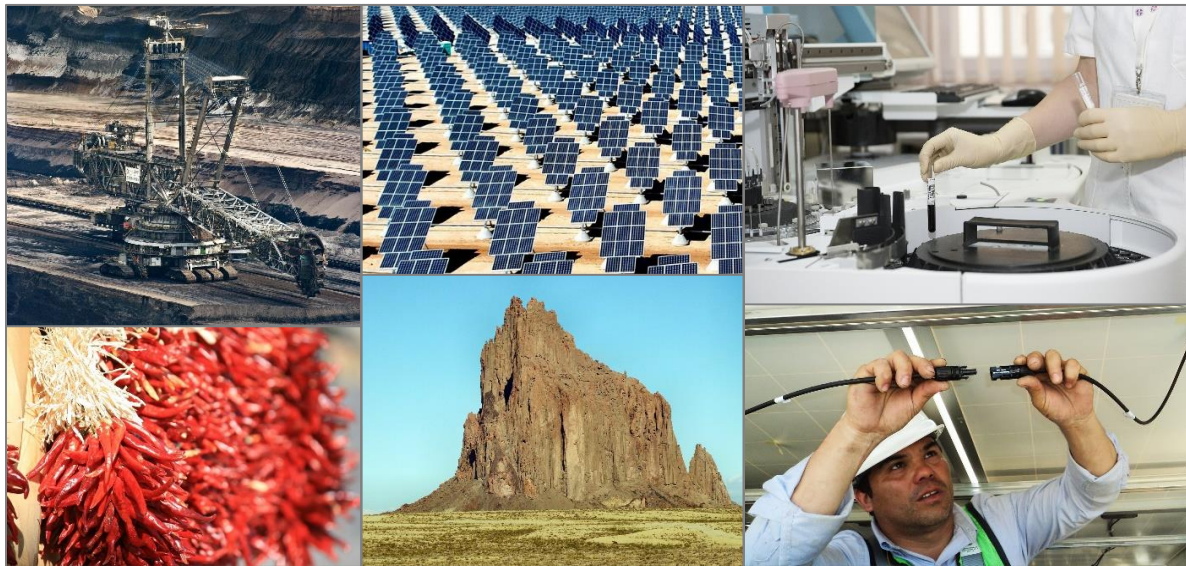


# Regional Economic Assessment & Strategy for the Coal-Impacted Four Corners Region

## *Final Report*

February 8, 2017



*Prepared for*



Northwest New Mexico Council of Governments

Partnership for Opportunities and Workforce & Economic Revitalization (POWER)

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## EXECUTIVE SUMMARY

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The coal mining and associated power production industries have historically been key economic engines in the Four Corners region of Northwest New Mexico. Changes in regional, national, and international energy markets, as well as changes in state and federal energy policy, have resulted in a decline of investment in these industries in the region. In turn, the region has suffered a reduction of employment, income, and taxes supported by the energy sector. In response to these changes, the counties in the Four Corners region are proactively seeking economic development strategies to strengthen and diversify its economy and stabilize the financial base for its communities and governments.

As part of this effort to increase resiliency, the **Northwest New Mexico Council of Governments (NWNMCOG or COG)** sponsored a comprehensive strategic planning process to assess the extent of the economic impact that changes to the region's energy industries have had and will have on Cibola, McKinley, and San Juan counties, and provided recommended actions for the region as a whole and for each of the three counties individually to strengthen their economic foundation. While the focus on assessing adverse impacts is on the coal and coal-related power generation sector, strategies for economic



resiliency encompass all economic sectors and geographic areas within the three counties. The funding is through the Federal Economic Development Administration's program, "Partnership for Opportunity and Workforce and Economic Revitalization", or POWER.

This report documents the findings of this strategic planning process, which has relied on close collaboration with the COG and other regional partners, such as local economic development organizations, Tribes/Pueblos, and businesses. Findings at this stage of the strategic planning process support Phase I of a three-phase POWER initiative. Phase II will include work at local institutions to develop paid internships, apprenticeships and other on-the-job learning opportunities to help displaced workers re-enter the workforce with a new career, and Phase III will implement recommendations made in Phase I to promote job opportunities in high-growth sectors.

**This POWER planning process builds on past and current economic development efforts in the region.**

Throughout Northwest New Mexico, extensive work has been done to identify and develop key economic sectors/clusters, including those in the retail, health care, energy, tourism, agriculture, manufacturing, logistics/transportation, and construction sectors. Local education institutions have developed training programs to provide the local population a means to develop the necessary skills for jobs in these sectors. This planning process ties together efforts throughout the region and identifies regional strategies to promote this wide spectrum of industries, as well as identify target growth businesses for each county in the region.

The overall approach, including process to gather input from key stakeholders and organizations is outlined in the Introduction in **Section 1**, with a detailed Process Documentation provided in **Section 9**. **This executive summary focuses on the five types of findings and recommendations developed through this process:**

1. Type and Magnitude of Adverse Economic Impact
2. Regional and Community Strategies for Mitigating Economic Impact
3. Energy Sector Opportunities for Coal and Other Energy Assets
4. Other Sector Economic Diversification Opportunities
5. Recommended Priority Actions and Next Steps

Findings in each of these five areas is summarized below.

## ES.1 TYPE AND MAGNITUDE OF ADVERSE ECONOMIC IMPACT



***Coal Pile at San Juan Generating Station***

Determining the magnitude of adverse impacts helps to ‘diagnose’ the level of economic dislocation in the Four Corners region, and informs the level and type of response required to mitigate these impacts in later phases of the analysis. The impacts that are analyzed in this assessment include power plant downsizings/shutdowns and the consequent reduction in regional coal demand, as well as current reductions in market demand for coal mined in the region and shipped to out-of-state power plants. These adverse impacts are occurring within the context of similar impacts throughout the Four Corners region, as well as other coal-dependent areas in the United States. In addition, the assessment recognizes that other energy

markets besides coal, particularly the decreased price of oil and natural gas, has also adversely affected the Northwest New Mexico economy. Thus, the adverse impacts related to coal are compounded by significant downturns in other energy sectors in Northwest New Mexico.

To assess the magnitude of the identified impacts, this assessment describes regional employment, income, and fiscal impacts that have already occurred, or are anticipated to occur within the next several years as partial power plant shut-downs are completed by the end of 2017. The assessment also evaluates additional impacts that may result if coal-fired power generation and associated demand for coal were to further decrease from San Juan Generating Station (SJGS), Four Corners Power Plant (FCPP), Escalante Generating Station, or at coal-fired power plants in Arizona that are supplied by coal produced at the El Segundo Mine.

Estimated adverse impacts associated with reduced coal-fired power generation include:

- 1) **Direct employment and income in the coal mining and power generation sectors are anticipated to decline by approximately 930 jobs and \$122.1 million in income annually.** This represents approximately one to two percent of the region’s employment and income. Approximately 85 percent of the impact is in San Juan County. However, as a proportion of its income and job base, Cibola County actually faces a greater impact (1.46 percent of jobs and 2.42 percent of income) due to the reduced production occurring at El Segundo Mine.<sup>1</sup>

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<sup>1</sup> We include impacts from El Segundo and Lee Ranch Mine with Cibola County since nearly all mine workers reside there, although the mines are located in McKinley County.

- 2) **Total employment and income impacts, including indirect and induced ripple effects in other economic sectors, are estimated at 2,260 to 3,180 jobs and \$195.2 to \$213.3 million in annual income.** Approximately 90 percent of this impact is expected to be experienced in San Juan County.
- 3) **Tax receipts to all levels of local, tribal, and state government that are directly related to coal extraction are expected to fall by \$43.3 million.** Thirty-four percent of this revenue loss is to the State of New Mexico, 56 percent is to Navajo Nation, and 10 percent is to local governments in Northwest New Mexico.

Reductions in coal mining and power generation in Northwest New Mexico clearly have a negative impact for many area families and businesses, particularly in the short-term as workers search and re-train for other jobs and the local economy adjusts and develops new employment opportunities. However, as described in detail in the full assessment report, with the proper planning, in the long-term a reduced reliance on the energy sector may provide an opportunity for the area to enhance long-term economic resiliency through increased investments and improvements in economic diversification, ecosystem restoration, and workforce training.

## ES.2 REGIONAL AND COMMUNITY STRATEGIES FOR MITIGATING ECONOMIC IMPACT

Regions that have diversified their economies and transitioned from a dependence on extraction industries, such as mining or timber, have commonly employed the following strategies:

1. Meeting immediate and longer-term needs through workforce development, including technical skills training and small business skills;
2. Enhancing quality of life, through investments in downtown redevelopment and other infrastructure, services, and amenities to attract businesses, residents, and visitors;
3. Nurturing local regional networks and state partnerships, and leveraging these to obtain funds and support;
4. Investing in regional branding initiatives to market regional products and regional strengths to benefit local businesses and/or attract visitors and residents; and
5. Engaging the community and develop a shared vision for the path forward.

As indicated by success stories from other regions around the country (see **Section 3**), as well as efforts already underway in Northwest New Mexico, economic development strategies across the region should include a focus on these strategies. These strategies are broadly applicable for all economic development and diversification efforts in the region, and not just for those areas most impacted by declines in coal mining and power generation. All of the strategies listed above are discussed in detail in **Section 4**, and each is key for the Four Corners regions' successful, long-term economic development and diversification. The focus for each of these strategies will depend on community priorities, which should become well-defined through a community visioning process. We briefly summarize each of these strategies and associated action items here.

### ES. 2.1 Workforce and Business Development

**Addressing human capital needs is critical in successfully assisting dislocated workers and in developing a new industry or enhancing an existing one.** For dislocated workers, overcoming obstacles to pursuing retraining or additional education is critical (see **Section 4.1**). As experienced in other areas of the country, many miners transition into healthcare, information technology, and advanced manufacturing fields, so training programs in these fields (as already implemented in the Four Corners region) are appropriate. Other regional growth industries for which miners' skillsets are well-suited, such as outdoor recreation, may need additional workforce training and small business development support.

Furthermore, community and regional economic development organizations in Northwest New Mexico can support business development in **targeted** local growth industries through training workshops (focusing on small business skills, opportunities in local industries, and entrepreneurship), business support services (one-on-one technical assistance, downtown relocation services, and loan/funding programs), funding a small business ombudsman and outreach specialist, developing mentorship programs and economic networks that connect existing business owners with new ones, and developing support facilities for small businesses, such as incubator spaces or commercial kitchen facilities that can be shared by multiple new businesses. Potential targeted local growth industries for each of the three counties are highlighted in **Sections 7.2, 7.3, and 7.4**.

### ES. 2.2 Quality of Life

Investments in quality of life are key to long-term, resilient economic development. **Regions with high quality of life are better able to attract and retain residents and businesses, as well as provide an attractive destination for tourists.** Residents and visitors alike are drawn to live and to recreate in areas with nice amenities – including cultural, natural, and built environment amenities. Northwest New Mexico has strong assets in these areas, but quality of life remains an impediment to economic growth in Northwest New Mexico, as noted in every focus group meeting conducted as part of this project in each area of the region. For several clusters identified in previous planning documents, including health care and education, enhancing quality of life is critical for growth because professionals in these industries are often highly mobile and employable and are best attracted and retained in areas with high quality of life. Retaining professionals in these and other sectors, in turn, supports a higher level of available local services and quality of life for all residents.

**Investments in quality of life can benefit and aid in developing all sectors of an economy, and therefore, support a more diversified, self-reliant, and resilient economy less subject to and dependent upon outside market forces by:**

- Keeping young people and retirees in the area;
- Growing the high-paying and geographically mobile professional, technical, and businesses service sectors;
- Attracting industrial and manufacturing employers; and
- Benefiting the tourism and visitor services sectors.

As discussed in detail with specific action items identified in **Section 4.2**, two primary weaknesses that the counties and cities in the Northwest New Mexico region could collectively and individually address are:

1. Increasing offerings and accessibility of arts, entertainment and recreation; and
2. Enhancing the attractiveness and vibrancy of downtown core areas.

**Additionally, the region should consider engaging in a concerted effort to identify key, quantitative quality of life indicators to measure current conditions, community quality of life goals, and measurement of progress in achieving those goals.** Identifying key indicators makes it possible for policymakers and interested citizens to look at a more manageable set of numbers when assessing changes in quality of life over time. The process of choosing key indicators also helps citizens and policymakers realize gaps in their current information (See **Section 4.2** for further discussion and indicator examples).

### ES. 2.3 Partnerships and Regional Marketing

**Developing relationships within a community and across community and county boundaries can enhance economic development efforts in many ways and is critically important for the Northwest New Mexico region.** Specifically, partnerships can benefit all parties by leveraging assets, increasing outside funding, limiting counterproductive competition, enhancing efficiency and reducing redundancy of efforts and investments, and facilitating communication across industries and agencies to coordinate and enhance mutually beneficial efforts. Partnerships between local businesses is also critical. Developing networks and clusters of local businesses, connects local business products with the regional brand and enables collaboration and information sharing amongst related businesses. Businesses can work together to support and promote each other. It is also **critically important to engage with each Native community, recognizing the diverse viewpoints among and between tribes, and address the history of tension and distrust in order to help foster a supportive atmosphere for constructive engagement and development of a shared vision and partnership for the path forward.** Building on past successful efforts, such as those developed through work on the Navajo-Gallup water supply project, is one path forward.

Finally, as discussed in several of the diversification industries, **regional marketing is a critical component of success, particularly for tourism.** By covering a greater area and more businesses, regional marketing increases visibility and effectiveness. Also, by pooling resources, regional marketing can enable larger-scale marketing of an area. A regional marketing plan can identify and include such elements as:

- Regional identity and key destinations, events, or products to highlight;
- Regional brand and logo;
- Signage design and grant programs for businesses and community centers and gateways; and,
- Regional ‘trails’ that link cultural, historic, natural, or retail attractions.

### ES.3 ENERGY SECTOR ECONOMIC OPPORTUNITIES

The region has tremendous assets in coal, oil, gas, uranium and solar resources, as well as in infrastructure to extract, use and transport these resources. **The energy sector will continue to be a strong economic contributor in Northwest New Mexico; however, the composition of this industry will likely change in the years and decades to come.** Coal-fired power generation will continue at least for another 15 to 25 years at FCPP and SJGS, but the future of coal mining and related power generation in the region is uncertain further into the future. Natural gas and oil extraction will also continue, but are expected to follow boom and bust patterns that reflect national and global trends in price, based on macroeconomic supply and demand factors determined outside the region.



*Natural Gas Well*

In addition to changes in environmental policy at the federal level, demand for coal from Northwest New Mexico is expected to decrease, with little opportunity for local use or coal export.

Advances in technology have resulted in relatively low capital cost to develop natural gas combined cycle power plants. In addition, the application of hydraulic fracturing in the region has increased natural gas supplies and lowered the relative cost of natural gas power plants. Natural gas plants also emit fewer criteria air pollutants compared to coal-fired power plants. All of these factors are leading to reduced demand for coal for base-load power generation, both in the United States and across the world. While possible, local use of coal in a clean coal facility is highly uncertain due to high costs; the only U.S. example of the application of clean coal technology is at the new Kemper Energy Facility in Mississippi, where cost over-runs came in 180 percent of initial projections. Furthermore, in terms of export, on a cost of production basis, coal from Northwest New Mexico is unlikely to be able to compete with lower cost coal from the Powder River Basin or foreign sources such as Indonesia. There does appear to be opportunities in deriving advanced liquid fuels or other types of manufacturing of coal based products (e.g. lubricating oils, plastics, asphalt coatings, etc.). While these products can be manufactured with coal, most processing of this type is done using crude oil currently. Changes in resource availability, markets, or technology could make this a viable use for coal at some point in the distant future.

Uranium mining is another historic energy industry in the region; the future of this industry is highly uncertain due to both economic and political factors. Uranium mining is politically controversial due to its legacy of contamination at previous mines in the area, while its economic viability is not clear as it is also subject to international market forces as the price of uranium fluctuates dramatically. Thus, for a **more stable energy future, the region should look to continue to support its extractive energy industries while diversifying into more stable long-term energy development such as through continued development of solar energy, energy storage facilities, and potentially long-term, a natural gas combined cycle plant.**

Based on solar resources as well as infrastructure assets, there appears to be **strong potential for additional utility-scale solar power production in the Northwest New Mexico region.** The technology

advancements for solar photovoltaic projects indicate that this renewable energy source will soon be price-competitive with fossil fuel energy sources. Furthermore, given the intersection of major transmission assets in the region as well as the strong potential for renewable power generation in the Four Corners region, San Juan County is a **natural location for a commercial-scale energy storage facility** (i.e. 100s of MW of storage) to serve as a trading hub for southwest utilities. New renewable energy projects throughout the Four Corners region could feed power to the storage facility where utilities could buy and transmit renewable energy through existing/upgraded transmission lines from FCPP. FCPP is owned and operated by six utilities in the southwest – Arizona Public Service Company, Public Service Company of New Mexico, El Paso Electric, Tucson Electric, and Salt River Project – and also has transmission lines to Arizona, Nevada, and Utah. This collection of power purchasers and existing infrastructure creates an instant marketplace for selling power. As the rate of renewable energy development is uncertain, a storage facility that could be scaled up as more renewable projects come online is recommended.

Finally, Northwest New Mexico infrastructure and natural gas resources are well-suited to a natural gas combined cycle plant. An example of such a facility in the area is the Farmington Electric Utility System Bluffview plant which was constructed in 2004. Current technology has improved to capture even greater amount of energy produced from these types of plants over the past decade. The main benefits the region could expect from additional plants include providing a steady source of demand for local natural gas resources as well as provide significant employment and income with reduced impacts on local air quality relative to coal power. Such a plant could also provide significant employment and income with reduced impacts on local air quality relative to coal power. The recent decision by PNM to not open a natural gas combined cycle and solar power facility in San Juan County is a setback for short term growth in this sector in the region. However, the **region should continue to seek and support siting of a natural gas power plant.**

#### ES.4 OTHER SECTOR ECONOMIC DIVERSIFICATION OPPORTUNITIES

Northwest New Mexico can adapt and reduce its reliance on coal-related energy sectors by developing other industries that draw on the region's strengths. With guidance from economic development organizations and community leaders from across Northwest New Mexico, specific diversification opportunities were analyzed in the logistics, manufacturing, natural resource, and tourism sectors. Specifically, the market and economic feasibility of the following industries were assessed in detail: petrochemical manufacturing, dimension stone mining, industrial gas manufacturing, crop production, food processing, forest restoration and forest products, mine reclamation, renewable energy component manufacturing, electronic component manufacturing, transloading/warehousing, and tourism (with focus on cultural and outdoor tourism).

The planning process does not explore all possible ventures that could promote additional economic activity, but rather presents a reconnaissance-level evaluation of enterprises across a wide range of economic sectors. The evaluation considers the current market conditions and expected trends in the sector, the key characteristics and input needs of the venture in question along with feasibility, and potential economic impacts if the venture were to be developed (jobs, income, and other). Where possible, the analysis identifies specific recommended actions along with key players in the industry for recruitment and/or retention efforts.

Case studies from other regions in transition have shown that successful diversification is often focused on local food systems, recreation/tourism, and entrepreneurship. Our findings are similar: in all three counties, we find that tourism as well as food production and/or manufacturing is an important growth area, with entrepreneurship playing an important role in these and other target sectors. We also find that petrochemical manufacturing is a key growth industry in San Juan County, while forest restoration is a key potential growth industry in Cibola, and transloading/warehousing/logistics is a key growth industry in McKinley County.

In general, the analysis finds many opportunities to expand and diversify the Northwest New Mexico economy. However, several of the enterprises with the greatest opportunity for immediate or mid-term development would create a relatively low number of jobs (although these jobs would provide relatively high levels of income generation potential). This is especially true for dimension stone mining. In addition, petrochemical manufacturing, industrial gas manufacturing, and electronic component manufacturing are seen as likely viable industries for the region largely because of the existing infrastructure and enterprises in place today.



***NAPI Crop Production***

Large scale agricultural production and food processing are well-suited to the region largely because of the irrigation potential and existing food processing and distribution at Navajo Agricultural Products Industries (NAPI) in San Juan County. On a small or medium scale there are also opportunities in specialty food products. However, unlike the other industries evaluated, these sectors tend to have seasonal workforce needs with low wage earning potential. The possible exception to this are large-scale greenhouses producing high-end food or medicinal products. There are also significant synergies

that could be explored between the agricultural / food-processing sectors and both industrial gas and trans-loading (inland port) sectors.

The forest restoration and mine reclamation enterprises evaluated were found to be heavily reliant on federal funding or federal action in order to expand. Also, both were found to have the potential to provide significant social and environmental benefits to the region.

The transloading and warehousing enterprise evaluated appears to have high potential in the near-term (i.e. 1-5 years); especially as ports in the coastal states struggle with logistics and capacity. An inland port located in Gallup, New Mexico could alleviate these pressures and provide full-time employment opportunities in the region, as well as provide a key asset that will likely attract other manufacturing related ventures. In order to capitalize on this recruitment potential, we identify several areas of coordination between ocean carriers, port operators, and the railroad (BNSF) that could lead to competitive advantages for future tenants in the form of cost and time savings.

Finally, the region has extraordinary cultural, historic, and outdoor recreation assets that can attract could attract a much greater number of visitors, domestic and international, and enhance economic development, with more focused attention on tourism services.

