I-WEST

Phase One Final Report | Detailed Chapter

Economic Impacts

VERSION 1.0 UNIVERSITY OF NEW MEXICO DECEMBER 2022

About this report

The Intermountain West Energy Sustainability & Transitions (I-WEST) initiative is funded by the U.S. Department of Energy to develop a regional technology roadmap to transition six U.S. states to a carbon-neutral energy economy. I-WEST encompasses Arizona, Colorado, Montana, New Mexico, Utah, and Wyoming. Each state is represented in this initiative by a local college, university, or national laboratory. Additional partners from beyond the region were selected for their expertise in applicable fields. In the first phase of I-WEST, the team built the foundation for a regional roadmap that models various energy transition scenarios, including the intersections between technologies, climate, energy policy, economics, and energy, environmental, and social justice. This chapter presents work led by an I-WEST partner on one or more of these focus areas. A summary of the entire I-WEST phase one effort is published online at www.iwest.org.

Author

Janie M. Chermak, University of New Mexico

Contributors

Renia Ehrenfeucht, University of New Mexico
Nahid Samimimotlagh, New Mexico Institute of Mining and Technology
Babetta Marone, Los Alamos National Laboratory
Paolo Patelli, Los Alamos National Laboratory

Table of Contents

Introduction

The economic impact of energy transition projects in the Intermountain West is a complex subject with spatial and temporal considerations. Since carbon dioxide (CO_2) is a global greenhouse gas, reducing CO_2 emissions has global benefits. However, the economic impacts of initiatives to reduce CO_2 are realized at local, state, or regional levels. Assuming a technology is viable, economic impacts at these levels may include a variety of considerations, including but not limited to jobs impacts, tax revenues, local environmental impacts, resource constraints, or timing of a project. This report focuses on factors that are highly variable at the county level and the potential that each has on economic outcomes.

Relative to the I-WEST energy transition roadmap, economic impacts are divided into five sections. The first section provides an overview of relevant economic factors in the Intermountain West states, with a focus on the county levels. The second presents two case reviews of counties that have a history of energy production and are moving toward transition economies. The third section provides a series of location-specific input-output analyses that illustrate the potential economic impacts of a project on that county. The fourth section focuses specifically on bioenergy, while the fifth and final section discusses the potential impact of heterogeneity on outcomes and the importance of considering heterogeneity in economic outcomes of projects.

Economic conditions

The Intermountain West states and counties are diverse in economic activity, community characteristics, employment, population density, and land ownership. The impact of a transition technology deployed in any of the 220 counties in the region may depend on current energy production; technology deployed; existing infrastructure; economic conditions, including economic diversity, workforce characteristics, or alternative opportunities; and impacts on air, water, and land.

County characteristics

Of the 220 counties in the region, 170 are classified as non-metropolitan areas by the USDA Economic Research Service (ERS), (2020a). As shown in Figure 1, the geographic distribution and number of non-metropolitan counties varies by state, with Montana (MT) and Wyoming (WY) having the largest percentage of counties with small populations.

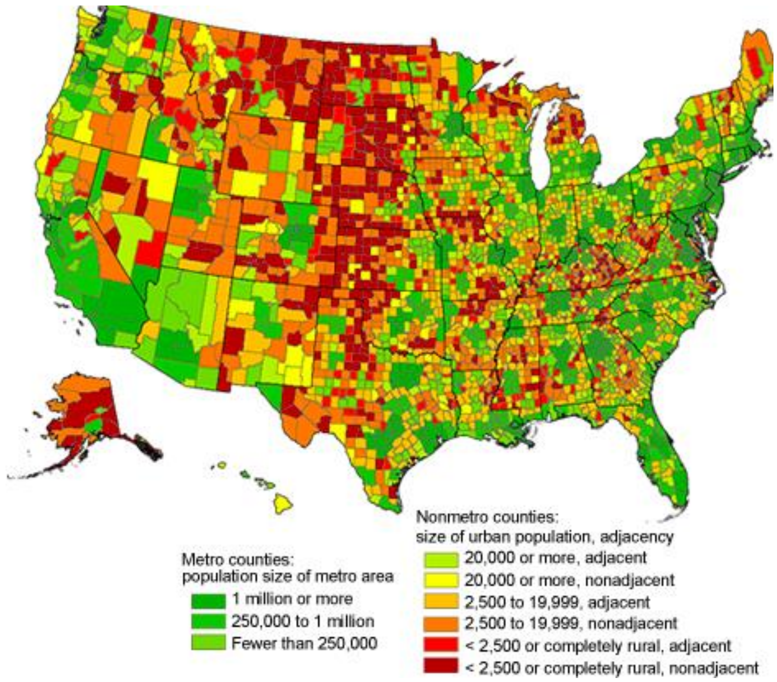


Figure 1: Rural-urban continuum county classification map1.

State-level economic activity

Economic activity, as evidenced by gross domestic product (GDP), varies across the states, not only in terms of the current level of economic activity, but also the compound annual growth rate from 2015 to 2020 (U.S. Bureau of Economic Analysis (BEA) 2022). Table 1 provides an overview at the state level. While the U.S. economy grew 2.8% over the 2015-2020 period (BEA 2022), the Intermountain West states exhibited varying levels of growth. Arizona (AZ), Colorado (CO), and Utah (UT) saw larger growth over the period than the U.S. as a whole. While Montana (MT) and New Mexico (NM) saw positive growth, it was lower than the national average. Wyoming (WY) experienced a decline over the same period, which was largely attributed to a decline in numerous industries impacted by the COVID-19 pandemic in 2020, (Wyoming Economic Analysis Division 2021). External shocks are unpredictable, and their often-substantial impacts can result in uncertainty.

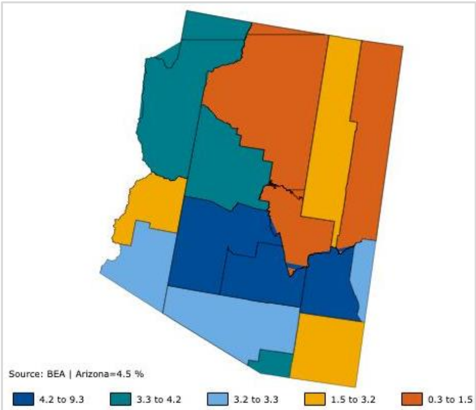
[1] The codes are based on the 2013 analysis – the most current available.

Table 1. Economic activity 2015 and 2020			
State	**2015 GDP (in millions of current $s)**	**2020 GDP (in millions of current $s)**	**Compound Annual Growth Rate (2015 to 2020)**
AZ	299,393.3	373,719.0	4.5%
CO	320,721.1	382,584.7	3.6%
MT	46,604.1	51,508.8	2.0%
NM	90,274.3	98,472.1	1.8%
UT	149,153.4	197,561.9	5.8%
WY	38,426.9	36,323.5	-1.1%

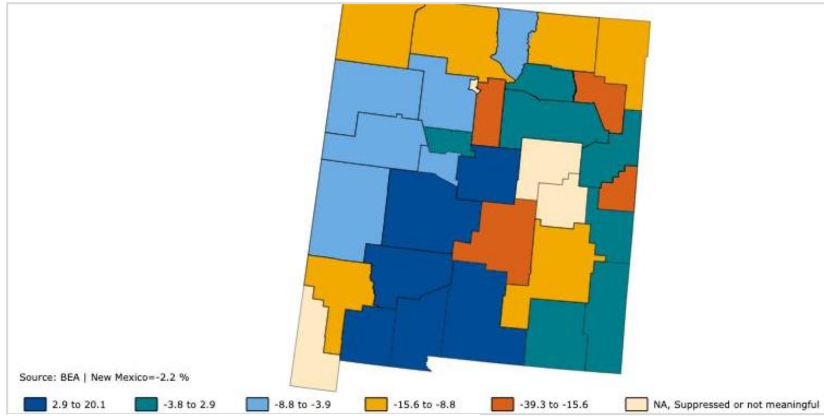
County-level economic activity

There are substantial variations in economic activity at the county level. Figure 2a-f show the 2015-2020 compound annual growth rates at the county level (BEA 2022). All Arizona counties had positive economic growth over the period, with the largest concentration of counties with low growth rates in the non-metropolitan, northeast part of the state. The highest growth rates were in the metropolitan counties.

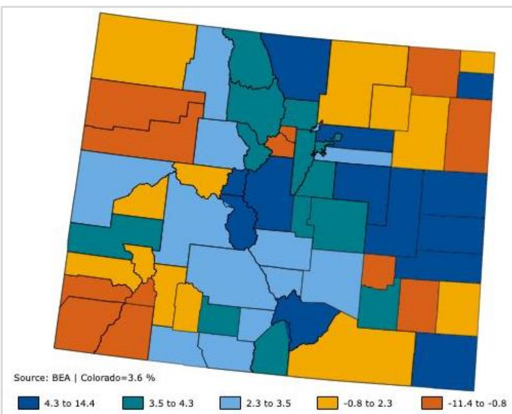
Colorado saw a variation in growth with many counties experiencing negative growth—up to an 11% decline (shown in yellow and orange)—while other counties experienced growth as high as 14%, compounded annually. Montana counties had high variations in annual growth rates ranging from over 40% growth to over 40% decline. Most New Mexico counties experienced negative growth over the period. The majority of Utah counties experienced growth, but the growth rates were much smaller than some counties in other states. This however, resulted in the highest state-level growth rate over the period (as shown in Table 1). Finally, Wyoming saw small positive growth in some counties, but larger declines in others, resulting in a negative overall state-level annual growth rate.



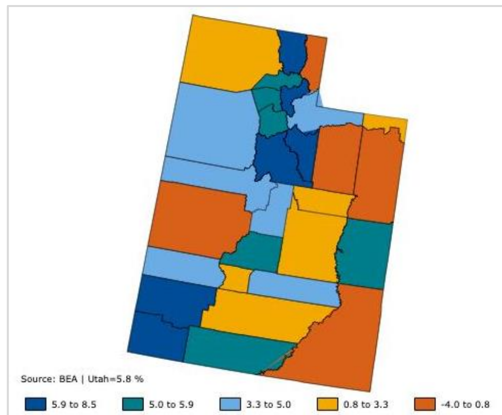
2a. Arizona



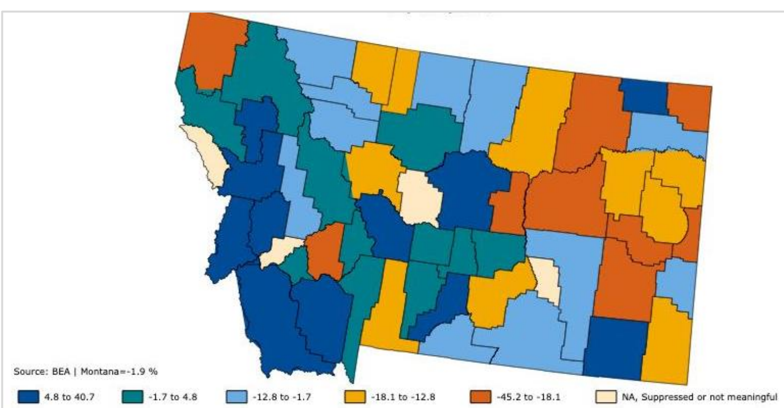
2d. New Mexico



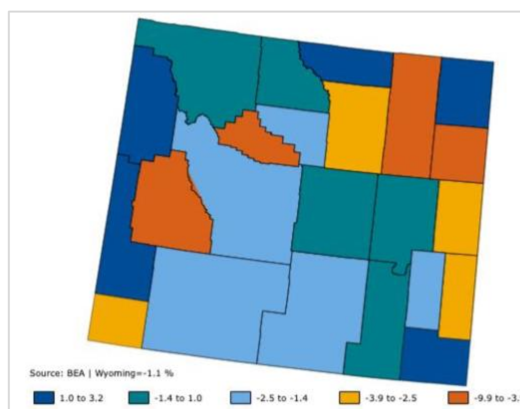
2b. Colorado



2e. Utah



2c. Montana



2f. Wyoming

Figure 2 (a-f). County annual compound growth rates 2015 to 2020.

