labor, Mine Data Retrieval System, Flying Eagle, Wyoming County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[347] Ibid.; Department of Labor, Mine Data Retrieval System, Blue Knob Surface Mine, Greenbrier County WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

Bituminous	Logan Coal Field	Logan	Eagle Seem Deep Mine[348]	Ramaco Resources, LLC	488,000 Tons	Power Generation and Export
Bituminous	Pocahontas Tug River Coal Field	McDowell	Mine No. 43[349]	XMV, Inc.	330,000 Tons	Power Generation and Export
Bituminous	Winding Gulf	Wyoming	Road Fork #52 Mine[350]	Spartan Mining Company, LLC	366,000 Tons	Power Generation and Export
Bituminous	Pocahontas Tug River Coal Field	McDowell	Berwind Deep Mine[351]	Ramaco Resources, LLC	147,000 Tons	Power Generation and Export
Bituminous	Logan Coal Field	Logan	Ram Surface Mine No. 1[352]	Ramaco Resources, LLC	152,000 Tons	Power Generation and Export
Bituminous	Logan Coal Field	Logan	No. 2 Gas[353]	Ramaco Resources, LLC	323,000 Tons	Power Generation and Export
Bituminous	Williamson Coal Field	Mingo	CAM Highwall Miner[354]	Appalachian Resources West Virginia, LLC	118,000 Tons	Power Generation and Export

[348] Ibid.; Department of Labor, Mine Data Retrieval System, Eagle Seem Deep Mine, Logan County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[349] Ibid.; Department of Labor, Mine Data Retrieval System, Mine No. 43, McDowell County WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[350] Ibid.; Department of Labor, Mine Data Retrieval System, Road Fork #52 Mine, Wyoming County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[351] Ibid.; Department of Labor, Mine Data Retrieval System, Berwind Deep Mine, McDowell County WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[352] Ibid.; Department of Labor, Mine Data Retrieval System, Ram Surface Mine No. 1, Logan County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[353] Ibid.; Department of Labor, Mine Data Retrieval System, No. 2 Gas, Logan County WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[354] Ibid.; Department of Labor, Mine Data Retrieval System, CAM Highwall Miner, Mingo County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

Bituminous	Winding Gulf	Raleigh	Black Eagle[355]	Marfork Coal Company, LLC	264,000 Tons	Power Generation and Export
Bituminous	Logan Coal Field	Logan	Eagle No 1[356] Mine	Greenbrier Minerals, LLC	539,000 Tons	Power Generation and Export
Bituminous	Logan Coal Field	Logan	Lynn Branch No. 2 Mine[357]	Aracoma Coal Company, LLC	122,000 Tons	Power Generation and Export
Bituminous	Kanawha Coal Field	Boone	Coal Branch No. 1 Mine[358]	Rockwell Mining, LLC	191,000 Tons	Power Generation and Export

KENTUCKY

Coal Rank	*Filed/ Region*	*County*	*Mine*	*Ownership*	*Yearly Production Estimate*	*Main Use*
Bituminous	Western	Union	River View Mine[359]	River View Coal, LLC	2.5 Million Tons	Power Generation
Bituminous	Western	Hopkins	Cardinal[360]	Warrior Coal, LLC	1.1 Million Tons	Power Generation
Bituminous	Western	Muhlenberg	Pride Mine[361]	Muhlenberg County Coal	2.1 Million Tons	Power Generation

[355] Ibid.; Department of Labor, Mine Data Retrieval System, Black Eagle, Raleigh County WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[356] Ibid.; Department of Labor, Mine Data Retrieval System, Eagle No. 1, Logan County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[357] Ibid.; Department of Labor, Mine Data Retrieval System, Lynn Branch No. 2 Mine, Logan County WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); EIA, State Profile and Energy Estimates: West Virginia, "Coal," https://www.eia.gov/state/analysis.php?sid=WV (Accessed June 16, 2021).

[358] Ibid.; Department of Labor, Mine Data Retrieval System, Coal Branch No. 1 Mine, Boone County, WV, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 11, 2021); Library of Congress, "Map showing the Fourteen Coalfields of West Virginia," 1933, https://www.loc.gov/resource/afc1999008.afc1999008_ms0008/ (Accessed June 16, 2021).

[359] Department of Labor, Mine Data Retrieval System, River View Mine, Union County, KY, MSHA, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); Kentucky Energy and Environment Cabinet Department for Energy Development and Independence and the Kentucky Coal Association, "Kentucky Coal Facts, 17th Edition, 2017, http://www.kentuckycoal.org/wp-content/uploads/2018/07/ky-coal-facts-2017.pdf (Accessed June 8, 2021)., 16, 41.

[360] Ibid., 16; Department of Labor, Mine Data Retrieval System, Cardinal Mine, Hopkins County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021).

[361] Ibid., 16, 41; Department of Labor, Mine Data Retrieval System, "Pride Mine, Muhlenberg County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021).

				Resources, Inc.		
Bituminous	Eastern	Pike	Job #49[362]	Virgie Clean Mining, LLC	100,000 Tons	Power Generation/ Industrial/ Coking
Bituminous	Eastern	Pike	Phoenix Mine[363]	Jet Coal Co., Inc.	125,000 Tons	Power Generation/ Industrial/ Coking
Bituminous	Eastern	Pike	Excel #5[364]	Excel Energy	369,000 Tons	Power Generation/ Industrial/ Coking
Bituminous	Eastern	Pike	Paw Paw 2[365]	Banner Blue Coal Company	386,000 Tons	Power Generation/ Industrial/ Coking
Bituminous	Eastern	Perry	No. 77[366]	Blue Diamond Coal Company	278,000 Tons	Power Generation/ Industrial/ Coking
Bituminous	Eastern	Perry	Bear Branch 2[367]	Blue Diamond Mining, LLC	100,000 Tons	Power Generation/ Industrial/ Coking
Bituminous	Eastern	Perry	East Mac & Nellie[368]	Pine Branch Mining, LLC	937,000 Tons	Power Generation/
						Industrial/ Coking

[362] Department of Labor, Mine Data Retrieval System, Job #49, Pike County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); Kentucky Energy Cabinet and Kentucky Coal Association, "Kentucky Coal Facts," , http://www.kentuckycoal.org/wp-content/uploads/2018/07/ky-coal-facts-2017.pdf (Accessed June 8, 2021)., 16, 41.

[363] Ibid., 16, 41; Department of Labor, Mine Data Retrieval System, "Phoenix Mine, Pike County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021).

[364] Department of Labor, Mine Data Retrieval System, Excel #5, Pike County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); Kentucky Energy Cabinet and Kentucky Coal Association, "Kentucky Coal Facts," , http://www.kentuckycoal.org/wp-content/uploads/2018/07/ky-coal-facts-2017.pdf (Accessed June 8, 2021)., 16, 41.

[365] Ibid., 16, 41; Department of Labor, Mine Data Retrieval System, Paw Paw, Pike County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021).

[366] Department of Labor, Mine Data Retrieval System, No. 77, Perry County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); Kentucky Energy Cabinet and Kentucky Coal Association, "Kentucky Coal Facts," , http://www.kentuckycoal.org/wp-content/uploads/2018/07/ky-coal-facts-2017.pdf (Accessed June 8, 2021)., 16, 41.

[367] Ibid., 16, 41; Department of Labor, Mine Data Retrieval System, Bear Branch 2, Perry County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021).

[368] Department of Labor, Mine Data Retrieval System, East Mac & Nellie, Perry County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); Kentucky Energy Cabinet and Kentucky Coal Association, "Kentucky Coal Facts," , http://www.kentuckycoal.org/wp-content/uploads/2018/07/ky-coal-facts-2017.pdf (Accessed June 8, 2021)., 16, 41.

Bituminous	Eastern	Perry	Orchard Branch Mine No. 89[369]	Blue Diamond Coal Company	340,000 Tons	Power Generation/ Industrial/ Coking
Bituminous	Eastern	Harlan	D-29 Darby Fork[370]	INMET Mining, LLC	178,000 Tons	Power Generation/ Industrial/ Coking
Bituminous	Eastern	Harlan	Putney Darby Mine #1[371]	JRL Coal Inc.	256,000 Tons	Power Generation/ Industrial/ Coking
Bituminous	Eastern	Harlan	Magnum #1[372]	JRL Coal Inc.	246,000	Power Generation/ Industrial/ Coking
Bituminous	Eastern	Bell	Four Mile [373]	Nally & Hamilton Enterprises, Inc.	152,000 Tons	Power Generation/ Industrial/ Coking
Bituminous	Eastern	Leslie	Cavalry No. 81[374]	Blue Diamond Coal Co.	305,000 Tons	Power Generation/ Industrial/ Coking
Bituminous	Eastern	Knott	Highwall Miner #12[375]	Bundy Auger Mining, Inc.	194,000 Tons	Power Generation/ Industrial/ Coking
Bituminous	Eastern	Knott	Alum Cave #17[376]	B&W Resources, Inc.	307,000 Tons	Power Generation/ Industrial/ Coking

[369] Ibid., 16, 41; Department of Labor, Mine Data Retrieval System, Orchard Branch Mine No. 89, Perry County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021).

[370] Department of Labor, Mine Data Retrieval System, "D-29 Darby Fork, Harlan County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); Kentucky Energy Cabinet and Kentucky Coal Association, "Kentucky Coal Facts," , http://www.kentuckycoal.org/wp-content/uploads/2018/07/ky-coal-facts-2017.pdf (Accessed June 8, 2021)., 16, 41.

[371] Ibid., 16, 41; Department of Labor, Mine Data Retrieval System, Putney Darby Mine #1, Harlan County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021).

[372] Department of Labor, Mine Data Retrieval System, Magnum #1, Harlan County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); Kentucky Energy Cabinet and Kentucky Coal Association, "Kentucky Coal Facts," , http://www.kentuckycoal.org/wp-content/uploads/2018/07/ky-coal-facts-2017.pdf (Accessed June 8, 2021)., 16, 41.

[373] Department of Labor, Mine Data Retrieval System, Four Mile Mine, Bell County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); Kentucky Energy Cabinet and Kentucky Coal Association, "Kentucky Coal Facts," , http://www.kentuckycoal.org/wp-content/uploads/2018/07/ky-coal-facts-2017.pdf (Accessed June 8, 2021)., 16, 41.

[374] Ibid., 16, 41; Department of Labor, Mine Data Retrieval System, "Cavalry No. 81, Leslie County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021).

[375] Department of Labor, Mine Data Retrieval System, Highwall Miner #12, Knott County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021); Kentucky Energy Cabinet and Kentucky Coal Association, "Kentucky Coal Facts," , http://www.kentuckycoal.org/wp-content/uploads/2018/07/ky-coal-facts-2017.pdf (Accessed June 8, 2021)., 16, 41.

[376] Ibid., 16, 41; Department of Labor, Mine Data Retrieval System, Alum Cave #17, Knott County, KY, https://www.msha.gov/mine-data-retrieval-system (Accessed June 8, 2021).

REGIONAL RESOURCES FOR COAL-TO-PRODUCTS ADVANCEMENT

This section documents available resources in the project region for coal-to-products initiative support. This include major research institutions, advanced manufacturing initiatives and Department of Energy laboratories in the region. These entities could serve as potential partners for research and development, help launch a coal-to-products industry, and attract investment.

RESOURCE AVAILABLE IN COLORADO

Research Institutions

Colorado School of Mines, Mining Engineering Program, Golden, CO

Website: https://mining.mines.edu

This program is ranked as the number one mining school in the world. It focuses on mining, tunneling, underground construction, and responsible use of natural resources. This program is also interdisciplinary and fosters collaboration with other mining schools, government agencies and industry. The program offers undergraduate and graduate degrees in mining engineering. It also has an experimental mine, mineral processing lab, and other facilities that facilitate mining research innovation.[377]

DOE National Laboratories

National Renewable Energy Laboratory (NREL), Golden, CO

Website: https://www.nrel.gov

NREL supports programs that advance the science and engineering of energy efficiency, sustainable transportation, and renewable power technologies. This also includes energy storage and battery technologies, as well as material science technologies that involve energy retention, transmission, and capture.[378]

Advanced Manufacturing Resources

Colorado Advanced Manufacturing Association (CAMA)

Website: https://coloradomanufacturing.org

CAMA is a statewide member-based trade association that connects members with each other and new business opportunities in advanced manufacturing. They do this through experiential events and seminars. CAMA puts members in touch with resources in Colorado that support advanced manufacturing and private industry, which could invest in ideas.[379]

RESOURCES AVAILABLE IN UTAH

Research Institutions

University of Utah, Industrial Combustion and Gasification Research Facility, Salt Lake City, UT

Website: https://www.icgrf.utah.edu

[377] Colorado School of Mines, Mining Engineering Department, https://mining.mines.edu/ (Accessed June 18, 2021).

[378] U.S. Department of Energy, "Mission and Programs, NREL Website, https://www.nrel.gov/about/mission-programs.html (Accessed June 22, 2021).

[379] Colorado Advanced Manufacturing Association, "The Association," https://coloradomanufacturing.org/about/ (Accessed June 23, 2021).

The Gasification Research Facility supports energy related research in partnership with government agencies, national labs, other universities, and private industry. Among their areas of focus are coal combustion and coal material technologies. This includes active work with the Department of Energy to study transforming coal pitch into carbon fiber.[380]

Advanced Manufacturing Resources

Utah Industry Alliance, Salt Lake City, UT

Website: https://utahira.org

The Utah Industry Alliance provides services and outreach to all of Utah's counties with special focus directed towards the manufacturing industry and rural businesses. This organization helps manufacturers improve operation efficiencies, supply chain optimization, quality systems, and certifications. It also helps companies grow through the adoption of new technologies, workforce development, strategic planning, and expanded markets.[381]

IACMI

Website: https://iacmi.org/

The Institute for Advanced Composites Manufacturing Innovation (IACMI) is a membership-based organization that is partnership of industry, academic, and governmental entities. These members collaborate to make low-cost, energy efficient composite materials ready for commercial marketing.[382]

5 General Innovation

COMPETITIVE ADVANTAGE: AGNC REGION

MOFFAT COUNTY

The loss of the coal industry is problematic for Moffat County, but it also creates opportunities to utilize existing local labor and infrastructure. Below are resources and opportunities that Moffat County can capitalize on as they transition from traditional coal production:

SPECIALIZED LABOR FORCE: Although many of the coal miners are set to retire in the next 10 years, many will still need employment. The coal mining and power generation labor force in Moffat County consists of individuals who have an assortment of valuable skills. These include equipment operation, maintenance, and repair, problem solving, system evaluation, mechanical skills, and physical labor. The coal mining skillset is transferable to several other industries such as advanced manufacturing, alternative energy production (solar and wind), natural gas extraction and power, and coal-carbon materials manufacturing.

POWERPLANTS: As both the Craig and Hayden stations are set to retire in the next 16 years, these coal-fired power plants will be empty and unused. There is

[380] University of Utah, "Research Areas," Industrial Combustion and Gasification Research Facility, https://www.icgrf.utah.edu/research/areas (Accessed June 23, 2021); The University of Utah, "Eddings Gets $1.9M Grant, January 30, 2020, The University of Utah Engineering, https://www.coe.utah.edu/2020/01/30/eddings-gets-1-9m-grant/ (Accessed June 23, 2021).

[381] Utah Industry Resource Alliance, "Helping Utah Manufacturers Grow and Thrive," https://utahira.org/ (Accessed June 23, 2021).

[382] IACMI, "About Us," https://iacmi.org/our-story/ (Accessed March 1, 2022).

an opportunity to utilize components of these plants and the buildings themselves. Specifically, these plants can be used as coal innovation sites, where coal to product manufacturing can take place. The coal plants could also be repurposed as natural gas power plants, as the proper infrastructure is in place. Furthermore, these facilities could be used as test bed sites for emerging renewable energy testing on the power grid.

OUTDOOR RECREATION: Outdoor recreation, including hunting, fishing, mountain biking, kayaking, and other activities, brings both direct and indirect economic impacts that can benefit the county currently and in the future. The Bureau of Economic Analysis states that the outdoor recreation economy accounted for 2.1% (or $459.8 billion) of 2019 GDP (BEA.gov). Colorado's percentage of GDP from outdoor recreation is estimated at 3.1%.[383] This contribution of outdoor recreation as measured by the BEA includes tourism, as well as the manufacturing and service sector as they relate to outdoor recreation. Both the attraction of tourism, as well as the attraction of outdoor recreation industry (such as manufacturing outdoor recreation goods) are viable alternatives for Moffat County.

The direct impacts of tourism are obvious and like that of other tourism-based economies. Outdoor recreation tourism creates jobs in retail, hotel and accommodations, restaurants, and other industries. The indirect impacts include things like awareness of the beauty of Moffat County. A first visit to the area may start as a hunting trip but may result in a business relocation, a business opportunity, increased migration for retirees or open space lovers, and other opportunities that only visiting an area can begin to develop. Having a strong outdoor recreation tourism economy also increases the possibility of recruiting outdoor recreation manufacturing or service.

ALTERNATIVE ENERGY

SMALL-SCALE NUCLEAR: TerraPower recently announced its plan to build its Natrium reactor at a coal mine set for retirement in Kemmerer, Wyoming. The small nuclear power plant will generate 345 MW of power, which would provide enough power for 250,000 homes, with enough capacity to produce 500 MW of power during peak demand. TerraPower says that they will employ approximately 2,000 workers during the construction phase of the project, with 250 people working at the plant during the operational phase. Based on previous research, 250 jobs in nuclear energy would create an additional 165 jobs in the local community, for a total of 415 jobs. The jobs created from a nuclear power plant range from skilled trades (welder, electricians, sheet metal workers) to professional jobs (accountants, lawyers), to nuclear specific jobs (nuclear engineer, civil engineer, scientists, chemists). In general, nuclear worker salaries are 50% higher on average than other electricity generation sources. In the context of northwestern Colorado, this is significant because coal-fired power plant jobs already pay above average and nuclear

[383] Note that the BEA does not estimate outdoor recreation contribution at the county level currently.

jobs would likely pay more. Additionally, with locally available energy infrastructure, adequate water from the Yampa River, and uranium mining potential in the region, Craig Station has potential to support small-scale nuclear power generation.[384]

SOLAR POWER GENERATION: The existing power infrastructure and the political climate make solar a viable option for NW Colorado. The National Renewable Energy Lab (NREL) annual average daily solar irradiance maps show that Moffat and Rio Blanco average 4.75 to 5.00 kWh/m2/day, which is in the middle of the scale. However, Tri-State Generation and Transmission Association have contracted to build a 145 MW solar facility set in between Meeker and Craig. Economic impact modeling performed by Perry (2020) show a few scenarios for solar employment within the region. Scenario one uses a regression approach based on previous literature suggests that a 145 MW solar plant will create 192.38 jobs during the construction phase and 6.67 jobs during operation on a yearly basis thereafter. The second modeling technique was using the economic impact software IMPLAN in conjunction with the NREL's Jedi estimates for solar. This model predicts that a 145 MW solar plant would create 163.98 direct jobs during construction and 263.84 jobs post-construction (considering indirect and induced effects). The operations and maintenance phases of the solar plant itself would create 6.72 direct jobs and 11.53 jobs on a yearly basis thereafter. Non-employment impacts include revenue that municipalities could create by selling their solar power to the grid, which could help offset the loss of ad valorem tax revenue as coal production is reduced.[385]

Table 64 illustrates IMPLAN modeling for 3 different sizes of solar plants, and shows their estimated employment, labor income, regional GDP, and total output estimates. This table is broken down by the construction phase and the operations and maintenance phase. Table 65 shows employment estimates for each nameplate size for both the statistical approach and the IMPLAN approach. In addition to the economic impacts of solar in tables 64 and 65, there are non-employment impacts, which include the revenue that municipalities could create by selling their solar power to the grid, which could help offset the loss of ad valorem tax revenue.