## ES.5 RECOMMENDATIONS AND NEXT STEPS

A key purpose of the POWER initiative is to help communities such as those in Northwest New Mexico that have historically coal-dependent economies to make these changes and investments in response to evolving energy markets and policy environments. The goal is to minimize the adverse effects of these changes and to build a more resilient, diverse economic future. Northwest New Mexico has made good progress on this path of investment and diversification, but still has work to do to strengthen its economy to make it less susceptible to resource boom and bust cycles and potential future reductions in the energy sector. Northwest New Mexico's strategy should be three-fold:

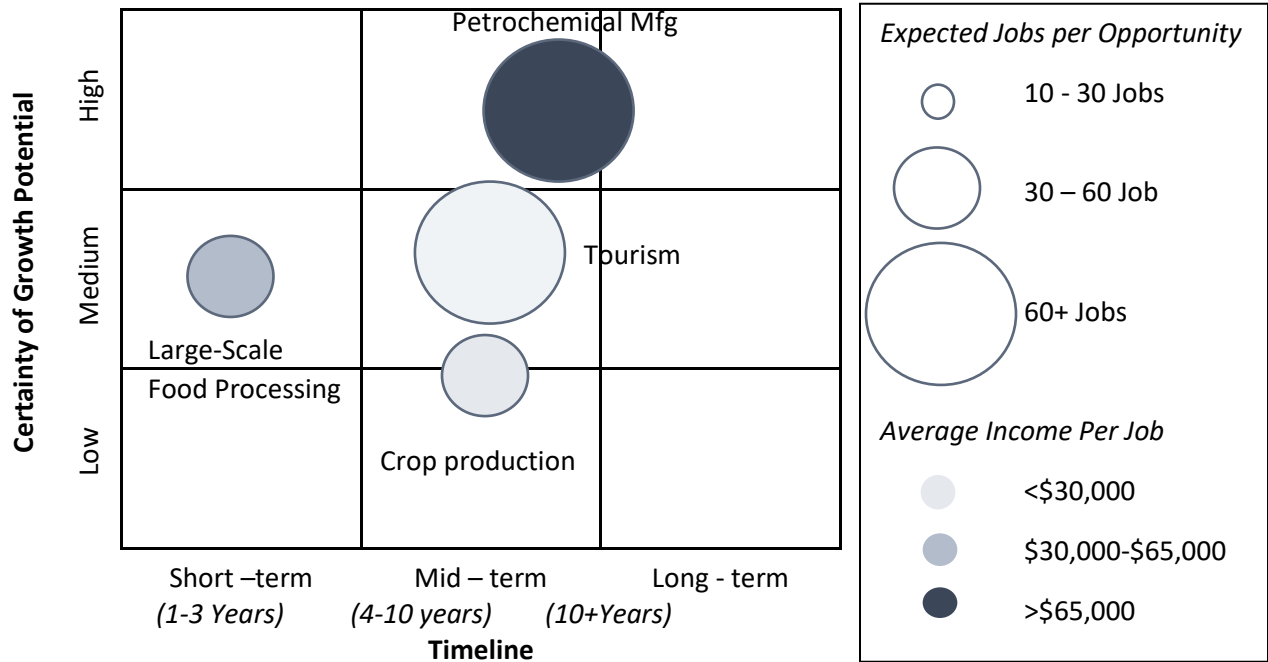
1. Continue to define and implement economic development strategies across the region that provide the foundational support for all industries at the regional and community level, including: A) workforce and business development; B) quality of life improvements; C) local, regional, and statewide partnerships; and D) regional marketing;
2. Continue to support existing businesses and enterprises in the energy sector, as well as encouraging promising new energy developments such as solar energy generation and energy storage; and
3. Further develop and leverage its cultural, geographic, natural resource, and community leadership assets through targeted investments and efforts to diversify its economy.

For each county below, we identify specific industries with potential to contribute to economic diversification and resiliency. The target industries for each county were selected from the set of industries evaluated based on the following factors: 1) economic contribution potential (jobs and income generated), 2) success potential, and 3) extent to which economic development efforts in the region would help to foster the industry (versus industries, such as solar energy generation or natural gas combined cycle power production, where industry growth rates will likely depend much more on market conditions than on local economic development efforts). The section identifies specific key actions and resources for economic development in these areas. In addition to these 'to do' items, it is important to note that any economic development opportunities that have a nexus with federal or tribal lands or resources, including federal funding, will need to comply with National Environmental Protection Act (NEPA) and National Historic Preservation Act (NHPA) and other applicable regulations.

### ES. 5.1 San Juan County

**Priority opportunities for economic development in San Juan County are large-scale food processing, petrochemical manufacturing, tourism, and crop production.** The timeline for growth in these industries and their potential economic contribution to the region in terms of number of jobs and income per job are highlighted in **Figure ES-1**.

**Figure ES-1: Summary of Impact for Top Targeted Opportunities**



**Table ES-1** summarizes a ‘to-do’ list of key actions and resources for economic development organizations (EDO’s) to make the most of these opportunities including those related to: competitive differentiation, marketing strategies, key contacts, and priority investments.

**Table ES-1: San Juan County Target Growth Areas and Actions**

Topic	Tourism	Petrochemical	Food Processing	Crop Production
<b>Competitive Differentiation for Marketing</b>	<p>Shiprock landmark and Navajo cultural assets</p> <p>Chaco Cultural NHP and Aztec Ruins NM</p> <p>River and lake-based recreation</p> <p>Urban amenities in close proximity to world-class cultural and outdoor recreation opportunities</p>	<p>Abundant supply of relatively cheap natural gas feedstock</p> <p>Companies involved in petrochemical manufacturing are already operating in the basin</p> <p>San Juan College has well developed educational programs producing graduates with skillsets well-suited to the industry</p>	<p>Existing large production base and storage infrastructure for key crop inputs</p> <p>Industry clustering benefits, as NAPI already has existing food processing facilities in the area</p> <p>Praxair facility in the area offers a reliable supply of nitrogen gas, often used in food processing</p> <p>Gallup transloading facility may offer a cost-effective method of transporting goods</p>	<p>NAPI has a proven successful track record</p> <p>Funding available for irrigation infrastructure through a settlement</p> <p>Transloading facility in Gallup offers a cost-effective method of transporting goods</p>
<b>Marketing Strategies</b>	<p>Market the state tax advantages (Consumables Gross Receipts Tax Deduction for Manufacturers, Investment Tax Credit for Manufacturers, Rural Jobs Tax Credits, Job Training Incentive Program)</p> <p>Offer local financial incentives to attract firms (property tax exemptions, Industrial Revenue Bonds, Local Economic Development Act, Local Options Gross Receipts Tax, New Mexico Community Capital)</p>			
	<p>Develop unifying brand for the region</p> <p>Collaborative marketing and communication throughout the broader interstate Four Corners area, EDO's and National Park Service (NPS) sites. Highlight existing cultural trails in region, such as with National Trail of the Ancients Scenic Byway</p>	<p>Appeal to local firms such as Chevron Phillips Chemical Company</p> <p>Promote the DeRosa study demonstrating high economic feasibility</p>	<p>Start by appealing to firms that rely on feedstocks produced in the area: e.g. Frito Lay and Poore Brothers (Inventure Foods)</p>	

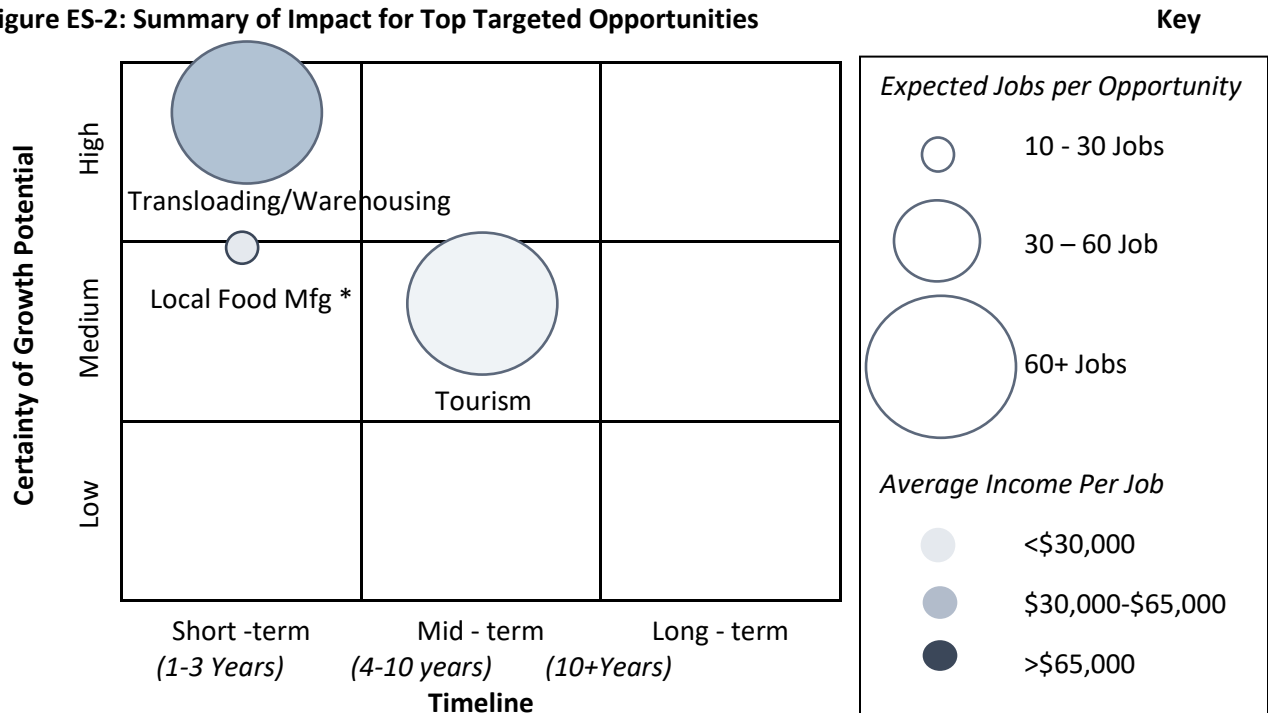
## Northwest New Mexico Economic Assessment & Strategy

Topic	Tourism	Petrochemical	Food Processing	Crop Production
Priority Infrastructure or Workforce Investments	<p>Fund a focused feasibility study to analyze 'authentic experiential tourism' concepts such as tribal homestay programs, an experiential heritage village, or a full-service lodge</p> <p>Support business development for cultural tourism and outdoor recreation entrepreneurs, including on Reservation</p>	<p>Pursue additional feasibility analysis with PRISM Analytics and Sean DeRosa</p> <p>Attend upcoming events for the petrochemical industry to market to potential companies (Annual Meeting, American Fuel &amp; Petrochemical Manufacturers, International Petrochemical Conference, American Fuel &amp; Petrochemical Manufacturers, World Petrochemical Conference)</p>	<p>Further explore rail line concept connecting Farmington area to BNSF</p>	<p>Join with Navajo and NAPI to push for full implementation of Navajo irrigation infrastructure funding</p>
Partnerships / Key Contacts	<p>New Mexico True, New Mexico Department of Tourism</p> <p>NPS and other Federal land management agencies</p> <p>Navajo Nation</p> <p>Tourism organizations across Four Corners region</p>	<p>Sean DeRosa, Sandia National Laboratories, 480-313-1228, sean.derosa@utexas.edu</p>	<p>Frito Lay</p> <p>Poore Brothers (Inventure Foods)</p>	<p>Anderson Hay - they ship alfalfa grown at NAPI all over the world and may be interested in transloading and expanding crop production (Craig Larson, Director of Operations PSW Division, 310-513-4230)</p> <p>NAPI - Hal Thomas, Marketing Director of NAPI, 505-566-2613</p>

### ES. 5.2 McKinley County

Priority opportunities for economic development efforts in McKinley County are large-scale food processing, transloading/warehousing, local food manufacturing, and tourism. The timeline for growth in these industries and their potential economic contribution to the region in terms of number of jobs and income per job are highlighted in **Figure ES-2**.

**Figure ES-2: Summary of Impact for Top Targeted Opportunities**



**Table ES-2** summarizes a ‘to do’ list of key actions and resources to make the most of these opportunities including those related to: competitive differentiation, marketing strategies, key contacts, and priority investments.

Table ES-2: McKinley County Target Growth Areas and Actions

Topic	Tourism	Transportation/Logistics	Local Food Manufacturing
<b>Competitive Differentiation</b>	<p>Proximity to I-40</p> <p>Navajo Nation, Trading Posts, Crownpoint Navajo Rug Auction</p> <p>Gallup Cultural Center</p> <p>El Morro National Monument</p> <p>Ancient Ways Art Trail</p> <p>Route 66</p>	<p>Gallup is at the confluence of major transportation lines and centers of economic activity:</p> <ul style="list-style-type: none"> <li>• U.S. Interstate 1-40</li> <li>• BNSF Class I Railway</li> <li>• Connects Four Corners, California, Texas, and the Midwest</li> </ul> <p>Gallup could service the broader interstate Four Corners region due to dearth of other major transloading and transportation hubs in region</p>	<p>Historic and cultural heritage is a source of unique foods</p> <p>Location provides two-day access to large markets</p> <p>Short term excess water from Navajo-Gallup may be well-suited to specialty crop production and associated local food manufacturing</p>
<b>Marketing Strategies</b>	<p>Develop unifying brand for the Northwest New Mexico Region. Collaborative marketing and communication throughout the broader interstate Four Corners area. Highlight existing cultural trails, particularly in connection with National Trail of the Ancients Scenic Byway.</p> <p>NM True Cooperative Marketing Grant</p>	<p>Gallup can service the broader interstate Four Corners region due to dearth of other major transloading and transportation hubs in region</p>	<p>Historic and cultural heritage offers unique marketing opportunities</p> <p>Regional food brand</p> <p>Buy local campaigns</p>

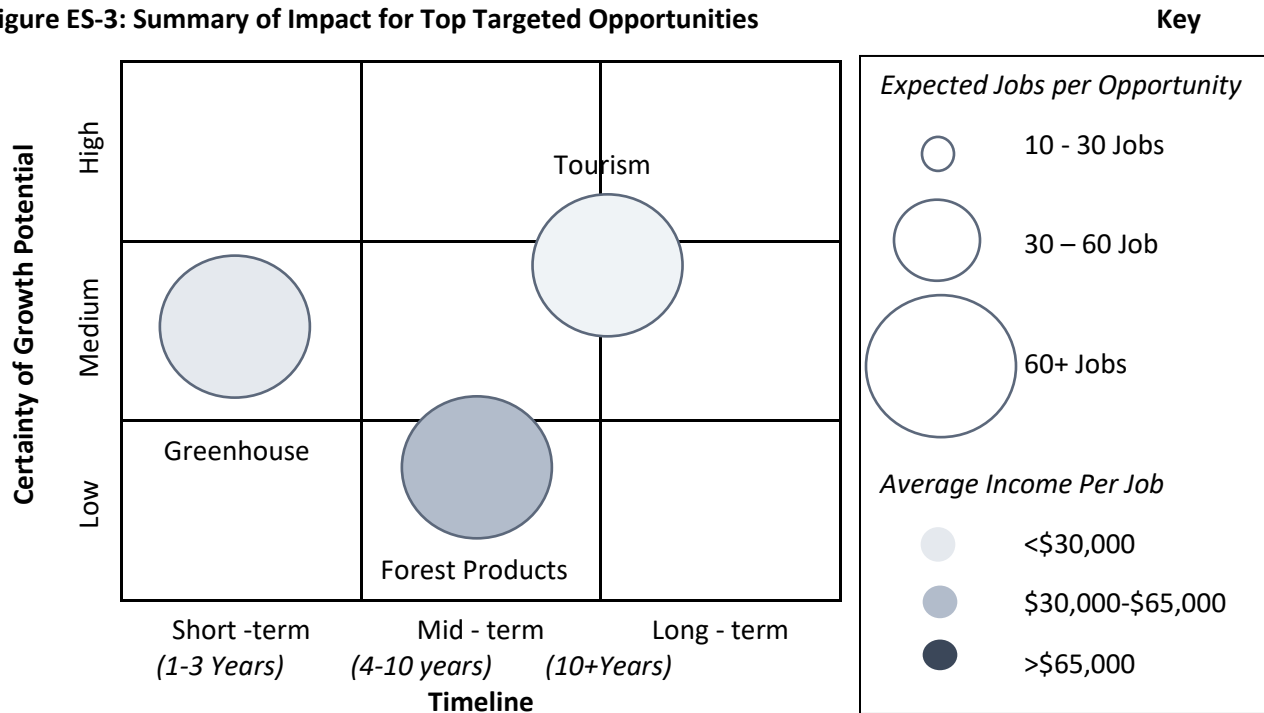
## Northwest New Mexico Economic Assessment & Strategy

Topic	Tourism	Transportation/Logistics	Local Food Manufacturing
Priority Infrastructure or Workforce Investments	<p>Fund a focused feasibility study to analyze ‘authentic experiential tourism’ concepts such as tribal homestay programs, an experiential heritage village, or a full-service lodge.</p> <p>Support business development for cultural tourism and outdoor recreation entrepreneurs, including on Reservation.</p>	<p>LEDA and Job Training Incentive program to encourage expansion and job training</p> <p>Free trade zone.</p> <p>Establish agreements between BNSF, Gallup port, and ocean carriers so that fees for transportation overseas are minimized, thus increasing attractiveness of location for exporters</p> <p>Need sufficient supply of commercial truck drivers and heavy equipment operators</p>	<p>Training and development:</p> <ul style="list-style-type: none"> <li>• USDA Rural Microenterprise Grants</li> <li>• USDA Rural Development Grants</li> </ul>
Partnerships / Key Contacts	<p>New Mexico True, New Mexico Department of Tourism</p> <p>Mitzi Frank, El Malpais National Monument</p> <p>Navajo Nation</p> <p>Tourism organizations across Four Corners region</p>	<p>Appalachian Center for Economic Networks (ACEnet) - a community development network in Appalachian Ohio has helped to start more than 50 kitchen incubators. Contact Leslie Schaller, Director of Programs, at 740-592-3854 ext. 115 or <a href="mailto:leslies@acenetworks.org">leslies@acenetworks.org</a></p>	<p>Gallup Land Partners</p> <p>BNSF</p> <p>Local export companies</p>

### ES. 5.3 Cibola County

Priority opportunities for economic development efforts in Cibola County are greenhouse industry, tourism, and forest products. The timeline for growth in these industries and their potential economic contribution to the region in terms of number of jobs and income per job are highlighted in **Figure ES-3**.

**Figure ES-3: Summary of Impact for Top Targeted Opportunities**



**Table ES-3** summarizes a 'to-do' list of key actions and resources to make the most of these opportunities including those related to: competitive differentiation, marketing strategies, key contacts, and priority investments.

\* Industry evaluation is based on the assumption that the forests around Mt. Taylor will be opened to commercial thinning, which will justify the construction of a new sawmill that will produce high-quality wood products.

Table ES-3: Cibola County Target Growth Areas and Actions

Topic	Tourism	Greenhouse Agriculture	Forest Products
<b>Competitive Differentiation</b>	<p>Proximity to I-40 and Albuquerque</p> <p>Pueblo of Acoma and Pueblo of Laguna</p> <p>Mining Museum</p> <p>El Morro National Monument, El Malpais National Monument</p> <p>Route 66</p> <p>Ancient Ways Art Trail</p>	<p>Mild climate</p> <p>Access to cheap natural gas allow for low heating costs</p> <p>Proximity to large markets</p> <p>I-40 and airport access</p>	<p>The forests around Mt. Taylor are overgrown and are at serious risk of wildfire</p> <p>Thinning operations could provide both economic and environmental benefits</p>
<b>Marketing Strategies</b>	<p>Develop unifying brand for the Northwest New Mexico Region.</p> <p>Collaborative marketing and communication with broader region.</p> <p>Highlight existing cultural trails, National Monuments.</p> <p>Ensure all local attractions are well represented at El Malpais Visitor Center</p> <p>Expand on Mt. Taylor Quadrathlon</p>	<p>Develop a marketing brochure that touts the regions mild winter weather, natural gas price advantage, land availability, and proximity to research institutions and seasonal workforce (e.g. college students), along with access to rail and road infrastructure, and ease of permitting. Targets could be Canadian greenhouse growers as well as the top 100 greenhouse producers in the United States<sup>3</sup></p>	<p>With partners, lobby Congressional representatives for the renewal of CFLRP funding for the Zuni Mountains and additional funding for the Mt. Taylor forests</p> <p>Facilitate discussion with the stakeholders (Pueblos, Forest Service, and Mt. Taylor Manufacturing) to identify and resolve challenges associated with thinning operations</p>

<sup>3</sup> See <http://www.greenhousegrower.com/business-management/2016-greenhouse-grower-top-100-growers-the-complete-list/>

## Northwest New Mexico Economic Assessment & Strategy

Topic	Tourism	Greenhouse Agriculture	Forest Products
Priority Infrastructure or Workforce Investments	<p>Focus on developing ‘authentic experiential tourism’ concepts such as tribal homestay programs, an experiential heritage village, or a full-service lodge.</p> <p>Support business development for cultural tourism and outdoor recreation entrepreneurs and small businesses that provide visitor services, including on Pueblos.</p> <p>Develop better signage</p>	LEDA and Job Training Incentive program to encourage expansion and job training	TA new mill will require a stable feedstock in order to attract investors. This will require a high likelihood of continued CFLRP funding.
Partnerships / Key Contacts	<p>New Mexico True, New Mexico Department of Tourism</p> <p>Mitzi Frank, El Malpais National Monument</p> <p>Pueblo of Acoma, Pueblo of Laguna</p> <p>Tourism organizations across Four Corners region</p>	Existing greenhouse growers (see lists provided in the footnotes of the Diversification chapter)	<p>Matt Allen, Owner of Mt. Taylor Manufacturing, 505-287-9469 (harvesting and processing of wood products)</p> <p>Eytan Krasilovsky, Southwest Regional Director at the Forest Guild, 505-470-0185 (Collaborative Forest Landscape Restoration Project, CFLRP, grants)</p> <p>Entities involved with Zuni Mt. CFLRP</p>

# 1 INTRODUCTION

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The coal mining and associated power production industries have historically been key economic engines in the Four Corners region of Northwest New Mexico. However, Clean Air Act regulations have contributed to reduced generation capacity at local coal-fired power plants, and the subsequent reduced demand for coal. In addition, changes in regional, national, and international energy markets, particularly coal markets, have resulted in the decline of these industries in the region and associated reduced employment opportunities. Additionally, many areas of the region, even those unaffected by the decline in the coal mining industry, currently experience high rates of poverty and unemployment. In response to these conditions, the region is proactively seeking economic development strategies to strengthen and diversify its economy and stabilize the financial base for its communities and governments. As part of this effort to increase resiliency, the Northwest New Mexico Council of Governments (NWNMCOG or COG) implemented a comprehensive strategic planning process to assess the extent of the economic impact to Cibola, McKinley, and San Juan counties of changes to the region's energy industries, and to identify best courses of action for the region to strengthen its economic foundation.