State-level energy economic activity

The variations in economic activity may be impacted by economic activity within each state. Specific to energy, of the 220 counties in the Intermountain West, ShaleXP (2022) reports 90 counties were producing oil in January 2022, and 103 produced natural gas during the same period. The USDA ERS (2020b) reported that during 2011, 104 counties produced oil and 113 produced natural gas. This is a 13.5% decline in oil producing counties and an almost 10% decline in counties producing natural gas.

The U.S. Energy Administration (EIA) (2021a) reports 19 counties produced coal in 2020, compared to 22 counties in 2015 (EIA 2016). The U.S. Environmental Protection Agency (EPA) reports 75 counties generated electricity from fossil fuels or biomass in 2020 (EPA 2022), nine of which had operating refineries (EIA 2021b).

These variations can impact economic activity. Table 2 presents activity levels in 2015 and 2020, as well as the compound annual growth rate over the five years for the mining, quarrying, and oil and gas production sectors (referred to as "extractive" from here forward), and utilities sectors (referred to as "utilities" from here forward), respectively.[2] Four of the six states saw contractions in economic activity levels for mining, quarrying, and oil and gas production, even though three of the four states saw overall positive economic activity during the same period. All six states saw positive growth rates in the utilities sector.

Table 2. State-specific economic activity 2015-2020

State	Mining, Quarrying, Oil and Gas Production (Extractive)			Utilities		
	2015 (millions current $s)	2020 (millions current $s	Compound Annual Growth Rate (%)	2015 (millions current $s)	2020 (millions current $s)	Compound Annual Growth Rate (%)
AZ	3,881.8	4,470.7	2.9	6,385.7	7,401.6	3.0
CO	11,663.1	7,345.4	-8.8%	4,055.0	4,784.1	3.4%

[2] While these sectors are broader than desired, they are the ones available at the county level. Mining, quarrying, and oil and gas production is the NAICS 21 sector and includes oil and gas extraction (NAICS 211), mining – except oil and gas (NAICS 212), and support activities for mining (NAICS 213). Utilities is the NAICS 22 sector and consists of electric power generation, transmission and distribution (NAICS 2211), natural gas distribution (NAICS 2212), and water, sewage and other systems (NAICS 2213).

MT	1,944.3	1,765.9	-1.9%	1,096.4	1,163.0	1.2%
NM	6,977.4	6,227.1	-2.2%	1,616.7	1,813.6	2.3%
UT	3,047.5	3,261.2	1.4%	2,002.6	2,908.1	7.7%
WY	7,023.8	4,614.2	-8.1%	1,011.4	1,024.7	0.3%

Comparing Tables 1 and 2, the importance of the energy sectors to each state becomes clearer. Table 3 provides the percentage of total GDP contribution for the two sectors for each state in 2015 and 2020. The state with the largest economy, Arizona, has the lowest dependence on the extractive sector (during both years), while the two states with the weakest economic performance between 2015 and 2020, New Mexico and Wyoming, have the highest dependence. Contributions from the utility sector are relatively small in all states.

Table 3. Contribution to state GDP by sector				
State	**GDP Contribution by Extractive Sector (%)**		**GDP Contribution by Utilities Sector (%)**	
	2015	**2020**	**2015**	**2020**
AZ	1.3%	1.2%	2.1%	2.0%
CO	3.6%	1.9%	1.3%	1.3%
MT	4.2%	3.4%	2.4%	2.3%
NM	7.7%	6.3%	1.8%	1.8%
UT	2.0%	1.7%	1.3%	1.5%
WY	18.3%	12.7%	2.6%	2.8%

County-level energy economic activity

The importance of energy and utilities to county level economies shows high variation. Figures 3-8 present the county level activity for extraction and utilities for 2020, as well as the compound annual growth rate between the 2015 and 2020 period.

In Arizona, the largest extractive activity in 2020 occurred in counties located in the southern part of the state. The largest compound growth rates occurred in the northwest and southeast, with the largest declines occurring in the northeastern counties, which include traditional coal producing areas. Specific to utility activity, while there is activity across the state, the growth in activity has occurred in the southern portion of the state. For both the extractive and utility sectors, the overall impact were annual increases in both sectors.

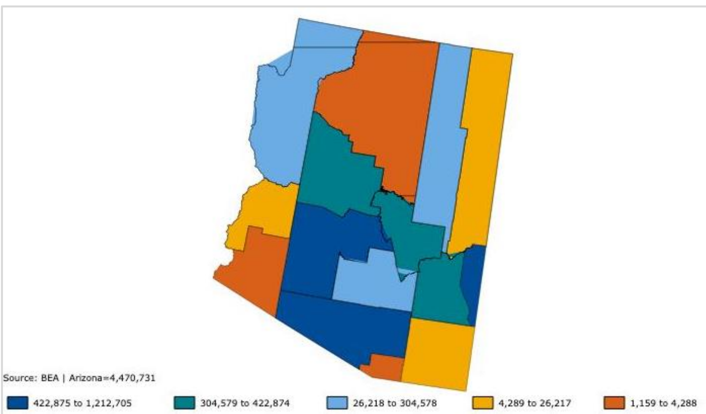


Figure 3a. 2020 Extractive activity ($k)

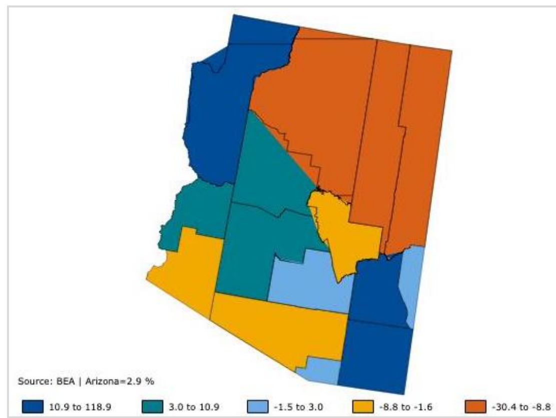


Figure 3b. Extractive compound annual growth rate

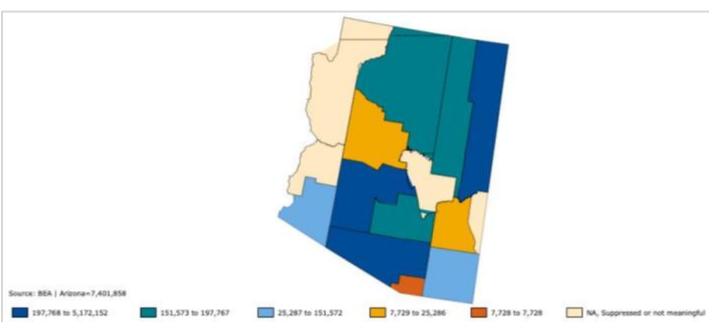


Figure 3c. 2020 Utility activity

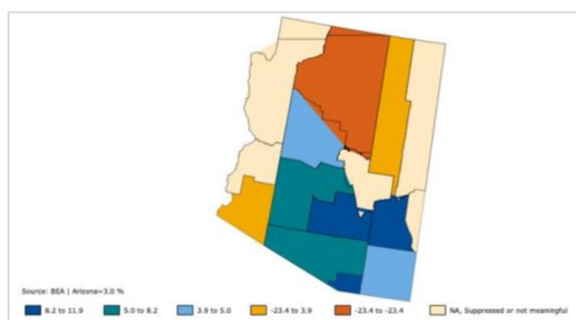


Figure 3d. Utility compound annual

Figure 3 (a-d). Arizona extraction and utility economic activity by county.

In Colorado, the largest contributions from extractive industries are in the northwest, southwest, and north central portion of the state; however, the annual growth rate has been largely negative. Specific to utilities, the largest contributions to GDP in 2020 are from the northern half of the state, but the largest growth has been in the southeast quadrant. Both the extractive and utilities sectors may reflect the changing focus on energy extraction and the move toward renewables. While the overall, state-level result is an annual decline in GDP contributions from the extractive sectors, there was an overall annual increase in the contribution from the utilities sector.

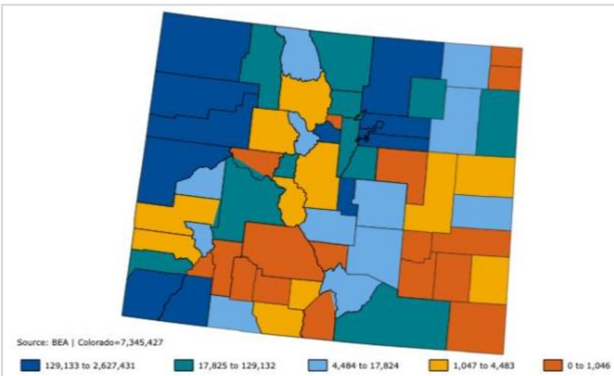


Figure 4a. 2020 Extractive activity ($k)

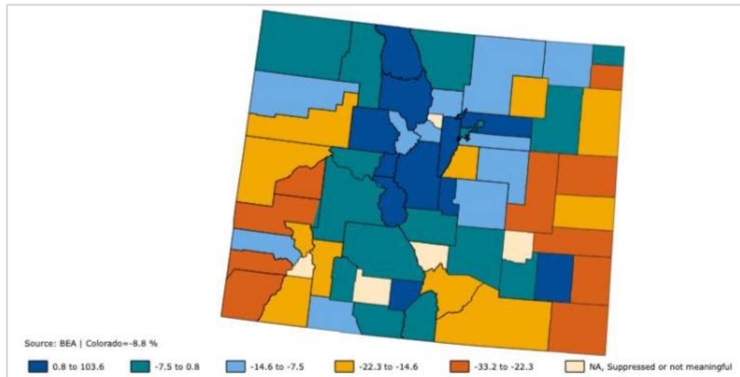


Figure 4b. Extractive compound annual growth rate

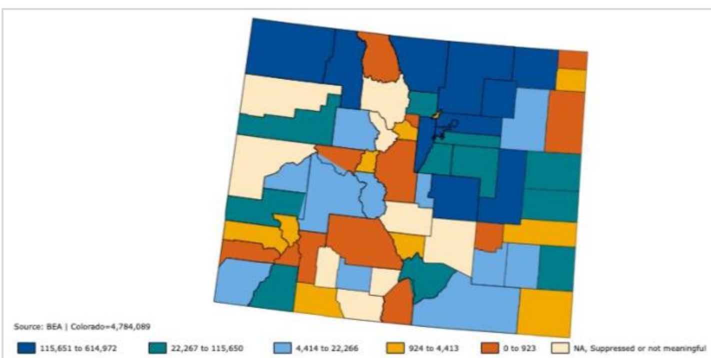


Figure 4c. 2020 Utility activity

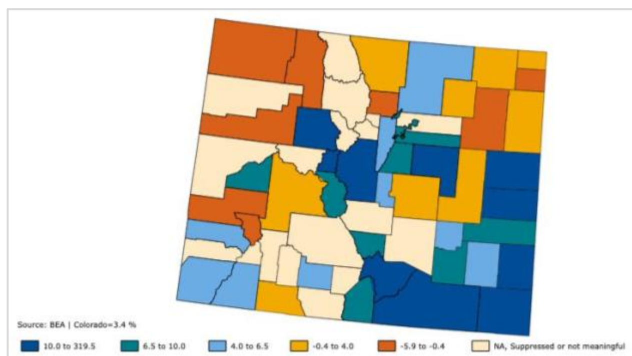


Figure 4d. Utility compound annual

Figure 4 (a-d). Colorado extraction and utility economic activity by county.

In Montana, the extractive industries in the southern portion of the state were among the largest contributors to state GDP. However, growth between 2015 and 2020 mainly came from the southeast portion of the state. The overall impact was an annual 1.9% decline in the extractive industries. 2020 GDP contribution from the utilities sector was from the central and northwest sections of the state. The annual growth from the sector is mostly from the central portion of the state. The overall impact was an annual 1.2% increase in the utilities sector contribution to GDP.