SOLAR PANEL/WIND TURBINE MANUFACTURE: With Colorado's recent focus on clean energy, and with the national landscape about to undergo the same clean energy focus, solar and wind manufacturing is a growth industry. Moffat County coal miners have a transferable skill set that

[384] https://www.energy.gov/ne/articles/next-gen-nuclear-plant-and-jobs-are-coming-wyoming#:~:text=TerraPower%20will%20build%20its%20Natrium,retiring%20coal%20plant%20in%20Wyoming.&text=The%20Natrium%20project%20will%20create,once%20the%20plant%20is%20online ; https://www.usatoday.com/story/news/nation/2021/11/16/warren-buffett-bill-gates-build-nuclear-power-plant-wyoming/8634699002/ ; www.nei.org/advantages/jobs#:~:text=The%20nuclear%20energy%20industry%20is,when%20you%20include%20secondary%20jobs.

[385] https://www.nrel.gov/gis/assets/images/solar-annual-ghi-2018-usa-scale-01.jpg ; https://www.craigdailypress.com/news/tri-state-to-invest-in-solar-wind-with-next-northwest-colorado-projects/ ; https://www.craigdailypress.com/news/tri-state-to-invest-in-solar-wind-with-next-northwest-colorado-projects/ ; Perry, N. (2020). "Economic transition in Northwest Colorado: The Economic Contribution of Coal Power and Coal Mining and the Economic Impact of Solar Power and Natural Gas Power." Prepared for and funded by the Unconventional Energy Center at Colorado Mesa University, https://www.coloradomesa.edu/energy/documents/economic-impact-of-coal-solar-gas-nw-co.pdf (Accessed January 26, 2022).

	Nameplate Size	Employment	Labor Income	Regional GDP	Output
Construction	145 MW	263.84	$19,278,482	$28,920,444	$37,132,226
	600 MW	1,092.16	$79,792,165	$119,699,011	$153,705,389
	1200 MW	2,184.51	$159,592,870	$239,411,436	$307,437,080
O&M	145 MW	11.53	$800,927	$1,910,438	$3,702,644
	600 MW	47.79	$3,319,154	$7,912,314	$15,334,640
	1200 MW	95.61	$6,639,610	$15,826,768	$30,673,523

Table 64: Economic Contribution of Solar, IMPLAN model Produced by Perry (2020)

Model	Direct Employment	145 MW	600 MW	1200 MW
Statistical model	Construction Phase (Yearly)	192.38	514.83	940.05
	O&M Phase (Yearly)	6.67	18.55	34.21
IMPLAN model	Construction Phase (Yearly)	163.98	678.56	1,357.12
	O&M Phase (Yearly)	6.72	27.81	55.61

Table 65: Employment Estimates Produced by Perry (2020)

with some retraining could enable them to work on solar panel and wind turbine manufacture.

BROADBAND AND REMOTE WORK: Broadband internet creates several important infrastructure changes. First, it enables emergent businesses form, which are reliant on high-speed internet. Second, it allows remote workers who may have high wages to relocate to or obtain jobs from rural areas like Moffat County. And third, it makes current businesses more efficient. Also, the deployment and maintenance of the broadband infrastructure creates jobs as well.

ROUTT COUNTY

TOURISM: Routt County is anchored by Steamboat Springs, which is a high-end resort town. Steamboat Springs offers access to skiing through the Steamboat Springs

Ski Resort. This resort community not only has access to skiing, it also possesses a historic downtown and access to other outdoor recreation activities as well. There are 2,052 people employed in the arts, entertainment, and recreation sector in Routt County.

PROFESSIONAL SERVICES: Routt County's education level and contribution of professional services is significantly higher than Moffat and Rio Blanco Counties. This provides Routt County with an advantage to expand professional services throughout the western portion of the county. There are 1,433 jobs in professional and technical services in Routt County.

BROADBAND: In part because of project THOR, there is a reasonable broadband infrastructure in place that can be expanded to enhance service. This provides advantages for remote workers, technology companies, and professional services within the community, and provides opportunities for broadband expansion into the rest of the region.

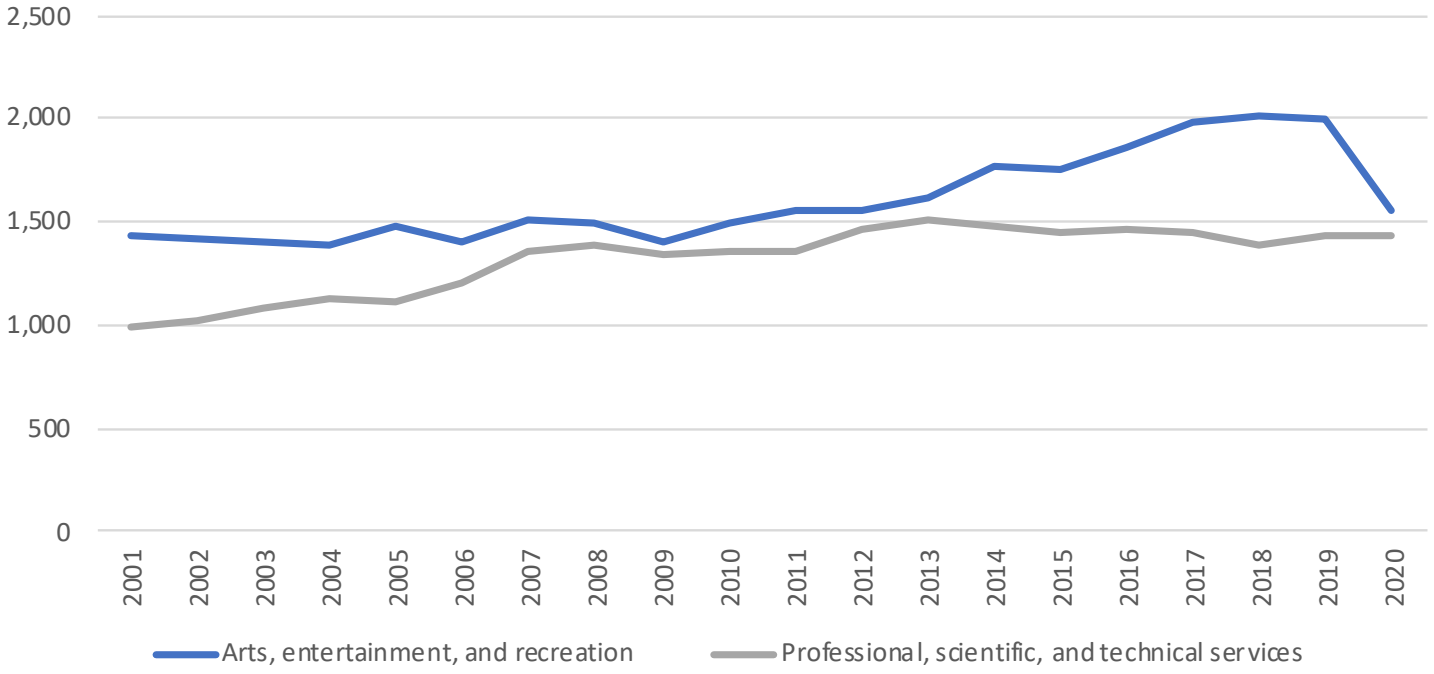

Figure 127 Arts, Entertainment and Recreation, and Professional Services Routt County
AUTHOR CALCULATED WITH IMPLAN DATA

RIO BLANCO COUNTY

Mining (Coal, Oil, and Gas): Rio Blanco shares a coal heritage with Moffat County and is home to employees in all the coal mines mentioned above. Additionally, the county is home to the Desarado Mine, which

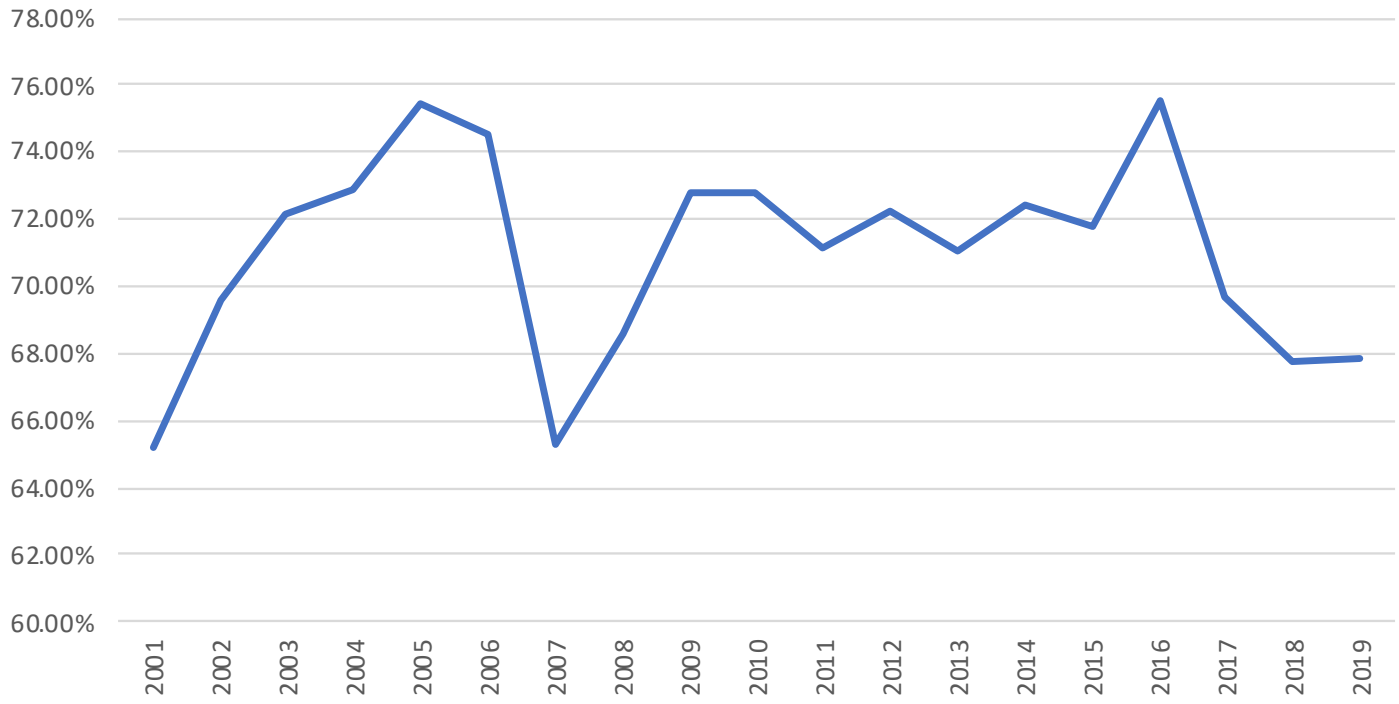

Figure 128: Oil, gas, and coal percentage of GDP Rio Blanco County
AUTHOR CALCULATED WITH DATA FROM BEA.GOV

provides high paying jobs to many of its residents. In Eastern Rio Blanco County, oil and gas is still operational. However, this will likely be at a lower output moving forward.

OUTDOOR RECREATION: Rio Blanco County has 1,514,622 acres of federally owned land, which makes up almost 74% of the total land in the County. The White River National Forest located in the county provides excellent opportunities for recreation activities, including hiking, ATV riding, camping, hunting, fishing, backpacking, horseback riding, and other activities. This brand of outdoor recreation is strengthened by the Meeker Sportsman's Club, which is a gun and archery range that contributes to Rio Blanco's role as an outdoor destination.

AIRPORT AND FLIGHT SCHOOL: The CNCC aviation program provides opportunities for students who want to enter aviation. The program and facilities provide students with a competitive advantage for aviation training and access to connections on the front range with aviation and aerospace companies.

AGRICULTURAL HERITAGE: According to the 2017 Census of Agriculture, Rio Blanco County has 320 farms and 410,923 acres of farmland for an average of 1,284 per farm. 82% percent of this land is pastureland, which supports mostly cattle. The top crops are hay, grains, oilseeds, dry beans, and dry peas. Like Moffat County, the views are picturesque and the small-town agricultural feel is attractive to those who desire a country setting. For this and other reasons, it

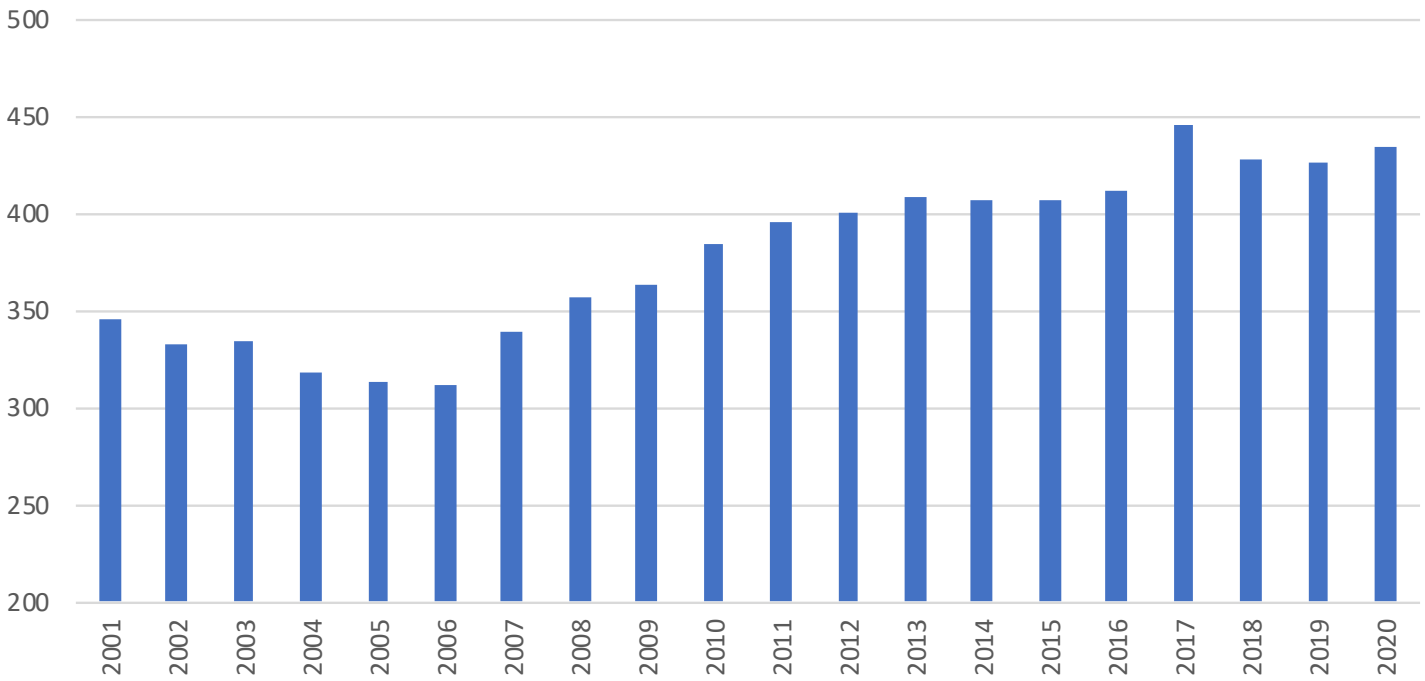

Figure 129: Agriculture Employment for Rio Blanco County
AUTHOR CALCULATED WITH IMPLAN DATA

is appealing to certain retirees and younger workers. Rio Blanco's agriculture makes up 10.5% of jobs, 1.86% of wages, and 6% of total output.

NATURAL SODA (RIO BLANCO): Natural Soda takes advantage of a very specific quarry of $NaCO_2$ in Rio Blanco County. Therefore, opportunity exists to expand the soda industry in the region beyond Natural Soda. It may also be possible to provide incentives to connect Natural Soda and other businesses by rail and encourage clustering in the region.

COMPETITIVE ADVANTAGE: EASTERN UTAH

CARBON COUNTY

Energy and Energy Infrastructure (Coal, Oil, and Gas): Carbon County is home to one active coal mine (Dugout Canyon) that is near northern Emery County's mines. Sunnyside coal power station is also located in the county. Coal power stations like this could potentially be used for coal-to-products or other advanced manufacturing facilities. Local railroad lines also exist in the county that could be used to transport manufacturing products.

UTAH STATE UNIVERSITY EASTERN: Combining the College of Eastern Utah with the resources of Utah State University created Utah State University Eastern (USUE). USUE has seen a small decline in enrollment, falling from over 2,500 students in 2010 to just under 2,000 since 2016. However, USUE, its facilities, and human capital create opportunities for the region. This includes research and development opportunities, a potential location for

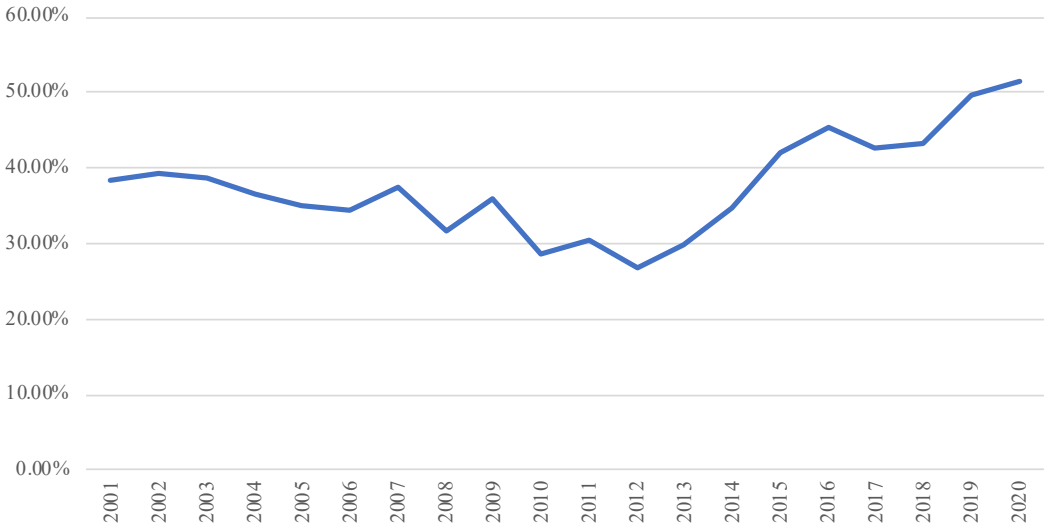

Figure 130: Oil, gas, and coal percentage of GDP Carbon County[386]

an innovation center, and workforce development/retraining programs.

TOURISM: Carbon County has potential to benefit from the outdoor recreation economy. Outdoor recreation areas include Nine Mile Canyon, Scofield State Park, Gordon Creek Falls, Buried Forest Concretions. These sites offer hiking trails, scenic byways, and OHV destinations, which attract visitors from all over the world. The county also has a unique history surrounding early Mormon settlement that attracts other visitors. The discovery of coal within the county in the 1880s adds to this heritage, providing small towns with historic resources that have tourism potential. The historic downtown of Helper, Utah is an example of how historic resources can be capitalized to support the arts and tourism. The county is also home two the Utah State University Eastern Prehistoric Museum and Helper's Mining and Railroad Museum, which attract other visitors. Tourism potential also has potential for support state support, as it is one of the four targets of the Utah Coal Country Strike Team plan put out by the governor's office.[387]

EMERY COUNTY

MINING (Coal, Oil, and Gas): Emery County shares a coal-themed heritage with Carbon County. In fact, the Carbon County was part of Emery County until 1894. Emery is home to the Hunter and Huntington coal fired power plants. Also, four active coal mines exist in the county: Lila Canyon Mine, Emery Mine, Gentry Mine, and Skyline Mine. Like Carbon County, the rail line that services the region is an excellent piece of infrastructure for the support of coal-to-products and other forms of manufacturing. Furthermore, the coal miner skillset is transferable to many forms of manufacturing, providing human resources that could be utilized for this purpose.

[386] Data from BEA.gov, author calculated.

[387] https://opportunityzones.utah.gov/wp-content/uploads/2019/12/Carbon-County-draft-12-23.pdf

SAN RAFAEL ENERGY RESEARCH CENTER: The San Rafael Energy Research Center conducts research on molten salt reactors and thorium powered nuclear energy. The research center is also home to the L-1500 gasification furnace. This unit is used to analyze the content of gasified materials and support coal-to-products research. The facility's goal is to encourage more energy diversity in the region while drawing on local resources. Therefore, San Rafael the has potential to attract further energy research and funding to the region, which could help support an innovation cluster.