This report documents the findings of this strategic planning process, which relied on close collaboration with the COG and other regional partners, including local economic development organizations, Tribes/Pueblos, and businesses. Findings at this stage of the strategic planning process support Phase I of a three-phase POWER initiative. Phase II will include work at local institutions to develop paid internships, apprenticeships and other on-the-job learning opportunities to help displaced workers re-career, and Phase III will implement recommendations made in Phase I to promote job opportunities in high-growth business sectors.

## 1.1 GEOGRAPHIC SCOPE

**This study focuses on Northwest New Mexico, specifically Cibola, McKinley, and San Juan Counties;** however, economic impacts are presented in the context of the broader Four Corners region and the nation in terms of economic activity and changes in coal mining and coal-fired power generation. Similarly, this study focuses on economic opportunities and strategies for Northwest New Mexico, analyzing them in the context of the interstate Four Corners regional markets, and where applicable, national and international market conditions.

## 1.2 APPROACH, SCOPE, AND REPORT OUTLINE

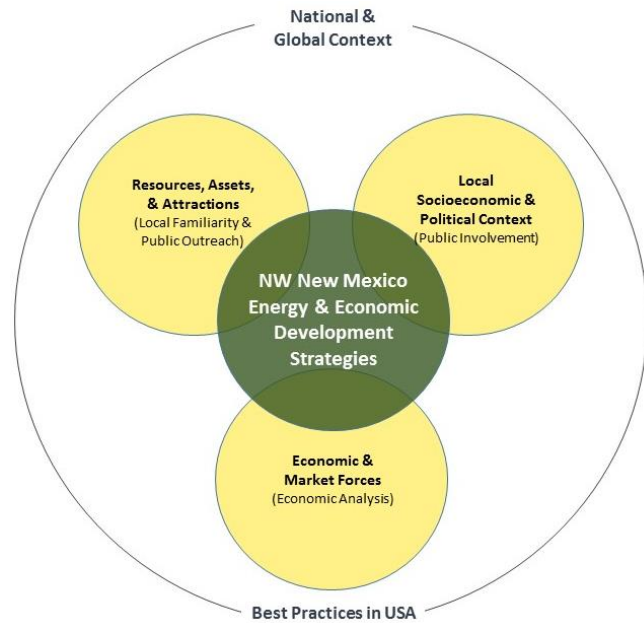
There are eight primary elements to the scope and approach in this planning process, each represented by a separate section of this document:

1. **Gather input from key stakeholders and organizations.** Focus groups and interviews provide critical information on local assets, local challenges faced by individuals and businesses, and local community goals and preferences. As part of this study, input was gathered from these sources to guide the economic analysis process. Further input is now required to verify and

ground-truth study findings. Before project completion, public input will be used to develop recommendations consistent with local preferences and priorities.

2. **Estimate type, magnitude, and distribution of economic impact (Section 2).** This section identifies the expected level of reduced coal mining and power generation, and translates that into total job and income impacts throughout the regional economy, with a focus on how these impacts are distributed among Cibola, McKinley, and San Juan counties.

3. **Identify case studies and best practices (Section 3).** This section reviews the experiences and best practices and initiatives from other areas that are also dealing with economic dislocation, past and present, associated with declines in resource extraction industries – such as timber communities in the Pacific Northwest, mining communities in Appalachia and the intermountain west, and coal areas in Australia.



*Conceptual Diagram of Analytical Approach*

4. **Recommend regional and community strategies for mitigating impact and for increasing economic vitality (Section 4).** Based on experiences in other regions that are applicable to the Northwest New Mexico region, this section identifies and recommends strategies for mitigating impacts of reduced mining and power plant generation, and more broadly, for increasing economic growth and vitality. These are public sector strategies that facilitate economic development and growth, often done in partnership with all stakeholders in a region including private business, educational institutions, tribes, non-profits, and residents. These strategies are distinct from the industry opportunities, which are focused on specific areas of growth potential for private businesses.
5. **Assess energy markets and identify energy industry opportunities (Section 5).** This section analyzes the opportunities and outlook for coal mined in Northwest New Mexico, and for other energy industries in the region based on current and projected energy markets and regional infrastructure.
6. **Identify priority growth industries for diversification (Section 6).** This section builds on previous analyses in the region that have identified potential target industries that can provide greater economic diversification, focusing on industry outlook and market analysis, labor considerations, siting considerations, economic development potential, major industry players, and legal/regulatory considerations.

7. **Target funding opportunities (Section 7).** This section focuses on funding sources for general economic development, as well as, where available, funding that is specific identified diversification and growth strategies and opportunities identified and prioritized in the strategic planning process.
8. **Recommendations and Next Steps (Section 8).** This section identifies areas of focus and steps for local and regional economic development organizations.
9. **Process Documentation.** This section documents the process used to conduct this assessment and develop a strategy for future actions.

### 1.3 PREVIOUS ECONOMIC DEVELOPMENT STUDIES

Economic development strategies in the Four Corners region have been thoroughly researched and developed in the past. This section presents a summary of the findings of these previous economic development studies. For each county, as well as the region, we outline the assets, industry clusters, economic development strategies, and potential growth industries identified in previous work. These reviews provide valuable information for this economic development analysis. In fact, the previous research, community engagement, and recommendations provided the foundation of the analysis.

#### **Building on Past Efforts**

This analysis builds on past economic analyses and plans to provide more in-depth research on the best strategies, industries, and initiatives with high probability of success.

The most comprehensive regional report on Four Corner's economic development is the 2009 **Comprehensive Economic Development Strategy (CEDS), led by the COG**. The CEDS is currently being updated, with a new version expected to be released in early 2017. The CEDS outlines five key economic sectors/clusters in the region: retail, health care, energy, tourism, and construction. In addition to the individual county assets discussed below, the strategy identified extensive tourism assets for the region

The CEDS included three general recommendations for economic development in the region: 1) improve organizational structure, 2) improve education and workforce development, and 3) research and implement best practices in economic development. The report also included specific examples of how these goals would be achieved. Similarly, the report recommended specific actions be taken to foster economic growth, which could be grouped into four general areas: downtown revitalization, agriculture, manufacturing, and transportation (NWNMCOG, 2009). Our analysis and findings also focus on the economic development potential of these areas.

In addition to the CEDS report, Foote Consulting conducted an economic development study in 2013 that had regional implications. The study identified industry clusters by recent expansions in the larger Four Corners area (including Colorado, Utah, and Arizona). This method showed existing regional industry clusters of manufacturing, warehouse/distribution, and office/call centers (FCG, 2013).

### 1.3.1 San Juan County

San Juan County has a diverse set of economic assets, which have been recognized in at least three recent economic development reports: *The E>P Report*, *A Field Guide to San Juan County*, and the COG CEDS. These reports highlight several local economic assets, including the San Juan Regional Medical Center, a historic downtown in Farmington, a vibrant art scene, and outdoor recreational resources. Additionally, the County has agricultural resources, primarily produced by the Navajo Agricultural Products Industries (NAPI). San Juan College provides the area with educational and workforce training resources (E>P Think Tank, 2012).

The most prominent industrial cluster in San Juan County is the energy development industry. **Abundant resources of coal, oil, and natural have attracted mining and extraction firms, as well as companies that support extraction activities.** This cluster has been further supported by two local coal-fired power plants, the Four Corners Power Plant (FCPP) and the San Juan Generating Station (SJGS), that consume the extracted fuels (E>P Think Tank, 2012; Le Ferrand, 2008).

Previous reports have identified many strategies that San Juan County could use to support economic development. One strategy that has been identified is to focus on import substitution - that is, identify goods and services that are currently imported, and either recruit or start firms that can provide these same services locally. The *E>P Report* cited the need for workforce, infrastructure, and local capital development, as well as tax and regulatory reform in order to implement this strategy and allow and encourage new industries and companies to locate in the area. The report further recommends more concerted efforts to conduct strategic planning, and market and develop strategic partnership agreements with communities and other stakeholders (E>P Think Tank, 2012).

The *E>P Report* found that San Juan County had potential growth in a variety of industries. One recommendation in the report was to expand new resource development in the natural gas and coal industry, and export the resources for power generation. Carbon sequestration, equipment and system maintenance and repair, and converting local vehicles to run on compressed natural gas (CNG) were listed as further ways to capitalize on the area's existing resources and industries. Among the other growth industries that build on existing strengths were healthcare (San Juan Regional Medical Center) and education (San Juan College). In addition, food processing and a biofuels plant were identified as a way to build off the area's existing agricultural industry (E>P Think Tank, 2012).

Building a new convention center in Farmington, along with a downtown business complex and a destination entertainment and resort district, were listed as ways to boost the County's tourism sector. Electronics assembly and data centers were listed as good prospects for manufacturing growth. Location-neutral work (such as people working from home that can be located anywhere) was cited as another possible growth industry that avoids high infrastructure costs or traffic congestion. The report emphasizes the importance of quality of life to keeping residents in rural areas, and suggests making shared resources available for mobile and home-based workers (E>P Think Tank, 2012).

### 1.3.2 McKinley County

In addition to the CEDS report, McKinley County was the focus of two recent economic assessments: One by the Greater Gallup Economic Development Corporation, *2014 Year in Review: Accelerating Our Initiatives*, and the *Target Industry Analysis* prepared by Foote Consulting. These assessments found that

among the County's most important economic assets is the confluence of transportation systems: U.S. Interstate 40, U.S. Highway 491, and the BNSF Railway TransCon Line (GGEDC, 2014). This transportation system provides the County with a natural economic opportunity, and an ability to connect markets between San Juan County, California, Texas, and the Midwest. Other assets lie in education: Navajo Technical College and University of New Mexico-Gallup.

One industry cluster identified in McKinley County is health care. The presence of two large medical facilities, the **Gallup Indian Medical Center and the Rehoboth McKinley Christian Hospital, have generated growth in support services**. The CEDS report cites 223 separate health care establishments in the County, comprised of doctor and dentist offices, nursing and residential care facilities, ambulatory health care services, medical transport, and home health services (NWNMCOG, 2009).

Taking into account the economic assets in McKinley County, the Foote report provided the following economic development strategies specific to McKinley County (FCG, 2013):

- Aggressively pursue the "best fit" targets;
- Develop research materials on targets;
- Conduct prospecting missions to Houston and California;
- Send City/County delegates to attend select trade shows;
- Continue to partner with the NM Partnership on trip opportunities;
- Certify the two industrial sites;
- Create a formal working committee and program on education and training, the Business-Education Roundtable;
- Include in the goals and objectives of the Roundtable: lowering the dropout rate significantly; improving proficiency scores; enhancing vocational technical education; bridging the gap between business and higher education; and developing new training programs and skills; and
- Develop specialized training programs aimed at the "best fit" targets

The Foote report also listed a variety of industries that had the potential for growth in McKinley County. Some were related to extractive industries, such as gravel/sand, pipe, mining/industrial equipment, turbines, and coal. Others were focused on manufacturing: Food processing/agricultural products, chemicals/oils/biofuels, solar farms/manufacturing, plastics products, electronics assembly, and industrial machinery/fab metal products. Warehouse/distribution was listed as a natural fit for the area's transportation assets. Film and digital media were also among the growth industries.

### 1.3.3 Cibola County

Cibola County's economy has not been as independently analyzed as the other counties in Four Corners. The only report specific to Cibola County is the *Grants, New Mexico Workforce Availability Report*, written in 2013 by the Employment and Economic Information Center of New Mexico, LLC. The study found that **local government was the largest employer in the County**, followed health care and social assistance (EEICNM, 2013). Among of the area's greatest economic assets **are large deposits of uranium and the Village of Milan Industrial Park** (NWNMCOG, 2009).

Taking into account the economic assets in Cibola County, the CEDS report identified the following economic development strategies for Cibola County and San Juan County together (NWNMCOG, 2009):

## Northwest New Mexico Economic Assessment & Strategy

- Take a proactive approach to economic development;
- Involve strategic local partners to develop and implement specific initiatives;
- Support regional development initiatives;
- Increase workforce training and development through collaborative partnerships with secondary and post-secondary educational institutions;
- Develop professional seminars to address common issues affecting business;
- Provide technical assistance in the areas of small business loans, marketing, long-term planning and personnel issues; and,
- Encourage industrial recruitment through development of industrial parks.

Some of the economic growth opportunities for Cibola were: athletic events (Mt. Taylor Quadrathlon), a biofuels project, retirement communities, expanding Cibola Hospital facilities, equestrian facilities, mining tourism, wineries, and greenhouses (NWNMCOG, 2009).

## 2 ADVERSE ECONOMIC IMPACTS FACING REGION

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This section reviews and builds upon existing economic impact analyses to estimate the effects of changes in power plant activity and coal mine production in the Northwest New Mexico region. This assessment provides information on the direct economic impacts in these sectors, and also estimates how this reduction in economic activity translates into total job and income impacts on the regional economy (including direct, indirect, and induced impacts). This section also provides discussion on the level of certainty of estimates, and implications from other areas regarding the potential short and long-term economic impacts of reduced reliance on extractive industries.

Adverse impacts identified in this section help to ‘diagnose’ the level of economic dislocation in Northwest New Mexico, and will inform the level and type of response required to mitigate adverse impacts in later phases of the analysis. A key purpose of the POWER initiative is to help communities that have historically coal-dependent economies adapt to change in evolving energy markets. This assessment focuses on the effects of power plant downsizings/shutdowns and consequent reduction in regional coal demand. However, it is very important to recognize that factors in other energy markets such as oil and gas, also affects the Northwest New Mexico economy. In particular the low price of natural gas and oil, has had an adverse effect on the regional economy. For example, in November 2015, oil and gas industry stalwart, Baker Hughes, laid off 67 workers from its pressure pumping offices in Farmington, and laid off additional workers (an undisclosed number) in June 2016 due to continued low oil and gas prices (Fenton, 2016). Thus, the adverse impacts related to coal that are highlighted in this chapter are compounded by significant downturns in other energy sectors in Northwest New Mexico, as well as already high unemployment and poverty levels historically experienced in many areas of the region (unrelated to coal mining and power generation).

This section focuses on the regional employment, income, and fiscal impacts that have already occurred, or are anticipated to occur within the next several years as partial power plant shut-downs are completed by the end of 2017. Additional impacts may result if coal-fired power generation and associated demand for coal were to further decrease from San Juan Generating Station (SJGS), Four Corners Power Plant (FCPP), Escalante Generating Station, or from the Arizona power companies supplied by El Segundo Mine.

Key findings include:

- 4) **Direct employment and income in the coal mining and power generation sectors are anticipated to decline by approximately 930 jobs and \$122.1 million in income annually.** This represents approximately one to two percent of the region’s employment and income. Approximately 85 percent of the impact is forecasted to occur in San Juan County. However, as a proportion of its income and job base, Cibola County actually faces a greater impact (1.46 percent of jobs and 2.42 percent of income) due to the reduced production occurring at El Segundo Mine.<sup>4</sup>

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<sup>4</sup> Impacts from El Segundo and Lee Ranch Mine are included with Cibola County since nearly all mine workers reside there, although the mines are located in McKinley County.

- 5) **Total employment and income impacts, including indirect and induced ripple effects in other economic sectors, are estimated at 2,260 to 3,180 jobs and \$195.2 to \$213.3 million in annual income.** Approximately 90 percent of this impact is expected to occur in San Juan County because of the presence of coal mines and power plants in the County.
- 6) **Tax receipts to all levels of local, tribal, and state government that are directly related to coal extraction are expected to fall by \$43.3 million.** Thirty-four percent of this revenue loss is to the State of New Mexico, 56 percent is to Navajo Nation, and 10 percent is to local governments in Northwest New Mexico (i.e. \$4.3 million annual loss of tax revenue to the counties included in this study).

## 2.1 ECONOMIC AND HISTORIC CONTEXT

This section provides context for the analysis of the economic role of the energy sectors in Northwest New Mexico. Specifically, this section presents data from the last ten years on the level of employment and income derived from mining and oil and gas extractive industries as well as utilities. This information is provided in the context of the overall economy by estimating the proportion of total wages and employment directly supported by these sectors.

Secondly, this section provides context on the economic impact and role of extractive industries, particularly coal industries, on economies throughout the United States. The purpose of this section is to present data that indicates how, in the long-term, reliance on extractive industries may influence the structure and growth of local economies. This information is useful in understanding how to identify potential opportunities and best transition strategies from a historical reliance on coal and other energy resources.

### 2.1.1 Importance of Energy Sectors in Northwest New Mexico

#### Contribution of Oil, Gas, Utilities

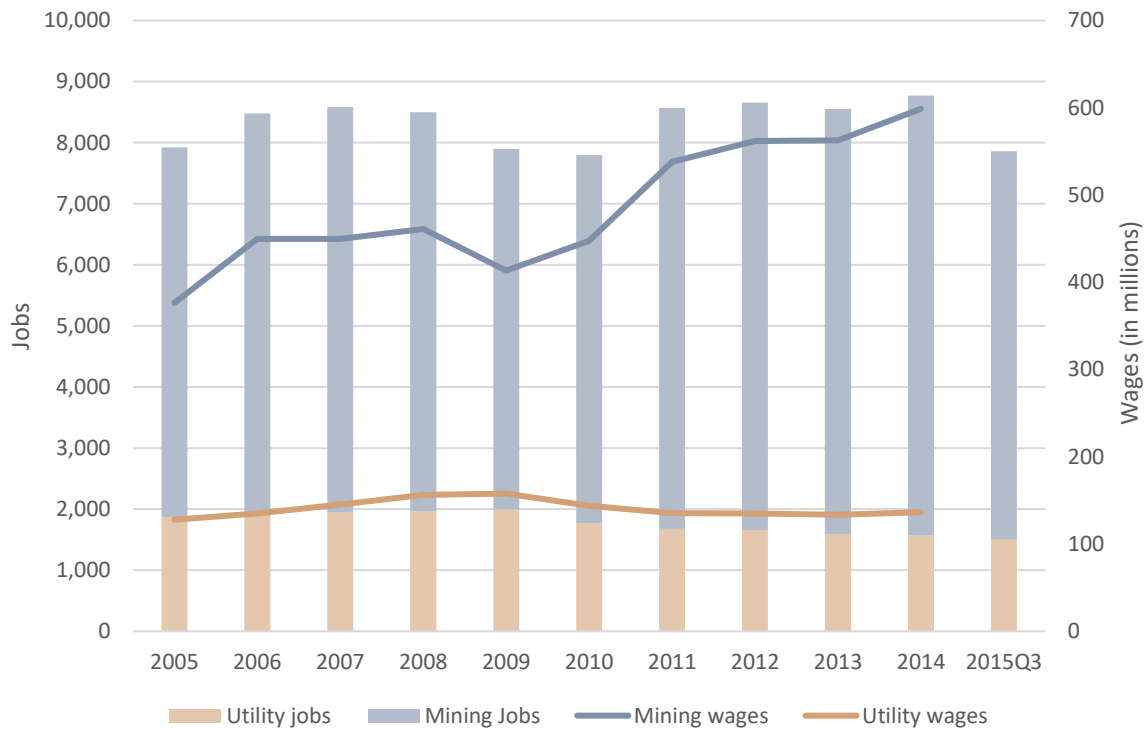
Over the last ten years, the utilities sector in Northwest New Mexico has provided nearly 2,000 jobs and around \$150 million in annual wages, while the mining and oil and gas sector, has provided around 6,000 jobs and \$400 million in wages

**Figure 2-1** shows the jobs and total wages in the mining and utilities sectors in Cibola, McKinley, and San Juan Counties since 2005. As the graph illustrates, over the last ten years, the utilities sector has provided nearly 2,000 jobs and around \$150 million in annual wages, while the mining and oil and gas sector, has provided around 6,000 jobs and \$400 million in wages. This represents just over 10 percent of all employment in the three-county area.<sup>5</sup> In the period 2005 to 2014, all utility jobs (including those unrelated to power production) have consistently represented 1.0 to 2.0 percent of all employment, while mining and oil and gas extraction jobs have accounted for approximately 6.0 to 7.0 percent of all employment. Data specific to coal mining and coal-fired electric power generation are suppressed for Northwest New Mexico; however, this analysis estimates that the

<sup>5</sup> Employment and wage data reported in this section is from the Quarterly Census of Employment and Wages (QCEW), which is the tabulation of employment and wages of establishments which report to the Unemployment Insurance (UI) programs of the United States. Employment covered by these UI programs represents about 97% of all wage and salary civilian employment in the country.

historical employment levels for these sectors is approximately 2,500 in the region (approximately 1,000 jobs in coal-fired electric power generation and 1,500 jobs in coal mining). This represents 2.4 percent of employment in the region. However, for certain areas, the dependence on coal mining is higher. In Cibola County, approximately 400 residents have historically been employed mining, representing approximately 4.0 percent of the roughly 10,000 jobs in the county. In terms of personal income, coal mining represents approximately 7.0 percent of total income in Cibola County.<sup>6</sup>

**Figure 2-1: Employment and Income in the Utilities Sector and the Mining Sector (including Oil and Gas Extraction)<sup>7</sup>**



Source: New Mexico Department of Workforce Solutions. Quarterly Census of Employment and Wages, accessed through Labor Analysis, Statistics, and Economic Research (LASER) at [www.jobs.state.nm.us/analyzer](http://www.jobs.state.nm.us/analyzer)

- <sup>6</sup> This is based on approximately 400 jobs with total compensation of approximately \$130,000 per job for total personal income of \$52 million, out of estimated total personal income (in 2014) of \$742 million according to the Bureau of Economic Analysis. In this estimate, we assume all jobs at El Segundo and Lee Ranch are held by Cibola County residents (based on information from local residents), and compare this to the total job base within Cibola County (assuming that most other jobs held by Cibola County residents are located in the county).
- <sup>7</sup> Jobs and employment data for some years were suppressed for confidentiality reasons. To avoid improperly counting these years as having zero jobs or income, when data was suppressed, we took the average of the industry's known jobs and income from other years and input this average as an estimate for that year. Because this was exclusively done in cases where the employment and wages were relatively small, the error associated with the regional jobs and income is likely to be negligible.