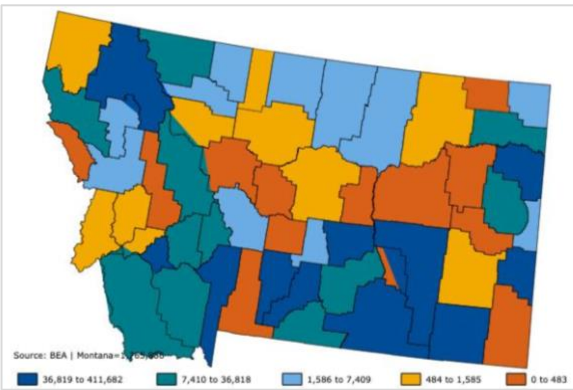


Figure 5a. 2020 Extractive activity ($k)

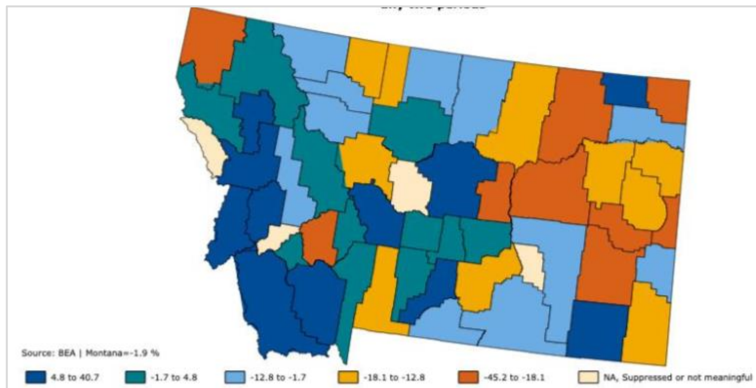


Figure 5b. Extractive compound annual growth rate

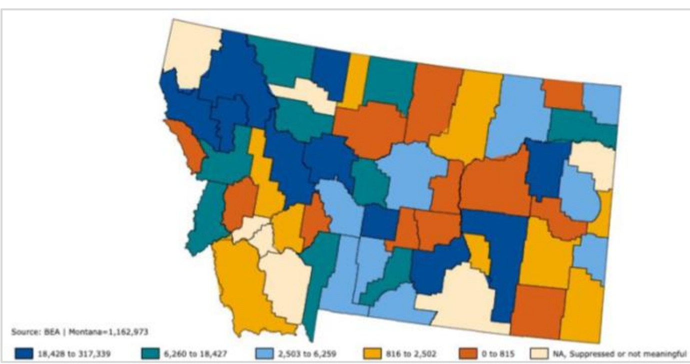


Figure 5c. 2020 Utility activity

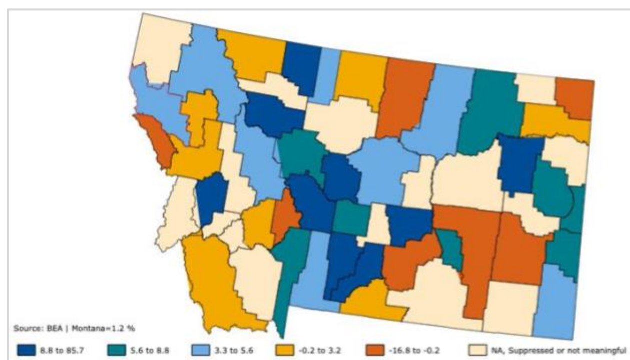


Figure 5d. Utility compound annual growth rate

Figure 5 (a-d). Montana extraction and utility economic activity by county.

New Mexico's largest contributions to the extractive sector GDP are from the northwest and the southeast portions of the state, which coincide with the San Juan Basin natural gas producing area and the Permian Basin, respectively. However, both areas saw negative annual growth rates over the period. Specific to utilities, many counties show no measurable economic activity in 2020. Individual counties, including those in the northwest, central, and eastern sections have the largest contributions in 2020. However, the largest annual increases are limited to those same counties in the central and eastern part of the state. As with other states, this may reflect changing generation sources.

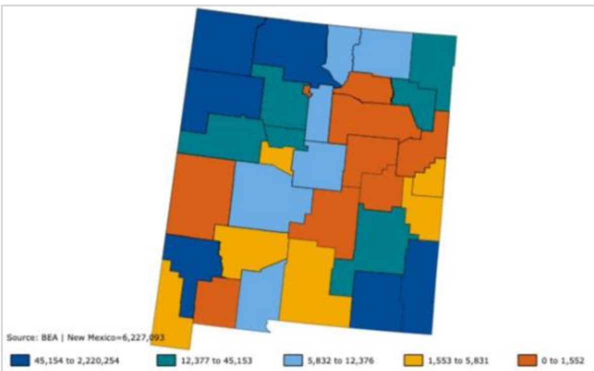


Figure 6a. 2020 Extractive activity ($k)

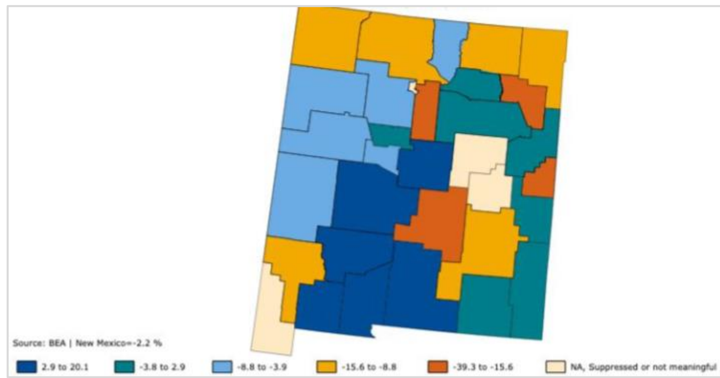


Figure 6b. Extractive compound annual growth rate

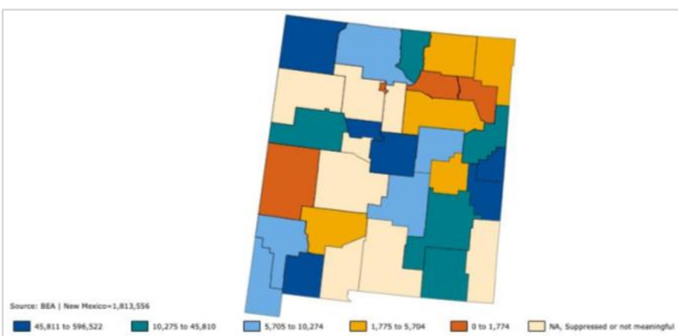


Figure 6c. 2020 Utility activity

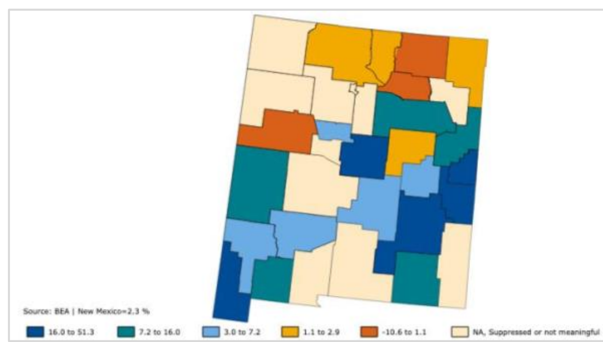


Figure 6d. Utility compound annual growth rate

Figure 6 (a-d). New Mexico extraction and utility economic activity by county.

In Utah, the 2020 extraction activity is strongest in the eastern half of the state with counties in the northeast providing large contributions. However, the rate of annual growth between 2015 and 2020 has been very low or negative for these same counties. Over the same time in the utilities sector, the largest annual growth from 2015 to 2020 is from counties in the northwest and southwest corners of the state.

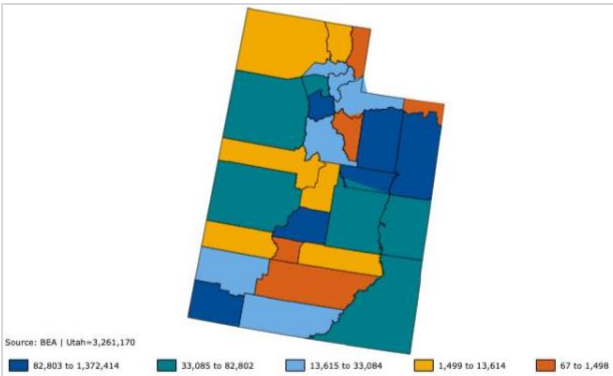


Figure 7a. 2020 Extractive activity ($k)

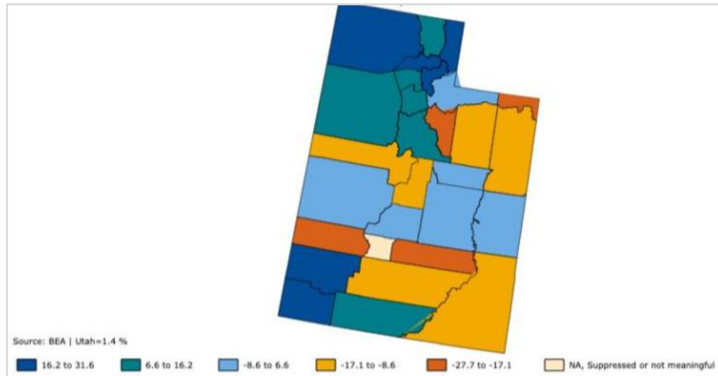


Figure 7a. Extractive compound annual growth rate

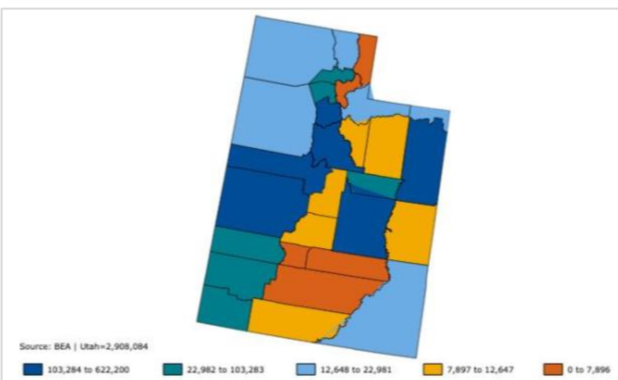


Figure 7c. 2020 Utility activity

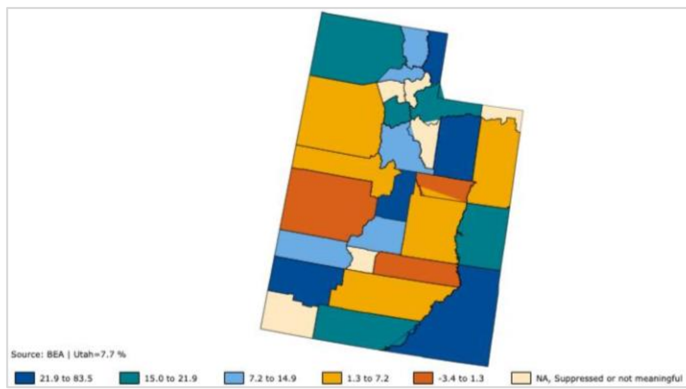


Figure 7d. Utility compound annual growth rate

Figure 7: Utah extraction and utility economic activity by county.

In Wyoming, the largest contributions to the economy from the extraction sector come from five counties (shown in dark blue). However, all five of these counties experienced negative annual growth rates between 2015 and 2020. The strongest annual growth rates come from counties that are among the smallest contributors to GDP in 2020. Most counties show little to no contribution to the utilities sector, with only five counties showing an annual compound growth rate of more than 3.8%. One county in the southeast portion of the state was among the top contributors to 2020 GDP and had one of the highest growth rates over the 2015-2020 period.