TOURISM: Tourism, defined by accommodation/food services, arts, entertainment, and recreation is not a large part of Emery County's economy (approximately 1% of its GDP). However, potential exists to capitalize on outdoor recreation tourism, which is a growing industry that has support on the state level to help create tourism infrastructure.[388] Local recreational areas that have potential to expand tourism include the San Rafael Swell, Goblin Valley State Park, Little Wild Horse Canyon, the Manti-Lasal National Forest, and other areas that support outdoor recreation. Cultural and scientific attractions such as the Cleveland-Lloyd Dinosaur Quarry and the Pioneer Museum also have potential to attract visitors to the area.

REMOTE WORK: The COVID-19 pandemic has led to an expansion of remote work in the United States. This has allowed millions of Americans to migrate from urban areas to lower-cost rural areas where they can work remotely. Both Carbon and Emery Counties are close in proximity to the Provo/Salt Lake area. Therefore, the Coal County Strike Team has specifically targeted the expansion and support of a "Silicon Slopes Eastern Hub" to support a remote workforce transition to these areas.[389] Support of remote work will draw residents to the region with high-paying jobs that could help support local businesses and the economy in general.

SAN JUAN COUNTY

TOURISM: San Juan County is home to outdoor recreation, cultural, and historical tourism. Natural areas in the county such as Bears Ears National Monument, Canyonlands National Park, Natural Bridges National Monument, Hovenweep National Monument, Four Corners Monument, and Lake Powell attract visitors from all over the world. Additionally, the Navajo Nation provides tourism opportunities focused on cultural, history, outdoor recreation, and the arts. Casinos and resorts operated by Nation are other destinations that attract visitors to the county.

[388] https://opportunityzones.utah.gov/wp-content/uploads/2019/12/Carbon-County-draft-12-23.pdf

[389] https://opportunityzones.utah.gov/wp-content/uploads/2019/12/Carbon-County-draft-12-23.pdf ; https://www.emerycountychamber.com/lone-eagle-initiative.html

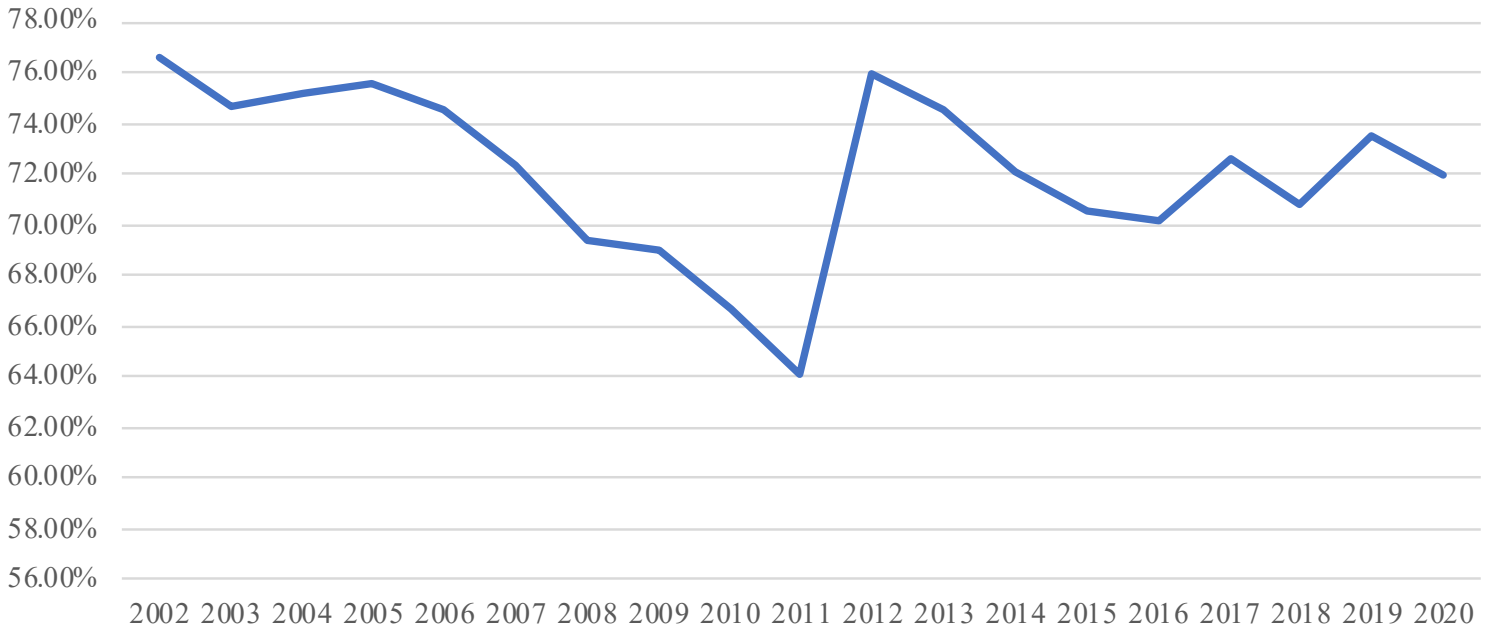

Figure 131: Oil, gas, and coal, and utilities percentage of GDP Emery County[390]

MINING AND OIL AND GAS: Uranium, Copper, and Vanadium are mined in San Juan County, making up 7.9% of the San Juan County GDP. It should be noted that mining is the largest contributor to GDP in the county.[391] Additionally, Blanding is the location one of the last uranium mills in operation in the United States. Uranium milling and mining both have potential expansion, as nuclear power gains renewed interest. Oil and gas represent 5.9% of the San Juan County economy; however, as of February 2022 there were no active rigs in the region.[392]

USUE CAMPUS IN BLANDING: Blanding has a USU statewide campus, which creates opportunities for the San Juan region. USU Blanding, facilities, and human capital create opportunities for the region. These include potential research and development programs, innovation centers, and workforce development/retraining programs.

6 Appendix

COLORADO SUPPLEMENTAL INFORMATION

POPULATION CHANGES

Although population loss can point to several factors, outmigration is a contributing factor in northwest Colorado. As can be observed in the map below (Figure 132), both Moffat and Rio Blanco Counties are forecasted to experience population declines between 2019 and 2030. It is likely that a portion of this is related to declines in the industry and the outmigration of

[390] BEA.gov

[391] Data from IMPLAN, 2019 data.

[392] Data from IMPLAN, 2019 data. Rig Count from Baker Hughes.

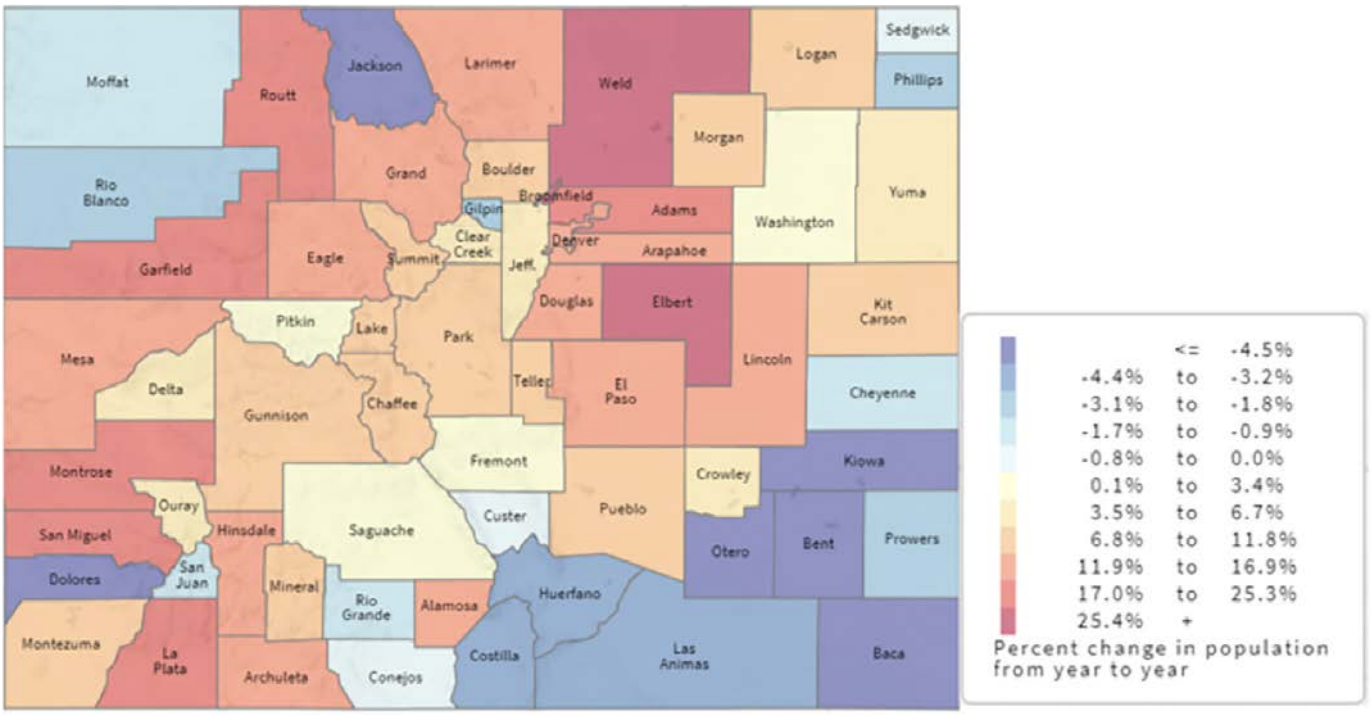

Figure 132: (Appendix) Colorado Percent Population Change 2019-2030[393]

workforce. According to this map, Moffat County will experience a population loss between .9%-1.7%, while Rio Blanco County will experience a loss between 1.8%-3.1%. Routt, on the other hand, is forecasted to experience a population increase of 17%-25.3%. As can be observed on the other two maps (Figures 133 and 134), both Moffat and Rio Blanco Counties are forecasted to experience positive birth rates when compared to death rates, yet still lose population.

EXISTING COLORADO FOSSIL FUEL REGULATORY CHALLENGES

Coal and Other Fossil Fuels

Although Colorado's renewable energy goals impact the coal industry, other important regulations impact fossil fuels in the state. Below is a list of recent important legislation that creates regulatory challenges for not only coal, but oil and gas as well:

- COLORADO RENEWABLE ENERGY GOAL: the State of Colorado has a goal to operate on 100% renewable energy by 2040. Governor Polis campaigned on this goal and Excel Energy aims to reach the same by 2050.[396] As part of this goal, Excel Energy intends to produce 80% of its energy from renewable sources by 2030.[397] This has made coal-fired power plants a target for decommissioning. It is important to note that Colorado's renewable energy mandate affects coal-fired power plants, but not coal mines directly. However, they are indirectly affected since mines like Colowyo and Trapper primarily supply coal to power stations like Craig and Hayden.

[393] Colorado Mesa University, "Mesa County Economic Update," Colorado Mesa University Business Department, First Quarter 2021., 4.

[396] https://coloradosun.com/2019/01/22/colorado-power-companies-net-zero-emissions-vs-100-percent-renewable/

[397] https://coloradosun.com/2019/05/29/guzman-tri-state-coal-plant-offer/

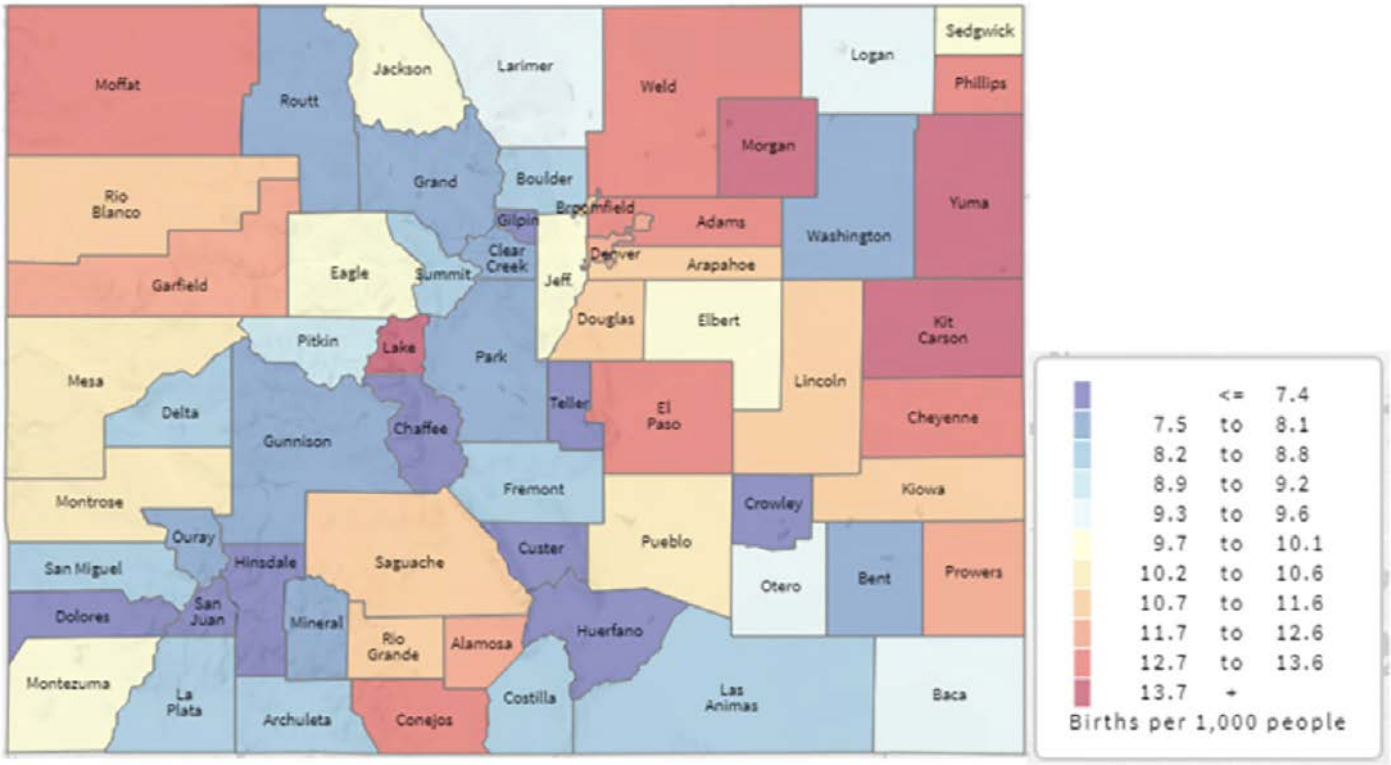

Figure 133: (Appendix) Colorado Birth Rate 2019-2030[394]

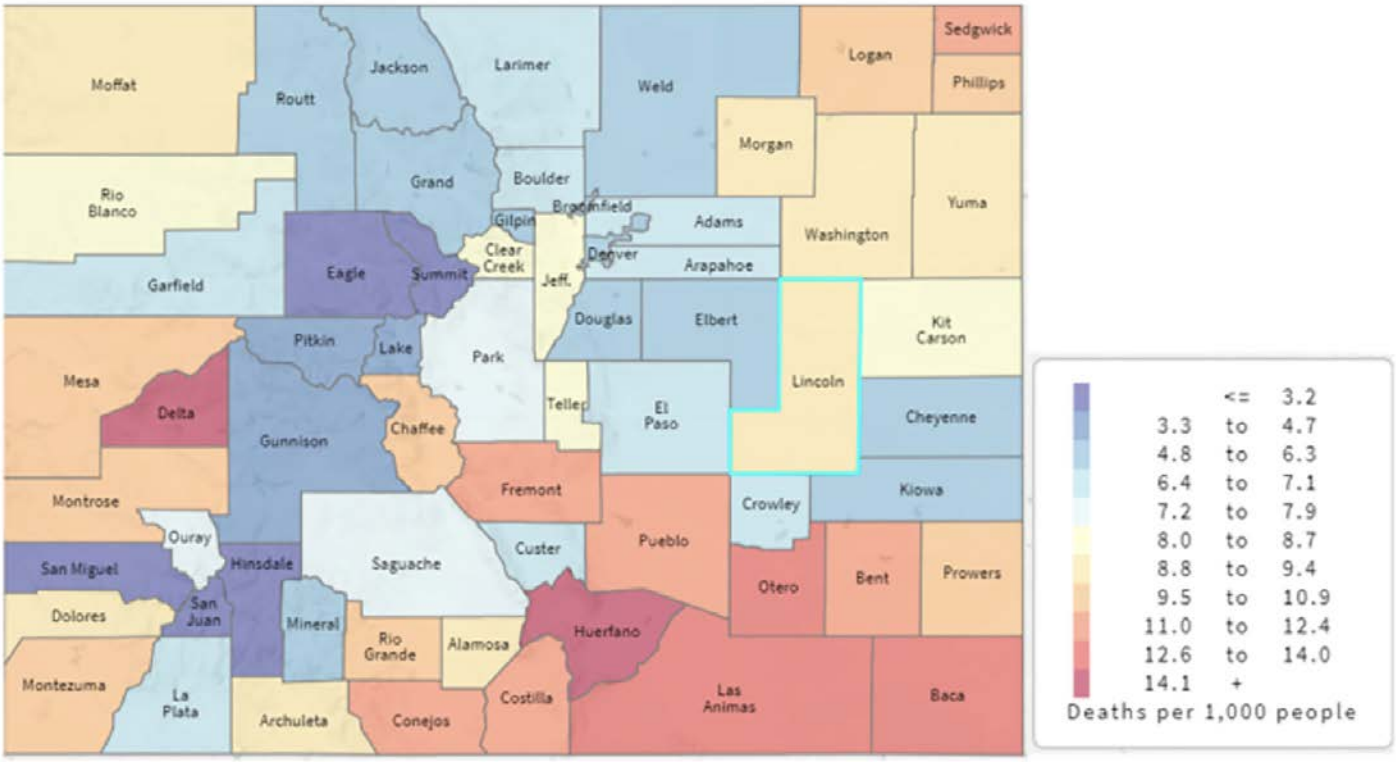

Figure 134: (Appendix) Colorado Death Rate 2019-2030[395]

[394] Ibid., 5.

[395] Ibid., 5.

- HB 19-1261: this bill aims to reduce greenhouse gas pollution by 26% by 2025, 50% by 2030, and 90% by 2050, compared to 2005 levels. [398]

- REGULATION 22: this regulation is a direct result of SB 181 and requires the emissions reporting from oil and gas operators and other greenhouse gas emitters to the state of Colorado. [399]

- REGULATION 7: this regulation requires all drilling operators monitor air quality before, during, and after drilling operations. The requirement state that air quality must be monitored starting 10 days before pre-production operations and "for at least 6 months after the well is capable of consistently producing either separable gas or salable liquid hydrocarbons." [400]

- HB 1266HB1266: this bill has several components that will affect oil, gas, and coal in the region. The first is the creation of environmental justice task force whose role is to" propose recommendations to the general assembly regarding practical means to address environmental justice inequities, particularly within disproportionately impacted communities." The bill "allows the Air Quality and Control Commission (AQCC) to adopt rules that add permit requirements for sources that affect DIC's." The bill also directs the AQCC to adopt rules that target near term reductions in greenhouse gas emissions, as well as adds permitting requirements for sources that affect disproportionately impacted communities (DIC). Specifically for oil and gas exploration, the bill "requires the AQCC to adopt rules to reduce GHG emissions from oil and gas exploration, production, processing, transmission, and storage operations by at least 36% by 2025 and 60% by 2030, relative to 2005 levels." [401]

- SB 19-236: This bill codifies Excel's 100% carbon-free by 2050 goal. This bill also requires that utilities that are retiring a power generation plant to produce a workforce transition plan for workers who lose their jobs. [402]

Oil and Gas Specific

Although the regulations above affect coal, oil, and gas, SB 181 is oil and gas specific. Therefore, it has had a big impact on the industry in the Piceance Basin. Below is a summary of SB 181:

- APPLICABILITY TO LOCAL GOVERNMENT JURISDICTION: provides local jurisdictions with the power to impose stricter regulation than those imposed by the Colorado Oil and Gas Conservation Commission (COGCC). However, local regulation is tempered with a requirement that regulations are "necessary and

[398] https://leg.colorado.gov/bills/hb19-1261

[399] https://www.sos.state.co.us/CCR/GenerateRulePdf.do?ruleVersionId=9860&fileName=5%20CCR%201001-26

[400] https://www.projectcanary.com/colorado-regulation-7-what-you-need-to-know-about-air-quality-monitoring/; https://www.sos.state.co.us/CCR/GenerateRulePdf.do?ruleVersionId=9716&fileName=5%20CCR%201001-9

[401] https://leg.colorado.gov/bills/hb21-1266 .