### 2.1.2 Economic History: Economic Development and Coal and Other Extractive Industries

While coal mines and power generation clearly support much employment and income in Northwest New Mexico, studies in other regions of the country indicate that **the dominant presence of coal and other extractive industries may have uncertain impacts on the net, long-term socioeconomic well-being of a local community and region** (as highlighted in the studies cited below). Numerous economic studies have found that countries (Sachs, 1995) and regions with higher levels of natural resource extraction tend to have lower levels of long-term economic growth, even after accounting for possible associated factors. This has become known as the “resource curse” phenomenon.

Explanations for this phenomenon include a potential lack of investment in growth-promoting activities such as infrastructure that can aid other industries, or in workforce training and education for other occupations. In other words, due to the presence of a strong natural resource sector that may require less formal education than other occupations, there may be little incentive to invest in otherwise growing or diversifying an economy or investing in higher education. Furthermore, the boom and bust cycles related to commodity prices of raw materials such as coal, uranium, oil, timber and natural gas can lead to lack of local investment by both private and public entities due to uncertainties regarding future economic conditions. Finally, there is also the potential that extractive industries and related industrial activity may adversely affect environmental quality and scenic attributes in an area, thereby potentially deterring newcomers and businesses from re-locating to or growing in the area.

#### Key Point

The boom and bust cycles related to commodity prices of raw materials such as coal, uranium, oil, timber and natural gas can lead to lack of local investment by both private and public entities due to uncertainties regarding future economic conditions.

It is not clear the extent to which this ‘resource curse’ effect has occurred in Northwest New Mexico. A 2011 study evaluating the relationship between oil and gas energy production and county-level economic growth in New Mexico during the period 1960 to 2000 (using decennial Census data) found that oil and gas extraction in New Mexico counties has had a small but positive effect on income, employment and population (Starbuck, 2011). In other words, the presence of oil and gas extraction benefited long-term economic conditions in these counties over this period. However, several studies focused on coal extraction in Appalachia indicate that, at least in those regions, a coal-focused economy may have had negative long-term impacts. For example, a 2010 study of coal areas in Kentucky found that the boom and bust cycle of development in coal counties resulted in these areas experiencing slower growth, higher poverty, and lower overall economic development (Harkness, 2010). A broader 2013 study examined the relationship between coal reserves on income growth in 409 counties across 11 states in Appalachia from 1970 to 2010 and found that coal abundance significantly reduced growth of per capita income; the study attributed the disparity largely due to a reduction in education attainment by the local population (Walker, 2013).

This report presents this information by way of introduction in order to highlight that while reductions in coal mining and power generation in Northwest New Mexico clearly have a negative short-term impact and hardship for many area families and businesses, with the proper planning, in the long-term a reduced reliance on the energy sector may provide an opportunity for the area to enhance long-term economic resiliency through investments in diversification and workforce training and education.

## 2.2 REDUCED POWER GENERATION & COAL DEMAND IN NORTHWEST NEW MEXICO

There are three coal-fired power generating plants in Northwest New Mexico: San Juan Generating Station, Four Corners Power Plant, and Escalante Power Plant. Coal to power these plants is all mined in Northwest New Mexico. In 2013, the combined capacity of the three generating plants was 3,471 MW, as summarized in **Table 2-1**. By the year 2018, partial shutdowns at the two largest plants, San Juan Generating Station and Four Corners Power Plant, will have reduced generation capacity in the region by one-third to 2,606 MW (a reduction of 865 MW). Consequently, **regional power plant demand for coal from currently forecast power plant shutdowns and reduced demand is estimated to cause coal production to drop 43 percent, from approximately 21.8 million tons to 12.5 million tons** (see **Table 2-2**). This section describes the change in current and future production from coal-fired power plants, and associated demand for coal, in Northwest New Mexico.

Although the focus of this analysis is Northwest New Mexico, it is important to note that similar power plant shutdowns, and associated adverse economic impacts, are occurring elsewhere within the broader Four Corners region. The Navajo Generating Station, located near Page, Arizona on the Navajo Reservation, is required to shut down one of the plant's three units (each with a generation capacity of 750 MW), or otherwise reduce electricity generation by one-third by 2020. This reduction in power generation approaches the total decline in generation capacity being experienced in Northwest New Mexico. The partial shutdown at Navajo Generating Station will particularly affect the Navajo Reservation, as 90 percent of Navajo Generation Station employees are Navajo, and the mine supplying the power station, Kayenta Mine, is also located on the Navajo Reservation in Arizona (Salt River Project, n.d.). The Navajo Generating Station partial shut-down is required to comply with Clean Air Act regulations. However, as of January 2017, the power plant owners have indicated that they are currently weighing if they may fully close the power plant this year due to economic reasons: the low price of natural gas makes coal-generated electricity more expensive than purchasing power from natural-gas-fired power plants (The Arizona Republic, 2017).

In terms of capacity, the largest generating station in the region is the San Juan Generating Station (SJGS) located near Waterflow in San Juan County. The plant has a capacity of 1,684 MW and produced 9 million MW hours (MWh) of electricity in 2015 (U.S. EIA, 2016). It is operated by Public Service Company of New Mexico (PNM) and its oldest unit went online in 1973. In 2014, the plant employed roughly 400 people (Zah, 2014). However, in order to comply with federal air quality regulations, in 2013 PNM reached an agreement with the state of New Mexico and the Environmental Protection Agency (EPA) to shut down two of the four coal-fired units at the plant by December 31, 2017 and install air emission control technology on the remaining two units by early 2016 (PNM, 2016). With this technology, Units 1 and 4 units may continue operating for another 25 years, though the PNM has publicly noted that the plant will be depreciated by 2052 (Tri-City Tribune, n.d.). Closure of Units 2 and 3, will result in reduced plant capacity of 836 MW. Baseload power will be supplemented from additional generation at the remaining units, as well as nuclear power from the Palo Verde Nuclear Generating Station in Arizona, and a small amount of power from wind and solar facilities. PNM also committed to constructing a 150 to 200 MW natural gas peaking plant in San Juan to offset local economic impacts. However, in October 2016, PNM announced that it withdrew its plan to build a natural gas plant and pipeline in San Juan County from the New Mexico Public Regulation Commission due to lower than expected energy demand projections (Irvin, 2016).

Reduced power generation at the SJGS is expected to reduce demand for coal by approximately 3 million tons annually (Tri-City Tribune, n.d.). The SJGS is supplied with coal by the adjacent San Juan Mine. This underground mine opened in 1973 and was owned and operated by BHP Billiton until Westmoreland acquired it in early 2016. Over the last 15 years the mine has averaged 5.5 million tons of annual production, and produced nearly 6.0 million tons in 2013. The mine currently employs almost 500 people (U.S. EIA, 2016). Westmoreland has an agreement with SJGS to continue supplying the generating station as its sole source of coal through 2022.

The next largest coal-fired power plant in the area is the Four Corners Power Plant (FCPP) located near Fruitland in San Juan County. This plant originally opened in 1963, and at its peak operated five generating units with capacity of 2,040 MW and employed approximately 500 people. Currently, the plant has two units operating out of its original five; the other three closed down in 2014 as part of an agreement to comply with federal air quality standards. The partial shutdown reduced capacity to 1,540 MW, and employment to approximately 350 people (NM EMNRD, 2015).

The FCPP receives coal exclusively from the adjacent Navajo Mine. The mine also opened in 1963 and is currently operated by MMCo, which owned the mine until 2013 when the Navajo Nation purchased the mine. The Navajo Nation formed Navajo Transitional Energy Company (NTEC) to manage the mine ownership transfer and oversee its operations. Starting in February 2017 operations will be managed by Bisti Fuels, which has a fifteen year contract with NTEC.

From 2001 to 2013, the Navajo Mine produced an average of 8.3 million tons of coal annually (U.S. EIA). Production in recent years has declined, with 7.2 million tons produced in 2013 and 6 million tons per year expected over the next 15 years. The mine employs about 320 people (Marcus, 2015).

The third coal-fired power plant in the region is the Escalante Generation Station near Prewitt in McKinley County. This plant opened in 1980 and is operated by Tri-State Generation and Transmission. It has a capacity of 247 MW, which includes some natural gas power generation. Since 2001 the power plant has produced an average of 1.6 million MWh. In recent years, its output has declined somewhat, producing 1.3 million MWh in 2015 (U.S. EIA). The plant employs approximately 120 people (McKinley County).

The Escalante Station is supplied by the Lee Ranch mine, which is located near the plant. The mine is currently owned by Peabody Energy (McDonald, 2015). The Lee Ranch Mine opened in 1984. Production at this surface mine has declined steadily over the last 15 years, from 6 million tons in 2001 to only 19,000 tons in 2013 (U.S. EIA), when it was idled for most of the year (McDonald, 2015). The mine has about 144 million tons of recoverable coal reserves, and employs approximately 30 people.

In addition to the three power plants described above, the El Segundo Mine opened in 2008, and is under short- and long-term contracts to supply coal to power companies in Arizona. This surface mine consistently increased production for five years after opening, from 3.3 million tons in 2008 to 8.6 million tons in 2013 (U.S. EIA). However, production has begun to decline recently, with 7.5 million tons produced in 2015 (McDonald, 2015). The Energy Information Administration (EIA) reports that the mine employed approximately 340 people in early 2016 (Peabody Energy, 2016). However, there have been multiple rounds of layoffs at El Segundo since early 2016, affecting an estimated 110 workers, leaving a current workforce of approximately 230 employees.

Table 2-1: NW New Mexico Coal-Fired Power Plants

Power Plant	Location	Generation Capacity, MW		% Reduction in Generation Capacity
		2013 (Pre Unit Shutdowns)	2018 (Post Unit Shutdowns)	
San Juan Generating Plant	Near Waterflow, San Juan County	1,683	847	-53%
Four Corners Generating Plant	Navajo Reservation, San Juan County	2,040	1,540	-21%
Escalante Generating Station	Prewitt, McKinley County	247	247	0%
<b>Subtotal</b>	<b>Northwest New Mexico</b>	<b>3,471</b>	<b>2,606</b>	<b>-34%</b>
Navajo Generating Station	Page, Arizona	2,250	1,500	-33%
<b>Total</b>	<b>Four Corners Region</b>	<b>6,721</b>	<b>4,106</b>	<b>-34%</b>

Table 2-2: NW New Mexico Coal Mines

Coal Mine	Location	Power Plant Customer	Annual Production, 1,000 Tons		% Reduction in Coal Production
			2013 (Pre Unit Shutdowns)	2018 (Post Unit Shutdowns)	
San Juan Mine	Near Waterflow, San Juan County	San Juan Generating Station	6,000	~3,000	-50%
Navajo Mine	Navajo Reservation, San Juan County	Four Corners Generating Station	7,200	~5,500	-23%
Lee Ranch Mine	Prewitt, McKinley County	Escalante	20	~20	0%
El Segundo Mine	Prewitt, McKinley County	Arizona Power Companies	8,600	~4,000 <sup>1</sup>	-53%
<b>Total</b>	<b>Northwest New Mexico</b>		<b>21,800</b>	<b>~12,500</b>	<b>-43%</b>

Note: Totals may not sum due to rounding.

<sup>1</sup>This is an estimate of current, 2016 production levels due to recent reduced coal demand from Arizona power company customers; production by 2018 may be higher or lower.

## 2.3 ECONOMIC IMPACTS OF REDUCED COAL MINING AND COAL-FIRED POWER GENERATION IN NORTHWEST NEW MEXICO

This section describes the anticipated changes in employment and income at coal mines and coal-fired power plants. As noted above, these are the changes that have already occurred, or are anticipated to

occur through workforce attrition within the next several years as partial power plant shut-downs are completed. Additional impacts may result if demand for coal were to further decrease from San Juan Generating Station, Four Corners Generating Station, Escalante, or from the Arizona Power Companies supplied by El Segundo Mine.

After describing the direct changes in employment and income at coal mines and coal-fired power plants in Northwest New Mexico, this report provides a review of existing studies of the total economic impacts, including ripple effects, of power plant generation and coal mining activities in Northwest New Mexico and throughout New Mexico. Economic impacts are modeled using an IMPLAN model of the regional economy. To the extent feasible, this analysis also presents the distribution of these impacts amongst the three counties in the region.

### 2.3.1 Direct Employment and Income Impacts in Coal and Power Generation Sectors

As presented in **Table 2-3, employment at power plants in Northwest New Mexico is expected to decrease by approximately 350 jobs once the partial shut-downs at San Juan and Four Corners plants are complete.** This represents one-third of the power plant workforce prior to the partial-shutdowns, consistent with one-third of power generation capacity being reduced. Operators of both power plants have made commitments that there will be no layoffs as a result of the unit shut-downs; rather, reduced employment at the plants will come from natural attrition or separations. However, while there are no planned layoffs, the change in jobs at the power plants results in a reduction in the job base in San Juan County and the three-county region, representing, respectively, 0.54 and 0.34 percent of total local jobs (there are approximately 65,300 jobs in San Juan County and 103,400 jobs in the three-county area as of 2014) (Bureau of Economic Analysis, 2014).

#### Direct Economic Impacts

Direct employment and income in the coal mining and power generation sectors are anticipated to decline by approximately 930 jobs and \$122.1 million in income annually. This represents approximately one to two percent of the region's employment and income. Approximately 85 percent of the impact is in San Juan County. However, as a proportion of its income and job base, Cibola County actually faces a greater impact (1.46 percent of jobs and 2.42 percent of income) due to the reduced production occurring at El Segundo Mine.

Annual wages and salaries of power plant employees are estimated to average approximately \$100,000 per employee, with total annual compensation packages estimated at approximately \$150,000 per employee.<sup>8</sup> Thus, with an estimated 350 fewer jobs, **the direct wage impact is estimated at \$35.0 million annually**, and the **total labor income impact (including benefits) is estimated at \$52.5 million annually**. As a proportion of local personal income, \$52.5 million represents 1.1 percent of San Juan County income and 0.93 percent of three-county regional personal income (as of 2014) (Bureau of Economic Analysis, 2014).

<sup>8</sup> Sources: Wage information from focus groups conducted in Farmington, Gallup, and Grants; Evans, James, and Madley (2013) study of employment and income effects at Four Corner Power Plant, and 2015 data from the Bureau of Labor Statistics Quarterly Census of Employment and Wages for Northwest New Mexico.

**Table 2-3: Reduced Generation and Employment:  
NW New Mexico Coal-Fired Power Generation Plants**

Power Plant	Peak Generation Capacity			Reduced Generation Capacity		Change in Jobs	Change in Labor Income (including Benefits), Millions 2016\$
	Generation Capacity (MW)	Jobs	Jobs /MW	Generation Capacity (MW)	Jobs		
San Juan Generating Plant	1,683	~400	0.24	847	~200 <sup>1</sup>	-200	-\$30.0
Four Corners Generating Plant	2,104	~500	0.24	819	~350 <sup>2</sup>	-150	-\$22.5
Escalante Generating Station	247	~120	0.49	247	~120	0	
<b>Total</b>	<b>4,034</b>	<b>~1,020</b>	<b>0.25</b>	<b>1,913</b>	<b>~670</b>	<b>-350</b>	<b>-\$52.5</b>

Note: Totals may not sum due to rounding.

1/Estimated assuming that the jobs per MW of generation capacity remains constant.

2/Based on Evans, James, and Madley (2013) study of Four Corners Generating Plant employment and income for units 1, 2, and 3.

As presented in **Table 2-4**, employment at coal mines in northwest New Mexico is projected to decrease by approximately 580 jobs once the partial shut-downs at San Juan and Four Corners plants are complete. This reduction in coal mining jobs results in a reduction in the job base in the three-county region of 0.56 percent (as of 2014) (Bureau of Economic Analysis, 2014). This report estimates that 430 of these job impacts will be at mines in San Juan County (San Juan and Navajo mines) representing 0.65 percent of the jobs in the county. The remaining 150 job reductions will occur at El Segundo mine in McKinley County, but primarily affect workers residing in Cibola County (affecting 0.39 percent of the combined employment in both counties).

Annual wages and salaries of mine employees are estimated to average approximately \$85,000 per employee, with total annual compensation packages estimated at approximately \$120,000 per employee.<sup>9</sup> This estimate is based on previous studies of coal mining in the region, information from local focus groups, and data from the Bureau of Labor Statistics. However, this estimate may overstate income benefits as data from the New Mexico Energy Minerals and Natural Resources Department data indicate that total payroll at New Mexico coal mines to be approximately \$60,000 per employee. Assuming wages at \$85,000 per employee and total compensation at \$120,000 per employee, a reduction of 580 mining jobs would result in direct wage impacts of approximately \$49.3 million annually, and the total labor income impact (including benefits) of \$69.6 million annually. As a proportion of local labor income, \$69.6 million represents 0.93 percent of three-county region personal income (as of 2014) (Bureau of Economic Analysis, 2014).

<sup>9</sup> Sources: Evans, James, and Madley (2013) study of Four Corners Generating Plant employment and income and 2015 data from the Bureau of Labor Statistics Quarterly Census of Employment and Wages for Northwest New Mexico.

The job impacts at the coal mines of reduced power plant generation, within and outside of the three-county region, are already underway. In March 2016, Westmoreland laid off workers at the San Juan Coal mine (an undisclosed number) (Fenton, 2016). An additional 85 underground mine workers were laid off at the San Juan Mine due to decreased demand for coal; these were in addition to nine other positions that were not filled (and were permanently eliminated) after employees left the firm or retired. The company explained that the latest workforce reduction was directly due to production cuts related to stricter environmental regulations (Fenton, 2016). In June 2016, coal mine workers were also laid off at the El Segundo mine, affecting 65 miners from Cibola and McKinley counties (Jaramillo, 2016).

**Table 2-4: Reduced Generation and Employment:  
NW New Mexico Coal Mines**

Coal Mine	Peak Production			Reduced Production		Change in Jobs	Change in Labor Income (including Benefits), Millions 2016\$
	Annual Production <sup>1</sup> (1,000 tons)	Jobs	Jobs/ 1,000 Tons	Annual Production (1,000 tons)	Jobs		
San Juan Mine	6,000	500	0.08	~3,000	~250	-250	-\$30.0
Navajo Mine	7,200	500	0.04	~4,800	320	-180	-\$21.6
Lee Ranch Mine	20	30	1.58	~19	~30	0	\$0.0
El Segundo Mine	8,600	400	0.05	~4,000	~250	-150	-\$18.0
Total	20,720	1,430	0.08	~11,820	~850	-580	-\$69.6

**Table 2-5** summarizes direct employment and labor income impacts for each county and all of Northwest New Mexico. Across the region, **reduced coal-fired power generation and reduced coal mining is expected to result in decreased employment in these sectors of approximately 930 jobs and decreased labor income (including benefits) of \$122.1 million annually.**

Table 2-5: Geographic Distribution of Direct Employment and Labor Income Impact

Geographic Area	Employment (Jobs)		Labor Income (Millions, 2016\$)	
	Change	% of Local Jobs	Change	% of Local Income <sup>1</sup>
San Juan County	-780	-1.19%	-\$104.1	-2.14%
Cibola County/McKinley County <sup>2</sup>	-150	-1.46% <sup>2</sup>	-\$18.0	-2.42% <sup>2</sup>
Total, Northwest NM	-930	-0.90%	-\$122.1	-1.63%

1/For each county, the percent reduction is calculated as a percent of each county job or income totals, while percent reduction at the regional level is based on the total three-county job or income totals.

2/Impacts at Lee Mine and El Segundo Mine are presented as impacts to Cibola or McKinley County, and are evaluated as a percent of employment and wages in Cibola County, as nearly all workers are expected to reside in Cibola County (even though the mines are located in McKinley County). Otherwise, all impacts are presented by place of work, rather than place of residence.

As noted elsewhere in this report, reductions in coal-fired power generation and coal mining employment are not isolated to the Four Corners region, but are rather being experienced elsewhere across the United States. In terms of examples around the country, in the spring of 2016, Peabody Energy and Arch Coal announced major coal mine worker layoffs in Wyoming, affecting approximately 15 percent of their employees, or 465 workers total (235 at Peabody's North Antelope Rochelle Mine) and 230 at Arch's Black Thunder Mine. The layoffs are in response to reduced demand for coal due to a combination of low natural gas prices, a warm winter, and environmental regulations (Rocky Mountain PBS, 2016). At around the same time in April, 2016, Alpha Natural Resources laid 37 workers at its Belle Ayr and Eagle Butte mines, leaving approximately 500 miners unemployed in Wyoming (The Associated Press, 2016). In West Virginia in early 2016, Blackhawk Mining idled coal operations and laid off 146 workers in Kanawha County. This is in addition to 600 coal miners losing jobs elsewhere in West Virginia and Ohio that were employed at Energy Corp mines. **This pattern and broad experience of decreased coal mining across the United States has two key implications for Northwest New Mexico: 1) displaced coal miners from the region are unlikely to be able to re-locate and find a job in another coal mining region of the United States, and 2) coal mining jobs are unlikely to rebound, even with a new federal administration, as market impacts are a driving force in reduced coal mining nation-wide.**

### 2.3.2 Total Regional Employment and Income Impacts

#### **Total Economic Impacts**

Total employment and income impacts, including indirect and induced ripple effects in other economic sectors, are estimated at 2,260 to 3,180 jobs and \$195.2 to \$213.3 million in annual income.