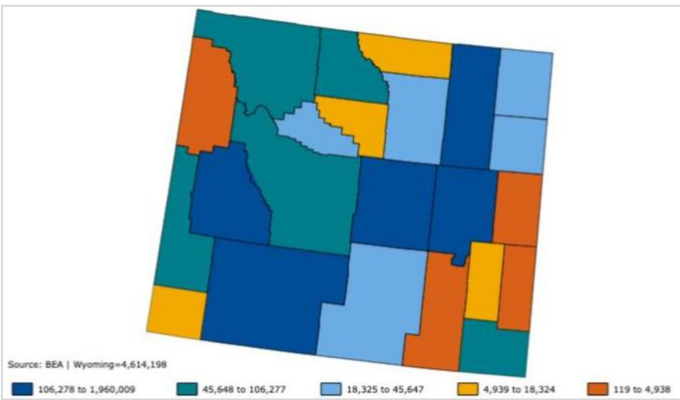


Figure 8a. 2020 Extractive activity ($k)

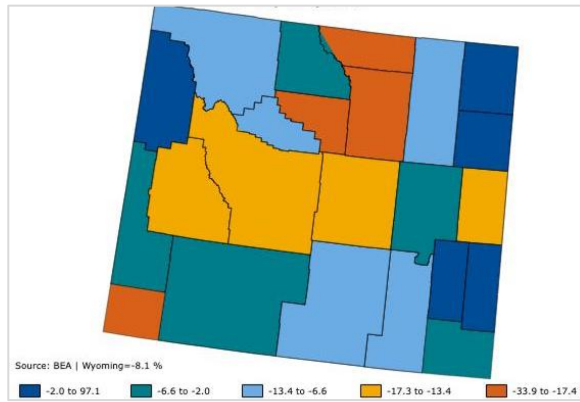


Figure 8b. Extractive compound annual growth rate

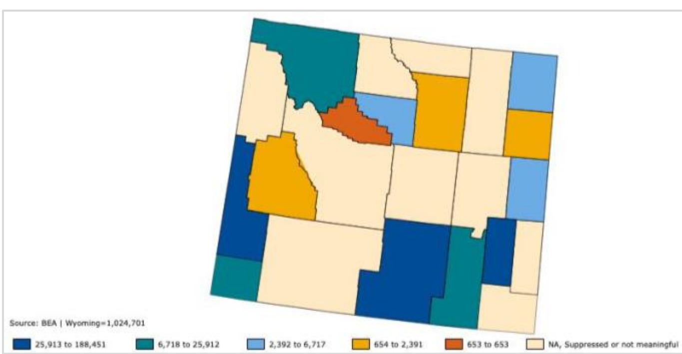


Figure 8c. 2020 Utility activity

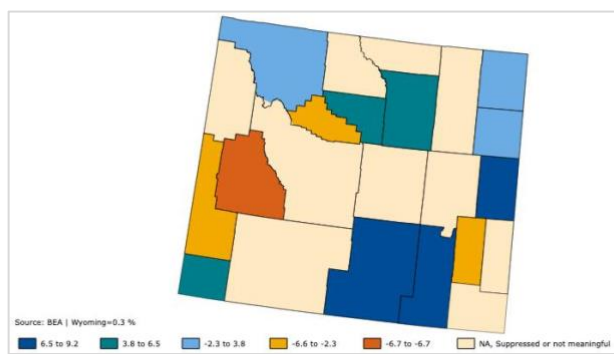


Figure 8d. Utility compound annual growth rate

Figure 8 (a-d). Wyoming extraction and utility economic activity by county.

The variation in growth rates and contributions across the states demonstrates how complex the energy industry in the region is, and how complex the deployment of energy-transitions technologies could be moving forward. There are, most likely, no two counties facing the same set of circumstances.

Many counties currently contributing to energy activities may be suited to technologies that can be added on to existing projects. For example, in Lincoln County, Wyoming, CO_2 as a by-product of natural gas production is separated and then used for enhanced oil recovery. Additional projects are being considered in Wyoming and in San Juan County, New Mexico that would allow coal-fired generation to continue with added carbon capture, utilization, and storage (CCUS) technology.

Counties with little or no current energy production may consider alternative technologies such as hydrogen, or biomass. Technology deployment will depend on the economic suitability of the location for that technology, where suitability is broadly defined to consider the unique characteristics of the location, as well as local goals and objectives.

Jobs

At the local level, job retention and the potential for new jobs are a primary focus for the technology deployment. Utilizing U.S. Bureau of Labor Statistics (BLS) data (BLS 2022), the annual unemployment rate in the U.S. during 2021 was 5.4%. At the same time, the unemployment rate in the Intermountain West region was 4.8%. Figure 9 presents the annual unemployment rate for the U.S., the region, and for each individual state within the region from 2011 through 2021. New Mexico and Arizona consistently have the highest state-level unemployment, while Utah has amongst the lowest.

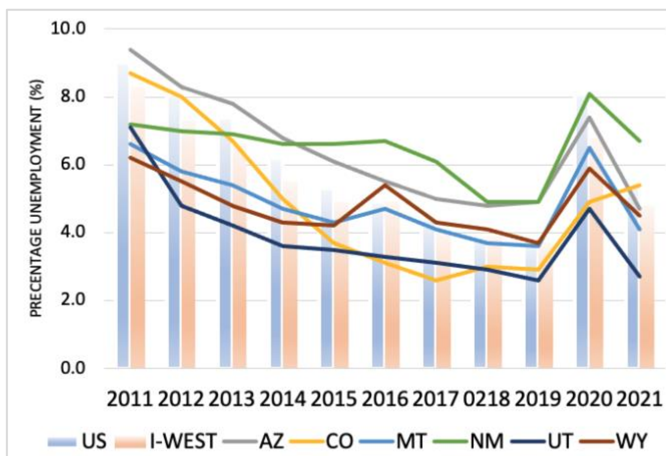


Figure 9. Annual unemployment rates.

The variation in unemployment rates across counties is as varied as that of the states. Figure 10 (a-f) presents the annual unemployment rates for 2021 by county. The darker the blue the higher the unemployment rate.[3] In the legend, the blue colors indicate an increase in unemployment while the yellows indicate a decrease. The more intense the color, the larger the impact.

[3] Note that the scale is unique to each state.

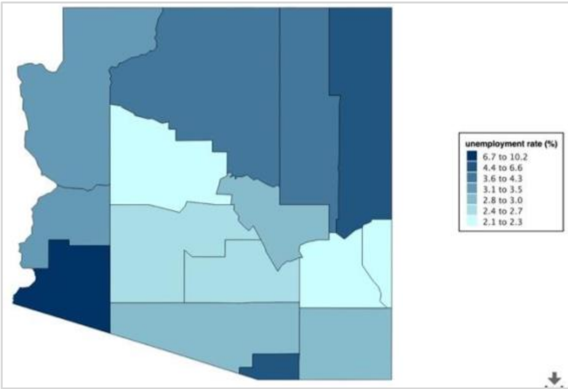


Figure 10a. Arizona annual unemployment rate 2021

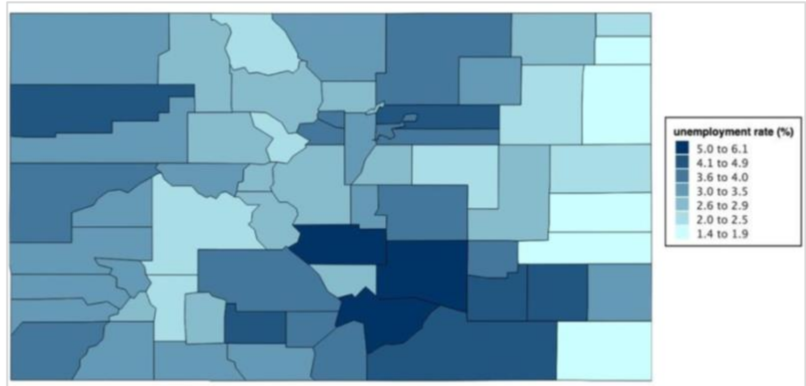


Figure 10b. Colorado annual unemployment rate 2021

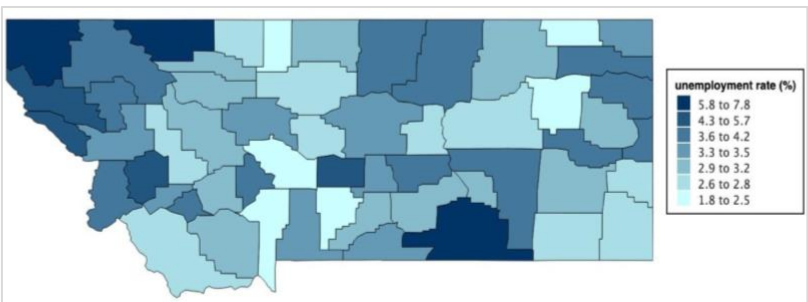


Figure 10c. Montana annual unemployment rate 2021

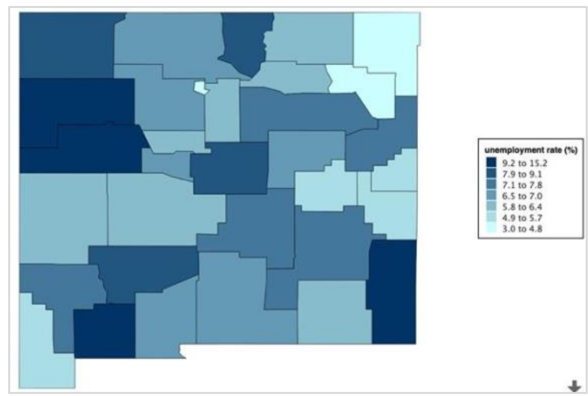


Figure 10d. New Mexico annual unemployment rate 2021

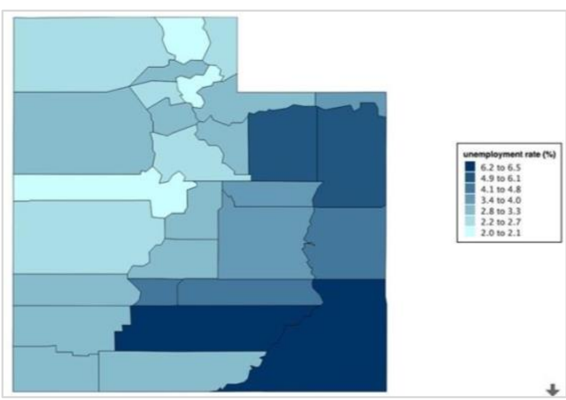


Figure 10e. Utah annual unemployment rate 2021

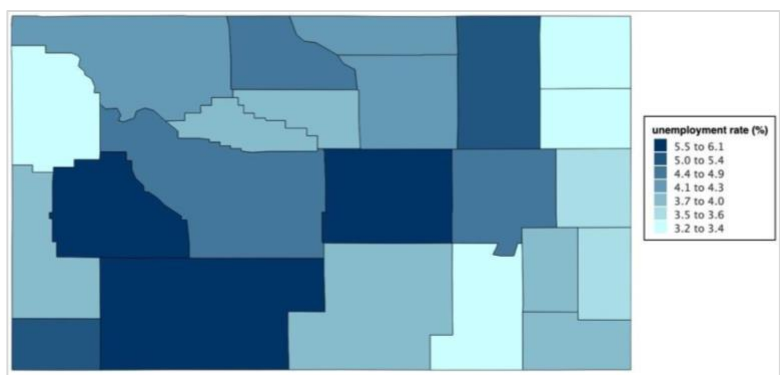


Figure 10f. Wyoming annual unemployment rate 2021

Figure 10 (a-f). Regional annual unemployment rates 2021.

In April 2022, while the monthly unemployment rate across the Intermountain West was 3.57%, the rate at the level of a single county ranged from 1.5% to 14.5%.

Of the 220 counties in the region, 84 (~38%) had unemployment rates above the regional average. In each county with an unemployment rate above the average, there is at least one factor previously discussed that correlates to that county. Almost all coal-producing counties had an above average unemployment rate. 39% of natural gas producing counties are above the average unemployment rate, as are 38% of the oil producing counties. 65% of the counties with an above average unemployment rate are non-metropolitan counties. Thus, there is not a strict correlation between factors, suggesting complexity and uniqueness at the county level.