[402] https://www.utilitydive.com/news/colorado-gov-polis-unveils-roadmap-to-100-carbon-free-by-2040-signs-11-cl/555975/ .

reasonable." SB 181 also removes limitations on local governments to impose fees or to tax for inspection/monitoring. [403]

- COGCC MISSION RESTRUCTURING: this restructuring changed COGCC's mission from fostering oil and gas development to a regulatory agency role with authority to protect public health and the environment. To accomplish this, COGCC was restructured from the previous model of nine volunteers, seven who were unpaid with the requirement of substantial experience in the oil and gas industry. After SB-181, this consisted of seven commissioners, to of which serve as ex-officio members. These two individuals are the executive directors of the Colorado Department of Natural Resources and the Colorado Department of Public Health. The other five are appointed by the governor with only one being required to have oil and gas experience.[404]

- POOLING, DRILLING, AND OPERATING REQUIREMENTS: This portion of SB 181 alters forced pooling, which allows oil and gas drilling to take place even if some mineral owners do not consent to drilling, which increases operation costs in the process. [405]

Overcoming the Challenges

The regulatory challenges listed above are important to consider for local innovation programs involving fossil fuels. In the case of programs involving coal like coal-to-products, the main challenges will be offsetting lost revenue from powerplant closures. A coal-to-products industry with a domestic focus does not have the ability to consume the level of coal that power generation does, which will result in mine closures, making domestic investment riskier. Therefore, domestic partners like the American auto industry, RAMACO Carbon, and others will be drawn to coal producing states with coal friendly laws. This makes foreign partnerships important, as they will have other incentives that determine profitability and have the potential to consume more feedstock in their coal-to-products industries.

In addition to foreign partnerships for coal innovation, converting power infrastructure to other forms of generation should be investigated to offset policy challenges with fossil fuels. Recommended power sources include solar and small-scale nuclear.

UTAH SUPPLEMENTAL INFORMATION

POPULATION CHANGES

According to the Kem Gardner Institute, Carbon and Emery Counties are expected to grow 9.6% and 9.2% respectively from 2020 to 2060. This is much lower than high growth areas in Utah such as Washington County at 155.1% and Wasatch County at 131.9%. Carbon and Emery have a similar

[403] https://leg.colorado.gov/bills/sb19-181 ; https://www.gibsondunn.com/colorados-sweeping-oil-and-gas-law-one-year-later/ .

[404] https://www.gibsondunn.com/colorados-sweeping-oil-and-gas-law-one-year-later/

[405] https://www.kirkland.com/publications/kirkland-alert/2019/04/new-era-of-change-and-uncertainty-for-oil-and-gas

trend when the data is broken down. Each are expected to see population growth in the next decade due to in-migration. However, by the 2030s in-migration is expected to slow, and the death rate is expected to outpace the birthrate, which will slow total population growth. San Juan County is expected to grow primarily due to in-migration and have a positive natural population increase (more births than deaths) through most of the forecast.

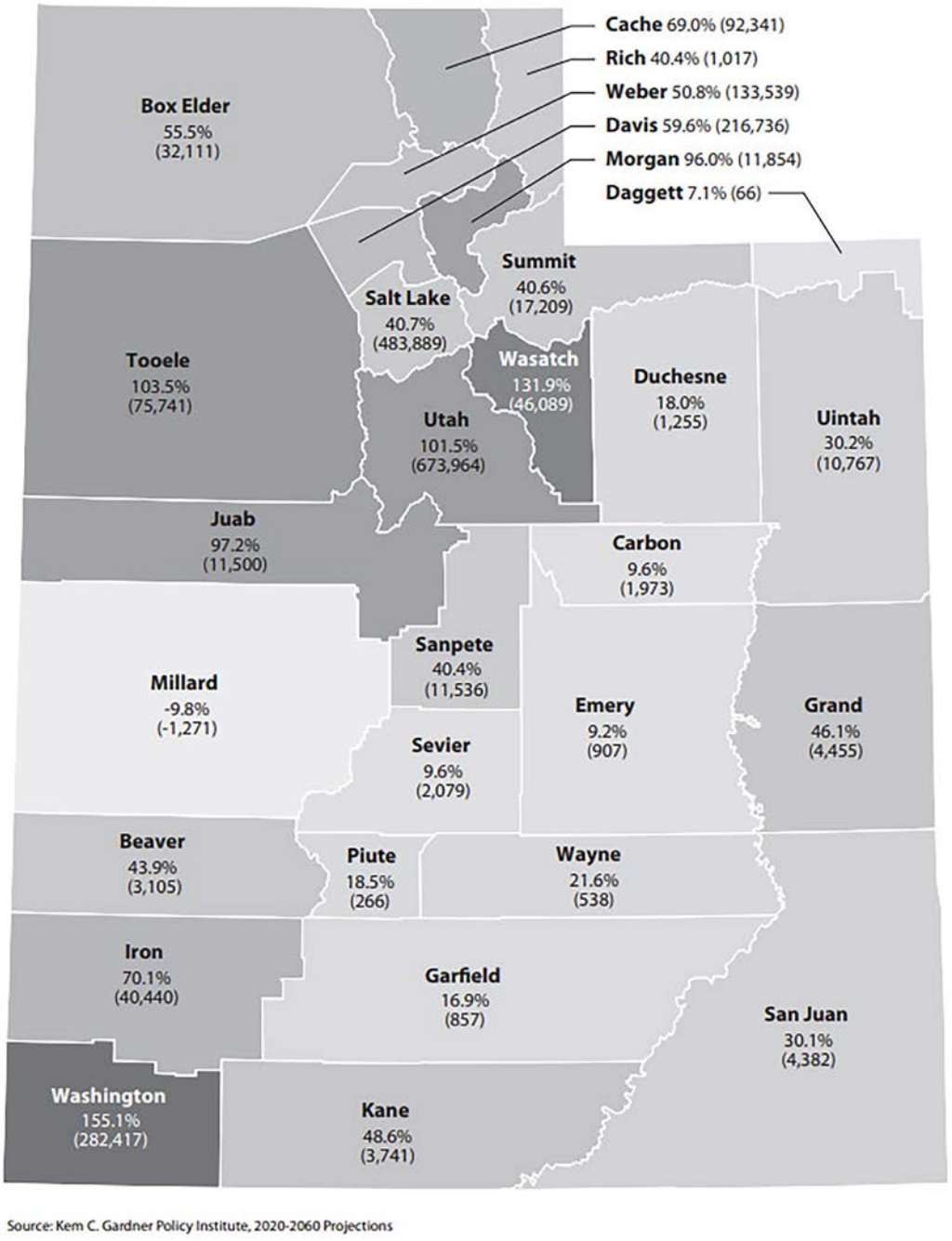

Figure 135: (Appendix) Utah Population Change Heat Map 2020-2060 from Kem Gardner Institute[406]

[406] https://gardner.utah.edu/wp-content/uploads/Carbon-Proj-Feb2022.pdf?x71849

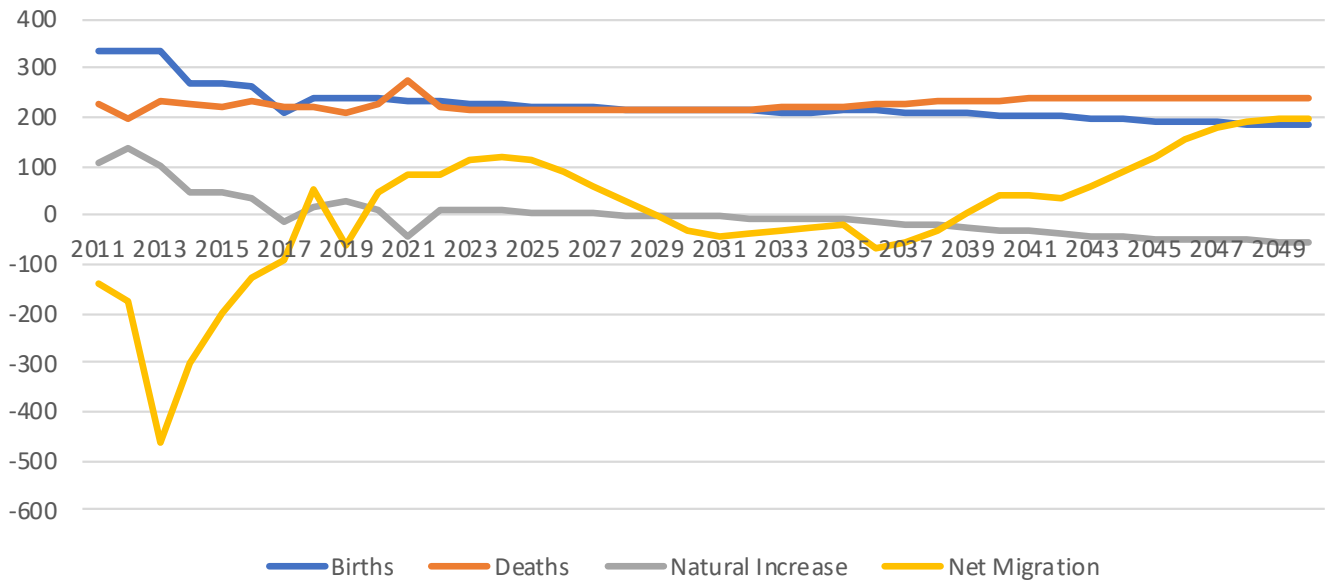

Figure 136: (Appendix) Carbon County Components of Population Forecast[407]

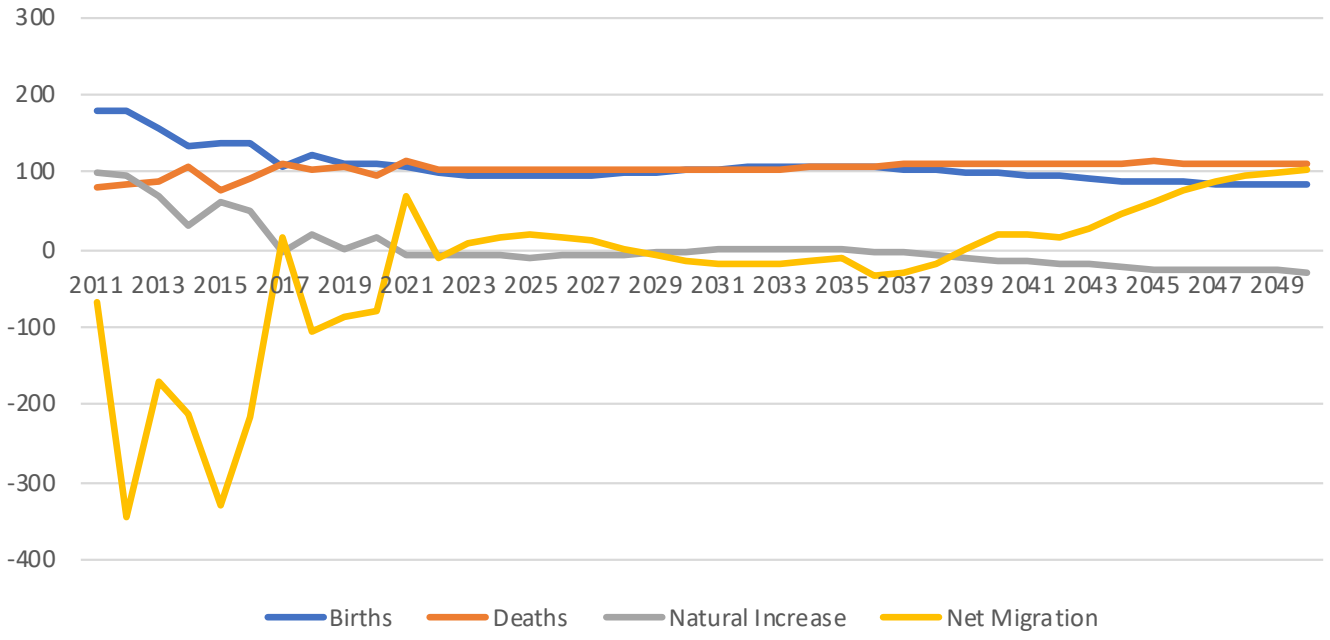

Figure 137: (Appendix) Emery County Components of Population Forecast[408]

[407] https://gardner.utah.edu/demographics/population-projections/

[408] https://gardner.utah.edu/demographics/population-projections/

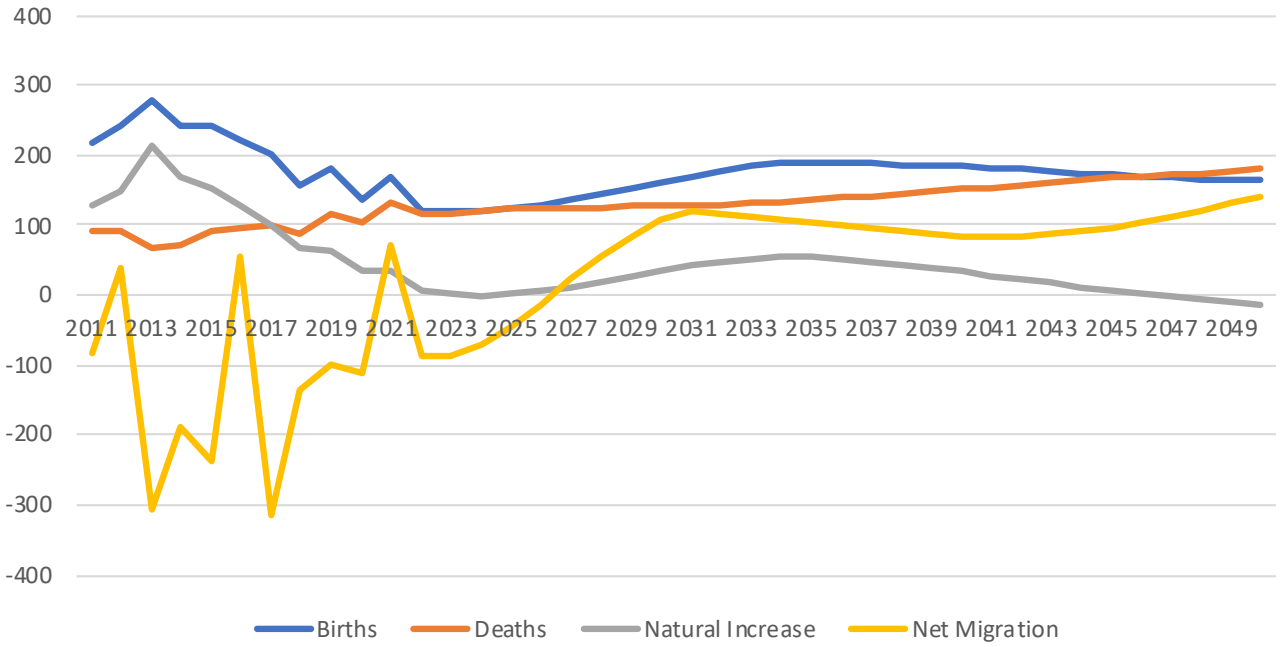

Figure 138: (Appendix) San Juan County Components of Population Forecast[409]

INNOVATION PROGRAM DATABASE

INNOVATION PROGRAM CATEGORIES

A

Accelerator
Accelerator (Industry Targeted)
Accelerator (Industry Targeted with Government Support)
Accelerator Network
Accelerator (University)

C

Community College Makerspace Network
Coworking Space
Cross Industry Analysis/Economic Planning

D

Downtown Revitalization/Economic Development

[409] https://gardner.utah.edu/demographics/population-projections/

E

Eco-Innovation District

I

Incubator
Incubator (Industry Targeted)
Incubator Network
Incubator (University)
Incubator (University: Industry Targeted)
Innovation Alliance
Innovation Campus
Innovation Center
Innovation Center (Government Affiliated)
Innovation Center (Industry Targeted)
Innovation Center (University)
Innovation Center (University: Industry Targeted)
Innovation Center Network
Innovation Center with International Partnership
Innovation Cluster (Industry Targeted)
Innovation Complex (Industry Targeted)
Innovation Consortium (Industry Targeted)
Innovation Corridor
Innovation Development Partnership
Innovation District
Innovation District (Industry Focused)
Innovation District (Mixed Use)
Innovation District (University Affiliated)
Innovation Lab
Innovation Network
Innovation Outreach
Innovation Outreach (Industry Targeted)
Innovation Park (Industry Targeted)
Innovation Park (University)
Innovation Partnership
Innovation Planning (Community)

M

Makerspace (Commercial Kitchen: Industry Targeted)
Makerspace (Community)
Makerspace (Community College)
Makerspace (Community-Large Scale)

Makerspace (Corporate Sponsored)
Makerspace (University: Industry Targeted)
Makerspace (Native American Community)
Makerspace (Prototyping Support)
Makerspace (University)
Makerspace Network
Makerspace Network (University Based)
Manufacturing Corridor
Manufacturing Initiative
Manufacturing Initiative (University Based)
Manufacturing Outreach (Industry Targeted)
Mentorship (Industry Targeted)
Mentoring and Outreach

N

Non-Profit Innovation Network/Outreach

P

Product Development (Industry Targeted)

R

Region Innovation Partnership
Research Institution Network
Rural Innovation Initiative
Rural Innovation Outreach
Rural Innovation Outreach (Industry Targeted)
Rural Innovation (University Affiliated)

S

Smart City Innovation Initiative
State Funded Technology Accelerator
Statewide Innovation Initiative (Industry Targeted)
Statewide Innovation Resource Network
Statewide Rural Innovation Initiative
Statewide University Innovation Collaborative

T

Tribal University Based Incubator

U

University Innovation Program
University Innovation Program (Industry Targeted)
University Innovation Zone

University Outreach
University Outreach (Industry Targeted)

V

Venture Fund Network
Venture Fund Source
Venture Fund Source (Industry Focused)

W

Workforce Development (Industry Targeted)

PACIFIC REGION

ALASKA

Alaska Ocean Cluster, Anchorage, AK
Website: https://www.alaskaoceancluster.com
Program Type: Industry Targeted Incubator and Innovation Outreach/Prospective Industry Targeted Innovation Center (Maritime Industry)

Alaska Startups, Center for Economic Development, UAA Business Enterprise Institute, Anchorage, AK
Website: https://www.alaskastartups.com
Program Type: University Outreach

Blue Pipeline, Seward AK
Website: https://www.alaskaoceancluster.com/engage/blue-pipeline/
Program Type: Industry Targeted Incubator (maritime industry)

Anchorage Makerspace, Anchorage, AK
Website: http://www.anchoragemakerspace.com
Program Type: Makerspace (Community)

Center for Innovation, Commercialization, and Entrepreneurship, University of Alaska Fairbanks, Fairbanks, AK
Website: https://alaska.edu/centerice/index.php
Program Type: University Outreach

Geeks Accelerator, Anchorage, AK
Website: https://geeksaccelerator.com
Program Type: Accelerator (software development/remote working)

Geeks in the Woods, Valdez, AK
Website: https://geeksinthewoods.com
Program Type: Accelerator (software development/remote working)

Innovate Alaska (2.0)
Website: https://www.innovatealaska.net
Program Type: Statewide Innovation Resource Network

Launch Alaska, Anchorage, AK
Website: http://www.launchalaska.com
Program Type: Industry Targeted Accelerator (food, water, energy, and transportation systems)

CALIFORNIA

Alchemist Accelerator, San Francisco, CA
Website: https://alchemistaccelerator.com
Program Type: Accelerator/ Coworking Space

BoostVC, San Mateo, CA
Website: https://www.boost.vc
Program Type: Accelerator (Competitive with Equity Exchange)

California Community College Maker, Rocklin, CA
Website: https://cccmaker.com
Program Type: Community College Makerspace Network

California Innovation Hub (IHubs), Statewide
Website: https://static.business.ca.gov/wp-content/uploads/2019/09/2019-iHub-Network.pdf
Program Type: Innovation Partnership

California Manufacturing Network (CMN), Torrance, CA
Website: https://www.cmtc.com
Program Type: Manufacturing Initiative

Engineering and Interdisciplinary Sciences Complex, San Diego University, San Diego, CA
Website: https://eis.sdsu.edu/index.html
Program Type: University Outreach/Innovation Center