Approximately 90 percent of this impact is expected to be experienced in San Juan County.

In addition to direct jobs and income at the mine and power plant, coal mining and power generation support economic activity in other sectors of the economy. For example, coal mines and power plants purchase goods and services such as equipment, fuel, maintenance and repair services. Such purchases increase economic activity in other sectors, supporting additional, indirect job and income. Employees of both directly and indirectly impacted sectors then re-spend their earnings on household goods and services, such as housing, food, retail stores, and entertainment. These purchases by households generate additional economic activity, known as induced economic impacts. In sum, the direct, indirect, and induced impacts comprise the total economic impact of the production at coal mines and power generation plants. The relationship between the direct economic impact and the total economic impact is often referred to as the multiplier. For example, if one job in coal mining supports 1.5 other jobs in other economic sectors, for total jobs of 2.5, then the employment multiplier is 2.5 for coal mining (2.5 jobs supported in total for every job in the coal mining sector).

Total economic impacts are often mistakenly believed to be solely based on the size of the industry or industries under consideration (in this case, coal mining and power generation). While it is true that the direct economic impacts are determined by the level of direct industry production in coal mining and power generation, the ripple effects and impacts in other economic sectors are determined by the size, structure, and diversity of the local economy. In general, the greater the extent to which the local economy is diverse and self-dependent, the greater the multiplier effect throughout the local economy. In other words, the more that a local area can supply its own needs versus importing goods, labor, or services from elsewhere, the less “leakage” of dollars and economic benefit to other areas there will be.

Thus, the total economic impact depends on the following variables:

1. Magnitude of direct economic activity in coal mining and power generation (determines size of direct economic impact);
2. Proportion of coal and power generation inputs (including materials, services, and labor) that are purchased from local households and businesses versus imported from other areas (determines size of indirect economic impact); and,
3. Ability of the local economy to meet other local business and household needs, including those related to retail purchases, wholesale trade, services, banking, and insurance (determines size of indirect and induced economic impacts).

In interpreting economic impact information, particularly indirect and induced impacts, it is very important to realize that the job and income impacts estimated are not likely to be permanent, long-term losses. Rather, these are jobs and income that are currently supported by economic activity associated with coal mining and electric power generation. To the extent that people can adjust by: a) establishing new businesses, b) finding other, productive work (albeit likely, at least in the short-term,

less appealing in terms of compensation), or c) increasing demand for their current services from other sources or markets, the job and income impacts will not be as severe as estimated.

A final cautionary note: total economic impact estimates are based on models of the size and inter-relationships in local economies, including estimates of the average proportion of spending that goes to local businesses and households. Many of the data in these models are derived, and as such, there is a fairly high degree of uncertainty associated with total economic impact results. This is highlighted in the first section below that presents some results from previous studies in the region.

Following this review of previous studies, this section discusses estimates of the potential total economic impact of projected reductions in coal mining and power generation in Northwest New Mexico.

#### 2.3.2.1 Previous Studies

The energy and mining sector in the Four Corners region has been the subject of a number of economic studies. We found eight studies completed in the last decade that are particularly pertinent; these studies are summarized in **Table 2-6**. The studies include both *ex ante* and *ex post* analyses; some estimating economic impacts that had already occurred and others projecting economic impacts that would happen in the future if activities continue or projects are completed. The studies include examinations of specific power generation facilities (including the Navajo Generating Station and the Four Corners Power Plant), specific mines (including the Kayenta and Navajo coal mines, and a proposed uranium mine in Utah), and entire industries, such as the oil and gas extraction or coal mining industries in New Mexico. This section presents these results to highlight how estimated multiplier effects vary significantly across studies, indicating that there is uncertainty in how changes in mining and power generation activities translates into total economic impacts.

First, in comparing economic impact estimates, it is important to understand that results are expected to differ depending on geographic area analyzed. Geographic areas analyzed vary, with some studies focusing on specific counties or Indian Reservations and some studies focusing on statewide impacts. In general, the larger the economic area analyzed, the larger the expected multiplier (as a larger economic area typically has a larger and more diverse economy with less “leakage” or imports from other areas). As observed in a 2013 study of the Navajo Mine: job multipliers for the Navajo Mine, while the mine was still supplying all five units at Four Corners Power Plant, at the state level were estimated at 4.0 (i.e., for every job at Navajo Mine, there were three other jobs supported, for a total of four jobs supported statewide) while job multipliers at the San Juan County level were estimated at 3.0 (Evans, James, & Madley, 2013). This implicitly indicates that a sizable portion of the materials and services that are purchased by the power plant and its suppliers/workers come from elsewhere in New Mexico, supporting an additional job elsewhere in New Mexico in addition to the three jobs supported in San Juan County. This same effect is also described in the two studies focused on uranium mining that look at effects in Cibola and McKinley county economies versus the state-wide economy (Peach & Popp, 2008; Power & Power, 2014). Ripple impacts in Cibola and McKinley Counties are very limited compared to the magnitude of ripple effects at the state-level due to the relatively small size of these counties’ economies.

However, even for the same geographic area, studies of similar types of economic activity provide very different multiplier estimates. For example, the finding from the 2013 of the Navajo Mine that the job multiplier is 4.0 for all areas in the State of New Mexico is 67 percent higher than the finding of a 2009 study of coal mining throughout New Mexico that estimated a state-wide job multiplier of 2.4 (Peach & Starbuck, 2009). Similarly, findings regarding the income multiplier also differed, though not quite as drastically. The 2013 study of the Navajo Mine found a statewide income multiplier of 2.1, which is 40 percent higher than the finding from the 2009 study that estimated a statewide income multiplier from coal mining of 1.5. Both of these studies used the same modeling data and software (from IMPLAN) to model impacts. Two studies of oil and gas extraction in New Mexico, performed by different researchers in 2009 and 2012 also highlight how different assumptions and datasets may affect multiplier results. (Peach & Popp, 2008; Downes, 2012). These two studies found employment multipliers ranging from 2.6 to 4.1, and income multipliers ranging from 1.5 to 1.8.

In sum, in comparing the multipliers from past studies, there is fairly extensive variability among studies, especially in the jobs multiplier. **Depending on the energy extraction or generation industry and geographic area studied, multipliers for labor income ranged from 1.2 to 2.1, while the jobs multiplier ranged from 1.3 to 4.0.** It is expected that the economic impacts that would be experienced within the Northwest New Mexico region would likely be most similarly to those modeled by: 1) Evans, James, and Madley in 2013 for San Juan County related to operations at the Navajo Mine and Four Corners Power Plant (applicable to these entities as well as the San Juan Mine and San Juan Generating Station), and 2) by Power and Power in 2014 regarding the effects of a uranium mine in Cibola and McKinley Counties (applicable to the effects on these counties of changes in coal production at the Lee Ranch and El Segundo Mines).

**Table 2-6: Review of Previous Economic Impact Studies of Four Corners Mining, Oil & Gas Extraction and Coal-Fired Power Plants**

Analyzed Economic Activity	Geographic Scope of Economic Impact	Multipliers		Source
		Job Multiplier	Income Multiplier	
Navajo Generating Station and Kayenta Mine	Navajo Nation	3.5	1.9	Evans, James, Gamez, and Madley (2013) <sup>1</sup>
Navajo Generating Station	Navajo Nation	3.4	1.9	
Kayenta Mine	Navajo Nation	3.5	1.9	
Coal Mining	State of NM	2.4	1.5	Peach and Starbuck (2009)
FCPP (Units 1-5 in operation)	State of NM	2.9	1.5	Evans, James, and Madley, (2013) <sup>2</sup>
Navajo Mine (Units 1-5 in operation)	State of NM	4.0	2.1	
FCPP (Units 1-5 in operation)	San Juan County	2.7	1.4	
Navajo Mine (Units 1-5 in operation)	San Juan County	3.0	1.7	
Proposed uranium mining and milling operations	State of NM	2.5	1.7	Peach and Popp (2008) <sup>3</sup>
Proposed uranium mine	McKinley and Cibola Counties	1.3	1.2	Power and Power (2014)
Oil and gas industry	State of NM	4.1	1.5	Downes (2012)
Oil and gas extraction	State of NM	2.6	1.8	Peach, Delgado, and Starbuck (2009)
Oil and gas exploration and production	State of Utah	2.1	1.5	BEER, Univ. of UT (2009)

*1/Findings list the projected impacts in 2020 for the Navajo Generating Station and the Kayenta Mine combined*

*2/Findings list the impacts for the Four Corners Power Plant and Navajo mine combined*

*3/Findings list the impacts for production alone and do not include capital expenditures*

#### 2.3.2.2 Estimated Total Economic Impacts

**Table 2-7** summarizes the potential regional economic impacts to the three-county economy of reduced production from coal mines and coal-fired power plants in Northwest New Mexico. **Table 2-8** summarizes the distribution of the three-county impacts within the three-county area. As shown in the table, a range of impacts are estimated based on a combination of new analysis conducted for this study (using a 2014 IMPLAN model of the region) as well as findings from previous studies. **Total employment impacts are estimated to range from 2,260 to 3,180 jobs, with approximately 90 percent of these losses occurring in San Juan County (see Table 2-8). Total income impacts are estimated to range from \$195.2 million to \$213.3 million, with just under 90 percent expected to occur in San Juan County.**

**Table 2-7: Summary of Economic Impacts of Reduced Coal Mining and Coal-Fired Power Plants: San Juan, Cibola, and McKinley Counties**

Source of Impact	Type of Economic Impact			Multiplier
	Direct	Indirect and Induced	Total	
Income Impacts (Millions, \$)				
Power Stations	-\$52.5	-\$21.0 to -\$35.1	-\$73.5 to -\$87.6	1.4 to 1.7
Coal Mines	-\$69.6	-\$52.1 to -\$56.1	-\$121.7 to -\$125.7	1.7 to 1.8
Total	-\$122.1	-\$73.1 to -\$91.2	-\$195.2 to -\$213.3	1.6 to 1.7
Employment Impacts (Full and Part-Time Jobs)				
Power Stations	-350	-420 to -950	-770 to -1,300	2.2 to 3.7
Coal Mines	-580	-910 to -1,300	-1,490 to -1,880	2.6 to 3.4
Total	-930	-1,330 to -2,250	-2,260 to -3,180	2.7 to 3.5

Source: Highland Economics Analysis using IMPLAN 2014 model data and software, and previous economic impact studies in the region.

**Table 2-8 Distribution of Impacts at the County Level**

Impact Location	Type of Economic Impact			Proportion of Total
	Direct	Indirect and Induced	Total	
Employment Impacts (Full and Part-Time Jobs)				
Cibola County / McKinley <sup>1</sup>	-150	-50 to -190	-200 to -340	9% to 11%
San Juan County	-780	-1,280 to -2,060	-2,060 to -2,840	91% to 89%
Total	-930	-1,330 to -2,250	-2,260 to -3,180	100%
Income Impacts (Millions, \$)				
Cibola County / McKinley <sup>1</sup>	-\$18.0	-\$3.6 to -\$7.2	-\$21.6 to -\$25.2	11% to 12%
San Juan County	-\$104.1	-\$69.5 to -\$84.0	-173.6 to -\$188.1	88% to 89%
Total	-\$122.1	-\$73.1 to -\$91.2	-195.2 to -\$213.3	100%

1/As noted above, nearly all direct employment and income impacts of reduced production at Lee Ranch and El Segundo mine are expected to be felt in Cibola County, however indirect impacts may be felt in Gallup due to the rail transportation connections and other inputs that may be purchased from McKinley County.

## 2.4 DIRECT FISCAL IMPACTS ON LOCAL, TRIBAL, AND STATE GOVERNMENTS

This section focuses on the potential direct, fiscal impacts on local, tribal, and state governments from reduced coal production (i.e. reduced taxes paid by the mines and sale of coal). Focusing on direct taxes paid by coal mines, taxes paid directly by power plants are primarily property taxes that are not expected to change due to reduced power production. The exception are Navajo Nation tribal taxes paid by the FCPP, including (Possessory Interest Tax) and BAT (Business Activity Tax), which would decrease

with reduced generation. Based on a 2013 analysis by Arizona State University, the value of these taxes are estimated to decrease by approximately \$5.0 million annually (assuming that the Navajo Nation as mine owner continues to pay taxes to the Navajo Nation government as a non-Navajo mine owner would) (Evans, James, & Madley, 2013). However, it is important to note that other, indirect taxes associated with the income and spending of FCPP employees and the economic activity of FCPP suppliers would decrease to the extent that these employees and suppliers do not find alternative sources of income and demand.

#### 2.4.1 Direct Fiscal Impacts of Decreased Coal Mine Production

##### Tax Impacts

Tax receipts to all levels of local, tribal, and state government that are directly related to coal extraction are expected to fall by \$43.3 million. Thirty-four percent of this revenue loss is to the State of New Mexico, 56 percent is to Navajo Nation, and 10 percent is to local governments in Northwest New Mexico.

New Mexico coal production is taxed at the federal, state, county and sometimes even local municipality level. Due to their sovereign nation status, tax structure is different on each Reservation, with state taxes typically not applicable. There are numerous types of federal and state taxes on coal production and related properties, including: severance tax and surtax, conservation tax, excise tax, royalties, property tax, and gross receipts tax. Production at the Navajo Mine, located on Reservation land, produces tribal royalties and taxes paid to the Navajo Nation. Property taxes are not expected to change based on a change in coal production at a mine. The severance tax and surtax, conservation tax excise tax, and some royalties are paid to the State of New Mexico. Historic levels of these taxes to the State and to the Navajo Nation are shown in **Table 2-9**. This analysis assumes that the proportion of these taxes received decreases linearly with reduced coal production (which implicitly and conservatively assumes that price per ton of production will remain steady even with a decreased production level). For example, this analysis also assumes that since total coal production in the state is expected to decrease by 43 percent, state-level taxes will also fall by 43 percent.

Direct tax impacts to local governments from a change in mining are anticipated to be limited to the gross receipts taxes collected directly by San Juan County, McKinley County, and Farmington (although gross receipts taxes and property taxes may all indirectly be affected as well). **With diminished production at San Juan, Navajo, and El Segundo coal mines, the county and municipal governments within San Juan County and McKinley County would receive less coal gross receipts tax revenue.** Data from the state on gross receipts are not consistently reported for San Juan and McKinley Counties or Farmington due to the state's policy of not reporting tax figures when the entirety of the industry for the given time period is comprised of only one business. Gross receipts taxes are 5.125 percent for the state, with an additional 1.44 percent collected by San Juan County, an additional 1.63 percent collected by McKinley County, and an additional 1.06 percent collected by Farmington for coal sold within each jurisdiction's boundaries.

The range of future gross receipt taxes following a 36 percent decrease of coal produced in San Juan County (and Farmington) and a 53 percent reduction in coal produced in McKinley County are presented in **Table 2-9** below. The range of values presented in the post shutdown loss of gross receipts taxes are the estimated average annual direct reduction in tax revenue to San Juan County, McKinley County, Farmington and the State of New Mexico. For San Juan County, the expected reduction in gross receipts

taxes are expected to be approximately \$350,000. In McKinley County, the reduction is expected to be approximately \$4.1 million. In Farmington, the loss is expected to be approximately \$10,000. And for New Mexico, the loss is expected to be approximately \$14.2 million. In addition, the state likely faces reduced revenue from other taxes directly on coal production, estimated to fall by \$9.8 million annually, for a total reduction to the state's revenue of \$24.0 million annually. Direct royalties and taxes to the Navajo Nation are also expected to fall by \$9.8 million annually due to decreased production at the Navajo Mine (this is in addition to the approximately \$5.0 million in reduced annual taxes they would receive from the Four Corners Power Plant, for a sum total reduction of \$14.8 million in Navajo Nation tax receipts annually). In sum, all jurisdictions in New Mexico, including tribal governments, would face an estimated reduction of \$38.3 million in annual direct coal production tax receipts from the projected 43 percent fall in coal production value.

These estimates represent direct fiscal impacts. A decrease in production of mined resources would also have indirect fiscal impacts. Decreases in overall economic activity, such as from mining, also result in diminished consumer expenditures and property values, which would affect government receipts from sales tax, gross receipts tax, personal income tax, and property tax.

Table 2-9: Direct, Annual Fiscal Impact of Reduced Coal Sales

Jurisdiction	Historic Tax Receipts From Coal Production	Expected Taxes with Reduced Coal Production	Change in Taxes with Reduced Coal Production
Gross Receipts Tax <sup>1</sup>			
San Juan CO	\$970,000	\$620,000	-\$350,000
McKinley CO	\$7,730,000	\$3,610,000	-\$4,120,000
Farmington	\$20,000	\$10,000	-\$10,000
New Mexico	\$27,820,000	\$13,580,000	-\$14,240,000
State level taxes <sup>2</sup>			
New Mexico	\$22,700,000 <sup>3</sup>	\$12,900,000	-9,800,000
Tribal Government <sup>4</sup>			
Navajo Nation (Navajo Mine only), including PIT, BAT, and Royalties	\$45,700,000	\$40,200,000	-\$5,500,000
Total (GRT and other tax sources)			
San Juan CO	\$970,000	\$620,000	-\$350,000
McKinley CO	\$7,730,000	\$3,610,000	-\$4,120,000
Farmington	\$20,000	\$10,000	-\$10,000
Navajo Nation	\$22,700,000	\$12,900,000	-\$9,800,000
State New Mexico	\$50,520,000	\$26,480,000	-\$24,040,000
Total, All Jurisdictions	\$81,940,000	\$43,620,000	-\$38,320,000

1/Based on average data that was available from 2010 to 2014.

2/ These state level taxes include: State Trust Land Mineral Lease royalties, rentals and bonuses; severance tax and surtax; resource excise tax; Resource Excise Tax and Conservation Tax revenue.

3/Based on taxes collected by the State in 2013 when total production was 22.0 million short tons, similar to the average historical production levels assumed in this document.

4/Based on analysis from Evans, James, and Madley (2013) includes direct taxes paid by Navajo Mine to Navajo tribal government, based on 2011 data. We assume that the tribal government changes in tax revenues due to decreased production being the same (or even greater) with the Navajo Nation now owning the mine.

### 3 BEST PRACTICES: CASE STUDIES FROM AROUND THE UNITED STATES AND WORLD

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This chapter describes the economic conditions and economic transition experiences of areas across the United States (with one case study region from abroad) currently and formerly dependent on natural resource extraction, focusing primarily on coal mining regions. The purpose of the chapter is to identify best practices and lessons learned to meet the economic and social challenges of transitioning from an economy reliant on natural resource extraction to a more diversified and resilient economy less subject to international commodity prices and forces. While the case studies for this chapter are drawn from around the United States and the world, the better to offer *new* insights to Northwest New Mexico, the region can also look to its own experience in recovering from past natural resource ‘bust’ cycles or other economic downturns for best practice lessons.

This review begins with a cautionary tale of the Powder River Basin in Wyoming, which is heavily reliant on coal mining and has not diversified its economy. The case study highlights the importance of forward-looking leadership that emphasizes economic diversification and resiliency. The Appalachian region of the United States is the next area of focus, which has been facing decreased coal production, and associated adverse economic impacts, for over 25 years. This review describes several of the diverse economic development initiatives in the region that aim to revitalize Appalachia’s economy, including: the Appalachian Regional Commission, the West Virginia Hub, the West Virginia Workforce Development Board, and the Appalachian Center for Economic Networks. These initiatives span those focusing on infrastructure investment, community visioning and capacity for economic transitioning, workforce development, and fostering of market development and technical capacity for local small businesses.

We then describe in-depth one Appalachian region in Pennsylvania and one region in Australia that have successfully developed visitor industries: one that is based on nature and one that is based on agriculture. While these case studies focus on an individual industry, both of which are applicable to Northwest New Mexico, the lessons they provide are broadly applicable to developing and fostering many other local industries, including: developing a shared vision, providing training in technical and small business skills, fostering links between regional businesses, and branding and marketing at the regional level.

Finally, this review highlights the experience of forest communities throughout the Pacific Northwest that were readily dependent on natural resource extractive activity (timber harvests). We describe the way that community economies have transitioned, and in some cases, thrived. Studies of the diverse communities affected, and the identification of the qualities and strategies of those who have thrived, provides several best practice lessons for Northwest New Mexico. These include the importance of focusing on a broad spectrum of industries to diversify the economy, developing community cohesiveness and civic leadership, connecting to regional economies, and developing the infrastructure and amenities to provide a high quality of life for residents and a high quality experience for visitors.

### 3.1 POWDER RIVER BASIN

The Powder River Basin (PRB) is not an example of an area that has successfully transitioned away from a coal economy, but a cautionary tale of an area dependent on coal production, with little planning for economic diversification. The region's dependence developed because it is one of the lowest cost coal-producing regions in the world. A low stripping ratio (the portion of non-coal material mined) has provided the area with unmatched production efficiency, averaging 40 tons per employee per hour compared to the U.S. average of 4.4 tons (Bleizeffer, 2015). Low costs of production, extensive reserves, and a low sulfur content (a desirable quality due to reduced air quality impacts) have helped make PRB the largest source of coal in the U.S., supplying 40 percent of all coal use (WMA, 2016a). **One out of every five homes and businesses in the U.S. uses electricity generated by PRB coal** (US BLM, 2016).