Unemployment is also correlated to workforce availability. Figure 11 shows the workforce numbers for each state from 2017 through 2021. The workforce availability in Arizona and Colorado dwarfs that of the other states.

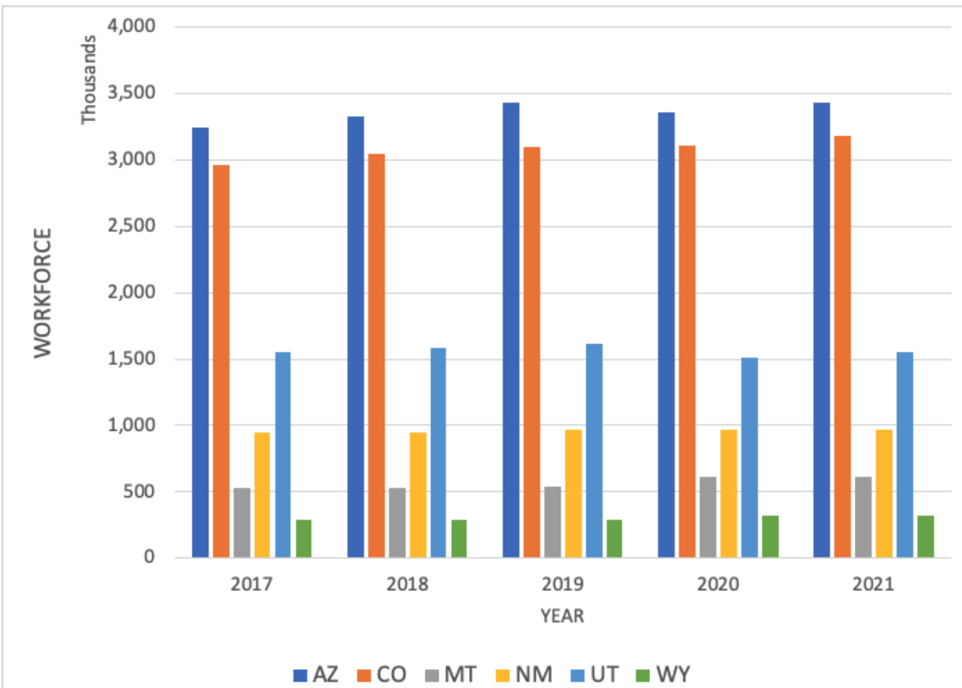


Figure 11. Workforce by state.

Table 4 provides the annual percentage change in workforce levels for each state. At the state level, comparing the change in workforce to the unemployment level can begin to provide detail concerning factors impacting unemployment levels. For example, in Colorado in 2021, the unemployment rate increased. However, the workforce also increased by 2.2%, suggesting either a potential workforce migration into the state, or workers returning to the workforce, which is an indication that the demand for work outpaced job opportunities.

Table 4. Annual percentage change in workforce					
	2017	2018	2019	2020	2021
AZ	-0.4%	2.7%	3.1%	-2.0%	1.9%
CO	2.4%	2.9%	1.7%	0.4%	2.2%
MT	1.3%	1.0%	1.6%	12.4%	1.1%
NM	0.5%	0.2%	1.4%	-0.1%	0.8%
UT	3.6%	1.9%	2.2%	-6.4%	2.6%
WY	-2.2%	-0.3%	0.5%	10.3%	-1.0%

Focusing on the county level, in 2021, 30% of Wyoming counties had an annual workforce percentage change less than the state average. Montana had 39% of its counties below the state average, CO had 45% below, NM had 61% below, and UT had 62% below. Thus, there is substantial unevenness in workforce growth across states and counties. Migration between counties and states and/or workers returning to the workforce may be partially responsible, as may have changes in job availability within the location. During 2021 all the states saw an increase in the number of workers employed. Only 5 out of the 108 counties in Colorado, Arizona, and Utah—the states with lowest contributions to GDP from the extractive and utility sectors combined—had a decline in the number employed in each county. Meanwhile, 49 of the 112 counties in New Mexico, Wyoming, and Montana saw declines in employee numbers between 2020 and 2021.

Additional considerations of economic impact

The discussion above provides basic factors of importance to local and regional economic activity, and factors of consideration for energy transition technologies. However, there are additional factors that may be of importance; some of which are discussed below.

Paramount among these factors is availability of key resources, such as water and land. Figure 12 (Bollinger, 2019) shows the number of weeks each county in the U.S. was in D3 (extreme) drought between 2000 and 2019.[4] Of the Intermountain West states, only Montana and Colorado have counties that experienced less than 50 weeks of drought over the period. Given the location and climate, Arizona and New Mexico have the largest number of counties with the longest periods of drought. Arizona, New Mexico, and Wyoming all have counties that have experienced more than 300 weeks of drought over this time period. This means these counties have experienced six or more years of extreme drought over the 20-year period. At the local or regional level, understanding the availability of water, and the potential impact (if water is a necessary input into a transition technology) is imperative, as is an understanding of the competing demands for water. Moving forward, the inextricable relationship between energy production and water will become a larger factor in local decisions for new projects as water scarcity is exacerbated by climate change.

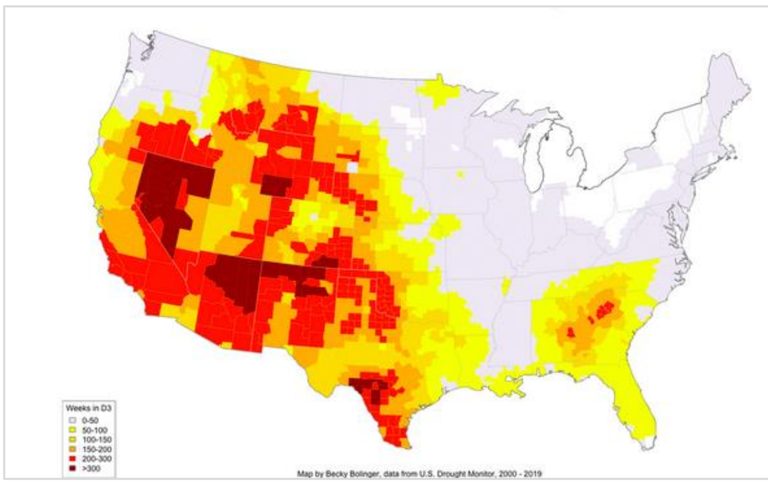


Figure 12. Weeks in D3 (extreme) drought 2000-2019.

Land ownership in the region is a complex issue, with private, state, federal, and tribal lands interspersed across each state. Figure 13 shows the diverse types of land ownership across the western U.S., which may impact the economic outcome for a community or region. Projects that cross land ownership boundaries may have increased local economic impacts.

[4] Potential impacts of D3, or extreme drought, are location specific, but in general include major crop or pasture loss, widespread water shortages, and restrictions.

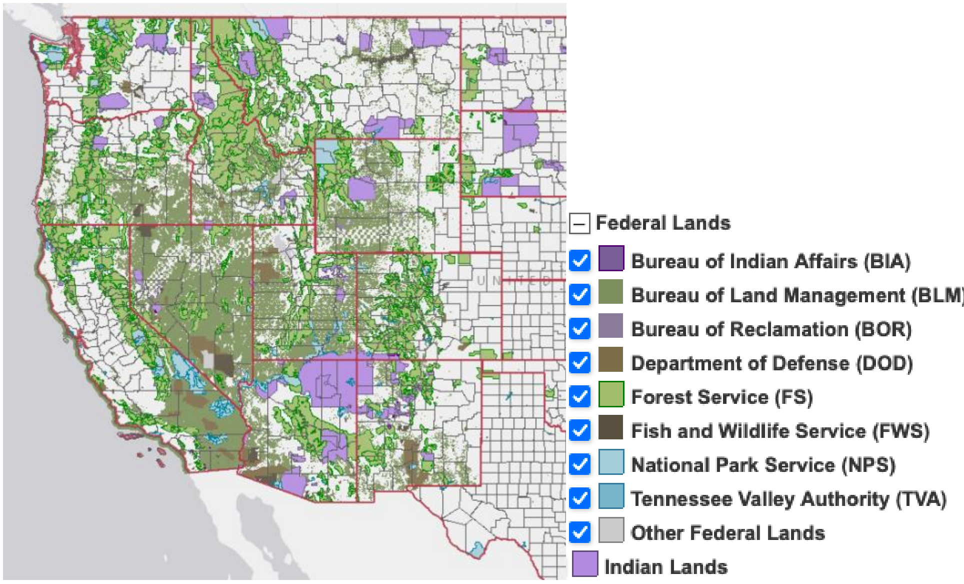


Figure 13. Land ownership.

The preceding paragraphs present an overview of factors that may influence the economic impact of a project on a region and factors that should be considered when developing place-based solutions. The discussion is not exhaustive, nor does it provide an assessment of individual locations. In addition, other factors such as policy and regulations, which are major factors of consideration, are not addressed due to their complexity and location specificity.

Two overviews

This section provides a brief overview of two counties: San Juan County, New Mexico, and Lincoln County, Wyoming. Both have a long history of energy production and have faced boom-and-bust cycles because of their dependency on energy. While both are moving toward energy transition, the processes and current issues are unique.

San Juan County

San Juan County, located in the northwest corner of New Mexico, has been a major producer of natural gas since the 1920's. Since 2010, production in the county has declined from a high of 571.8 million, thousand cubic feet (MCF) to 257.9 million MCF in 2021. Oil peaked at 5.59 million barrels (bbl) in 2019 and then declined to 4.25 million bbl (MineralAnswers.com 2022). A large portion of conventional natural gas reserves have been produced, and there is substantial interest in the Mancos Shale. However, increased production from the basin will depend on energy prices, tying a substantial portion of San Juan County's economic activity to boom-and-bust cycles outside the control of the county. For example, while the first commercial well was drilled in the area in the 1920s, the absence of a pipeline to export natural gas resulted in little activity until the 1950s, when a pipeline to the west coast was completed. This led to the county's first "boom" and a population increase from about 3,500 residents in 1950 to 23,000 in 1960 (Romeo, 2021)—an over 20% annual increase for the decade. The 1950s were followed by a series of cycles. In the 1990's the boom was associated with the production of natural gas from coalbed methane (CBM), which was aided by governmental subsidies to encourage development of CBM resources.

Coal production was a later addition, with surface mining starting in the 1960s at the Navajo Mine and in 1973 at the San Juan Mine. Underground mining via a single longwall began in 2000 (Mercier 2010). Coal from the San Juan Mine was used to fuel the San Juan Generating Station, while coal from the Navajo Mine was supplied to the Four Corners Power Plant. Both the Navajo Mine and the Four Corners Generating Station are located in San Juan County on Navajo Nation lands.

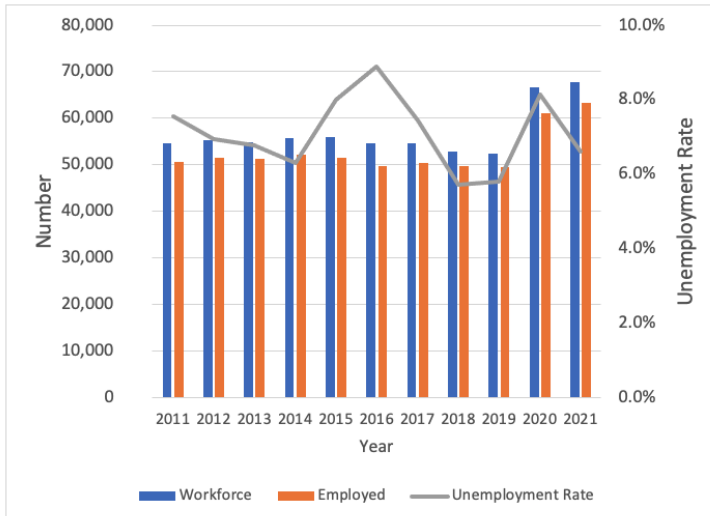


Figure 14. San Juan County, NM workforce and employment 2011-2021.