500 Startups, San Francisco, CA
Website: https://500.co
Program Type: Incubator/Venture Fund Network

FabWorks, University of California, Irvine, CA
Website: https://manufacturing.uci.edu/index.php/fabworks-2/
Program Type: Makerspace (University)

Founders Embassy, San Francisco, CA
Website: https://www.foundersembassy.com
Program Type: Accelerator (Immigrant and International Entrepreneurs)

Hacker Lab, Sacramento, Rocklin, and Rancho Cordova, CA
Website: https://hackerlab.org/en
Program Type: Makerspace (Community) /Incubator/Co-Working Space (multiple locations)

Illumina Accelerator, Foster City, CA
Website: https://www.illumina.com/science/accelerator.html
Program Type: Accelerator (Bioscience)

Make It In LA
Website: https://makeitinla.org
Program Type: Non-Profit Innovation Network/Outreach
Level of Focus: Specialized

Mucker, Santa Monica, CA
Website: https://www.mucker.com/muckerlab-accelerator/
Program Type: Accelerator/Venture Fund Source

SF Made, San Francisco, CA
Website: https://sfmade.org
Program Type: Manufacturing Initiative

Silicon Valley Innovation Center, Mateo, CA
Website: https://svicenter.com
Program Type: Innovation Center

Startup Sandbox, Santa Cruz, CA
Website: https://www.startupsandbox.org
Program Type: Incubator (Bioscience)

SVG Ventures: Thrive, Los Gatos, CA
Website: https://thriveagrifood.com
Program Type: Accelerator (Agricultural Technology)

University Lab Partners (ULP), Irvine, CA
Website: https://www.universitylabpartners.org
Program Type: Incubator (Biomedical Wet-Lab)

Upwest Labs, Palo Alto, CA
Website: http://upwest.vc
Program Type: Venture Fund Source with a Focus on Israeli Startups

Urban Workshop, Costa Mesa, CA
Website: https://urbanworkshop.net
Program Type: Makerspace (Community-Large Scale)

Venture Catalyst Program (DRIVE), University of California, Davis, Davis, California
Website: https://research.ucdavis.edu/offices/vc/start/drive/
Program Type: Incubator (University-Research and Venture Engine)

HAWAII

FAB Lab, University of Hawaii, Honolulu, HI
Website: https://www.eng.hawaii.edu/fablab/
Program Type: Makerspace (University)

HTDC, Honolulu, HI
Website: https://www.htdc.org/programs/
Program Type: Innovation Outreach/Incubator/Manufacturing Initiative (state agency supported)

I Lab, University of Hawaii, Honolulu, HI
Website: http://ilab.hawaii.edu
Program Type: Innovation Center and Makerspace (University)

Mana Up, Honolulu, HI
Website: https://manauphawaii.com/pages/overview
Program Type: Accelerator (retail, beauty, or value-added food products)

Manoa Innovation Center, University of Hawaii, Honolulu, HI
Website: https://www.hawaii.edu/research/manoa-innovation-center/
Program: Incubator (: University-Technology)

Maui Makers, Kahului, HI
Website: https://mauimakers.com
Program: Makerspace (Community)

Oahu Makerspace, Honolulu, HI
Website: http://oahumakerspace.com
Program Type: Makerspace (Community)

XLR8UH, University of Hawaii, Honolulu, HI
Website: https://xlr8uh.com
Program Type: University-Based Accelerator

OREGON

DAMLAB Makerspace, Oregon State University, Corvallis, OR
Website: https://business.oregonstate.edu/student-experience/resources/DAMlab
Program Type: Accelerator (University)

DeArmand Makerspace, University of Oregon, Eugene, OR
Website: https://library.uoregon.edu/scilib/psc-dearmond-makerspace
Program Type: Makerspace (University)

Food Innovation Center, Oregon State University, Corvallis, OR
Website: https://fic.oregonstate.edu
Program Type: Innovation Center (University-Food Industry)

Innovate Collaborate Oregon (ICO), Oregon (Statewide)
Website: http://www.icoregon.net
Program Type: Statewide University Innovation Collaborative

Oregon Manufacturing Innovation Center R&D, Scappoose, OR
Website: https://www.omic.us
Program Type: Innovation Center (Advanced Metal Manufacturing)

Oregon State University Advantage, Corvallis, OR
Website: https://advantage.oregonstate.edu
Program Type: University Innovation Outreach/ Accelerator

Oregon Story Board, Portland, OR
Website: http://www.oregonstoryboard.org
Program Type: Incubator (Virtual Reality Technology)

PDX Hackerspace, Portland, OR
Website: https://pdxhackerspace.org/index.html
Program Type: Makerspace (Community)

RAIN Eugene, Eugene, OR
Website: http://www.raineugene.org/home/
Program Type: Accelerator and Innovation Network

Talent Maker City, Talent OR
Website: https://www.talentmakercity.org
Program Type: Makerspace (Community)

WASHINGTON

Accelerator Life Science Partners, Seattle, WA
Website: http://www.acceleratorlsp.com
Program Type: Accelerator (Life Sciences)

Area 01, University of Washington, Seattle, WA
Website: https://www.washington.edu/area01/
Program Type: Makerspace (University)

CAPRIA, Seattle, WA
Website: https://capria.vc
Program Type: Venture Fund Network

Cascadia Clean Tech Accelerators, Seattle, WA
Website: https://cascadiacleantech.org
Program Type: Accelerator (Clean Technology)

Fablab Tacoma, Tacoma, WA
Website: https://fablabtacoma.com/
Program Type: Makerspace (Community)

Fabrication Labs, Washington State University, Pullman, WA
Website: https://sdc.wsu.edu/fabrication-labs/
Program Type: Makerspace (University)

Frank Innovation Zone, Washington State University, Pullman, WA
Website: https://vcea.wsu.edu/fiz/
Program Type: Makerspace (University)

Madrona Venture Labs, Seattle, WA
Website: https://www.madronavl.com
Program Type: Incubator

Reactor, Seattle, WA
Website: http://insidereactor.com
Program Type: Accelerator (Interactive Media)

Pioneer Square Labs, Seattle, WA
Website: https://www.psl.com
Program Type: Incubator

The Collaboratory: Campus Makerspace, University of Washington, Seattle, WA
Website: https://www.uwb.edu/academic-affairs/collaboratory
Program Type: Makerspace (University)

The Mill, University of Washington, Seattle, WA
Website: https://hfs.uw.edu/The-MILL/Maker-Space-1
Program Type: Makerspace (University)

Voiland College Engineering Shops, Washington State University, Pullman, WA
Website: https://vcea.wsu.edu/2020/01/06/innovation-makers/
Program Type: Makerspace (University)

W CoMotion, University of Washington, Seattle, WA
Website: https://comotion.uw.edu
Program Type: Innovation Center/Incubator (University)

Yakima Makerspace, Yakima, WA
Website: https://www.yakimamakerspace.org
Program Type: Makerspace (Community)

ROCKY MOUNTAIN REGION

COLORADO

Atlas Institute, University of Colorado, Boulder, Boulder, CO
Website: https://www.colorado.edu/atlas/
Program Type: University Innovation Program and Makerspace (BTU Lab)

Boulder Innovation Venture Report, Boulder, CO
Website: http://boulderеconomiccouncil.org/bec_publications/boulder-innovation-venture-report/
Program Type: Cross Industry Analysis/Economic Planning

Boomtown, Boulder, CO (Affiliated with The Farm and Sports Tech in Atlanta, GA)
Website: https://boomtownaccelerators.com
Program Type: Accelerator (general, hardware, and medical technology)

Business Incubator Center, Grand Junction, CO
Website: https://gjincubator.org
Program Type: Incubator/Makerspace

Catalyst Accelerator, Colorado Springs, CO
Website: https://catalystaccelerator.space
Program Type: Accelerator (Defense and National Security) with Industry Focus. This program is supported by the United States Space Force.

Center for Entrepreneurship and Innovation, Colorado School of Mines, Golden, CO
Website: https://innovation.mines.edu
University Innovation Program (mining and individual derived technology) and Makerspace (Blaster Design Factory)

Colorado Main Street Program (an affiliate of Main Street America through DOLA)
Website: https://www.colorado.gov/pacific/dola/main-street-story
Program Type: Downtown Revitalization/Historic Preservation-Based Economic Development

Denhac, Denver, CO
Website: https://denhac.org/page/homepage
Program Type: Makerspace (Community)

Denver Design Incubator, Denver, CO
Website: https://www.denverdesignincubator.com
Program Type: Incubator/Makerspace (Apparel and Design)

Ice Lab, Gunnison, CO
Website: https://icelab.co
Program Type: Incubator/Coworking Space

Idea Forge, University of Colorado, Boulder, Boulder, CO
Website: https://www.colorado.edu/ideaforge/
Program Type: Innovation Center (University)

Innovation & Entrepreneurship Initiative, University of Colorado, Boulder, CO
Website: https://www.colorado.edu/innovate/
Program Type: University Outreach

Fort Collins Creator Hub, Fort Collins, CO
Website: https://www.fortcollinscreatorhub.org
Program Type: Makerspace (Community)

Greater Colorado Venture Fund (Statewide)
Website: https://www.greatercolorado.vc
Program Type: Venture Fund

Innovation at Colorado College, Colorado Springs Colorado (Under Construction)
Website: https://www.coloradocollege.edu/us/giving/campaign/innovation_vid.html
Program Type: Innovation Center (University)

Inworks, Colorado University, Denver/Anschutz, Denver and Aurora, CO
Website: https://inworks.ucdenver.edu/w/
Program Type: Innovation Center (University): Two Locations

LCC Innovate and Make Space, Lamar Community College, Lamar, CO
Website: https://www.lamarcc.edu/about-lcc/innovate/
Program Type: Makerspace (Community College)

Loveland Creatorspace, Loveland, CO
Website: https://lovelandcreatorspace.com
Program Type: Makerspace (Community)

Mindcraft Makerspace, Aurora, CO
Website: https://www.mindcraftmakerspace.com
Program Type: Makerspace (Community)/Education Outreach

Mergelane, Boulder, CO
Website: https://www.mergelane.com/
Program Type: Accelerator/Venture Capital Fund (woman owned companies)

Solid State Depot, Boulder, CO
Website: https://boulderhackerspace.com
Program Type: Makerspace (Community)

Tinkermill, Longmont, CO
Website: https://www.tinkermill.org
Program Type: Makerspace (Community)

Telluride Venture Accelerator, Telluride, CO
Website: https://www.tellurideva.com
Program Type: Accelerator

The Gizmo DOJO, Broomfield, CO
Website: http://thegizmodojo.com/#
Program Type: Makerspace (Community)

Uncharted, Denver, CO
Website: https://uncharted.org
Program Type: Accelerator (Social Impact)

Rocky Mountain Innovation Partners, Colorado Springs, CO
Website: http://www.rmipartners.org
Program Type: Accelerator

IDAHO

Gizmo-CDA, North Idaho College, Coeur' d' Alene', ID
Website: https://www.gizmo-cda.org
Program Type: Makerspace (Community College)

Idaho Innovation Center, Boise, ID
Website: https://innovateidaho.org
Program Type: Incubator/Accelerator/ Mentoring and Outreach

Ketchum Innovation Center, Ketchum, ID
Website: https://ketchuminnovationcenter.org
Program Type: Mentoring and Outreach

SBDC Boise and Nampa Business Accelerator, Boise, ID
Website: https://idahosbdc.org/accelerators/
Program Type: Innovation Center/Accelerator (2 locations)

University of Idaho Agribusiness Incubator, University of Idaho, Caldwell, ID
Website: https://www.uidaho.edu/cals/caldwell-research-and-extension-center/agribusiness-incubator
Program Type: Incubator (University-Agribusiness)

University of Idaho Food Technology Center, University of Idaho, Caldwell, ID
Website: https://www.uidaho.edu/cals/food-technology-center
Program Type: University Outreach (Food Industry)

MONTANA

Accelerate Montana Rural Innovation Initiative (AMRII),
University of Montana, Missoula, MT
Website: http://acceleratemontana.umt.edu
Program Type: Accelerator/Rural Innovation Initiative (University)

Bitterroot Fab Lab, Bitterroot College, Hamilton, MT
Website: https://www.umt.edu/bitterroot-college/fablab/default.php
Program Type: Community College-Based Makerspace

Blackstone Launch Pad, Montana State University, Bosman, MT
Website: https://www.montana.edu/launchpad/
Program Type: Accelerator and Innovation Outreach (University)

Bozeman Technology Incubator, Bozeman, MT
Website: https://bozeman.com
Program Type: Incubator (Technology and Manufacturing)

Innovation Campus, Montana State University, Bosman, MT
Website: http://msuinnovationcampus.com
Program Type: Innovation Park (Applied Research Laboratory)—partially constructed

Innovation Factory, University of Montana, Missoula, MT
Website: https://www.umt.edu/innovation-factory/about_us.php
Program Type: Innovation Center (University)

NEVADA

AFWERX Vegas Innovation Hub, Las Vegas, NV
Website: https://www.afwerx.af.mil/vegas-hub.html
Program Type: Industry-Targeted Innovation Center (Air Force Defense Technologies).

Innovate Las Vegas, Las Vegas, NV
Website: https://innovate.vegas
Program Type: Smart City Innovation Initiative

Nevada Innovation Center, Las Vegas, NV
Website: https://www.nevadainnovation.com
Program Type: Innovation Center with International Partnership (Israel)

The Innovation District, Las Vegas, NV
Website: https://safesmart.city/en/innovation-district-las-vegas/
Program Type: Innovation District (Smart City Technology)

Rob Roy's Innevation Center, Las Vegas, NV
Website: https://www.innevation.com
Program Type: Innovation Center

Startup NV, Las Vegas and Reno, NV
Website: https://startupnv.org
Program Type: Incubator and Venture Fund Source

University of Nevada, Reno Innevation Center, Reno, NV
Website: https://www.unr.edu/innevation
Program Type: Innovation Center (University)

UTAH

Altitude Lab, Salt Lake City Utah
Website: https://www.altitudelab.org
Program Type: Incubator/Accelerator (Life Sciences)

Atwood Innovation Plaza, Dixie State University, Saint George, UT
Website: https://innovation.dixie.edu
Program Type: Innovation Center/Makerspace/Incubator (University)

BoomStartup, Salt Lake City, UT
Website: https://boomstartup.com
Program Type: Accelerator (Technology)

Center for Medical Innovation, University of Utah, Salt Lake City, UT
Website: https://uofuhealth.utah.edu/center-for-medical-innovation/
Program Type: Innovation Center (University-Healthcare)

Fleet Block Innovation District, Salt Lake City, UT
Website: https://www.slc.gov/hand/wp-content/uploads/sites/12/2018/12/FleetBlockPresentation12Dec2018.pdf
Program Type: Innovation District

Grow Utah, Kaysville, UT
Website: http://www.growutah.com
Program Type: Accelerator

Hen House, Salt Lake City, UT
Website: https://www.hen-house.com
Program Type: Incubator

Innovation Ecosystem, University of Utah, Salt Lake City, UT
Website: https://www.utah.edu/innovate/#
Program Type: University-Based Innovation Initiative

Innovation Lab, Center for Medical Innovation, University of Utah, Salt Lake City, UT
Website: https://uofuhealth.utah.edu/center-for-medical-innovation/prototyping/
Program Type: Innovation Lab (medical technology)

Lassonde Studios, University of Utah, Salt Lake City, UT
Website: https://lassonde.utah.edu
Program Type: Innovation Center (University)

Make it Salt Lake, Salt Lake City, UT
Website: https://membership.makesaltlake.org
Program Type: Makerspace (Community)

Rural Online Initiative, Utah (Statewide)
Website: https://remoteworkcertificate.com/index
Program Type: Innovation Outreach/Workforce Development (Remote Work)

San Rafal Energy Research Center, Emery County, UT
Website: None
Program Type: Innovation Complex (Advanced Energy)

Sustainable Startups, Salt Lake City, UT
Website: http://www.sustainablestartups.org
Program Type: Incubator/Innovation Outreach

Utah Industry and Innovation Center, Salt Lake City, UT
Website: https://business.utah.gov/utah-industry-and-innovation-center/
Program Type: Statewide Innovation Initiative (Advanced manufacturing, aerospace and defense, financial services, life sciences/healthcare, software and IT)

WYOMING

Advanced Carbon Products Innovation Center, Gillette, WY
Website: Facility under construction. Link to business plan: https://www.wyoleg.gov/InterimCommittee/2018/09-20180827ACPICSummaryPresentation-JointMineralsCommittee.pdf
Program Type: Innovation Complex (coal to products focus)

Energy Innovation Center, university of Wyoming, Laramie, WY
Website: http://www.uwyo.edu/ser/building/index.html
Program Type: Innovation Center (University-Energy)

Impact 307, Casper, Laramie, and Sheridan, WY
Website: https://www.impact307.org
Program Type: Incubator and Innovation Outreach

GBeta, Cheyenne, WY
Website: https://www.gbetastartups.com/cheyenne
Program Type: Accelerator

Innovation Wyrkshop, University of Wyoming, Laramie
Website: https://www.wyrkshop.org
Program Type: Makerspace (University)

Lovell Inc. Incubator, Lovell, WY
Website: https://lovellinc.org/incubator/
Program Type: Incubator

Powell Maker Space, Powell, WY
Website: https://powellmakerspace.org
Program Type: Makerspace (Community)

Rainbow Te-ton Entrepreneur Center (RTEC), Rawlins, WY
Website: https://rawlinsmainstreet.org/business-assistance/rainbow-te-ton-entrepreneur-center/
Program Type: Incubator and Innovation Outreach

SOUTHWEST REGION

ARIZONA

Arizona Manufacturing Partnership (AMP), AZ (Statewide)
Website: http://amparizona.com
Program Type: Manufacturing Initiative

Arizona State University Entrepreneurship and Innovation, Scottsdale, AZ
Website: https://entrepreneurship.asu.edu/engage
Program Type: University Outreach

Arizona State University Chandler Innovation Center, Scottsdale, AZ
Website: https://entrepreneurship.asu.edu/asu-chandler-innovation-center-acic
Program Type: Innovation Center (University)

CEI: Center for Entrepreneurial, Innovation
Website: https://www.ceigateway.com
Program Type: Incubator (Bioscience, Medical Device, Clean Tech, and Software)

Falcon District, Mesa, AZ
Website: https://www.selectmesa.com/business-districts/falcon-district
Program Type: Innovation Cluster (Defense Contracting)

Innovation Zones at ASU, Tempe, AZ
Website: https://innovationzones.asu.edu
Program Type: University Innovation Zone

Local First Arizona Foundation
Website: https://www.localfirstazfoundation.org
Program Type: Rural Innovation Outreach

Mesa Innovation District, Mesa AZ
Website: (Program Currently Under Construction) Link to ASU @ Mesa City Center, a vital component of the district: https://azbigmedia.com/real-estate/commercial-real-estate/construction/asu-mesa-city-center-breaks-ground/
Program Type: Innovation District

PHX Core, Phoenix, AZ
Website: http://www.phxcore.com
Program Type: Innovation District

Skysong, The ASU Scottsdale Innovation Center, Scottsdale, AZ
Website: https://www.skysong.com
Program Type: Innovation Development Partnership (University—Local Government—Private Business)

The University of Arizona Center for Innovation, Tucson, AZ
Website: https://techparks.arizona.edu/ua-center-innovation/right/ua-center-innovation-facts
Program Type: Innovation Center (University)

NEW MEXICO

Arrowhead Center, New Mexico State University, Las Cruces, NM
Website: https://arrowheadcenter.nmsu.edu
Program Type: Incubator/Accelerator/Innovation Network (University)

Innovate ABQ, Albuquerque, NM
Website: https://innovateabq.com
Program Type: Innovation District

Innovate New Mexico, STC, University of New Mexico
Website: http://www.innovatenewmexico.com
Program Type: Accelerator (Technology)/Research Institution Network

FUSE Makerspace, Central New Mexico Community College, Albuquerque, NM
Website: https://fusemakerspace.org
Program Type: Makerspace (Community College)

Make Santa Fe, Santa Fe, NM
Website: https://makesantafe.org
Program Type: Makerspace (Community)