*Long Wall Mining in PRB*

The economic impacts of PRB mining are extensive, and are important not just for the local area, but are also a significant share of the state economy. In 2012, the coal economy accounted for 14 percent of Wyoming's gross state product, nine percent of its total labor income, six percent of all employment, and 11 percent of state government revenues. Since the 1970's, coal has been the most stable source of Wyoming's tax revenues (Godby *et al.*, 2015). It is estimated that roughly one in every six Wyoming workers are directly or indirectly employed in coal development (U.S. BLM, 2016). In 2015, PRB coal mines directly employed 6,646 people (WMA, 2016a).

Until recently, the strength of PRB's coal industry has provided little incentive for the area to diversify its economy. Despite PRB's production advantages and the country's continued demand for coal, both national and international forces are now weakening and reducing the size and economic contribution of its coal industry. Because these forces also affect the Four Corner's coal industry, the challenges facing PRB can provide lessons for Northwest New Mexico about the importance of economic transition and diversification.

Among the threats to the PRB economy is one that is common to all mining: the farther one digs, the harder and more expensive it is to bring materials to the surface. Load-out facilities that were built directly adjacent to mines 30 years ago now lie several miles away from the active pit. Many PRB mines must now use expensive overland conveyors to transport coal across the distance, increasing production costs. Between 2001 and 2012, the average productivity of a Wyoming coal miner dropped 32 percent, which is largely attributed to digging deeper. Adding to the difficulty, as mines have dug deeper the quality of deposits has decreased, further lowering productivity and increasing prices (Bleizeffer, 2015).

Increasing production costs exacerbate problems with another major challenge facing PRB coal similar to that facing Northwest New Mexico: competition with natural gas. Since the early 1990's, coal's share of national electrical production has been falling while the share generated from natural gas has been rising. The U.S. Energy Information Administration (EIA) predicted that 2016 will be the first year natural

gas has surpassed coal as the largest generator of electricity. This trend has primarily been a market-driven response to falling natural gas prices, which has resulted from abundant and cheap gas production made possible by hydraulic fracturing (Crawford, 2016; U.S. EIA, 2016a). In the coming decades, gas is expected to continue to replace coal nationwide, which will further reduce demand for PRB and other coal (Tweed, 2013).

In addition to natural gas, PRB coal also faces pressure from growing generation from renewable energy sources. Energy from renewables reached a record level in 2015, and is predicted to continue its rise in the foreseeable future (US EIA, 2016b). Government subsidies, state renewable energy portfolio targets, and falling costs of renewable generation (especially for solar), will continue to incentivize renewable power generation in the near future.

Concerns over climate change and other air quality issues also motivate the replacement of coal-generated electricity with renewable resources and natural gas, which emits half as much carbon dioxide as coal when generating power (Crawford, 2016). Rules established under the Clean Power Plan (CPP) aim to encourage the nation's transition away from coal. While the future impact of CPP is uncertain due to current litigation and potential political changes, it is important to note that national coal use is expected to remain flat in the coming decades even if CPP is eliminated. If CPP remains in effect, coal use will decline substantially (US EIA, 2016b).

When taken together, these forces raise an uncertain outlook for PRB's coal industry in the coming decades. Adverse effects of the area's reliance on coal are already occurring. Coal production in Wyoming appears to have peaked in 2008 when it produced over 466 million tons. Production in 2015 was 375 million tons, a decline of almost 20 percent. Wyoming coal production is down 31 percent in 2016 (Paterson, 2016). Coal employment may have peaked in 2011 at 7,000, down five percent to 6,646 in 2015 (WMA, 2016b). Further evidence of the industry's troubles are apparent from the fact that three major PRB mining companies (Arch Coal Inc., Peabody Energy, and Alpha Natural Resources Inc.) have filed for bankruptcy in the last 15 months (Jamasmie, 2016; Miller, 2016). Over 450 miners were laid off last spring as a result of shrinking production (Joyce, 2016).

Some PRB mining companies have hoped that exporting coal will open their products to new and potentially growing markets in Asia. When PRB coal companies (including Arch Coal, Ambre Energy, and Peabody Energy) began taking steps to build the export infrastructure in the Pacific Northwest, local opposition prevented the development (Roberts, 2016). While local opposition to coal terminals obstructed this necessary infrastructure, global market forces decreasing demand and prices for coal would now likely make such exports economically unfeasible (even if the export terminal infrastructure were to go forward unchallenged). PRB coal exported to Asia has to compete with Indonesian and Australian coal. Transporting coal across the Pacific Ocean is expensive, and it makes the once-cheap PRB coal uncompetitive with closer producers (Roberts, 2016; Williams-Derry, 2016). In China, the largest market for PRB coal abroad, demand for foreign coal has been dwindling as a result of a slowing economy, growth in energy efficiency and renewable energy, and tariffs put in place to protect its own coal mines (Williams-Derry, 2016). As with domestic markets, currently foreign markets do not appear to be the answer for growing the PRB coal industry.

In the face of these challenges, the PRB region seems unprepared to handle a downturn or economic transition. There are no state-initiated jobs programs in place to support those laid off from the energy

sector. On the contrary, there were recent budget cuts to the Department of Workforce Services, and state leadership has vowed to “double down” on coal, investing in research for coal technologies and value-added processes rather than making efforts to diversify the economy. While the area has used tax revenues from coal to make significant investments in schools and local infrastructure, these investments may be underutilized if large portions of the community leave to find work elsewhere, which is already starting to happen (Bleizeffer, 2016).

The challenges facing the coal industry are not unique to PRB. In 2015, U.S. coal production reached a 30-year low (Valentine, 2016). Production is down roughly 33 percent nationwide from the same time last year (Paterson, 2016). The 12 months have seen hundreds of miner layoffs and diminished production across the country (Spencer, 2016). While many in the coal mining industry blame the country’s executive administration for waging a “war” on coal, the most substantial troubles facing the coal industry are not political. **The combined forces of slowing domestic energy demand, cheap and abundant natural gas, renewable energy production that continues to fall in price, and a competitive international coal market, will continue to depress the U.S. coal industry regardless of the nation’s political leadership and energy policy.** These energy market conditions and trends are driven by national and international markets and technological change, and are likely to continue or even accelerate in the decades to come.

Of all coal producing regions in the country, the PRB is best suited to withstand challenges to the coal industry. Its abundant, cheap, and comparatively-clean coal reserves give it an advantage over all other U.S. producers. The fact that the PRB coal industry is also facing a downturn demonstrates that all communities reliant on coal production are facing a short-term, and likely a long-term economic transition. **This PRB case study, which describes that region’s lack of coordinated efforts to diversify its economy, highlights the importance of forward-looking leadership that emphasizes economic diversification and resiliency.** It is possible that in the years to come, Wyoming will look to Northwest New Mexico for lessons on how to successfully transition away from a coal economy.

### 3.2 APPALACHIA



*Strip Mine in West Virginia*

Because of its extensive history in coal mining and its economic struggle in the face of a waning coal industry, Appalachia provides one of the most useful case studies in transitioning away from extractive industries. There is a wide variety and number of programs that have been created to help in this transition. While not always successful or sufficient, the efforts made to help the communities and coal miners of Appalachia provide valuable lessons and guidance to Northwest New Mexico.

Coal production in Appalachia peaked in 1990 at about 450 million tons (McIlmoil & Hansen, 2010). In the 25 years since then, production shrank more than 50 percent to 222 million tons in 2015. This year, production in the region is expected to fall another 46 percent from 2015 levels (U.S. EIA, 2016). Appalachia’s coal decline is attributed to less expensive energy alternatives, namely: low-sulfur coal

from the western U.S. and natural gas (Valentine, 2016). In addition to weakened demand, mechanization has reduced the need for labor (Valentine, 2016).

Reduced coal production has had a devastating impact on Appalachia's miners and communities. The two largest coal-producing states in the region, West Virginia and Kentucky, have seen coal mining employment drop more than 70 percent in the last three decades (Flaccavento, 2010). In the region as a whole, employment has fallen steadily since 2011, from around 60,000 to less than 40,000 in 2015 (Hodge, 2016). Kentucky alone has lost more than 11,000 coal mining jobs since 2009 (Valentine, 2016). From 2012 to 2015, hours worked by miners in Central, Southern, and Northern Appalachia fell by 52, 32, and 22 percent, respectively (Bomey, 2016).

In response to the coal industry downturn, non-profit organizations, advocacy groups, businesses, educational institutions, and all levels of government have made efforts to revitalize Appalachia's economy. While the scope, depth, and history of these efforts is large enough to justify an entire book on the subject, we attempt here to brief summary some of the initiatives, and associated lessons and strategies that may be most relevant for Northwest New Mexico. This analysis primarily draws on information gathered during interviews with organizations that have first-hand experience helping communities diversify their economies.

### 3.2.1 Appalachian Regional Commission: Investing in Infrastructure & Workforce to Leverage Local Assets

The organization that has likely done the most work to support economic diversity in the Appalachian economy is the Appalachian Regional Commission (ARC). Created by Congress in 1965, it is a federal, state, and local government partnership that works for sustainable community and economic development in Appalachia. It has five primary goals:

- Invest in entrepreneurial and business development strategies that strengthen Appalachia's economy
- Improve the education, knowledge, skills, and health of residents to work and succeed in Appalachia
- Invest in critical infrastructure
- Leverage the Region's natural and cultural heritage assets
- Build the capacity and skills of current and next-generation leaders and organizations

Each year ARC provides funding for business development, education and job training, telecommunications, infrastructure, community development, housing, and transportation. These projects create thousands of new jobs; improve local water and sewer systems; increase school readiness; expand access to health care; assist local communities with strategic planning; and provide technical and managerial assistance to emerging businesses (ARC, n.d.).

In speaking with ARC about making successful economic transitions, a few important themes arose: **Developing a viable economic vision for the future, gathering community support for that vision, and building the infrastructure to support it. The region's economic vision must capitalize on regional sectoral strengths and opportunities. Different regions offer their own competitive advantages, and the economic vision should harness and build on those advantages. Developing a clear direction forward for the region's economy is key to its success. Because no single industry will replace coal,**

**communities should use a broad-based approach that may include supporting local food systems, recreation, tourism, downtown redevelopment, and entrepreneurship** (Theobald, 2016).

**The overall strategy should also incorporate plans to balance short-term impacts with long-term opportunities.** Economic downturns bring negative effects within weeks or months: Unemployment, reduced revenues to local businesses, and fewer tax revenues for infrastructure and schools. However, it often takes years to grow new local industries and economic development programs. Rectifying this temporal disparity is one issue a transition vision must address. **Job retraining is typically a key component that bridges the gap** (Daffner, 2016).

**In order for an economic transition plan to be successful, it must have support from the community.** Involving the community in the creation of the transition vision is one way of gaining this support. In some cases, communities are not ready to make an economic transition, and instead hold onto the hope of rejuvenating the industry that supported them previously. In these cases, it is especially critical that local leadership work to gather community support for economic transition, and foster a positive attitude toward the area's new economic future (Daffner, 2016). An organization in Appalachia called West Virginia (WV) Hub focuses specifically on this aspect of economic transition, and its strategy for success is discussed later in this section.

**Communities making an economic transition must create support systems that facilitate their vision.**

The basic support structures include: technical support, financing, networks, and education. For many extractive economies, assets have not been reinvested and the industry revenue has been moved outside the local area. This makes it important to find new sources of investment and methods of financing business ventures and programs. Of course, one source of funding comes from outside grants for economic development, but determining how to spend that money can be difficult. To help ensure that economic development funds have the intended impact, ARC has found that communities should ultimately decide what investments will be supported (Daffner, 2016). To qualify for ARC funding, proposed projects must demonstrate that they are regional in nature, foster collaboration with partners, are sustainable and impactful (Theobald, 2016).

The Crooked Road Music Trail in Southwest Virginia is one example of how ARC helped to build on regional strengths to grow new economic activity. The project began in 2003 as a way to capitalize on the region's rich heritage of traditional music. The trail links nine music venues and over 60 affiliated venues and festivals that bring in thousands of visitors each year (The Crooked Road, n.d.). Funding from ARC, as well as other sources, **was used to improve the venues and create a regional marketing plan.** While the project took 20 years to becoming fully-effective, today it brings substantial economic impacts to Southwest Virginia (Theobald, 2016). A study in 2008 estimated roughly 109,000 people visited The Crooked Road, generated \$12.9 million in direct spending, \$23 million in total economic impacts, and produced the equivalent of 445 full-time jobs (Tennis, 2008).

### 3.2.2 West Virginia Hub: Community Vision for Economic Diversification

As briefly mentioned above, WV Hub works to build and organize community change, and facilitate local action for economic transition and diversification for WV coal areas. Rather than supporting businesses and providing incubation services, WV Hub's five full-time staff offer community coaching for economic development related to team building, project planning, and implementation assistance. The group's

primary strategy is to convene community members to develop a post-coal economic vision, with the goal of moving the conversation from supporting the coal industry toward diversifying the local economy. Their efforts are targeted toward rural and small communities. Other methods include connecting community leaders who are working in different industries and maintaining a statewide community development network (Tyree, 2016).

**WV Hub’s community coaching process provides useful best practices for helping a community generate a common economic vision.** The Hub’s “coaches” are a combination of facilitator, organizer, and coach, and must go through a training program that took WV Hub years to develop. Each coaching process begins by using referrals from contacts within the community to gather a diverse mix of people, which includes elected leadership, volunteers, leaders of community organizations, and business leaders. The Hub never gathers a group of community members without local contacts, as introductions are an important first step to building the trust and support necessary to make the process successful. Attaining the appropriate mix of attendees is difficult and takes a lot of time and effort, but getting it right can mean the difference between success and failure. Often times this kind of gathering can be dominated by elected officials that have been in their positions for a long time, and are less open to the changes that may be needed for the community’s best interests (Tyree, 2016).

**In community meetings, it is important that the facilitator create a welcoming space and a level-playing field for voices to be heard.** This helps to encourage full participation and support from all attendees. Churches and community centers have been found to make the best meeting venues. Regardless of the building, the venue should be conducive to group work and should provide tables for small group productivity. Stages and other venues that inherently promote top-down communication should be avoided (Tyree, 2016).

As WV Hub has found, bringing communities together toward a common economic vision can be very difficult. **There is often fear and confusion about economic transition.** Communities can form deep relationships with mining, and deciding to turn away from an industry that has provided decades of economic stability and security can seem daunting. In WV Hub’s experience, many people in declining coal communities would rather support an old, weakening industry than work to bring in new ones. One strategy that has helped overcome this barrier is to **demonstrate in-person the positive changes that have come from economic transition.** Peer sharing programs and learning trips, where attendees visit other WV communities that have persevered through similar challenges, have proven effective. The closer the example is to their home, the more effective it seems to be in changing the audience’s perception of the problem (Tyree, 2016).

### 3.2.3 Workforce Development Board (West Virginia and SW Virginia): Training Programs

When an industry suffers a sudden downturn, the most pressing issue for laid-off workers is where they will find new employment. In Appalachia, Workforce Development Boards (WDBs) are a primary resource in helping out-of-work coal miners transition into new employment. WDBs act as a nationwide connection linking the U.S. Department of Labor (DOL) with American Job Centers (CareerOneStop, n.d.). The West Virginia WDB partners with the United Mine Workers of America career centers, and identifies useful training programs based on job market trends. The WDB helps to provide classroom and on-the-job training that builds on the miners’ existing skills. The organization is funded through the National Dislocated Workers Grant awarded by the DOL. Starting with a \$1.8 million grant, funding has

increased each year since then and now stands at \$15 million. Approximately 2,000 miners have accessed services under their current grant, and the office has an 84 percent employment rate (Persons, 2016).

The WV WDB's work begins before miners lose their jobs. The office receives notice of upcoming layoffs and holds a "rapid response" meeting, gathering resources and people before the miners are out of work. They try to anticipate the needs of workers, which is aided by a "Dislocated Worker Questionnaire Survey." This survey asks the miners about their current skills and employment preferences, and acts as a starting point for helping them. The WV WDB has found that often miners do not fully understand the marketable skills they possess, so the questionnaires give both parties a better idea of the miners' current skillset. **Specialties common in the mining industry include equipment operation, welding, diesel mechanics, and electrical work. In WV WDB's experience, some of the more common fields for displaced miners to transition to include information technology (IT), healthcare, truck driving, and machining (Persons, 2016).**

A major challenge facing WDBs is that coal mining provides workers with a good wage without requiring a college degree. As WDBs in Appalachia have found, that type of job is difficult to replace. Despite the fact that additional education could increase the career prospects of displaced miners, many are opposed to the idea of going back to school, instead preferring short-term training. Also, for many miners, coal mining is a family tradition that has lasted multiple generations. Because it is part of miners' identity, changing careers from them can be particularly challenging (Persons, 2016).

The WV WDB has offered some useful guidance for leadership involved in economic transition. **First, it is important to make people aware of the transition plan, to coordinate resources, and to bring in partners to assist in the process.** Approaching the change with a positive outlook and focusing on the future's potential can reframe perspectives. A publicly-available community resource directory can be valuable asset by providing a list of services, relevant organizations, job openings, training opportunities, and other resources in a single location (Persons, 2016).

WV WDB is involved in one program that offers a good example of how partnering with local business and colleges can help displaced coal miners expand their skills and attain good-paying jobs. **The "Learn and Earn" program combines four semesters of classroom training (32 credit-hours) with eight to 12 weeks of on-the-job training.** The classroom portion occurs at West Virginia University Parkersburg, where attendees learn about chemical manufacturing. The hands-on training is conducted at local DuPont or Chemours facilities, and students are paid up to \$18,000 while they train (West Virginia University - Parkersburg, n.d.). After program completion, graduates receive a certificate of applied science in chemical and polymer operator technology, and some are hired by DuPont (although this is not guaranteed) (Persons, 2016).

**In a similar plan to repurpose the skills of displaced coal miners, the Southwest Virginia (SWV) WDB is using a POWER Initiative grant to prepare workers for careers in advanced manufacturing and outdoor recreation.** The programs represent a collaborative effort between the SWV WDB, individual community colleges, the Office of Economic Development, and the Virginia community college system. The two industries were chosen because of their viability in the region, potential for growth, and their compatibility with coal miners' existing skills. The retraining programs are a partnership with local community colleges that allows workers to get the skills they need to gain new employment without

having to earn a four-year degree. Advanced manufacturing programs offer classes in growth industries such 3-D design, information technology, precision machining, and industrial maintenance (mechatronics). These programs are beneficial to displaced workers and local firms alike, as workers with the right combination of skills in electronics, mechanics, and computer skills are in short supply. The outdoor recreation program offers training in adventure tourism and entrepreneurship. Funding for these programs comes from DOL, the U.S. Commerce Department's Economic Development Administration (EDA), and the ARC. Because these programs started their first classes in the fall of 2016, it is too soon to judge their efficacy. As of August 2016, there were only seven enrollees in the program (Mullins, 2016).

As with the WV WDB, the SWV WDB offers some useful guidance in how to best cope with the unique challenges that come with a downturn in the coal industry. Outreach to displaced workers is especially important and can be tricky. Many miners are accustomed to a specific method of job searching, which traditionally has involved reaching out to past coworkers and personal contacts and using them to identify opportunities with other mining companies, as well as providing them with a recommendation that increases the chances of being hired. **Convincing displaced miners to utilize other resources to find employment outside of the coal industry, such WDBs and career centers, can be challenging. The SWV WDB has had some success using social media, advertising in newspapers and radio, providing press releases, and conducting information sessions in local communities (Mullins, 2016).**

Another challenge with retraining displaced miners comes from a widespread belief that the coal mining industry will recover given the proper political support. There also exists a mistrust of people who try to convince out-of-work miners to seek other career paths, which is interpreted as being "anti-coal," and therefore "anti-coal miner." As one member of the SWV WDB put it, "If coal miners believe you are 'anti-coal' they will stop listening to you." Consequently, one tactic that helps to convince displaced coal miners to use retraining resources is avoiding the political debates that surround the coal industry's future. Emphasizing the uncertainty of future developments (i.e. "We don't know what will happen with coal"), highlighting the advantages of gaining additional skills regardless of coal's prospects (e.g. "Gaining new skills will open up career opportunities both in and out of the coal industry"), and the importance of making a living during an economic lull in the industry (e.g. "This training will help you get a job while we wait for the coal industry to recover"), can help to persuade coal miners of the value of retraining while side-stepping the political issues that can act as a barrier (Mullins, 2016).

### 3.2.4 Appalachian Center for Economic Networks: Fostering Entrepreneurship & New Markets

Organizations that promote and support entrepreneurship in Appalachia are helping to ease the economic transition away from coal. These initiatives can act as useful models to Northwest New Mexico. One example is the Appalachian Center for Economic Networks, or ACEnet. By building economic networks, providing resources to fledgling businesses, and leading regional branding campaigns, ACEnet has opened up new markets in Appalachian Ohio, providing residents with economic opportunities outside of the coal industry. ACEnet began in 1985 as a small group of community members trying to find opportunities in local economic sectors and identifying how they could be grown (ACEnet, n.d.).

One area ACEnet recognized as having potential was local food and sustainable agriculture. Using donations and grant funding from the EDA, they began by conducting research into **statewide branding**

**programs**, which indicated the “buy local” movement was an opportunity to create new economic activity. To tap into this potential, ACEnet started the “Food We Love” regional branding program. This **initiative helps to connect producers, food processors, distributors, and local restaurants**. For farmers in the program, “Food We Love” markets their products under a larger regional brand that encourages retailers to buy from small local firms (Klein, 2008). This allows farmers to reach wholesale markets that would normally be difficult for small, individual producers (Schaller, 2016). ACEnet also offers technical assistance to firms in the program, providing guidance on recipes for large-scale production, labeling, marketing and pricing. As part of the “Food We Love” program, ACEnet created the “30-mile meal” program to market “super local” foods (Schaller, 2016).