Two units of the San Juan Generating Station were closed in December 2017, and the remaining two units are tentatively slated for closure in 2022, resulting in a full retirement of the plant. In addition, the Four Corners Power Plant decommissioned three of its five units, which greatly reduced the demand for coal.

The reliance of San Juan County on the energy industry is evident. In 2018, almost 7,720 San Juan County jobs were in the mining (including oil and natural gas extraction) and utilities sectors (Arrowhead Center, 2020). The jobs in these industries accounted for 15% of all jobs in the county. Change in employment in this sector can have a significant impact on the county's employment and overall economic activity. Figure 14 shows the overall workforce, employment, and the unemployment rates for the county from 2011 through 2021 (data from the BLS, 2022).

The reduced demand for coal, the push towards carbon zero electricity generation, and a location that is somewhat isolated has resulted in San Juan County focusing on broadening their economic base.

A variety of avenues are being considered. For example, in a 2018 report detailing economic opportunities in the Four Corners area, O'Donnell recommended that the region prioritize tourism and recreation, solar and scalable storage, mine reclamation, healthcare, and local food systems.

In a second report, O'Donnell (2019) estimates that a 450-megawatt solar photovoltaic plant on the San Juan Generating site could replace lost property tax revenue, support thousands of jobs during construction, and generate over $65 million in additional tax revenue at the state and local level.

An alternative to closing the generating station is the installation of amine-based CO_2 capture technology for use in enhanced oil recovery, which is currently being pursued by Enchant Energy. Estimated jobs impacts are substantial, with Management Information Services, Inc. (2020) estimating this CCUS project would result in 92 times as many operations and maintenance jobs as a solar project. Without an influx of workers into the county, this level of job creation would result in full employment, which may be unrealistic.

County officials, Farmington city officials, Four Corners Economic Development, and Sovereign Nations are working towards a broader economic base, and as one official said, "all options are on the table." Their focus is centered on enhancing existing projects and expanding in new directions, both in energy and non-energy sectors. Specific to energy, the City of Farmington is partnering with Enchant Energy to develop the San Juan Generating Station Carbon Capture Project, and Navajo Transitional Energy Company (NTEC) has invested in Enchant Energy. San Juan Community College is focused on workforce development to broaden the base of workers in the area, to retrain displaced workers, and to provide opportunities to residents to remain in the county. A main focus in this area is to retain jobs, develop new job opportunities, increase economic activity in the county, and provide stability to the economy.

Lincoln County

Lincoln County, located in the southwest corner of Wyoming, has a long history of energy production. The majority of production is in the southern portion of the county in the Kemmerer, Cokeville, and Diamondville regions. Lincoln County has been a coal producing region since the late 1880s. Initially, the railroad was a major factor in the coal industry; the Oregon Short Line Railroad provided transportation and a market for coal for steam engines (Goldby, et al., 2015). Coal production from the Kemmerer Mine, the only remaining mine in Lincoln County, generated about 4.1 million short tons in 2018, but production declined to about 2.5 million short tons in 2020 (EIA, 2021a). Coal from the mine is utilized at the Naughton power plant, also located in Lincoln County.

The county remains one of the top 10 natural gas producing counties in Wyoming (ShaleXP, 2022), but the county appears to be past peak production for oil and natural gas. Oil production peaked in 1999 at

3.1 million barrels and by 2020 declined almost 75%. Natural gas production peaked in 1994 at 344 million MCF and by 2020 declined by 70% (MineralAnswers.com, 2022). In addition, the Naughton coal-fired power plant is slated for closure in 2025, which would result in a substantial loss of jobs both at the power plant and the Kemmerer Mine.

At the same time, Lincoln County is home to a number of innovative energy projects, such as the Shute Creek processing facility. High CO_2 and low methane levels in natural gas produced from the La Barge field required a combination of technology and economics to produce the natural gas. Over 30 years ago, technological advances and favorable economic conditions led to the decision to build the facility. The project's economics hinged on high oil prices and the ability to use CO_2 for enhanced oil recovery (EOR). Since its inception, the facility has sold about 50% of the total CO_2 for EOR and vented the remainder (Robertson and Mousavin 2022). Shute Creek is the largest and third oldest CCUS facility in the world. Owner ExxonMobil initiated plans in late 2021 to expand the plant with a final decision expected in 2022 (Natural Gas World 2021).

The county is expanding its focus on energy; for example, permits for an 80-megawatt solar plant were filed in 2021. Also, in 2021, TerraPower announced Lincoln County as the home of its demonstration Natrium plant, which would be located near the Naughton plant. The technology is described as a cost-competitive sodium fast reactor combined with a molten salt energy storage system. The economic impacts on the county, if realized, would be substantial. This estimated $4 billion dollar project would double the population of Kemmerer during construction and, when operational, would provide about 250 permanent jobs. This project could provide an expanded energy economy in the county.

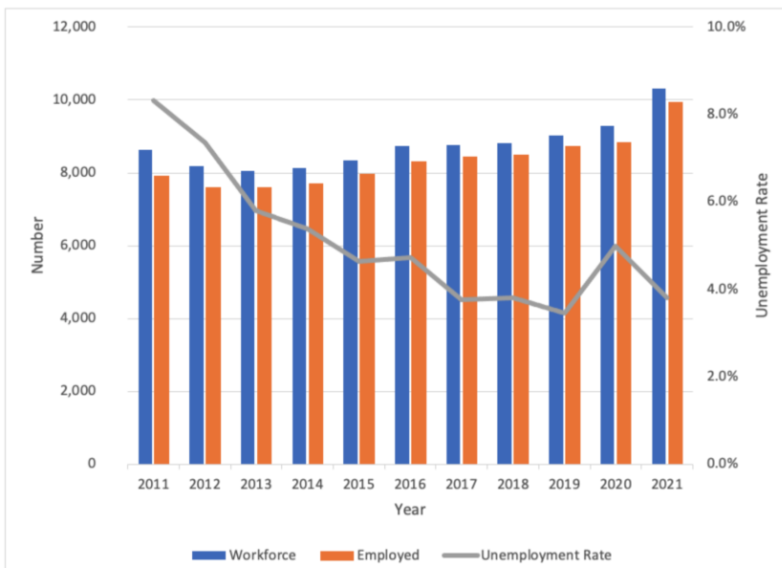


Figure 15. Lincoln County, WY Workforce and Employment (2011-2021).

As shown in Figure 15, the county has a workforce slightly above 10,000 and its unemployment rate is among the lowest in Wyoming (data from BLS, 2022). The county-level workforce has steadily increased since 2014, as have employment levels, with the only increase in annual unemployment rates occurring during the pandemic period. However, this county-level assessment does not reflect the reality in southern Lincoln County, where the population has been stagnant or declining since 2010, resulting in a stagnant workforce (The Bank of Star Valley, 2021). Energy prices and their impact on the area has been a contributing factor.

Lincoln County's approach to economic development may best be summed up by a letter of support for the TerraPower project from the County Commissioners. It reads in part:[5]

> *"Lincoln County is no stranger to energy projects. Our citizenry has long worked in energy production…energy is the heart of our county's economy… We have an existing workforce that is willing and able to transition to nuclear energy production.*
>
> *The existing infrastructure would already support the needs this project would bring to Lincoln County."*

The two counties highlighted above both have long, proud histories in energy production. The cyclical nature of the energy economy has resulted in both counties seeking paths to broaden their economic base, but both remain focused on energy as a main contributor to their economies. There is, however, a difference in the current apparent success of the counties. Location and accessibility may be contributing factors. Moving forward toward new energy transition energy projects, these local factors may become increasingly relevant.

Economic impacts of energy transitions

As discussed in previous sections, significant goals for many regions and counties include developing job opportunities and enhancing local economic outcomes. One difficulty in developing an energy transition roadmap with an economic assessment is that there is a lack of project-specific information. Project, initial capital costs, and jobs created (both during construction and operations) have not been determined for most potential projects, though there are exceptions. In a pre-feasibility study, it is estimated that the Enchant Energy CCUS project in San Juan County, New Mexico will result in 18 permanent O&M jobs in the utilities sector. Using IMPLAN input-output modeling, the interdependencies between producing and consuming industries can be captured. From the established number of permanent O&M jobs and anticipated labor income, direct (expenditures associated with the event), indirect (expenditures associated with business support (supply chain) activities), and induced effects (expenditures from households associated with the event) a change from the status quo is estimated. With 18 potentially permanent O&M jobs, a preliminary assessment of the total annual impact of the CCUS project on San Juan County would be 203 jobs. In addition, the

[5] July 21, 2021 memo from the Lincoln County Commissioners (https://svinews.com/lincoln-county-commissioners-echo-support-for-proposed-nuclear-plant/ last accessed 06/01/2022).

added labor value is estimated to be $20.7 million (direct, indirect, and induced) and the value added (the difference between value of output and cost of intermediate products) from the addition of the CCUS to the existing plant is estimated to be $79.4 million. While this assessment is based on a number of assumptions, it provides a realistic base assessment of the potential impact of a project.[6]

A series of hypothetical projects are assessed across counties in the Intermountain West utilizing IMPLAN. The impact of annual operations for projects consistent with either fossil fuel or renewable energy generation are considered, and the economic impacts are assessed as if the project were developed in 18 different counties in the region. Each project is treated as the only economic event to isolate the potential impact of the project. In addition, the economic impacts on surrounding area counties are also estimated.[7] A total of 12 scenarios for each county were run. The scenarios include a small job impact (five permanent direct jobs added) or a large job impact (20 permanent jobs added). Each job level is assessed under two salary levels based on the Bureau of Labor Statistics estimated average salaries for each state for the average construction and extraction salary and for power plant operators. Finally, each of these scenarios is considered as a fossil fuel, solar, or wind generation project. The impact of initial construction is not included, as this would be site and project specific. Table 5 presents the counties considered, the 2021 labor force, the 2021 unemployment rate, the two salaries used in the scenarios, and the surrounding counties that are included in more regional impact. There are substantial differences across these counties, including differences in the labor force and unemployment rates, as well as variations in salaries across the states and the current energy activity in the counties.

[6] Input-output models are static models that assume constant returns to scale, no supply constraints, a fixed input structure, and fixed technology structure.

[7] The area counties are those that surround the county of interest. In some cases, the counties cross state lines. If a county is not in an I-WEST state, it is not included in the analysis.

Table 5. Counties assessed by state

State	County	Labor Force (2021)	Unemployment Rate (2021)	Average Salaries	Surrounding Area
AZ	Apache	2,441	12.4%	$50,150/ $67,870	Navajo, Greenlee, Graham, Gila, Navajo; San Juan UT; San Jan, McKinley, Cibola NM
	Pinal	480,903	5.0%		Graham, Gila, Maricopa
	Maricopa	8,616	5.1%		Pinal, Gila, Yavapai
CO	La Plata	4,974	4.4%	$54,450/ $96,510	Montezuma, San Juan (CO), Hinsdale, Archuleta; San Juan NM
	Moffatt	463	5.0%		Rio Blanco, Routt; Sweetwater WY; Uinta, Daggett UT
	Pueblo	6,265	4.5%		Huerfano, Las Animas, Otero, Crowley, Lincoln, El Paso, Fremont, Custer
MT	Rosebud	4,330	4.2%	$53,720/ $78,990	Treasure, Big Horn, Powder River, Custer, Garfield, Petroleum, Musselshell
	Stillwater	17,489	3.6%		Carbon, Yellowstone, Golden Valley, Sweet Grass. Park
	Teton	1,904	2.4%		Ponderosa, Chouteau, Cascade, Lewis & Clark, Flathead,
NM	Lincoln	27,957	9.6%	$47,830/ $92,680	Chavez, De Baca, Guadalupe, Torrance. Socorro, Sierra
	San Juan	62,732	6.6%		Rio Arriba, Sandoval, McKinley; Apache, AZ; La Plata, Montezuma, CO
	San Miguel	49,527	8.0%		Santa Fe, Mora, Harding, Quay, Guadalupe, Torrance
UT	Emory	7,748	4.9%	$49,650/ $84,330	Carbon, Grand, Wayne, Sanpete, Sevier
	Iron	6,574	4.4%		Piute, Garfield, Kane, Beaver, Washington

	Uintah	36,804	2.9%		Daggett, Grand, Carbon, Duchesne; Moffatt, Rio Blanco, CO
WY	Campbell	5,316	4.4%	$56,260/ $84,800	Crook, Weston, Converse, Sheridan, Johnson; Power River, MT
	Converse	7,884	3.9%		Campbell, Niobrara, Platte, Albany, Natrona
	Lincoln	49,373	4.0%		Teton, Subletter, Sweetwater, Uinta

Tables 6 through 11 present the scenarios for each county that result in the maximum and minimum impacts for jobs and for value added. Direct, indirect, and induced impacts are presented for the county in which the project is located. Impacts to surrounding counties are either indirect or induced. These numbers are reported in aggregate rather than for individual counties.