Navajo Tech Innovation Center, Navajo Tech University, Church Rock, NM
Website: http://innovate.navajotech.edu
Program Type: Tribal University-Based Incubator and Innovation Outreach

NMSBA, Santa Fe, NM
Website: https://www.nmsbaprogram.org

Santa Fe Business Incubator, Santa Fe, NM
Website: https://sfbi.net
Program Type: Incubator
Program Type: National Laboratory Innovation Partnership

OKLAHOMA

B&K Makerspace, Tulsa, OK
Website: https://bk-makerspace.com
Program Type: Makerspace (Community)

Institute for New Venture Creation, Oklahoma State University, Stillwater, OK
Website: https://business.okstate.edu/entrepreneurship/accelerateosu/index.html
Program Type: Accelerator/Innovation Outreach (University)

I2E, Oklahoma City and Tulsa, OK
Website: https://i2e.org
Program Type: Accelerator

Oklahoma City Innovation District
Website: https://okcinnovation.com
Program Type: Innovation District

Tom Love Innovation Hub, University of Oklahoma, Oklahoma, City, OK
Website: https://www.ou.edu/innovationhub
Program Type: Innovation Center (University)

TEXAS

AFWERX Austin Innovation Hub, Austin, TX
Website: https://www.afwerx.af.mil/austin-hub.html
Program Type: Innovation Center (Air Force Defense Technology)

ATX Hackerspace, Austin, TX
Website: http://atxhs.org/wiki/Welcome_to_the_ATX_Hackerspace_Wiki
Program Type: Makerspace (Community)

Austin Innovation District, Austin, TX
Website: https://downtownaustin.com/innovationdistrict/
Program Type: Innovation District

Maker Lab, Abilene Cristian University, Abilene, TX
Website: https://makerlab.online
Program Type: Makerspace (University)

Capital Factory, Austin, TX
Website: https://www.capitalfactory.com
Program Type: Mentoring and Outreach/Co-Working

Cockrell School of Engineering Innovation Center, University of Texas, Austin, TX
Website: http://www.engr.utexas.edu/research/innovation-center
Program Type: University Outreach (Grant Making)

Dallas Innovation Alliance, Dallas, TX
Website: http://www.dallasinnovationalliance.com
Program Type: Innovation Planning (Community)

Dallas Makerspace, Dallas, TX
Website: https://dallasmakerspace.org
Program Type: Makerspace (Community)

Houston Health Ventures, Houston, TX
Website: http://www.houstonhealthventures.com/acceleration/
Program Type: Accelerator (Healthcare)

Innovation Hub, Texas Tech University, Lubbock, TX
Website: http://www.depts.ttu.edu/research/research-park/
Program Type Innovation Center (University)

Rockwell Makerspace, Rockwell, TX
Website: http://www.rockwallmakerspace.com/index.html
Program Type: Makerspace (Community)

Shell Game Changer, Houston, TX
Website: https://www.shell.com/energy-and-innovation/innovating-together/shell-gamechanger.html#vanity-aHRocHM6Ly93d3cuc2hlbGwuY29tL2dsb2JhbC9mdXR1cmUtZW5lcmd5L2lubm92YXRpb24vaW5ub3ZhdGUtd2loaC1zaGVsbC9zaGVsbC1nYW1lY2hhbmdlci50dG1s
Program Type: Accelerator (Energy Technology)

SKU (FKA Incubation Station), Austin, TX
Website: https://sku.is
Program Type: Industry Focused Accelerator (Consumer Products)

Texas Innovation Center, University of Texas at Austin, Austin, TX
Website: https://texasinnovationcenter.utexas.edu
Program Type: Innovation Center (University)

Texas Medical Center Accelerator, Houston, TX
Website: https://www.tmc.edu/innovation/innovation-programs/tmcx/
Program Type: Accelerator (Healthcare)

Texas Tech Accelerator, Lubbock, TX
Website: https://www.depts.ttu.edu/research/commercialization/innovation-resources/
Program Type: Accelerator (University)

The Founders District, Houston, TX
Website: https://www.foundersdistrict.com
Program Type: Innovation District (Mixed Use)

The Maker Barn, Magnolia, TX
Website: https://www.themakerbarn.org
Program Type: Makerspace (Community)

TXRX Labs, Houston, TX
Website: https://www.txrxlabs.org
Program Type: Makerspace (Prototyping Support)

UTD Venture Development Center, University of Texas, Dallas, TX
Website: https://centers.utdallas.edu/venture/
Program Type: University-Based Incubator

WT Enterprise Center
Website: https://wtenterprisecenter.com
Program Type: Incubator

MIDWEST REGION

ILLINOIS

CU Community Fab Lab, Urbana, IL
Website: http://cucfablab.org
Program Type: Makerspace (Community)

Discovery Partners Institute, University of Illinois, Chicago, IL
Website: https://dpi.uillinois.edu
Program Type: University Outreach

Illinois Innovation Network, Chicago, IL
Website: https://www.illinoisinnovation.com
Program Type: Innovation Network/Accelerator

Illinois Medical District, Chicago, IL
Website: http://medicaldistrict.org
Program Type: Innovation District

Peoria Innovation Alliance, Peoria, IL
Website: https://peoriainnovationalliance.org
Program Type: Innovation Alliance

Peoria Innovation District, Peoria, IL
Program Type: Innovation District
Website: https://www.peoriainnovationdistrict.com

Peoria Next Innovation Center, Bradly University, Peoria, IL
Website: https://www.bradley.edu/sites/pnic/
Initiative Type: Innovation Center/Incubator

Make-it-Here, Downers Grove, IL
Website: https://www.make-it-here.com
Program Type: Makerspace (Community)

MHub, Chicago, IL
Website: https://mhubchicago.com
Program Type: Innovation Center/Mentorship (Technology)

Polsky Center for Entrepreneurship and Innovation, University of Chicago, Chicago, IL
Website: https://polsky.uchicago.edu/programs-events/new-venture-challenge/
Program Type: University-Based Accelerator/Outreach

Pumping Station: One, Chicago, IL
Website: https://pumpingstationone.org
Program Type: Makerspace (Community)

Rockford Makerspace, Rockford, IL
Website: https://www.rockfordmakerspace.com
Program Type: Innovation Makerspace (community)

Skeleton Key Brewery Incubator
Website: https://www.skeletonkeybrewery.com/brewery-incubator/
Program Type: Incubator (Brewing)

INDIANA

Maker 13, Jeffersonville, IN
Website: https://www.maker13.com
Program Type: Makerspace (Community)

Maker Factory, South Lebanon, IN
Website: https://www.makerfactoryindy.com
Program Type: Innovation Makerspace (Community)

Northeast Indian Innovation Center, Fort Wayne, IN
Website: https://theniic.org
Program Type: Incubator/Accelerator/Innovation Outreach/Co-Working (Technology and Bioscience)

P3 Makerspace, Purdue University, Anderson, IN
Website: https://polytechnic.purdue.edu/anderson/p3-makerspace
Program Type: Makerspace (University)

Purdue Foundry, West Lafayette, IN
Website: https://purduefoundry.com
Program Type: Innovation Center (University)/ University Outreach

16 Tech, Indianapolis, IN
Website: https://www.16tech.com
Program Type: Innovation District (Science, Technology, Engineering, and Advanced Manufacturing)

Shoemaker Innovation Center, Indiana University, Bloomington, IN
Website: https://kelley.iu.edu/faculty-research/centers-institutes/entrepreneurship-innovation/cross-campus-initiatives/shoemaker-innovation-center.cshtml
Program Type: Innovation Center (University)

The Innovation Center at Columbus Regional Health, Columbus, IN
Website: https://www.crh.org/about-us/innovation
Program Type: Innovation Center (Healthcare)

3D Fabrication and Design Inquiry Labs, Indiana University, Bloomington, IN
Website: https://luddy.indiana.edu/about/facilities/makerspaces.html
Program Type: Makerspace (University): Multiple at one Institution

IOWA

Area 515 Des Moines Makerspace
Website: https://area515.org/contact/
Program Type: Makerspace (Community)

Empower Rural Iowa, Des Moines, IA
Website: https://www.iowaeconomicdevelopment.com/empowerruraliowa
Program Type: Rural Innovation Initiative

Fairfield Makerspace, Fairfiled IA
Website: https://www.fairfieldmakerspace.com
Program Type: Makerspace (Community)

Iowa State University, Pappajohn Center for Entrepreneurship, Ames, IA
Website: https://www.isupjcenter.org
Program Type: University Outreach

Iowa State University Student Innovation Center, Ames, IA
Website: https://www.sictr.iastate.edu
Program Type: Innovation Center (University)

KANSAS

Block 22, Pittsburg State University, Pittsburg, KS
Website: https://block22psu.com
Program Type: Innovation District (University Affiliated)

Fab Lab, Independence Community College, Independence, KS
Website: https://www.fablabicc.org
Program Type: Makerspace (Community College)

Great Plains Technology and Manufacturing Cluster, Manhattan, KS
Website: https://greatplainstmc.org
Program Type: Manufacturing Initiative

Innovation Campus, Wichita State University, Wichita, KS
Website: https://www.wichita.edu/about/innovation_campus/
Program Type: Innovation Campus

Kansas Polymer Research Center, Pittsburg State University, Pittsburg, KS
Website: https://www.kansaspolymer.com/index.html
Program Type: Manufacturing Initiative (University Based)

Quest Center for Entrepreneurs, Hutchison Community College, Hutchison, KS
Website: http://www1.hutchcc.edu/business-industry/quest-center/
Program Type: Rural Innovation Outreach

MICHIGAN

Ann Arbor Spark, Ann Arbor, MI
Website: https://annarborusa.org
Program Type: Incubator Network/Innovation Center (multiple)

Innovate Blue, University of Michigan, Ann Arbor, MI
Website: http://innovateblue.umich.edu
Program Type: -Incubator/Multi-Disciplinary Innovation (University)

Detroit Center for Innovation, University of Michigan, Detroit, MI
Website: https://detroitcenterforinnovation.com
Program Type: Innovation Center (University)

East Lansing Technology Innovation Center, East Lansing Mi
Website: https://www.eastlansingtic.org
Program Type: Incubator

I3 Detroit, Ferndale, MI
Website: https://www.i3detroit.org
Program Type: Makerspace (Community)

Maker Works, Ann Arbor, MI
Website: https://www.maker-works.com
Program Type: Makerspace (Community)

Michigan Manufacturing Association (MMA), Lansing, MI
Website: https://mimfg.org
Program Type: Manufacturing Initiative

Michigan State University Innovation Center, East Lansing, MI
Website: https://innovationcenter.msu.edu
Program Type: Innovation Center (University)

MSU Extension Product Center, East Lansing, MI
Website: https://www.canr.msu.edu/productcenter/
Program Type: Product Development (Agriculture, Food, Natural Resources)

SME, Southfield, MI
Website: https://www.sme.org
Program Type: Manufacturing Initiative

MINNESOTA

Iron Range Makerspace, Hibbing, MN
Website: https://www.ironrangemakerspace.com
Program Type: Makerspace (Community)

Gener8tor, Minneapolis, MN
Website: https://www.gener8tor.com/gener8tor
Program: Accelerator (Science and Technology)

Launch Minnesota, St. Paul, MN
Website: https://mn.gov/launchmn/
Program Type: State Funded Startup/Innovation Grant Source

Minnesota Initiative Foundations, (Multiple Locations)
Website: https://www.greaterminnesota.net
Program Type: Statewide Rural Innovation Initiative

MnDrive, University of Minnesota, Minneapolis, MN
Website: https://mndrive.umn.edu
Program Type: University Outreach (Robotics, Environment, and Bioscience)

MN Innovation and Commercialization Consortium (Rural-Based Innovation), Minneapolis, MN
Website: https://mntech.org/mnsbir/rural-innovation-commercialization/
Program Type: Innovation Consortium (Rural-Based Firms)

Towerside Innovation District, Minneapolis-St. Paul, MN
Website: http://towersidemsp.org
Program Type: Innovation District

White Bear Makerspace, White Bear Lake, WI
Website: https://whitebearmakerspace.com/content.aspx?page_id=0&club_id=669289
Program Type: Makerspace (Community)

MISSOURI

Cortex Innovation Community, Washington University, St. Louis, MO
Website: https://www.cortexstl.com
Program Type: Innovation District (University Affiliated)

Innovation Stockyard, St. Joseph, MO
Website: https://innovationstockyard.com
Program Type: Incubator (Animal Science)

Made in STL, St. Louis, MO
Website: https://madestl.com
Program Type: Makerspace (Community)

Missouri Enterprise, Rolla, MO
Website: https://www.missourienterprise.org
Program Type: Manufacturing Initiative

Missouri Innovation Center, Columbia, MO
Website: https://missouriinnovation.com
Program Type: Innovation Center/ Incubator (University-Life Science)

Missouri Rural Enterprise & Innovation Center (MREIC), Kirksville, MO
Website: https://www.mreic.org
Program Type: Innovation Center/Incubator

Missouri Technology Corporation (Innovation Centers)
Website: https://www.missouritechnology.com/innovation-centers
Program Type: Innovation Center Network

Roy Blunt Jordan Valley Innovation Center, Missouri State, Columbia, MO
Website: https://jvic.missouristate.edu
Program Type: Innovation Center (University)

St. Louis Makes, Valley Park, MO
Website: https://stlouismakes.org
Program Type: Innovation Manufacturing Outreach (Private Nonprofit)

UMKC Innovation Center, University of Missouri, Kansas City, Kansas City, MO
Website: https://www.kcsourcelink.com/s/umkc-innovation-center#slide-head
Program Type: Innovation Center (University)

NEBRASKA

Biotech Connector, Lincoln, NE
Website: https://innovate.unl.edu/news/biotech-connector-open-business
Program Type: Incubator (Wet-Lab/Biotech)

Nebraska Innovation Studio, University of Nebraska, Lincoln, NE
Website: https://innovationstudio.unl.edu
Program Type: Makerspace (University)

NMotion, Lincoln, NE
Website: https://www.nmotion.co
Program Type: Accelerator

The Combine, Lincoln, NE
Website: https://nebraskacombine.com
Program Type: Incubator)/Innovation Outreach (Agriculture and Food

The Startup Collaborative, Omaha, NE
Website: http://thestartupcollaborative.com/
Program Type: Accelerator

Whiteclay Makerspace, Whiteclay, NE
Website: https://whiteclayredo.com
Program Type: Makerspace (Native American Community)

NORTH DAKOTA

Meld Workshop, Fargo, ND
Website: http://www.meldworkshop.com
Program Type: Innovation Makerspace (Community)

NDSU Startup Incubator, North Dakota State University, Fargo, ND
Website: https://www.ndsuresearchpark.com/ndsu-startup-incubator/
Program Type: Incubator (University)

Tech Accelerator, University of North Dakota, Grand Forks, ND
Website: https://und.edu/research/tech-accelerator/
Program Type: Accelerator (University)

The Center for Innovation, University of North Dakota, Grand Forks, ND
Website: https://business.und.edu/about/center-for-innovation.html
Program Type; University Outreach/Technology Incubator

OHIO

Akron Makerspace, Akron, OH
Website: https://akronmakerspace.org
Program Type: Makerspace (Community)

DYI Hub, Kent State University, Kent, OH
Website: https://www.kent.edu/designinnovation/di-hub-part-kent-state-master-plan
Program Type: Innovation Center (University)

1819 Innovation Hub, University of Cincinnati, Cincinnati, OH
Website: https://uc1819.com
Program Type: Innovation Center (University)

Endeavor Center, Ohio State University, Piketon, OH
Website: https://southcenters.osu.edu/endeavor-center
Program Type: Incubator (University)

Idea Foundry, Columbus, OH
Website: https://www.unleashthemaker.com
Program Type: Makerspace (Community)/Co-Working Space/Event Center

Launchpad Incubation, The University of Toledo, Toledo, OH
Website: https://www.utoledo.edu/incubator/
Program Type: Incubator (University)

MAGNET, Akron, OH
Website: https://www.manufacturingsuccess.org
Program: Incubator/Accelerator (Manufacturing)

Ohio University Center for Entrepreneurship Innovation Center, Ohio University, Athens, OH
Website: https://www.ohio.edu/entrepreneurship/innovation-center
Program Type: Innovation Center/Incubator

The Brandery, Cincinnati, OH
Website: https://www.brandery.org/programs
Program Type: Accelerator

The Hamilton Mill Incubator, Hamilton, OH
Website: https://hamiltonmill.org
Program Type: Incubator (Green, Clean Water, Digital, and Advanced Manufacturing Technologies)

Youngstown Business Incubator, Youngstown, OH
Website: https://ybi.org
Program Type: Incubator

SOUTH DAKOTA

Ascent Innovation, Rapid City, SD
Website: https://ascent-innovation.com
Program Type: Incubator

Brookings Innovation Center, Brookings, SD
Website: http://www.rpsdstate.com/programs-and-services.html
Program Type: Innovation Center

CREATE, Aberdeen, SD
Website: https://www.createaberdeen.com
Program Type: Community Based Makerspace

MakerSpace, Sioux City, SD
Website: https://www.makerspacesiouxcity.org
Program Type: Community Makerspace

Research Park, South Dakota State University, Brookings, SD
Website: http://www.rpsdstate.com
Program Type: Accelerator/Co-Working Space/Mentorship (University)

Startup Sioux Falls/Zeal Center, Sioux Falls, SD
Website: https://www.startupsiouxfalls.com
Program: Incubator/Accelerator/Innovation Outreach

University of South Dakota Discovery District
Website: http://www.usddiscovery.com
Program Type: Innovation District (University Affiliated)

WISCONSIN

Brown County STEM Innovation Center, Green Bay, WI
Website: https://www.browncountywi.gov/community/stem-innovation/general-information/
Program Type: Innovation Center/Incubator (County Government Affiliated)

Doyonne Strategy Accelerator, Madison, WI
Website: https://doyennegroup.org/programs/retreat
Program Type: Accelerator (Women Led Businesses)

Einstein Project, Green Bay, WI
Website: https://www.einsteinproject.org
Program Type: Makerspace (Community)

FaBCAP, Milwaukee, WI
Website: https://www.fabwisconsin.com/fabcap-accelerator
Program Type: Accelerator (Food and Beverage Businesses)

Fresh Tech Innovation District, Sheboygan, WI
Website: https://freshtechinnovation.com
Program Type: Innovation District

Incubator Platteville, Platteville, WI
Website: https://www.pbii.org
Program Type: Incubator (Goods and Services)

Gener8tor, Madison and Milwaukee, WI
Website: https://www.gener8tor.com/gener8tor
Program Type: Accelerator (Science and Technology)

Janesville Innovation Center, Janesville, WI
Website: http://www.janesvilleinnovation.com/#wrapper
Program Type: Incubator (Technology and Manufacturing)

Madworks, Madison, WI
Website: http://www.madworksaccelerator.org/program-information/
Program Type: Accelerator

WARF, University of Wisconsin, Madison, WI
Website: https://www.warf.org/through-programs-and-events/for-inventors-entrepreneurs-and-researchers/accelerator-program/accelerator-program.cmsx
Program Type: Accelerator (University)

Whitewater Launch Pad, University of Wisconsin, Whitewater, WI
Website: http://www.uwwlaunchpad.org/whatis
Program Type: Accelerator (University)

White Water University Innovation Center, University of Wisconsin, Whitewater, WI
Website: https://whitewatertechpark.org/innovation-center/about
Program Type: Innovation Center/Incubator (University)

WERC Bench Labs, Milwaukee, WI
Website: https://www.m-werc.org/wercbenchlabs
Program Type: Accelerator (Energy, Power, and Controls)

WMEP Manufacturing Solutions, Madison, WI
Website: https://www.wmep.org
Program Type: Manufacturing Initiative

Scale Up Milwaukee, Milwaukee, WI
Website: https://www.scaleupmilwaukee.org/about/programs/
Program Type: Innovation Outreach and Accelerators (one high growth and the other minority focused)

Titan Accelerator, University of Wisconsin, Oshkosh, Oshkosh, WI
Website: https://uwosh.edu/cei/programs/titan-accelerator/
Program Type: Accelerator (University)

UW Makerspace, University of Wisconsin, Madison, WI
Website: https://making.engr.wisc.edu
Program Type: Makerspace (University)