In addition to branding and technical assistance, **ACEnet works to support facilities for food producers to grow their businesses**. These include more than 50 kitchen incubators nationwide, food hubs, and packing and distribution facilities, totaling more than 30,000 square feet of business incubation space. The facilities typically create 50 – 100 new jobs per year (or turn part-time jobs into full-time jobs). In the food center alone, 380 businesses have been started. Not only do the facilities provide a crucial service to food entrepreneurs, but rental agreements give ACEnet a steadier and more reliable source of revenue than the donations and grants that they have historically relied upon (Schaller, 2016).

While much of ACEnet’s work and success has centered on food production, the economic development model could easily be applied to other industries. In fact, ACEnet has also worked in the manufacturing, arts, and tourism sectors. **The organization’s successes are grown out of existing regional economic strengths, using a sector and network approach, and an emphasis on local ownership and control**. In starting a similar initiative, there are a variety of grants available at the national level: USDA Rural Development Grants, USDA Rural Microenterprise Grants, USDA “Know Your Farmer, Know Your Food” grants, Food Access/Food Security grants from the U.S. Department of Health, and grants from the Ford and Kellogg Foundations. To maximize the likelihood being awarded a grant, applications must be strong in following areas: Value proposition, logic model, matched funding, strength of concept, and demonstrated need. Because federal funding and philanthropic grants often have a regional focus, making initiatives regional can be an effective strategy for winning funding (Schaller, 2016).

### 3.3 PENNSYLVANIA WILDS

The Pennsylvania Wilds region includes 12 counties in north central Pennsylvania. More than half of the counties are impacted by coal industry contractions. Since 2000, the region has experienced a loss of 744 coal jobs, with 434 of those jobs occurring in the last five years (Pennsylvania WILDS, 2016). The region has historically been subject to the boom and bust cycles of extractive industries, including logging, oil and gas, and coal mining. Recently the Pennsylvania Wilds Center for Entrepreneurship, Inc. (PA Wilds Center) received a three-year, \$500,000 grant from ARC through the POWER Initiative to assist with nature tourism cluster development. This will build on the Pennsylvania Wilds initiative that was initiated by the Pennsylvania governor in 2003 to provide economic development to the region through nature tourism.

The region has experienced consistent declines in population, an aging population as young people leave for better opportunities, and a decline in income, despite significant economic growth elsewhere in Pennsylvania (Patricia Patrizi, 2009). However, the weak economic conditions in the area are set against

a backdrop of natural resource attractions with diverse appeal. The area has two million acres of public land including 29 state parks, eight state forests, 50 state game lands, and the Allegheny National Forest (Patricia Patrizi, 2009). The region also includes two National Wild and Scenic Rivers, the largest wild elk herd in the Northeast, populations of bald eagles and river otters, and the largest block of natural lands between New York City and Chicago. **This case study highlights how approximately a decade of collaboration between local, regional, and state public and private organizations has leveraged the natural resource assets in the region to enhance local businesses, based primarily on nature tourism and improving quality of life to attract and retain other types of businesses.**

In 2003, the Governor of Pennsylvania established a task force of state departments, regional organizations, and congressional and county governments, and charged the Department of Conservation and Natural Resources with organizing the Pennsylvania Wilds Initiative. The Initiative has developed into a broad coalition of a vast alliance of partners including state and federal agencies, county and local governments, visitor bureaus, legislators, businesses, heritage areas, economic development agencies and other nonprofits. The Initiative has been successful in driving investment in the region, including in communities, infrastructure, and parks and forests in the region. Initially the focus was on drawing visitors for elk viewing, but then it was recognized that it was necessary to establish a Recreation Plan for developing diverse activities that would appeal to a broad range of visitors and attract them for a multi-day stay, increasing economic development opportunities in the area (Patricia Patrizi, 2009).

Elements of the Initiative have included:

- **Marketing of Pennsylvania Wilds as a distinct brand** by the Department of Community and Economic Development and the Office of Tourism, Film, and Marketing, with more than \$5 million invested. The goal has been to develop a unified approach to tourism marketing and a unified regional identity for the Pennsylvania Wilds. The first step was to develop a brand and a logo; the second step was to create a more unified region-wide umbrella organization to market the region. This has enabled larger-scale marketing of the region, including a website, a visitor's guide, a discover map, and a fishing guide. They have also advertised in national publications.
- **Development of visitor amenities and the visitor experience.** This included development of an Elk Scenic Drive and a Pennsylvania Wilds Gateway Welcome Center with assistance from the Pennsylvania Department of Transportation, development of amenities at state parks including new visitor facilities and major interpretive centers, and a Pennsylvania Lumber museum. The Recreation Plan for the region has focused on enhancing the visitor experience through better directional signs, more and better information, maps, and improved and expanded recreational opportunities. Building trails in the region, particularly those that linked towns to each other or those that linked towns to special natural features, have a particularly high priority in the plan.
- **Development of local businesses** to serve visitors, organized through the Wilds Cooperative of PA, which focuses on growing and clustering local businesses that serve the tourism industry, including food and accommodation, guiding, and other services. A big focus on this cooperative is linking and developing local arts and craft producers and connecting their products with the regional brand; the result has been a network of juried artisans, trading posts, public art, and

host sites. The Initiative has recognized that both demand and supply are critical to address: demand for experiences, services, and products from the region; and supply of diverse and sufficient infrastructure and local businesses that can cater to visitors.

A challenge to the Initiative has been overcoming opposition and skepticism from some parts of the region who fear commercialization or suspect that it is anti-hunting, or that officials want to turn the area into pure wilderness (Patricia Patrizi, 2009). **Consistent and meaningful public engagement has been key to increasing support for the Initiative and over time residents are increasingly seeing it as beneficial to the region.** Another challenge has been maintaining communication and a collaborative relationship between public lands staff and local businesses that use public lands such as outfitters and concession operators.

**As the initiative has progressed, the lead state agency has increasingly reviewed the ‘readiness’ of a community to engage in the effort, as engagement and interest in partnering are key to success.**

Readiness has been gauged on such factors as: “natural or economic assets, interest among community stakeholders about the environment and economy, political will of local elected officials, political skills and ability to work on teams and in partnerships, access to funding pools to generate matching funds for grants, planning and technical capacity, and a long-term perspective toward achieving goals” (Patricia Patrizi, 2009).

### 3.4 NEW SOUTH WALES

New South Wales (NSW) is Australia’s largest state economy with a gross state product of A\$507 billion in the 2014/15 fiscal year (ABS, 2015). The mining industry is a major source of economic activity in the province, producing an estimated A\$11.3 billion in 2014/15, and supporting more than 21,000 direct jobs and 114,000 indirect jobs (UOW Research, 2016). Mining is also important to the provincial government, generating A\$1.3 billion in royalties to the state in 2012/13 (NSW Mining, 2014).



*Muswellbrook Coal Mine in NSW*

Coal accounts for roughly 80 percent of the value of mineral production in the province. In 2012/13, NSW produced 260 million metric tons of raw coal (CIE, 2014). Most of the coal mined in NSW (approximately 85 percent) is sold in markets overseas, making it the province’s most valuable export. The largest buyer is Japan (72 million tons in 2012/13), followed by China (38 million tons in 2013/14) (NSW Mining, 2014). Coal production in NSW increased steadily from 1991 to 2013, primarily due to demand from Japan, Korea, and more recently, China (CIE, 2014).

In recent years, NSW mining has seen a decline as a result from low export prices and weakening demand from China. Total coal production fell five percent from 2012/13 to 2015/16 (CIE, 2014; NSW Government, 2016). Total income from NSW mining, including labor income, profits, and rents/royalties, dropped 21 percent from 2012 to 2015 (ABS, 2015). Mining companies have responded to the decline

with widespread labor reductions. In 2013 and 2014, the coal industry in NSW shed more than 4,000 jobs (Lannin, 2014). The beginning of 2016 brought announcements of more than 800 layoffs in the mining industry, with another 245 planned before the end of the year. More than half of the layoffs were in coal mining (Cook, 2016; Harris, 2016).

**Fortunately for NSW, the province has consistently encouraged the development of industries outside of mining that may be able provide economic opportunities in the absence of a thriving mining industry. A number of private and public organizations at the state, federal, and local level have worked to foster the growth of tourism, agriculture, and entrepreneurship.**

NSW has found one regional economic opportunity in agritourism. As the name implies, agritourism is any tourist activity that focuses on agriculture. While agritourism can involve different activities in different areas, NSW offers agritourism opportunities in farm tours, working farms, wine tasting, technical study tours, special technique demonstrations, bed & breakfasts, and farmstays (Destination NSW, 2013).

Promoting the agritourism industry in NSW was a way to build on the region's existing strength in tourism. Tourism directly supports approximately 160,000 jobs in NSW, and another 129,000 jobs indirectly. Tourism consumption generates over A\$28 billion (NSW Government, 2012). Over three million international visitors and 79 million domestic visitors make NSW the most visited state in Australia (NSW Government, n.d.). By using the region's existing economic strength, promoting agritourism has shifted tourism dollars to rural areas that are in need of economic development. The movement takes advantage of a growing interest in learning where food comes from and how it is grown (Browne, 2009).

Agritourism provides an important source of revenue to farmers and rural communities. For many farmers, agritourism offers a way to diversify their businesses and find new sources of income. While farm tourism is often used to supplement agricultural income, in some cases tourism can make up the vast majority of a farm's revenue. One study of agritourism in Australia found that one-fifth of respondents surveyed earned more than 90 percent of their income from agritourism (ADAWR, 2010). It also helps farmers survive productivity challenges, such as drought and climate change (Browne, 2009). In other cases, agritourism allowed farmers to diversify their income by selling directly at the farm-gate or in local markets (ADAWR, 2010).

The NSW agritourism has received support in a variety of ways. One has been through market research. The Australian Department of Agriculture, Fisheries and Forestry (ADAFF) conducted a study aimed at finding ways to support and expand farm tourism (Browne, 2009). The research investigated the industry's dynamics, strengths, vulnerabilities, and barriers to growth. The lessons found in this study are discussed later in this section, but it is worth noting that federal support for market research can be valuable to growing local industry.

Another means of bolstering agritourism has come from state funding. In 2015, the NSW government contributed A\$171,500 to the Riverina Regional Tourism Organization with the expressed goal of marketing the Riverina region of NSW as a must-visit food and wine destination. The funds are aimed at increasing the products and packages available that attract overnight visitors, such as food and wine experiences, farm gate visits, and provenance trails and events, and delivering a targeted marketing

campaign to increase awareness of the destination (Riverina, 2015). So far it is unclear what impact the funds have had on the local agritourism industry.

In another effort, Destination NSW, the state's tourism department, organized and funded workshops for local farmers and rural land owners to learn about opportunities in agritourism. In addition to the educational workshops, there were also follow-up workshops available for farmers who wanted to participate in the establishment of new agritourism products. This event represented a combined effort of state government, local businesses, and community organizations (Town&Country Magazine, 2012).

Educational institutions have been another source of support for agritourism in NSW. One example is Southern Cross University, who in 2004 began helping local farmers market their different communities as a single, cohesive agricultural destination: The Long Paddock Touring Route. The marketing campaign takes advantage of a local legend surrounding cattle driving routes, and has drawn tourists to areas in need of more diverse sources of income. Since the project began, the area has experienced a 12.5 percent increase in tourism worth about A\$8 million. The region offers visitors a variety of experiences, from "living the life of a farmer," to primitive camping on river banks, to gourmet meals (Markham, 2010).

The study funded by ADAFF offers some valuable insights for any region hoping to grow agritourism. Among the key takeaways were that **growing a successful agritourism industry, or almost any other local industry, is underpinned by effective market research and marketing, customer service skills, and strong coordination at regional and local levels.** In general, local and regional support were found to be critical factors for expanding the industry. The study found four key drivers that can enhance regional agritourism (and are applicable to developing many other local industries, as well):

- **Clustering and linkages:** Tourism businesses work together to support and promote each other. Food and wine trails are a prime example.
- **Regional Information Centers:** Integrating tourism organizations (i.e. visitor centers) with each other and with agritourism businesses in order to maximize promotion of tourism opportunities.
- **Marketing research and promotion:** Marketing materials are critical. Examples include: Brochures, websites, festivals, experience packaging, events, innovative advertising, and promotional activities. Consumer–farmer interactions act as an 'incubator' for product development, which makes farmers markets especially valuable. The need for agritourism operators to have marketing skills was highlighted in all the study regions.
- **Regional leadership and support:** Important support factors include formal regional coordination, leadership and entrepreneurship, organizational support, regional economic and community development, awareness and training, collaboration, and development of effective local food distribution systems to support food tourism.

**Other notable strategies found to nurture agritourism were developing a shared definition and vision for the region's agritourism industry, and creating training and extension opportunities to increase skills, especially among farmers. Important training areas include marketing, customer relations, and product development (Ecker *et al.*, 2010).**

The ADAFF study also identified challenges and barriers inhibiting the growth of agritourism in Australia. For example, there seemed to be a lack of long-term, strategic resourcing targeting the industry. Public and private sector initiatives largely provided indirect, rather than direct support. Other barriers included the following:

- Labor shortages
- Issues with signage
- Roads and infrastructure
- Lack of skills among operators
- Regulations that were not tailored to facilitate agritourism
- Concerns over public liability implications, particularly with working farm experiences
- Lack of understanding and commitment on the part of industry and government institutions
- Lack of farmer or agricultural industry involvement in agritourism initiatives

As a case study, NSW offers lessons in how to capitalize on regional strengths and cultural trends to diversify its economy outside of extractive industries. Recognizing a growing interest in food production and local food, the province was able to use its thriving tourism industry to create new markets in rural areas. Through a mix of public, private, and educational organizations, NSW has helped farmers and rural communities expand their incomes and endure economic hardship that arise from droughts, floods, and climate change. While this example is focused on the agritourism industry, which may be specifically applicable to Northwest New Mexico, it also highlights more broadly the key pieces that are applicable in growing not only any tourism industry, but nearly any local service industry.

### 3.5 PACIFIC NORTHWEST TIMBER COMMUNITIES

Historically, timber production has been a major economic driver throughout the Pacific Northwest, particularly in Oregon. While modernization, industry restructuring, and global competition were transforming the industry and community economic dependence on it in the latter half of the twentieth century, a major shock to the industry occurred in the early 1990's (Doghue, 2007). In 1991, a court injunction halted new sales of federal timber on federal lands in much of the Pacific Northwest to protect the habitat of the northern spotted owl. Primary wood products employment dropped by 30,000 jobs between 1990 and 2000.

However, this occurred across a backdrop of a regional economy that gained 1.4 million jobs over the same period. **The experience of communities**

**throughout the Northwest in response to reduced natural resource extractive activity (timber harvests), and the way that community economies have transitioned, and in some cases, thrived, also provides several best practice lessons for Northwest New Mexico.**

To meet Endangered Species Act requirements while mitigating impacts to forest communities, the federal government developed the Northwest Forest Plan (Plan). The Plan included elements intended



*Logging Crew in early 1900s in Pacific NW*

to maintain a certain level of timber harvest, as well as assistance strategies for affected communities, including the Economic Adjustment Initiative (EAI) that invested \$1.2 billion to provide loans to businesses, develop local infrastructure, retain workers, and fund ecosystem restoration projects (Doghue, 2007). However, the initiative elements to fund ecosystem restoration did not “create sustainable local jobs comparable to the number and quality of jobs lost” (Doghue, 2007). Rather, economic transition stemmed from action by community leaders and residents to transition to other regional strengths and to position their communities as attractive to location-neutral workers.

Effects of the Plan differed dramatically among communities. Specifically, socioeconomic monitoring of the 1,314 forest-dependent communities revealed that between 1990 and 2000 the socio-economic well-being (as measured by six indices related to education, employment levels and diversity, poverty, income equality, and travel time to work) increased in approximately one-third of communities, decreased in another one-third, and remained approximately steady in the remaining one-third. Socioeconomic well-being was not as dependent on timber flows as previously thought, many other factors affected well-being. Factors that determined community ability to transition included:

1. Community cohesiveness
2. Civic leadership and community capacity to seek help and respond to economic stress
3. Connection to regional economies
4. Size and sophistication of the communities
5. Availability of alternatives and the infrastructure and capacity to develop those alternatives.

**Communities that successfully transitioned often employed the following strategies:**

1. Adapting to reduced timber harvest by **developing and depending on the following in industries: agriculture, recreation and tourism, regional trade, and tribal business and administration;** and
2. Re-defining and re-focusing forestry jobs on fuel reduction (such as through thinning), manufacturing wood products from small diameter wood, and using biomass for energy generation; and
3. **Focusing on developing infrastructure and amenities to attract location-neutral workers** (including small businesses, commuters, and amenity-seekers).

However, even in communities that have adapted well, the transition involved outmigration of workers who were displaced, and the economic dislocation of former timber workers who are now in lower paying or seasonal jobs in the service, construction, or tourism sectors (Doghue, 2007). The transition also often entailed in-migration of new residents seeking recreation and scenic amenities provided by forests, who often have a different perception of natural resource management that may conflict with traditional views held by long-time residents. For example, Coos Bay, located near the Oregon Coast, is a former timber and fishery dependent community that has done relatively well in transitioning into a more diversified economy. Thriving economic sectors include retail trade, real estate, medical care, and tourism. However, not all residents have welcomed the transition that to some have altered the identity of the town, and “to the regret of some long-time residents, it’s not the place it was.” (Doghue, 2007). Development of a shared vision of the future that meets residents’ needs and addresses community concerns, as well as demonstrating the positive impacts of the vision, is critical to limit the challenges of transition and to facilitate success.

## 4 STRATEGIES TO MITIGATE ADVERSE ECONOMIC IMPACTS IN NORTHWEST NEW MEXICO

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This section identifies and recommends strategies for mitigating impacts of declining economic activity in the energy sector that have been successful in other areas. While the lessons from this chapter arise from the experience of coal-dependent regions in other areas of the country, the successful strategies employed to transition from coal apply broadly to economic development efforts throughout the Northwest New Mexico region and not just to areas adversely affected by the downturn in the coal mining and power generation industries. As highlighted in the preceding chapter, regions that have diversified their economies and transitioned from a dependence on extraction industries, such as mining or timber, have commonly employed the following strategies:

1. Meeting immediate and longer-term needs through workforce development, including technical skills training and small business skills;
2. Enhancing quality of life, including investments in downtown redevelopment and other infrastructure, services, and amenities to attract businesses, residents, and visitors;
3. Nurturing local regional networks, state partnerships, and leveraging these to obtain funds and support;
4. Investing in regional branding initiatives to market regional products and regional strengths to benefit local businesses and/or attract visitors and residents;
5. Engaging the community, and in particular engaging with each Native community (recognizing the diverse viewpoints among and between tribes and addressing the history of tension and distrust in order to help foster a supportive atmosphere for constructive engagement) in order to develop a shared vision for the path forward; and
6. Adapting to reduced extraction by developing other industries that draw on the region's strengths, with the following diversification elements showing success across many other similar regions: local food systems, recreation/tourism, and entrepreneurship.

Apart from the last point, on developing or enhancing other industries, addressed in later sections of this document when economic diversification opportunities are discussed, each strategy is separately addressed in the sections below.

### 4.1 WORKFORCE AND BUSINESS DEVELOPMENT

This section addresses two related components of workforce and business development. The first is the immediate need to engage and successfully meet the needs of dislocated mining and power plant workers. The second is a more long-term strategy in developing programs to target the training needs for entrepreneurs and businesses within a developing business sector.

#### 4.1.1 Dislocated Worker Training

As the SJGS and the FCPP have both committed to no layoffs during the partial shut-down transition, this section focuses on job training for laid off mine workers. Presented below is a brief profile of the types of existing skills and occupations for mine workers, and the new occupations that may be most suited to

their existing skill sets. We then discuss strategies to overcome the numerous obstacles for workers displaced from mining to pursuing re-training or additional education.

**Table 4-1** profiles the types of occupations for workers employed in the mining industry, based on national statistics from the Bureau of Labor Statistics. The table highlights that the existing skillsets of many miners are likely closely aligned with those required in transportation, construction, and maintenance and repair occupations; specialty skills often include equipment operation, welding, diesel mechanics, and electrical work. Experiences elsewhere in the country, as highlighted in the West Virginia Workforce Development Board case study (see **Section 3.2.3**), indicate that many miners also commonly transition into healthcare and information technology fields. As such, numerous programs in Appalachia and other coal-impacted regions have focused on job training programs for these occupations, as well as for regional growth industries for which miners' skillsets are well suited, such as outdoor recreation and advanced manufacturing.

**Table 4-1: National Occupational Profile of Mining Workers**

Occupation	Employment	Proportion Employment
Construction and Extraction	32,840	47.3%
Transportation and Material Moving Occupations	13,910	20.0%
Installation, Maintenance, and Repair Occupations	8,810	12.7%
Production Occupations	3,280	4.7%
Other	2,960	4.3%
Office and Administrative Support	2,980	4.3%
Management	2,450	3.5%
Architecture and Engineering	2,230	3.2%
Total	69,460	100%

Source: US Bureau of Labor Statistics.

Displaced mine workers may not immediately seek job retraining for diverse reasons, including: 1) resistance to changing careers, as mining may have been a multi-generational career that is part of the individual and community identity, and 2) a need to continue to support a family or other dependents, so a long-term commitment to going back to school may be challenging. The experience of the West Virginia Workforce Development Board case study indicates that the following strategies may be effective in job placement and training needs:

1. Developing a publicly-available community resource directory that lists services, relevant organizations, job openings, training opportunities, and other resources in a single location.
2. Partnering with local companies to offer trainings to meet current labor needs (such as the West Virginia Parkersburg "Learn to Earn" chemical manufacturing program developed in partnership with Dupont and Chemours).
3. Offering short-term training that provides marketable skills without requiring a four-year or even two-year degree.
4. Outreach to inform people of the resources available to them, including social media, advertising in newspapers and radio, providing press releases, and conducting information sessions in local communities

#### 4.1.2 Small Business Development and Entrepreneurship

As highlighted in several of the case studies in the preceding chapter, many of the challenges associated with developing an industry are related to the level of skills and capacity in the workforce and with business owners. Addressing human capital needs is critical in successfully developing a new industry or enhancing an existing one.