There is substantial variation in the impact of the projects across counties. This can be due to a number of factors, including the current economic activity characteristics of the county and the characteristics of other counties in the area. Job impacts may be larger for indirect than for direct, or the area jobs may be relatively large (or small) compared to the project county. For example, counties with larger populations may be able to accommodate more indirect and induced jobs and not depend on neighboring counties. In other cases, the impact on surrounding counties is substantial as more of the indirect and induced impacts are accrued to the surrounding counties. A major takeaway of these results is the variation in outcomes across counties and across areas, depending on the project specifics—keeping in mind that the models are based on a set of hypothetical characteristics and that a model of an actual proposed project would be project specific. These results also illustrate the potential value of cooperation among counties or locations as there can be economic benefits across a larger region.

Table 6. Arizona economic impacts

County	Scenario	Impacts	Jobs	Value Added	Area Jobs	Area Value Added
Apache	Solar/20/High	Direct	20	$1,357,400	--	--
		Indirect	40.7	$9,038,186	4.3	$1,092,936
		Induced	8.2	$690,372	2.9	$231,636
	FF/5/Low	Direct	5	$1,227,687	--	--

		Indirect	2.6	$528,879	0.6	$231,567
		Induced	0.9	$71,732	0.4	$30,149
Pinal	FF/20/High	Direct	20	$1,357,400	--	--
		Indirect	21.4	$1,087,795	54.8	$8,406,900
		Induced	4.0	$144,415	27.1	$2,665,514
	Solar/5/Low	Direct	5	$339,350	--	--
		Indirect	5.5	$272,953	7.0	$1,284,298
		Induced	0.9	$35,164	3.9	$395,360
Maricopa	FF/20/High	Direct	20	$1,357,400	--	--
		Indirect	82.7	$13,000,000	1.4	$168,098
		Induced	43.8	$4,310,997	1.0	$92,452
	Solar/5/Low	Direct	5	$1,387,980	--	--
		Indirect	2.9	$726,672	0.02	$3,511
		Induced	2.8	$368,131	0.05	$4,912

Table 7. Colorado economic impacts

County	Scenario	Impacts	Jobs	Value Added	Area Jobs	Area Value Added
La Plata	FF/20/High	Direct	20	$1,930,200	--	--
		Indirect	61.5	$8,656,439	16.2	$4,815,280
		Induced	37.8	$3,088,173	9.5	$779,432
	Solar/5/Low	Direct	5	$272,250	--	--
		Indirect	6.3	$915,767	3.4	$660,999
		Induced	3.5	$286,486	1.2	$93,884

Moffatt	Solar/20/High	Direct	20	$1,930,200	--	--
		Indirect	36.7	$7,502,484	8.8	$1,511,878
		Induced	15.3	$1,245,335	4.4	$370,623
	FF/5/Low	Direct	5	$1,034,233	--	--
		Indirect	2.2	$1,143,353	0.8	$159,485
		Induced	1.8	$263,737	0.5	$43,957
Pueblo	FF/20/High	Direct	20	$1930,200	--	--
		Indirect	40.7	$6,996,402	18.1	$3,107,724
		Induced	19.5	$1,611,439	14.1	$1,221,935
	Solar/5/Low	Direct	5	$272,250	--	--
		Indirect	4.6	$780,943	1.4	$227,622
		Induced	2.3	$187,426	1.1	$98,550

Table 8. Montana economic impacts						
County	**Scenario**	**Impacts**	**Jobs**	**Value Added**	**Area Jobs**	**Area Value Added**
Rosebud	Solar/20/High	Direct	20	$1,579,800	--	--
		Indirect	20.4	$2,765,208	3.2	$466,558
		Induced	5.6	$354,976	1.7	$126,170
	FF/5/Low	Direct	5	$1,267,966	--	--
		Indirect	1.9	$316,999	0.4	$78,501
		Induced	1.0	$66,419	0.2	$18,836
Stillwater	FF/20/High	Direct	20	$1,579,800	--	--
		Indirect	16.9	$1,921,880	23.5	$5,831,366
		Induced	3.5	$282,988	14.7	$1,150,488

	Solar/5/Low	Direct	5	$268,600	--	--
		Indirect	2.9	$323,381	3.0	$782,043
		Induced	0.6	$47,012	1.7	$131,482
Teton	FF/20/High	Direct	20	$1,579,800	--	--
		Indirect	17.6	$2,469,425	11.4	$1,226,021
		Induced	6.8	$470,362	5.6	$405,264
	Solae/5/Low	Direct	5	$268,600	--	--
		Indirect	2.8	$382,031	1.7	$164,736
		Induced	1.0	$72,742	0.8	$59,702

Table 9. New Mexico economic impacts

County	Scenario	Impacts	Jobs	Value Added	Area Jobs	Area Value Added
Lincoln	FF/20/High	Direct	20	$1,853,600	--	--
		Indirect	36.9	$4,062,858	3.5	$953,051
		Induced	13.2	$991,308	1.6	$125,616
	Solar/5/Low	Direct	5	$239,150	--	--
		Indirect	4.3	$435,624	0.3	$79,910
		Induced	1.6	$118,880	0.14	$11,419
San Juan	Solar/20/High	Direct	20	$1,853,600	--	--
		Indirect	48.3	$10,622,428	5.1	$970,360
		Induced	23.1	$1,889,121	5.9	$464,871
	FF/5/Low	Direct	5	$849,325	--	--
		Indirect	2.7	$711,103	0.3	$127,128
		Induced	1.9	$154,133	0.5	$80,059

San Miguel	FF/20/High	Direct	20	$1,853,600	--	--
		Indirect	23.3	$2,545,286	4.6	$741,990
		Induced	7.3	$502,703	1.8	$151,235
	Solar/5/Low	Direct	5	$239,150	--	--
		Indirect	3.0	$328,182	0.2	$29,168
		Induced	0.9	$65,110	0.2	$13,691

Table 10. Utah economic impacts

County	Scenario	Impacts	Jobs	Value Added	Area Jobs	Area Value Added
Emery	Solar/20/High	Direct	20	$1,686,600	--	--
		Indirect	31.4	$8,473,916	5	$546,408
		Induced	7.5	$603,510	4.4	$296,591
	FF/5/Low	Direct	5	$1,070,450	--	--
		Indirect	1.6	$425,064	0.4	$73,825
		Induced	0.7	$58,598	0.4	$27,022
Iron	FF/20/High	Direct	20	$1,686,600	--	--
		Indirect	50.9	$5,043,234	24.4	$2,829,853
		Induced	18.3	$1,115,910	7.3	$504,736
	Solar/5/Low	Direct	5	$963,207	--	--
		Indirect	1.6	$161,981	0.4	$67,460
		Induced	1.7	$102,525	0.3	$18,682
Uintah	Solar/20/High	Direct	20	$1,686,600	--	--
		Indirect	30	$4,405,740	10.6	$4,067,259
		Induced	10.6	$808,579	5.6	$456,483

	FF/5/Low	Direct	5	$1,248,930	--	--
		Indirect	2.9	$455,113	1.0	$392,256
		Induced	1.6	$120,835	0.6	$51,186

Table 11. Wyoming economic impacts						
County	**Scenario**	**Impacts**	**Jobs**	**Value Added**	**Area Jobs**	**Area Value Added**
Campbell	Solar/20/High	Direct	20	$16,960,000	--	--
		Indirect	38.2	$7,221,182	3.1	$622,492
		Induced	10.3	$889,052	1.6	$115,361
	FF/5/Low	Direct	5	$883,397	--	--
		Indirect	2.9	$710,795	0.2	$44,071
		Induced	1.2	$104,049	0.1	$11,158
Converse	Wind/20/High	Direct	20	12,000,000	--	--
		Indirect	23.5	$4,725,025	13.4	$3,589,903
		Induced	4.7	$429,310	5.5	$473,340
	FF/5/Low	Direct	5	$894,473	--	--
		Indirect	1.6	$392,510	1.4	$443,952
		Induced	0.6	$50,519	0.7	$56,193
Lincoln	Wind/20/High	Direct	20	$1,696,000	--	--
		Indirect	33.1	$5,224,536	1.7	$360,336
		Induced	9.4	$655,155	1.3	$109,867
	FF/5/Low	Direct	5	$896,085	--	--
		Indirect	2.8	$556,157	0.1	$42,366
		Induced	1.2	$83,954	0.2	$13,451

The impact on jobs in the project county depends on the economic conditions prior to the project event. Table 12 provides the impact on unemployment for the highest impact project in each county. As expected, in all counties, there is a positive impact on the rate of unemployment (using 2021 conditions as the starting point). In two cases, the potential impact of jobs would result in a near zero unemployment rate, suggesting that current workforces would not be able to cover all potential new jobs, resulting in net migration into the county.

Table 12. Jobs impact by county

State	County	Scenario	Labor Force (2021)	Jobs Added	Unemployment Prior to and After Event
AZ	Apache	Solar/20/High	2,441	69	12.4% to 9.6%
	Pinal	FF/20/High	480,903	45	5.0% to 5.0%
	Maricopa	FF/20/High	8,616	147	5.1% to 3.4%
CO	La Plata	FF/20/High	4,974	119	4.4% to 2.0%
	Moffatt	Solar/20/High	463	72	5.0% to ~0%
	Pueblo	FF/20/High	6,265	80	4.5% to 3.2%
MT	Rosebud	Solar/20/High	4,330	46	4.2% to 3.1%
	Stillwater	FF/20/High	17,489	40	3.6% to 3.4%
	Teton	FF/20/High	1,904	44	2.4% to 0.1%
NM	Lincoln	FF/20/High	27,957	70	9.6% to 9.3%
	San Juan	Solar/20/High	62,732	91	6.6% to 6.5%
	San Miguel	FF/20/High	49,527	51	8.0% to 7.9%
UT	Emory	Solar/20/High	7,748	59	4.9% to 4.1%
	Iron	FF/20/High	6,574	98	4.4% to 2.9%
	Uintah	Solar/20/High	36,804	61	2.9% to 2.7%

WY	Campbell	Solar/20/High	5,316	69	4.4% to 3.1$%
	Converse	Wind/20/High	7,884	48	3.9% to 3.3%
	Lincoln	Wind/20/High	49,373	63	4.0% to 3.9%

An additional complexity concerning jobs depends on the types of needed jobs in the direct, indirect, and induced categories. General skills jobs are more easily filled than specialized skills jobs, so understanding matching between available workforce skills and needed skills is critical. Table 13 provides an example for Lincoln County, Wyoming and the top five indirect employment areas for the Wind/20/High scenario. While the numbers in this illustration are relatively small, the importance of understanding whether or not the size of the workforce can accommodate a project and whether or not the existing workforce has the necessary skills for the project—and supporting jobs—is an important factor for assessing potential projects. If labor cannot be supplied locally, then an additional concern for a project may be net migration into a community or county.