SOUTHEAST REGION

ALABAMA

Design and Innovation Center, Auburn University, Auburn, AL
Website: http://www.eng.auburn.edu/makerspace/index.html
Program Type: Innovation Center (University)

Innovation Depot, Birmingham, AL
Website: https://innovationdepot.org
Program Type: Innovation Center/Co-Working Space

Invention to Innovation Center, University of Alabama, Huntsville, AL
Website: https://www.uah.edu/i2c
Program Type: Innovation Center/Incubator (University)

Make BHM, Birmingham, AL
Website: https://www.makebhm.com
Program Type: Makerspace/Coworking Space

MAST, Mobile, AL
Website: https://mastalabama.com/wpc/
Program Type: Manufacturing Corridor

Northeast Alabama Entrepreneurial Center, Anniston, AL
Website: http://www.neaes.org
Program Type: Incubator

The Edge, University of Alabama, Tuscaloosa, AL
Website: https://edge.culverhouse.ua.eduProgram
Program Type: Incubator/Accelerator (University)

The Switch, Birmingham, AL
Website: https://www.theswitchbham.com
Program Type: Innovation District

Wiregrass EDC, Enterprise, AL
Website: https://www.wiregrassedc.com/business-incubator
Program Type: Incubator (Manufacturing)

ARKANSAS

Arkansas Food Innovation Center, University of Arkansas, Fayetteville, AR
Website: https://afic.uark.edu
Program Type: Innovation Center (University-Food Processing)

Catalyst Innovation Center, State University, AR
Website: https://catalystinnovation.org
Program Type: Innovation Center (University-Bioscience, Engineering, and Technology)

Fab Lab, Fayetteville, AR
Website: https://nwafablab.com
Program Type: Makerspace (Community)

Fayetteville Innovation District, Fayetteville, AR
Website: https://www.fayetteville-ar.gov/3162/Innovation-District
Program Type: Innovation District

Lab2Launch, Little Rock, AR
Website: https://asbtdc.org/l2l-accel/
Program Type: Accelerator (Government Contracting)

Innovate Arkansas, Little Rock Arkansas
Website: http://www.innovatearkansas.org
Program Type: State Funded Technology Accelerator

The Innovation Hub, Little Rock, AR
Website: https://arhub.org
Program Type: Makerspace (Community-Under-Represented Groups)

FLORIDA

Florida Tech Research Park, Florida Tech University, Melbourne, FL
Website: https://www.fit.edu/research-park/
Program Type: Innovation District (University Affiliated)

Gainesville Innovation District, Gainesville, FL
Website: http://innovationdistrictgainesville.com
Program Type: Innovation District

Innovation Hub, Florida State University, Tallahassee, FL
Website: https://innovation.fsu.edu
Program Type: Innovation Center (University)

Maker FX Makerspace, Orlando, FL
Website: http://www.makerfx.org
Program Type: Makerspace (Community)

Miami Innovation District, Miami, FL
Website: http://innovatemiami.com
Program Type: Innovation District

The Florida Tech Corridor, Heathrow, FL
Website: https://floridahightech.com
Program Type: Innovation Corridor

UF Innovate, Gainesville, FL
Website: http://innovate.research.ufl.edu
Program Type: Incubator (University)/Outreach (biomedical and technology)

GEORGIA

Atlanta Tech Village, Atlanta, GA
Website: https://atlantatechvillage.com
Program Type: Pre-Accelerator/Co-Working Space

Engage, Atlanta, GA
Website: https://engage.vc
Program Type: Venture Fund Source

Enterprise Innovation Institute, Georgia Tech University, Atlanta, GA
Website: https://innovate.gatech.edu
Program Type: University Outreach

Georgia's Innovation Crescent, Atlanta, GA
Website: https://www.georgiainnovationcrescent.com/
Program Type: Regional Innovation Partnership

Innovation Incubator and FabLab, Georgia Southern University, Statesboro, GA
Website: https://parker.georgiasouthern.edu/big/big-programs/fablab/
Program Type: University-Based Innovation Center

Innovation District, University of Georgia, Athens, GA
Website: https://innovation.uga.edu
Program Type: Innovation District (University Affiliated)

Innovation Gateway, University of Georgia, Athens, GA
Website: https://research.uga.edu/gateway/
Program Type: University Outreach

Invention Studio, Georgia Tech University, Atlanta, GA
Website: https://inventionstudio.gatech.edu
Program Type: Makerspace (University)

Sports Tech, Comcast NBC Universal, Atlanta, GA (affiliated with Boomtown in Boulder, CO)
Website: https://www.comcastsportstech.com
Program Type: Accelerator (sports technology)

Russell Center for Innovation and Entrepreneurship (RCIE), Atlanta, GA
Website: https://rcie.org/home/
Program Type: Innovation Center

Spark Macon, Startup Space, Macon, GA
Website: https://www.sparkmacon.com
Program Type: Accelerator/Coworking Space (Minority-Focused)

Tech Alpharetta, Alpharetta, GA
Website: https://www.techalpharetta.com
Program Type: Incubator (Technology)

The Hatch, Athens, GA
Website: https://rcie.org/home/
Program Type: Makerspace (Community)

The Farm, Atlanta, GA (affiliated with Boomtown in Boulder, CO)
Website: https://thefarmatl.com
Program Type: Innovation Center/Co-Working Space/Accelerator (Corporate Sponsored)

KENTUCKY

Kentucky Association for Manufactures (KAM), Frankfort, KY
Website: https://kam.us.com
Program Type: Manufacturing Initiative

Kentucky Highlands Innovation Center, London, KY
Website: http://khic-center.com
Program Type: Accelerator/Incubator

Kentucky NSF EOSCOR, Lexington, KY
Website: http://kynsfepscor.org
Program Type: Innovation Outreach (Science, Robotics, and Technology)

KY Innovation, Lexington, KY
Website: https://www.kyinnovation.com
Program Type: Innovation Outreach/Startup Support

University of Kentucky Innovation Center, Lexington, KY
Website: https://www.engr.uky.edu/students/student-success/maker-spaces
Program Type: Makerspace (University)

XLerate Health, Louisville, KY
Website: https://www.xleratehealth.com
Program Type: Accelerator (Healthcare)

LOUISIANA

Innovation Catalyst, Baton Rouge, LA
Website: https://www.innovationcatalyst.us
Program Type: Innovation Outreach

Louisiana Chemical Manufacturing Initiative, Louisiana State University, Baton Rouge, LA
Website: http://lcmi.lsu.edu
Program Type: Manufacturing Initiative (University-Based)

Louisiana State University Innovation Park, Baton Rouge, LA
Website: https://www.lsu.edu/innovationpark/index.php
Program Type: University Outreach

Urban League of Louisiana, New Orleans, LA
Website: https://urbanleaguela.org
Program Type: Innovation Outreach (Minority Focused)

MISSISSIPPI

CEO Research Park (Business Incubator), Mississippi State University, Starkville, MS
Website: https://ecenter.msstate.edu/programs/ceo-research-park-incubator/
Program Type: Incubator (University)

Eagle Maker Hub, University of Southern Mississippi, Hattiesburg, MS
Website: https://www.eaglemakerhub.org
Program Type: Makerspace (University)

Gulfport Innovation District, Gulfport, MS
Website: https://www.wlox.com/2018/12/20/gulfport-looks-expand-downtown-with-new-innovation-district/
Program Type: Innovation District

Innovate Mississippi, Jackson, MS
Website: https://www.innovate.ms
Program Type: Accelerator

Mississippi State University Center for Entrepreneurship and Outreach, Starkville, MS
Website: https://ecenter.msstate.edu
Program Type: University Outreach

The Innovation Center, Biloxi, MS
Website: https://www.innovatems.com
Program Type: Incubator (Foreign Trade and Export)

NORTH CAROLINA

Be a Maker (BEAM), University of North Carolina, Chapel Hill, NC
Website: https://beam.unc.edu
Program Type: Makerspace Network (University-Based)

Durham ID, Durham, NC
Website: http://durhamid.com/
Program Type: Innovation District

Forge, Greensboro, NC
Website: https://www.forgegreensboro.org
Program Type: Makerspace (Community)

Innovate Raleigh, Raleigh, NC
Website: https://www.innovateraleigh.com
Program Type: Innovation Outreach

Innovation Quarter, Winston-Salem
Website: https://www.innovationquarter.com
Program Type: Innovation District

Nonwovens Institute (NWI), North Carolina State University, Raleigh, NC
Website: https://thenonwovensinstitute.com
Program Type: Manufacturing Initiative (University-Based)

Regional Triangle Regional Partnership, Raleigh, NC
Website: https://www.researchtriangle.org
Program Type: Innovation Campus

Riot, Raleigh, NC
Website: https://ncriot.org
Program Type: Accelerator

The Maker's Space, Raleigh, NC
Website: https://www.themakersspaceraleigh.com
Program Type: Makerspace (Community)

SOUTH CAROLINA

Beaufort Digital Corridor, Beaufort, SC
Website: https://www.beaufortdigital.com
Program Type: Innovation Corridor

Charleston Digital Corridor, Charleston, SC
Website: https://www.charlestondigitalcorridor.com
Program Type: Innovation Corridor

Charleston Innovation District, Charleston, SC
Website: https://www.crda.org/news/charlestons-emerging-innovation-districts/
Program Type: Innovation District

Clemson Makerspace, Clemson University, Clemson, SC
Website: https://www.cumaker.space
Program Type: Makerspace (University)

Conway Innovation Center, Conway, SC
Website: https://cicinnovation.com
Program Type: Innovation Center/Incubator/Innovation Outreach

Don Ryan Center for Innovation, Bluffton, SC
Website: https://www.donryancenter.com
Program Type: Innovation Center/Incubator/Innovation Outreach

South Carolina Manufacturers Alliance, Columbia, SC
Website: https://myscma.wh3.idfsites.com
Program Type: Manufacturing Initiative

Synergy Mill, Greenville, SC
Website: https://synergymill.com
Program Type: Makerspace (Community)

The Harbor, Charleston, SC
Website: https://www.harborec.com
Program Type: Accelerator/Coworking Space

USC/Columbia Technology Incubator, Columbia, SC
Website: https://www.usccolainc.org
Program Type: Incubator (University)/Coworking Space/University Outreach

TENNESSEE

ChatLab, Chattanooga, TN
Website: http://makenashville.org
Program Type: Makerspace (Community)

Driving Innovation, TN (Statewide)
Website: https://www.tndrivinginnovation.com
Program Type: Rural Innovation Outreach

Enterprise Center, Chattanooga, TN
Website: https://www.theenterprisectr.org
Program Type: Innovation Center

Fort Houston, Nashville, TN
Website: https://www.forthouston.com
Program Type: Makerspace (Community)

Jumpstart Foundry, Nashville, TN
Website: https://jsf.co
Program Type: Incubator (Healthcare)

Innovation District of Chattanooga, TN
Website: https://www.chainnovate.com/contact/
Program Type: Innovation District

Innovation Laboratory, East Tennessee State University, Johnson City, TN
Website: https://www.etsu.edu/ilab/default.php
Program Type: Innovation Center (University)

Knox Makers, Knoxville, TN
Website: https://knoxmakers.org
Program Type: Makerspace (Community)

Make Nashville, Nashville, TN
Website: http://makenashville.org
Program Type: Makerspace (Community)

Nashville Business Incubation Center, Nashville, TN
Website: https://nbiconline.com
Program Type: Incubator

Nashville Entrepreneur Center, Nashville, TN
Website: https://www.ec.co
Program Type: Incubator/Innovation Outreach

Skillville, Johnson City, TN
Website: https://www.skillvillejc.com
Program Type: Makerspace (Community)

Sync Space, Kingsport, TN
Website: https://syncspace.org
Program Type: Accelerator

The Inventor Center, Kingsport, TN
Website: https://theinventorcenter.com
Program Type: Makerspace (Community-Local Government Supported)

The Wondry, Vanderbilt University, Nashville, TN
Website: https://www.vanderbilt.edu/thewondry/
Program Type: Innovation Center (University)

Union University Engineering Makerspace, Union University, Memphis, TN
Website: https://www.uu.edu/dept/engineering/makerspace/
Program Type: Makerspace (University)

Zero to 510, Memphis, TN
Website: http://zero to 510.com
Program Type: Accelerator (Medical Devices)

MID-ATLANTIC REGION

DISTRICT OF COLUMBIA

AFWERX DC Innovation Hub, Washington, DC
Website: https://www.afwerx.af.mil/dc-hub.html
Program Type: Industry-Targeted Innovation Center (Air Force Defense Technologies).

DC Fashion Foundation, Washington, DC
Website: http://www.dcfashionfoundation.org
Program Type: Incubator/Virtual Incubator (Fashion Industry)

5G First Responder Lab, Washington, DC
Website: https://www.5gfirstresponderlab.com
Program Type: Incubator (First Responder Technology)

GWIC, George Washington University, Washington, DC
Website: https://gwic.io
Program Type: University Innovation Center

Halcyon Incubator, Washington DC
Website: https://halcyonhouse.org/incubator
Program Type: Incubator (social impact)

Innovation Center—Booz Allen Hamilton, Washington DC
Website: https://www.boozallen.com/about/innovation/washington-dc-innovation-center.html
Program Type: Innovation Center

In3, Washington, DC
Website: https://www.in3dc.com
Program Type: Incubator (minority targeted)

Union Kitchen, Washington, DC
Website: https://unionkitchen.com
Program Type: Accelerator (food manufacturing)

1776, Lafayette Square, Washington, DC
Website: https://www.1776.vc/lafayettesquare/
Program Type: Accelerators/Incubator

DELAWARE

Delaware Innovation Space at the Experiment Station, Wilmington, DE
Website: https://deinnovates.org
Program Type Incubator/Accelerator (University: Science and Technology)/Co-Working Lab Space.

Downtown Development Districts
Website: https://udel.maps.arcgis.com/apps/MapSeries/index.html?appid=709de4becdd54cf58136004ec3aa78dc
Program Type: Downtown Revitalization/Economic Development

Nextfab, Wilmington, DE
Website: https://nextfab.com/location/downtown-wilmington/
Program Type: Makerspace Network

Makerspace, Delaware State University, Dover, DE
Website: https://www.desu.edu/news/2020/01/makerspace-established-student-innovation
Program Type: Makerspace (University)

UD Maker Gym, University of Delaware, Newark, DE
Website: https://www.udel.edu/research-innovation/maker/spaces/makergym/
Program Type: Makerspace (University)

MARYLAND

BioHealth Innovation, Rockville, MD
Website: http://www.biohealthinnovation.org
Program Type: Accelerator (Biohealth)

Maryland Rural Enterprise Development Center, University of Maryland Extension, Keedysville, MD
Website: https://extension.umd.edu/mredc
Program Type: Rural Innovation (University Affiliated)

The Maker Space by Stanly and Black and Decker, Towson, MD
Website: http://www.sbdmakerspace.com
Program Type: Makerspace (Corporate Sponsored)

TEDCO Rural Business Innovation Initiative, Columbia, MD
Website: https://www.tedcomd.com/gateway-services/rural-business-innovation-initiative
Program Type: Rural Innovation Outreach (Technology and Commercialization)

PENNSYLVANIA

Alphalab, Pittsburgh, PA
Website: https://alphalab.org
Program Type: Industry Focused Accelerator (Software and Technology)

Ben Franklin Technology Partners, PA (Multiple Locations)
Website: https://benfranklin.org
Program Type: Innovation Outreach and Capital Source

Dr. Welch Workshop, Pennsylvania College of Technology, Williamsport, PA
Website: https://www.pct.edu/academics/makerspace
Program Type: University Makerspace

East Stroudsburg University Innovation Center, East Stroudsburg, PA
Website: https://www.esu.edu/ede/innovation_center.cfm
Program Type: Innovation Center (University)

Energy Innovation Center, Pittsburgh, PA
Website: http://www.eicpittsburgh.org
Program Type: Innovation Center (Energy)

Innovation Park at Penn State, University Park, PA
Website: https://www.innovationpark.psu.edu
Program Type: Innovation Park/Incubator (University)

Make 717, Lancaster, PA
Website: https://www.make717.org
Program Type: Makerspace (Community)

NextFab, Pittsburg, PA (2 Locations)
Website: https://nextfab.com
Program Type: Makerspace (Community)

Pittsburgh Eco-Innovation District, Pittsburgh, PA
Website: https://pittsburghpa.gov/dcp/eid
Program Type: Eco-Innovation District

Pittsburgh Innovation District, Pittsburgh, PA
Website: https://www.pittsburgh-id.com
Program Type: Innovation District

Penn Center for Innovation, University of Pennsylvania, Philadelphia, PA
Website: https://pci.upenn.edu
Program Type: University Innovation Outreach and Startup Support

Pennovation Center, University of Pennsylvania, Philadelphia, PA
Website: https://www.pennovation.upenn.edu
Program Type: Incubator (University-Bioscience)

Pennsylvania Angel Fund, PA (Statewide)
Website: http://www.paangelnetwork.com
Program Type: Venture Fund Source

VIRGINIA

Catalyst Accelerator, University of Virginia, Charlottesville, VA
Website: https://www.darden.virginia.edu/batten-institute/ventures/catalyst
Program Type: Accelerator (University)

Creativity and Innovation District, Virginia Tech University, Blacksburg, VA
Website: https://www.facilities.vt.edu/planning-construction/campus-construction-projects/active-projects/facilities-CID.html
Program Type: Innovation District (University)

Hack RVA, Richmond, VA
Website: https://www.hackrva.org/blog/
Program Type: Makerspace (Community)

Ignition, Williamsburg, VA
Website: https://ignitioncenter.com
Program Type: Accelerator

ILab, University of Virginia, Charlottesville, VA
Website: https://ilab.virginia.edu/space
Program Type: Innovation Center/Makerspace (University)

Mason Enterprise Center, Fairfax, VA
Website: https://www.masonenterprisecenter.org
Program Type: Incubator (University: Government Contracting, International Business, Technology, and Telework)

Nova Labs, Reston, VA
Website: https://www.nova-labs.org
Program Type: Makerspace (Community)

ODU Innovation Center, Old Dominion University, Norfolk, VA
Website: https://www.odu.edu/iie/innovation-center
Program Type: Innovation Center/Incubator (University)

Startup Virginia, Richmond, VA
Website: https://www.startupvirginia.org
Program Type: Innovation Center/Incubator

Staunton Makerspace, Staunton, VA
Website: http://www.stauntonmakerspace.com
Program Type: Makerspace (Community)

The Garden, Alexandria, VA
Website: https://thegarden.spaces.nexudus.com/en
Program Type: Makerspace (Community)/Co-Working Facility

Vector Makerspace, Lynchburg, VA
Website: https://vector-space.org
Program Type: Makerspace (Community)

VentureLab, University of Virginia, Charlottesville, VA
Website: https://www.darden.virginia.edu/batten-institute/ventures/venture-lab
Program Type: Based Incubator (University)

WEST VIRGINIA

Center for Regional Innovation, Shepherd University, Shepherdstown, WV
Website: https://www.shepherd.edu/innovation
Program Type: University Outreach

Innovation Hub, West Virginia University, Morgantown, WV
Website: https://innovationhub.wvu.edu/the-hub
Program Type: Makerspace (University: Manufacturing/Prototyping)

LaunchLab, West Virginia University, Morgantown and Beckley
Website: https://launch.wvu.edu
Program Type: Innovation Center (University)

Media Innovation Center, West Virginia University, Morgantown, WV
Website: https://mediainnovation.wvu.edu
Program Type: Innovation Center (University: Media)

Robert C. Byrd Institute, Marshall University, Huntington, WV
Website: http://www.rcbi.org
Program Type: Innovation Center/Makerspace (University)

Russell and Martha Wehrle Innovation Center, University of Charleston, Charleston, WV
Website: https://www.ucwv.edu/innovation/
Program Type: Innovation Center (University)

WV Hive Network, Beckley, WV
Website: https://wvhive.com
Program Type: Incubator/Accelerator Network

NORTHEAST REGION

CONNECTICUT

CNext, Rocky Hill, CT
Website: https://ctnext.com
Program Type: Incubator

Baur Hall Innovation Center, University of Bridgeport, Bridgeport, CT
Website: https://www.bridgeport.edu/news/2019-10-01/university-bridgeport-opens-bauer-hall-innovation-center (Program website not up and running as of March 5, 2020.
Program Type: Innovation Center (University)

Innovation Destination, Hartford, CT
Website: https://www.innovationhartford.com
Program Type: Innovation Outreach

Makerspace CT, Hartford, CT
Website: https://makerspacect.com
Program Type: Makerspace (Community)

ReSet, Hartford, CT
Website: https://www.resetco.org
Program Type: Incubator (Food Industry)/Accelerator (Social Impact)/Coworking Space
UConn, Connecticut Center for Entrepreneurship and Innovation,

University of Connecticut, Hartford, CT
Website: https://ccei.uconn.edu
Program Type: University Outreach

Yale Center for Innovation, Design, and Engineering, New Haven, CT
Website: http://ceid.yale.edu
Program Type: Innovation Center (University)

MAINE

Advanced Manufacturing Center, The University of Maine, Orono, ME
Website: https://umaine.edu/amc/
Program Type: Makerspace (University: Advanced Manufacturing)

Bangor Innovation Center, Bangor, ME
Website: https://www.bangorinnovationcenter.com
Program Type: Incubator (Industrial)

Foster Center for Student Innovation, The University of Maine, Orono, ME
Website: https://umaine.edu/innovation/innovate-for-maine/
Program Type: Incubator/Outreach (University)

Maine Accelerates Growth, Brunswick, ME
Website: http://maineacceleratesgrowth.com
Program Type: Innovation Outreach

Main Aquaculture Innovation Center, Walpole, ME
Website: https://www.maineaquaculture.org
Program Type: Innovation Center (Aquaculture)

Manufacturers Association of Maine, Portland, ME
Website: https://www.mainemfg.com
Program Type: Manufacturing Initiative

MASSACHUSETTS

Boston Innovation District, Boston, MA
Website: http://intersector.com/wp-content/uploads/2015/10/The-Development-of-Bostons-Innovation-District.pdf
Program Type: Innovation District

Cambridge Innovation Center, Cambridge MA
Website: https://cic.com
Program Type: Innovation Center/Incubator

Center for Innovation & Entrepreneurship, UMass Dartmouth, Fall River, MA
Website: https://www.umassd.edu/innovate/
Program Type: Innovation Center (University: Biotechnology/Biopharmaceutical)

District Hall, Boston, MA
Website: https://districthallboston.org
Program Type: Innovation Center/Accelerator

Kendall Square Initiative, MIT, Cambridge MA
Website: https://kendallsquare.mit.edu
Program Type: Innovation District (University Affiliated)

Greentown Labs, Somerville, MA
Website: https://www.greentownlabs.com
Program Type: Incubator/Manufacturing Initiative (Cleantech)

Mass Challenge, Boston, MA and Multiple Locations (Domestic and Abroad)
Website: https://masschallenge.org/about
Program Type: Accelerator

Fimbel Maker & Innovation Lab, Mount Holyoke College, South Hadley, MA
Website: https://www.mtholyoke.edu/FimbelLab
Program Type: Makerspace (University)

MIT Innovation Initiative, MIT, Cambridge, MA
Website: https://innovation.mit.edu
Program Type: University Outreach

M2I2, Massachusetts Manufacturing Innovation Initiative, Westborough, MA
Website: https://m2i2.masstech.org
Program Type: Manufacturing Initiative

N2 Innovation Corridor, Newton-Needham, MA
Website: https://www.n2innovationdistrict.com
Program Type: Innovation Corridor

The Innovation Institute at the MassTech Collaborative, Westborough, MA
Website: https://innovation.masstech.org
Program Type: Innovation Outreach

NEW HAMPSHIRE

Claremont Makerspace (CMS), Claremont, NH
Website: https://claremontmakerspace.org
Program Type: Makerspace (University)

Creative Chef Kitchens, Derry, NH
Website: https://creativechefkitchens.com
Program Type: Makerspace (Commercial Kitchen: Food Service Startups)

GALA Makerspace, Wolfeboro, NH
Website: https://galacommunity.org
Program Type: Makerspace (Community)

Hannah Grimes Center for Entrepreneurship, Keene, NH
Website: https://www.hannahgrimes.com
Program Type: Incubator/Innovation Outreach

Make It Labs, Nashua, NH
Website: http://www.makeitlabs.com
Program Type: Makerspace (Community)

Makerspace at the ECenter, University of New Hampshire, Durham, NH
Website: https://www.unh.edu/ecenter/makerspace
Program Type: Makerspace (University)

Manchester Makerspace, Manchester, NH
Website: https://manchestermakerspace.org
Program Type: Makerspace (Community)

New England Innovation Center, Portsmouth, NH
Website: http://www.ne-ic.com
Program Type: Incubator/Accelerator

Port City Makerspace, Port City, NH
Website: https://www.portcitymakerspace.com
Program Type: Makerspace (Community)

UNHInnovation, University of New Hampshire, Durham, NH
Website: https://innovation.unh.edu
Program Type: University Outreach

NEW JERSEY

Fownders Accelerator, Newark, NJ
Website: https://www.f6s.com/fowndersaccelerator
Program Type: Accelerator

Maker Depot, Totowa, NJ
Website: https://www.themakerdepot.com
Program: Makerspace (Community)

NJIT Makerspace, Newark, NJ
Website: https://www.njitmakerspace.com
Program Type: Makerspace (Community)

NUMC Business Accelerator, Lyndhurst, NJ
Website: http://www.njmcaccelerator.com
Program Type: Accelerator

Princeton Entrepreneurial Hub, Princeton University, Princeton, NJ
Website: https://kellercenter.princeton.edu/princeton-entrepreneurial-hub
Program Type: Incubator/Accelerator (University)

Rutgers Makerspace, Rutgers University, Piscataway, NJ
Website: https://makerspace.rutgers.edu
Program Type: Makerspace (University)

South Jersey Technology Park, Rowan University, Mullica Hill, NJ
Website: https://sjtechpark.org/innovation-center/the-incubator/
Program Type: Incubator (University: Technology)

NEW YORK

Angle Pad, New York, NY and San Francisco, CA
Website: https://angelpad.com
Program Type: Program Type Accelerator

Betaworks Ventures, New York, NY
Website: https://betaworksventures.com
Program Type: Venture Fund Source (Product-Focused)

Blueprint Health, New York, NY
Website: https://www.blueprinthealth.org
Program Type: Accelerator (Healthcare IT)

Center for Regional Economic Advancement, Cornell University, Ithaca, NY
Website: https://crea.cornell.edu
Program Type: University Outreach

Digital NYC, New York City
Website: https://www.digital.nyc/incubators/nystar
Program Type: Statewide Online Innovation Network

Dreamit, New York, NY
Website: https://www.dreamit.com
Program Type: Accelerator/Venture Fund (Healthtech, Securetech, Urbantech)

Entrepreneurs Roundtable Accelerator, New York, NY
Website: https://www.eranyc.com
Program Type: Accelerator

FinTech Innovation Lab, New York, NY
Website: https://www.fintechinnovationlab.com/new-york/
Program Type: Accelerator/Venture Fund Source

FuzeHub, Albany, New York
Website: https://fuzehub.com
Program Type: Manufacturing Initiative

Genspace, Brooklyn, NY
Website: https://www.genspace.org
Program Type: Makerspace (Bioscience Lab)

University at Albany, Albany, NY
Website: https://www.albany.edu/innovation/
Program Type: University Outreach

New York Digital Health Innovation Lab, New York, NY
Website: https://digitalhealth.nyc
Program Type: Accelerator/Venture Fund Source (Healthcare)

Metaprop, Columbia University, New York, NY
Website: https://www.metaprop.org/preaccelerator
Program Type: Accelerator /Venture Fund Source (Real Estate)

Rochester Downtown Innovation Zone (RocDiz), Rochester, NY
Website: https://rocdiz.com
Program Type: Innovation District (Mixed Use)

Startup 52, New York, NY
Website: http://startup52.com
Program Type: Accelerator/Co-Working Space (Diversity Focused)

Tandon School of Engineering Makerspace, New York University
Website: https://engineering.nyu.edu/research-innovation/makerspace
Program Type: Makerspace (University)

VentureOut, New York, NY
Website: https://ventureoutny.com
Program Type: Accelerator (International Startups)

XRCLabs, New York, NY
Website: https://www.xrclabs.com
Program Type: Accelerator/Incubator (Retail)

Zahn Innovation Center, New York, NY
Website: http://www.zahncenternyc.com
Program Type: Innovation Center/Incubator

RHODE ISLAND

Brown Design Workshop, Brown University, Providence, RI
Website: http://www.browndesignworkshop.org
Program Type: Makerspace (University)

Hope and Main, Warren, RI
Website: https://makefoodyourbusiness.org
Program Type: Incubator (Food Enterprises)

Providence Innovation & Design District, Providence, RI
Website: https://www.195district.com
Program Type: Innovation District

Nature Lab, Rhode Island School of Design, Providence, RI
Website: https://naturelab.risd.edu
Program Type: Makerspace (Biodesign)

Nielson Center for Entrepreneurship, Brown University, Providence, RI
Website: https://entrepreneurship.brown.edu
Program Type: Innovation Center (University)

RHub, Providence, RI
Website: https://rihub.org
Program Type: Accelerator/Innovation Network

Urban Ventures, Providence, RI
Website: http://www.urbanventuresri.org
Program Type: Incubator (Micro-Enterprise Focused)

VERMONT

BTV Startups, University of Vermont, Burlington, VT
Website: https://www.uvm.edu/newsstories/news/btv-startup
Program Type: Incubator (University)

BTV Ignite, Burlington, VT
Website: https://www.btvignite.com
Program Type: Smart City Innovation Initiative

Center for Rural Innovation (CORI), Hartland, VT
Website: https://ruralinnovation.us/careers/
Program Type: Innovation Outreach (Rural Places)

DeltaClimeVT, Montpelier, VT
Website: https://deltaclimevt.com
Program Type: Accelerator (Sustainable Energy and Climate Technology Innovation)

Generator, Burlington, VT
Website: https://generatorvt.com
Program Type: Makerspace (Community)

IBM Smarter Cities Challenge, Burlington, VT
Website: https://www.burlingtonvt.gov/Mayor/Burlington-IBM-Smarter-Cities-Challenge
Program Type: Smart City Innovation Initiative

Launch VT, Burlington, VT
Website: https://www.launchvt.com
Program Type: Accelerator

The Foundry Workshop, Lyndon Center, VT
Website: http://www.thefoundryvt.org/index.php
Program Type: Makerspace (Community)

The Mint, Rutland, VT
Website: https://rutlandmint.org
Program Type: Makerspace (Community)

VCET, Burlington, VT
Website: https://vcet.co
Program Type: Incubator (Technology)

Conclusion

The DIER provided a detailed economic overview of the AGNC and eastern Utah regions. This included discussions on county demographics, employment trends, major industries, and the economic contribution of coal. Additionally, due to the emergence of COVID-19 during the first quarter of this project, it discussed how the crisis impacted the region and augmented exiting challenges.

Following an economic overview of the region, the DIER documented infrastructure and resources available for innovation. This included local physical infrastructure that could support innovation initiatives. It also included potential partners that could help design, implement, and participate in programs.

The DIER also discussed coal innovation. This included an introduction to products made from coal, the subtility of coal types for these products, and a national picture of coal production, which provides regional context for coal-to-products potential. Additionally, it contained regional resources that could assist with launching programs of this type.

Following coal innovation, the DIER outlined each county's competitive advantage, which may be used to add focus to general innovation programs. Lastly, it discussed population trends such as out migration and provided an innovation program database. This database covered major innovation programs in all 50 states as of 2020. These initiatives are successful examples of approaches taken in other areas that could be applied within the region and help encourage ideas for partnership development.

Ultimately, this resource serves as a starting point for regional innovation. However, the journey from here should focus on multiple industries, activities, and involve other regional partners to broaden opportunity. The result will be a more diverse, innovative, and resilient regional economy. This will not only lead to recovery, but prosperity in the coal communities of AGNC and eastern Utah for years to come. ■

Notes

[1] Nathan Perry is an Associate Professor of Economics at Colorado Mesa University.

[2] Nathan Perry is an Associate Professor of Economics at Colorado Mesa University.

[3] Source: U.S. Census Bureau (USCB). Regional GDP is from the Bureau of Economic Analysis (BEA). Census poverty estimates are from the Small Area Income and Poverty Estimates (SAIPE).

[4] Source: United States Census Bureau.

[5] Source: United States Census Bureau.

[6] Colorado State Demographer's Office

[7] Source: Bureau of Economic Analysis. Real GDP is calculated with chained 2012 dollars.

[8] Source: Bureau of Economic Analysis.

[9] Source: Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages.

[10] Data for the Hachman Index taken from the USCB American Community Survey (Employment Data 5-year Average). We utilized American Community Survey data instead of QCEW or BEA data because QCEW and BEA data omit industries that have too few companies reporting (such as utilities).

[11] Source: U.S. Census Bureau (USCB). Regional GDP is from the Bureau of Economic Analysis (BEA). Census poverty estimates are from the Small Area Income and Poverty Estimates (SAIPE).

[12] Source: U.S. Census Bureau (USCB

[13] Ibid.

[14] Source: Colorado State Demography Office

[15] Source: U.S. Census Bureau

[16] Source: Bureau of Economic Analysis

[17] Source: Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages.

[18] Source: Bureau of Economic Analysis

[19] Ibid.

[20] Source: Bureau of Economic Analysis

[21] Source: U.S. Census Bureau (USCB). Regional GDP is from the Bureau of Economic Analysis (BEA). Census poverty estimates are from the Small Area Income and Poverty Estimates (SAIPE).

[22] Source: U.S. Census Bureau (USCB)

[23] Source: Colorado State Demography Office

[24] Source: U.S. Census Bureau

[25] Source: Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages.

[26] Source: Bureau of Economic Analysis

[27] Source: Bureau of Economic Analysis

[28] Data for the Hachman Index taken from the USCB American Community Survey (Employment Data 5-year Average). We utilized American Community Survey data instead of QCEW or BEA data because QCEW and BEA data omits industries that have too few companies reporting (such as utilities).

[29] Author Calculated. Data for the Hachman Index taken from the USCB American Community Survey (Employment Data 5-year Average). We utilized American Community Survey data instead of QCEW or BEA data because QCEW and BEA data omit industries that have too few companies reporting (such as utilities).

[30] Source: Bureau of Economic Analysis

[31] Source: Colorado Division of the Reclamation, Mining and Safety.

[32] Perry, N. (2020). Economic transition in Northwest Colorado: The economic contribution of coal power and coal mining, and the economic impact of solar power and natural gas power. Retrieved from: https://www.coloradomesa.edu/energy/documents/economic-impact-of-coal-solar-gas-nw-co.pdf

[33] Tables 19 through 27 are directly from Perry (2020).

[34] For details on how these estimates were derived, see Perry (2020).

[35] Data is from the Moffat, Rio Blanco, and Routt County Assessor's office's and is taken from Perry (2020).

[36] Indirect effects are essentially supply chain effects, or the effects of local spending on suppliers. Induced effects are the effects of induced spending caused from coal and supply chain employment.

[37] Note that these results do not take into consideration any Colorado government programs or revenue backfill that may take place.

[38] Data for coal mine workers taken from Colorado Division of Reclamation, Mining, and Safety (2019 data).

[39] Taken from "Economic Transition in Northwest Colorado: The Economic Contribution of Coal Power and Coal Mining, and the Economic Impact of Solar Power and Natural Gas," by Nathan Perry, PhD, 2020.

[40] Colorado Department of Labor and Employment, "EMSI Software Job Compatibility," Colorado Department of Labor and Employment.

[41] Initial claims, continued claims, employment, unemployment, and labor force, unemployment rates, initial unemployment claims by industry, and QCEW data from the Colorado Department of Labor and Employment.

[42] Initial claims, continued claims, employment, unemployment, and labor force, unemployment rates, initial unemployment claims by industry, and QCEW data from the Colorado Department of Labor and Employment.

[43] Data from the Colorado Department of Public Health and the Environment (CDPHE).

[44] Small business data is collected by Womply, and organized by the Harvard Opportunity Insights Team. For more information, see the following paper explaining the data: Chetty, R., Friedman, J., Hendren, N., Stepner, M, and the Opportunity Insights Team (2020). The economic impacts of COVID-19: Evidence from a new public database built using private sector data. Retrieved from: https://www.tracktherecovery.org/

[45] Initial claims, continued claims, employment, unemployment, and labor force, unemployment rates, initial unemployment claims by industry, and QCEW data from the Colorado Department of Labor and Employment.

[46] Data from the Colorado Department of Public Health and the Environment (CDPHE).

[47] Small business data is collected by Womply and organized by the Harvard Opportunity Insights Team see https://www.tracktherecovery.org/ . For more information, see the following paper explaining the data: Chetty, R., Friedman, J., Hendren, N., Stepner, M, and the Opportunity Insights Team (2020). "The economic impacts of COVID-19: Evidence from a new public database built using private sector data". https://opportunityinsights.org/wp-content/uploads/2020/05/tracker_paper.pdf (Accessed June 2, 2021).

[48] Initial claims, continued claims, employment, unemployment, and labor force, unemployment rates, initial unemployment claims by industry, and QCEW data from the Colorado Department of Labor and Employment.

[49] Data from the Colorado Department of Public Health and the Environment (CDPHE).

[50] Small business data is collected by Womply and organized by the Harvard Opportunity Insights Team see https://www.tracktherecovery.org/ . For more information, see the following paper explaining the data: Chetty, R., Friedman, J., Hendren, N., Stepner, M, and the Opportunity Insights Team (2020). "The economic impacts of COVID-19: Evidence from a new public database built using private sector data". https://opportunityinsights.org/wp-content/uploads/2020/05/tracker_paper.pdf (Accessed June 2, 2021).

[51] Source: U.S. Census Bureau (USCB). Regional GDP is from the Bureau of Economic Analysis (BEA). Census poverty estimates are from the Small Area Income and Poverty Estimates (SAIPE).

[52] https://gardner.utah.edu/demographics/population-projections/.

[53] Source: United States Census Bureau.

[54] Source: United States Census Bureau.

[55] Source: United States Census Bureau and the Kem Gardner Institute

[56] Source: Bureau of Economic Analysis. Real GDP is calculated with chained 2012 dollars.

[57] Source: Bureau of Economic Analysis. Real GDP is calculated with chained 2012 dollars.

[58] Bold text indicates primary industry, non-bold text indicates a subcategory.

[59] Source: Bureau of Economic Analysis.

[60] Bureau of Labor Statistics

[61] Bureau of Labor Statistics

[62] Bureau of Labor Statistics

[63] Source: Utah Department of Workforce Services.

[64] Data for the Hachman Index taken from the USCB American Community Survey (Employment Data 5-year Average). American Community Survey data was used instead of QCEW or BEA data because QCEW and BEA data omit industries that have too few companies reporting (such as utilities).

[65] Source: U.S. Census Bureau (USCB). Regional GDP is from the Bureau of Economic Analysis (BEA). Census poverty estimates are from the Small Area Income and Poverty Estimates (SAIPE).

[66] https://gardner.utah.edu/demographics/population-projections/.

[67] Source: United States Census Bureau, estimates as of July 1st, 2021.

[68] Source: United States Census Bureau.

[69] Source: United States Census Bureau and the Kem Gardner Institute.

[70] Source: Bureau of Economic Analysis. Real GDP is calculated with chained 2012 dollars.

[71] Source: Bureau of Economic Analysis. Real GDP is calculated with chained 2012 dollars.

[72] Bold text indicates primary industry and non-bold text a subcategory.

[73] Source: Bureau of Economic Analysis.

[74] Source: Utah Department of Workforce Services, QCEW data.

[75] Data for the Hachman Index taken from the USCB American Community Survey (Employment Data 5-year Average). American Community Survey data was used instead of QCEW or BEA data because QCEW and BEA data omit industries that have too few companies reporting (such as utilities).

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[84] Bold text indicates primary industries and non-bold text indicates a subcategory.

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[95] Data for labor force, employment, and unemployed, and unemployment rate, come from the U.S. Bureau of Labor Statistics

[96] Source: QCEW data from Utah Department of Workforce Services

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[99] Bolded indicates primary industry, not bolded indicates subcategory.

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[112] Data for labor force, employment, and unemployed, and unemployment rate, come from the U.S. Bureau of Labor Statistics

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