Table 13. Lincoln County, WY top five indirect job areas

Employment Area	**Number of Jobs (% of indirect jobs)**
Transportation, truck transportation, and support	4.1 (12.4%)
Electric power transmission and distribution	3.3 (10%)
Other real estate	3.1 (9.4%)
Electric power generation - Fossil fuel	1.9 (5.7%)
Misc. Professional	1.9 (5.7%)

Bioenergy

Bioenergy is unique within the energy transition as it involves the use of forest or waste products. These factors impact project location and magnitude of production, which in turn may point to locations that are substantially different than those for other energy-related projects. An analysis of available and accessible forest residues on a county basis—either from selected harvesting, (land use change), or forest management, or from harvesting standing dead trees from drought or fire—provides the basis for a preliminary set of economic indicators for each of the 220 counties in the region to assess potential bio-ethanol production. Figure 16 highlights the top two counties in each, platting harvesting radius against production potential and illustrating substantial variations across the states. The top two counties in Colorado, namely Washington and Morgan, have significantly larger production potentials, at a larger area, than any of the counties in the other states. The potential economic impact of bioenergy in these counties, or in any other, ultimately depends on the scale and type of operation.

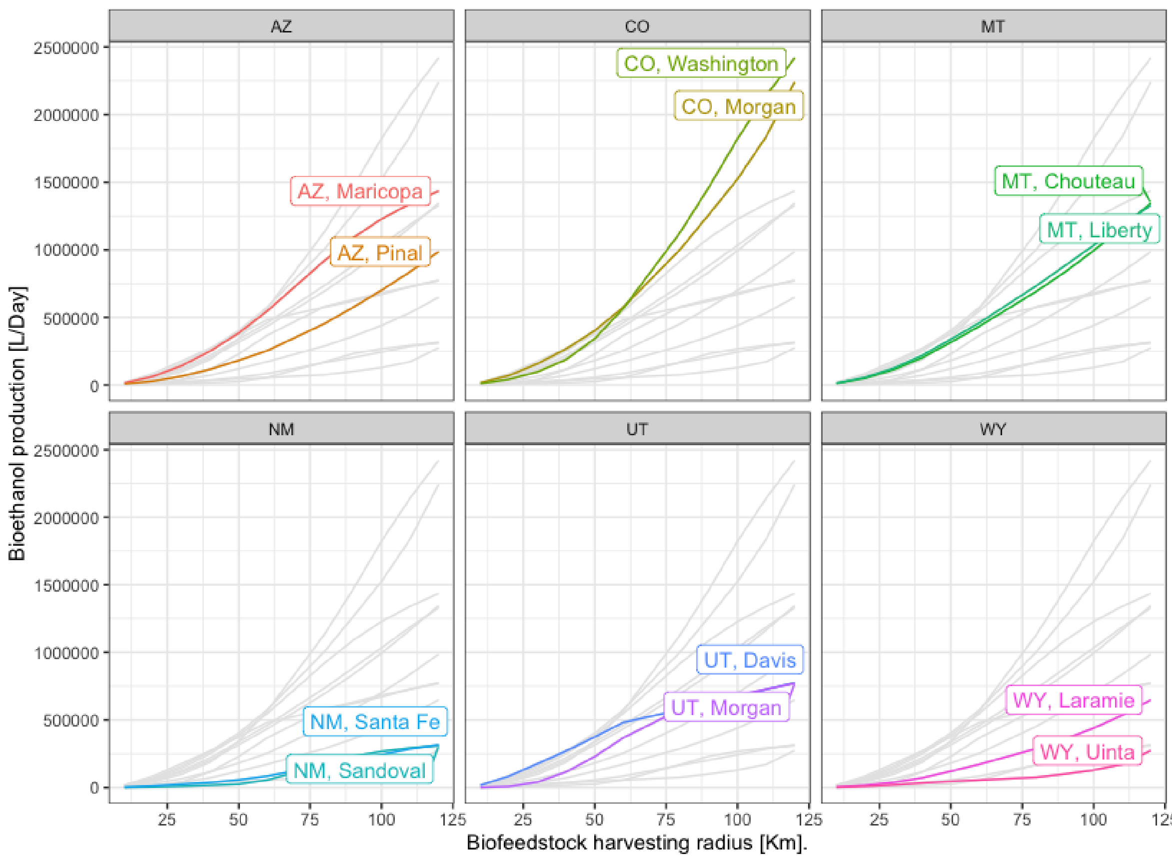


Figure 16. Potential bioethanol production counties.

Moving forward, climate change impacts, which may include increased temperatures, and decreased precipitation, could threaten supplies of biomass that may be available for bioenergy (biofuels or biogas), or in some cases may make more resources available for harvesting. In particular, forest resources in the Intermountain West are at risk from wildfires, which are increasing in frequency, extent, and severity in most of the region.

Heterogeneity

A variety of factors that can impact the economic outcome of a project have been discussed in the preceding sections of this report. Those, however, focus on heterogeneity associated with location, including current economic conditions, water availability, or labor availability. Policy, (which I-WEST also considered in its phase-on assessment) can also result in heterogeneity of outcome. An additional aspect of heterogeneity that could impact the outcome of a project is heterogeneity of preferences of residents impacted by a project.

A variety of studies and surveys suggest that, in general, there is support for energy transition technologies. However, the support is not universal and there are some aspects of a technology that may be more important than others to residents.

A study focusing on New Mexico (Chermak and Ehrenfeucht, 2022) finds 20% of survey respondents would not support carbon neutrality, regardless of the cost, while more than 50% say that they *would* support carbon neutrality regardless of the cost. They also find stronger support for technologies with which individuals are more familiar. Respondents were most familiar with renewables and almost 40% of respondents were very supportive of deploying renewables. Support for hydrogen and CCUS was slightly over 20%, depending on the time frame for deployment. Creation of new jobs was consistently an important factor as were health impacts and impacts on individual households through energy costs. These results suggest knowledge or education is an important factor for community support for a project. Further, potentially positive impacts on the individual are important, as were potentially negative impacts. For example, almost 80% of respondents thought higher energy costs due to transitions would be a very or somewhat important concern. This is also consistent with comments from regional stakeholders at the I-WEST Economics Workshop regarding the potential impact on energy burdens in communities if energy transition projects result in higher costs or energy burdens to households.

The impact on the local economy through job gains or losses was also important, with more than 70% of respondents focusing on jobs as a very important or somewhat important factor in transition projects.

Finally, an individual's knowledge about specific technologies was important in how supportive of specific aspects of a technology they were. For example, those who indicated they had a very strong understanding of hydrogen technology was ~8.5%, which is similar to the percentage of those who had a strong understanding of CCUS. Those two technologies also had substantially lower levels of strong support for deployment in either 5 or 15 years than did renewables, where ~23% of respondents indicated a strong understanding.

Western and Gerace (2021) conducted a survey of Wyoming perspectives from residents in 12 counties focusing on a net zero energy economy. Key findings include 94% of respondents believe energy production is very important now and, in the future, while 43% believe it is important for the state to transition to carbon-neutral energy. Demographic indicators of preferences included political affiliation. Similar to the New Mexico study, understanding or knowledge of a technology (in this case, hydrogen) resulted in stronger support for that technology. Also similar to the NM study, jobs were of high importance.

The above provide results for single states. While each state in the Intermountain West has some representative surveys focusing on various aspects of energy transitions and residential support, the results cannot be easily compared to draw conclusions about support for future projects and the potential impacts that support (or lack thereof) will have on the economic outcome of a project.

Two projects that focus on aspects of energy and/or climate change and include all the states under assessment by I-WEST are Colorado Colleges' annual "State of the Rockies" survey and the "Yale Program on Climate Change Communication," which includes a mapping of attitudes and preferences towards climate change. The former provides results at a state level, while the latter provides results at the national, state, county, or congressional district level.

As an example, the Yale work includes a question asking if the respondent is worried about climate change. Table 14 provides the county in each state that had the highest and lowest percentage of respondents who were worried.

Table 14. Worried about climate change

State	Highest Response (%)	Lowest Response (%)
AZ	Pima (73%)	Mohave (55%)
CO	Denver (76%)	Kiowa (50%)
MT	Glacier (71%)	Richland, Fallon (49%)
NM	Mora (78%)	Eddy (55%)
UT	Salt Lake (70%)	Emery (47%)
WY	Teton (70%)	Campbell (48%)

A second question asks if the respondent agrees or disagrees with setting strict CO_2 limits on existing coal-fired power-plants. These results are reported in Table 15. In those cases where the same county is found in both tables, those that fall in the highest response rate are relatively more consistent across the two questions. For example, Denver County in Colorado had a 76% response rate for both questions. In general, for the low response rates, the percentage of respondents that agree with setting strict CO_2 limits is lower than the low response rate for being worried about climate change. For example, 43% of respondents in Emery County are worried about climate change, but only 38% of respondents believe there should be strict CO_2 limits set on existing coal-fired power-plants.

Table 15. Setting strict CO_2 limits on existing coal-fired power-plants

State	Highest Response (%)	Lowest Response (%)
AZ	Pima (72%)	Mohave (53%)
CO	Denver, Boulder (76%)	Moffatt (44%)
MT	Glacier (72%)	Rosebud (46%)
NM	Santa Fe, Taos, Mora (78%)	San Juan (49%)
UT	Summit (72%)	Emery (38%)
WY	Teton (73%)	Washakie, Converse (39%)

The 2022 Annual Survey of Voters in the Rocky Mountain West, conducted by Colorado College as part of the “State of the Rockies” poll focused on a number of issues, including the gradual transition to 100% renewable energy over the next 10 to 15 years. Across the Intermountain West, support ranged from 49% (Wyoming) to 69% (Arizona). Compare this to the 2020 poll, which focused on support for requiring states to transition to 100% clean, renewable sources over the next 30 years, where responses from the region ranged from 36% (Wyoming) to 70% (Arizona and Colorado). The questions asked were not identical; there are differences in sample sizes and mode of survey, but the results suggest an increase in support at the state level for a transition to renewables. The 2020 and 2022 state level results are presented in Table 16. The level of support is fairly constant for five of the six states. Wyoming, however, has a 13-point increase over the time period. The caveat to these results is that it is at a state level and may not capture location nuances.

Table 16. State-level support for transitioning to renewable energy		
State	2020 (support at any level)	2022 (support at any level)
AZ	70%	69%
CO	70%	68%
MT	55%	59%
NM	63%	63%
UT	60%	61%
WY	36%	49%

These results provide an example of the heterogeneity of opinion and policy preference across and within the region. Moving forward, the structure of a program or of a project may be an important factor in whether or not there is local support for that project.

Conclusions and future directions

The states and counties within the Intermountain West are diverse in their current economic conditions, current reliance on energy in their economy, land ownership, experience with drought, and population density (i.e., metropolitan versus rural). Economic outcomes from projects depend on a variety of factors. As the hypothetical projects suggest, the current conditions and ability of a county to accommodate a project will affect its economic value and impact on jobs. In some cases, job creation occurs mainly within the county, while in other instances, the surrounding counties play an important part in economic activity. These examples also show the potential benefit of regional cooperation for projects.

Economic success of projects may also depend on location characteristics. For example, San Juan County, New Mexico, and Lincoln County, Wyoming, both have a long history of energy production, including boom-and-bust cycles. Energy is still a significant part of these counties' economies and both are pursuing transitions to new energy economies. The success of those transitions may depend on the characteristics of the location, including access to that location. Further, transitions that are not subject to the boom-and-bust economics of fossil fuels could provide stability within communities.

The development of a successful energy transition roadmap will take these factors into account and can provide an improved understanding of the future potential of energy-related projects. Due to the disparate characteristics of the Intermountain West, the interactions among counties, the potential for collaboration among counties, and the social economic impacts of a specific project are not easily estimated; furthermore, comparisons across projects are even more difficult. The development of a holistic modeling tool to assess economic impacts and tradeoffs (market and nonmarket) of projects, and to incorporate factors of importance into those assessments, would provide a mechanism to better understand the impacts and tradeoffs of different energy futures in the Intermountain West. This report provides an initial presentation of factors that would prove relevant within such a modeling tool.

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