For example, in the New South Wales case study (see **Section 3.4**), development of the agritourism industry faced numerous challenges associated with labor and management, including: labor shortages; shortage of business owner and manager skills in marketing, customer relations, and product development; limited industry understanding of regulations; and lack of business owner or industry involvement in industry development initiatives. Similarly in the Pennsylvania Wilds case study, economic development from tourism was hindered by a lack of supporting businesses as well as a lack of retail infrastructure and marketing skills for products produced by existing businesses and artisans.

Based on the experience of these regions, once specific local growth industries are identified, successful elements of business development may include:

- Training workshops through local extension programs, federal or state agencies, or educational institutions that focus on small business skills, opportunities in local industries, and entrepreneurship.
- Developing a guide for starting and growing a business that provides information on local resources, permitting and zoning, tax policies, and steps and resources to get business loans.
- Providing business support services at the county or regional level, such as: one-one-one technical assistance, downtown relocation services, and loan/funding programs.
- Funding a small business ombudsman and outreach specialist (as created by the Pennsylvania Wilds initiative), who helps the private sector leverage the benefits of regional initiatives (such as those relating to agriculture, food products, or tourism).
- Developing mentorship programs and economic networks that connect existing business owners with new ones.
- Developing support facilities for small businesses, such as incubator spaces or commercial kitchen facilities that can be shared by multiple new businesses.

## 4.2 QUALITY OF LIFE INVESTMENTS

Economic growth in many areas is closely related to a high local quality of life. Put simply, people from business Chief Executive Officers to retirees to millennials are drawn to live and to recreate in areas with nice amenities – including cultural, natural, and built environment amenities. Northwest New Mexico has numerous quality of life assets to build upon. Natural environment amenities, such as the sunny climate and diverse recreation opportunities are strong assets in the region. Cultural attractions related to Native American art, jewelry, and culture are also strong assets.

Despite these assets, quality of life as an impediment to economic growth in Northwest New Mexico arose in every focus group meeting (in June 2016) in each area of the region. Regional leaders noted not only that young people and retirees are leaving the area, but that it is hard to attract and retain professionals, such as medical providers and teachers. This is borne out when looking at regional

location quotients (which measure the proportion of businesses or people employed in a specific industry relative to the state or national average); throughout Northwest New Mexico, there are relatively fewer residents who are employed in professional, technical, and businesses services; and there are relatively few physicians, dentists, and other independent medical professionals. This has a snowball effect: professionals like to live in areas with high quality of life, and high quality of life partly depends on having professionals such as doctors and teachers that provide desired services. Furthermore, a higher quality of life and a more diverse economy with more diverse services can in turn attract industrial and manufacturing employers. **A quality of life development strategy thus can benefit and aid in developing all sectors of an economy, and thus generate a more diversified, self-reliant, and resilient economy less subject to and dependent upon outside market forces.**

Focus group participants cited numerous reasons why different areas in the region struggle to attract and retain professionals, including the limited number of things to do, limited services available locally, and, for all areas, the aesthetics of the town (“too many chain link fences”). Said differently, two primary weaknesses that the counties and cities in the region could collectively and individually address are:

1. Increasing offerings in terms of arts, entertainment and recreation (a sector that is currently under-represented across the region), and
2. Enhancing the attractiveness and vibrancy of downtown core areas.

By addressing these two elements areas, which often go hand and hand, the region may be better able to attract and retain professionals, creative workers, and artists. Such workers can provide services to the community, and also add to the regional economy and provide momentum for an increasing quality of life for all residents.

**Downtown redevelopment and revitalization is at the core of many successful community economic rejuvenations.** An attractive and vibrant downtown attracts new businesses and customers, new residents, serves as a tourist attraction, and can also provide social value by providing public gathering spaces and reflecting civic pride and community identity. Investments in downtown areas tend to have ripple effects throughout communities as it often inspires investments to enhance properties elsewhere in the community by other community members and businesses. Many communities motivate investment by making the process easier for developers and community members: streamlining the development process, providing technical assistance, giving tax relief or tax credits, and creating information guides.

Many communities have participated in the Main Street Program, which provides the skills and organizing framework for downtown revitalization. The New Mexico Main Street Program, a program of the State’s economic development department, works with local communities to invest in and revitalize downtowns across the state. Work in the region has already started in this area: in 2014 the City of Gallup successfully applied for both the state Main Street and the Arts and Cultural District program and designation. The role of Arts and Cultural Districts, as described in the Gallup Arts and Cultural District strategy document, could just as well describe the quality of life and economic development benefit of downtown rejuvenation more generally: “providing a vibrant and appealing environment is a major factor in retaining young citizens and their families, attracting a well-educated and creative workforce,

and positioning the community as a [cultural] tourism destination”, as well as bringing “citizens out from their homes and into a vibrant social space to interact and bond with their families and neighbors” (Arts Engaged, CommunityByDesign, RPI Economics, Milagro Design, 2015).

Downtown redevelopment is most successful when it is based on a shared community vision, and when it builds on the specific historical, cultural, and geographic assets of the downtown area. Specific steps for downtown redevelopment may include:

- Cataloguing downtown buildings,
- Advertising community to developers,
- Promoting pedestrian and bike friendly areas,
- Developing greenspace connections,
- Recruiting businesses downtown and providing relocation services to reduce vacancy and provide infill,
- Subsidizing rent (one town, Paducah Kentucky, identified a dilapidated area of town for development into an artist enclave by establishing an Artist Relocation Program and sold or rented space to artists for as little as \$1, and provided the artists business and marketing support; the result has been a thriving neighborhood with galleries, shops, and restaurants),
- Developing quality housing,
- Financing façade improvement programs,
- Increasing tree cover and landscaping, and
- Advertising the community to developers.

**Additionally, the region should consider engaging in a concerted effort to identify key, quantitative quality of life indicators to measure current conditions, community quality of life goals, and measurement of progress in achieving those goals.** Identifying key indicators makes it possible for policymakers and interested citizens to look at a more manageable set of numbers when assessing changes in quality of life over time. The process of choosing key indicators also helps citizens and policymakers realize gaps in their current information.

Considerations in quality of life indicator selection:

- 1) What is quality of life to the community – which factors are important to the community?
- 2) Which factors are locally influenced? (Climate and geography may play a role, but are static and not locally influenced. Similarly, coal prices play a role, but are not locally influenced)
- 3) What is the relationship between different factors?
- 4) What indicators will reflect not just the ‘average’, but the community as a whole?
- 5) What indicators will we be able to collect and analyze long-term?
- 6) What area(s) is/are our benchmark?

These criteria for indicator selection include clarity, availability, reliability, policy relevance, and reflection of community values. As an example for the region, **Table 4-2** provides some sample indicators that are readily available from Census and other data sources. Data shaded in dark grey identify areas in which the jurisdiction within Northwest New Mexico has a higher quality of life compared to the United States as a whole (based on the assumptions that more education, higher

income, more income equality, higher employment rates, and greater housing affordability lead to higher quality of life). Apart from generally faring well on measures regarding commute time and housing affordability, the region as a whole has work to do to attain the national average on several aspects of quality of life. Communities with quality of life indicator projects that can serve as resources if the region decides to undertake a quality of life indicators project include Austin, Texas; Seattle, Washington; and Jacksonville, Florida.

Table 4-2 Example Quality of Life Indicators for Northwest New Mexico

	US	NM	Cibola County	McKinley County	San Juan County	Acoma Pueblo	Laguna Pueblo	Navajo Nation	Farming-ton	Grants	Gallup
<b>Education</b>											
% Population 25+ Years with High School Diploma or Equivalent	86%	84%	81%	73%	82%	87%	89%	71%	86%	78%	78%
% Population 25+ Years with Post-Secondary Degree (Associates or More)	37%	34%	20%	17%	25%	16%	18%	16%	30%	28%	21%
<b>Income</b>											
% Families with Children under 18 Receiving Social Assistance such as Food Stamps	28%	35%	54%	48%	31%	46%	57%	56%	26%	34%	49%
% Poverty Level											
Income Inequality: Ratio of Highest Quintile Income to Lowest Quintile Income	15.93	16.23	13.50	26.68	16.17	16.41	12.89	25.28	17.29	21.49	17.12
Median household income	\$53,482	\$44,968	\$36,279	\$29,812	\$48,824	\$36,094	\$31,895	\$26,314	\$55,810	\$47,177	\$40,882
<b>Employment</b>											
Labor Force Participation Rate	64%	60%	54%	49%	59%	63%	54%	44%	63%	56%	56%
Unemployment Rate, 2010 to 2014 Average	9%	10%	16%	14%	9%	27%	31%	22%	7%	7%	10%
Unemployment Rate, October 2016, Seasonally adjusted	0.049	0.067	0.083	0.088	0.083						
<b>Housing Affordability</b>											
% Renting Population Paying more than 30% of Income in Rent	48%	46%	47%	34%	38%	25%	32%	22%	46%	43%	51%
% Homeowners with Mortgage paying more than 30% of income in housing cost											

# Northwest New Mexico Economic Assessment & Strategy

Education	US	NM	Cibola County	McKinley County	San Juan County	Acoma Pueblo	Laguna Pueblo	Navajo Nation	Farming-ton	Grants	Gallup
<b>Commute Time</b>											
Less than 25 minutes commute time to work	58%	68%	71%	67%	64%	70%	62%	51%	81%	84%	81%
<b>Crime Rates</b>											
Violent Crime Rates (2012) (murders, robberies, aggravated assault, rape)	386.9	559.1	N/A	N/A	N/A	N/A	N/A	N/A	1061.2	N/A	1873.5
Property Crime Rates (per 100,000 residents in 2012) (burglary, vehicle theft, larceny)	2859.2	3600.7	N/A	N/A	N/A	N/A	N/A	N/A	4116.7	N/A	8696.6

Sources: US Census Bureau and Uniform Crime Reporting Statistics (UCR Data Online).

Note: Values highlighted in red indicate that the measure indicates a less desirable attainment level (i.e., lower quality of life) in this area than the Nation as a whole.

### 4.3 LOCAL, REGIONAL, STATE-WIDE PARTNERSHIPS

Developing relationships within a community and across community, county, and tribal boundaries can enhance economic development efforts in many ways. Specifically, partnerships can benefit all parties by:

1. Leveraging assets that each entity brings to the table,
2. Increasing likelihood of obtaining funding from outside sources,
3. Limiting counterproductive competition,
4. Increasing networks and cluster effects,
5. Enhancing efficiency and reducing redundancy of efforts and investments, such as market research applicable across the region;
6. Facilitating communication across industries and agencies to coordinate and enhance mutually beneficial efforts;
7. Strengthening and coordinating a unified message for marketing of regional attractions and products.

The Pennsylvania Wilds case study highlighted in **Section 3.3** provides an example of a region that benefited from extensive partnerships at every level of government and across private and non-profit entities. Through that partnership, a comprehensive plan was developed to meet the goal of enhancing nature based tourism over a large geographic area. The development and coordinated implementation of that plan, including substantial investment, would not have been feasible without the diverse staff, funds, and resources from disparate local, state, and federal sources. The region's partnerships have also been able to leverage funding, similarly to how Northwest New Mexico has levered funding, through the POWER grant.

Both in the case of nature tourism in the Pennsylvania Wilds and in the case of agritourism in New South Wales, partnerships between local businesses have also been critical. Development of networks and clusters of local businesses, has connected their products with the regional brand and enabled collaboration and information sharing amongst related businesses. Businesses can work together to support and promote each other.

### 4.4 REGIONAL MARKETING

Across all case studies, regional marketing has been a critical component of success. Regional marketing, simply by virtue of covering a greater area and more businesses, increases visibility and effectiveness. Also, by pooling resources, regional marketing can enable larger-scale marketing of an area. For example, in the Pennsylvania Wilds, regional marketing has enabled them to advertise in national publications and enabled them to develop a sophisticated website, a visitor's guide, a discover map, and a fishing guide. This would not have been possible for each of the 12 counties, much less individual communities, in the region.

A regional marketing plan can identify and include such elements as:

- Regional identity and key destinations, events, or products to highlight
- Regional brand and logo

- Signage design and grant programs for businesses and community centers and gateways
- Regional ‘trails’ that link cultural, historic, natural, or retail attractions

#### 4.5 SHARED COMMUNITY VISION

Throughout the case study examples, there is a common thread that a shared community vision is central to a successful economic transition. Transition can involve not just economic dislocation but also social challenges. Transition often includes new residents, visitors, or industries that may influence the identity of a community and a region. Development of a shared vision of the future that meets residents’ needs and addresses community concerns is critical for communities to successfully navigate and embrace economic transition.

The case study of the WV Hub provides several lessons and concrete suggestions for creating this shared vision (**see Section 3.2.2**). The WV Hub specializes in working with communities to develop a post-coal vision of a diversified local economy. In their experience the following steps are critical:

1. Ensure input from diverse mix of people, including elected leadership, volunteers, leaders of community organizations, tribal nations, and business leaders. Attaining the right mix of attendees merits substantial time and effort investment.
2. Create a welcoming and neutral space where all people are comfortable speaking and participating. Churches and community centers are often good meeting locations. The venue should avoid stages that focus attention on one speaker or group of speakers, and should also provide tables for small group productivity.
3. Avoid political discussions about reasons for economic decline, and stress benefits of diversification even if there is a resurgence in existing sector activity.
4. Demonstrate the positive changes that can come from economic transition to mitigate fear and confusion. Peer sharing programs and examples from other communities can be effective.

## 5 ECONOMIC OPPORTUNITY: ENERGY SECTORS

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The objective of this section is to identify the future outlook for the energy industry in Northwest New Mexico, and identify current and future potential economic development opportunities within the energy sector. There are three primary parts to the section:

1. *Characterization of the existing energy economy, including regional resources and energy-related infrastructure (Section 5.1).*
  - a. Northwest New Mexico is an area rich in natural resources, especially coal, oil, gas, uranium and solar.
  - b. Infrastructure to extract, use and transport these resources have been developed over the past 100 years; with mine mouth operations for coal power plants, and pipelines for natural gas energy. These developments have made the study area a net exporter of energy.
2. *Identification and assessment of the implications for energy markets in Northwest New Mexico (NWNM) of recent developments and trends in energy technology, energy-related regulations, and energy economics (Section 5.2).*
  - a. Natural Gas Combined Cycle (NGCC): Advances in this technology during the 1990's along with new developments of natural gas and corresponding price reductions have made this technology the fastest growing energy development in the United States over the past decade, adversely affecting demand for coal.
  - b. Uranium: While projections are that uranium demand will outstrip supply around 2020 it is uncertainty how prices will respond due to uncertainty surrounding the amount of uranium that is being stockpiled currently. Interest in nuclear power (and corresponding price of uranium) is sensitive to public perception.
  - c. Renewable Energy: There appears to be strong potential for utility scale solar power production in the study area. The technology advancements for solar photovoltaic along with cost reduction in the technology have some suggesting Power Purchase Agreements (PPA) for solar could drop below \$50 per MWh in the near future. While it is not providing base load capacity, it would be price competitive with fossil fuel energy sources at these levels. The area was not found to be an ideal site for utility scale wind, or geothermal.
  - d. Continued low gas prices combined with air quality and greenhouse gas emissions policy both in the US and abroad have depressed national and international coal markets, expected to be a long-trend trend.
3. *Evaluation of opportunities for coal, including export (Section 5.3).*
  - a. Coal Export: Analysts project that peak coal use will occur before the end of the decade. While port capacity in the Los Angeles area could handle some additional coal from Northwest New Mexico, it is highly unlikely that coal prices from the study area could be competitive with PRB or international suppliers such as Indonesia when transporting internationally.
  - b. Clean Coal: Using coal to produce a syngas which could be used in electricity generation in an integrated combined cycle (IGCC) system, along with carbon capture technology is

still somewhat of an unproven concept in the United States and is unlikely to be an appealing alternative to NGCC. The most notable example of the application of clean coal technology is at the new Kemper Energy Facility in Mississippi, where cost overruns came in 180 percent of initial projections.

4. *Cursory review of other energy development opportunities for including solar energy, uranium battery storage, and natural gas combined cycle (Section 5.4).*
  - a. Natural resource and infrastructure assets in Northwest New Mexico are highly suited to both commercial solar energy generation and transmission and an energy storage facility associated with renewable power generation.
  - b. Northwest New Mexico infrastructure and natural gas resources are well suited to a natural gas combined cycle plant, but the recent decision by PNM to not open a natural gas facility in San Juan County indicate that such a project is highly unlikely in the short or mid-term.
  - c. The potential for uranium mining in Cibola County and elsewhere in the region is highly uncertain due both to market forces (prices are currently low) and regulatory hurdles.

## 5.1 NORTHWEST NEW MEXICO ENERGY ECONOMY & ASSETS

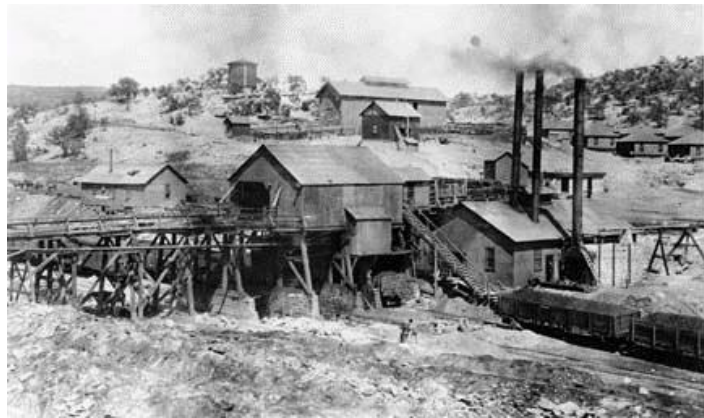
This section provides a review of the region's existing energy economy, including regional resources and energy-related infrastructure.

### 5.1.1 Energy Resources

This section provides an overview of the quantity, availability, and location of energy resources in Northwest New Mexico, including coal, oil, natural gas, uranium, and renewable resources such as wind, solar, and hydropower.

#### *Coal*

**Coal has been mined in New Mexico since the 1850s, and until recently the state continued to produce more than 20 million tons of coal per year.** New Mexico has coal deposits around the state, but the San Juan Basin in the state's northwest corner is the largest coal-bearing region and the only area currently being mined. As described in **Section 2**, there are four active coal mines in the Basin, one underground and three surface operations. Lee Ranch and El Segundo Mines are located 35 miles northwest of



*Picture of Weaver Coal Mine in Gallup, NM (1910)*

Grants in McKinley County, while San Juan Mine and Navajo Mine are both located west of Farmington in San Juan County. The Navajo Mine is located on the Navajo Reservation. Two of the mines, San Juan and Navajo, are dedicated suppliers to neighboring coal-fired power plants. Coal from Lee Ranch and El

Segundo is shipped by rail to Arizona for power generation; coal from Lee Ranch also supplies Escalante Power Plant in McKinley County.

New Mexico has approximately 5 percent of the nation's estimated recoverable coal reserves at producing mines. Most of the state's known reserves are located in the San Juan and Raton Basins in northern New Mexico (Energy Information Administration, 2015).

### *Oil*

The United States Geological Survey (USGS) conducted an assessment of undiscovered oil and gas resources in the San Juan Basin. **Table 5-1** provides the amount of estimated undiscovered oil and gas in the San Juan Basin, which is as indicated in the table, is exceptionally rich in natural gas.

**Table 5-1 Undiscovered Oil and Gas in San Juan Basin**

Resource	Value
Oil	19 million barrels (MMB)
Gas	50.6 trillion cubic feet (Tcf)
Total natural gas liquids	148 million barrels (MMB)

Source: USGS. National Assessment of Oil and Gas Fact Sheet. 2002. Assessment of Undiscovered Oil and Gas Resources of the San Juan Basin Province of New Mexico and Colorado, 2002. USGS Fact Sheet FS-147-02

New Mexico has two operating oil refineries (EIAAd, 2015). Local San Juan Basin crude oil is the main feedstock for a small refinery in Gallup, New Mexico. It is the only refinery in the Four Corners area and supplies the region with motor gasoline, diesel, propane, butane, and heavy fuel oils. Pipelines also deliver the refinery's products to other southwestern markets, including metropolitan Albuquerque, New Mexico, and northern Arizona (Refining, 2015).

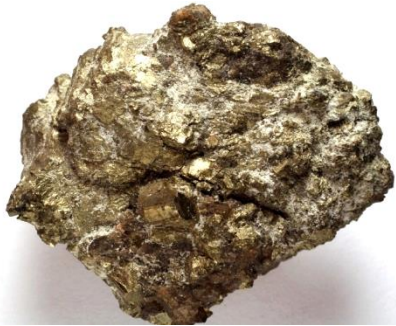
### *Natural Gas*

The San Juan Basin contains one of the largest proved natural gas reserves in the United States (EIAI, 2013). Although New Mexico's total proved natural gas reserves have declined over the past decade, the state's proved shale gas reserves have risen significantly (EIAm, 2015) (EIAAn, 2015) (EIAo, 2015). Shale gas reserves are a small portion of the state's total proved gas reserves, but several New Mexico basins have shale gas potential (Broadhead, 2014). New Mexico produces more natural gas than it uses and sends natural gas through interstate pipelines to Arizona and Texas and on to markets from the West Coast to the Midwest (EIAp, 2015) (EIAq, 2008). The Blanco Hub, located in the San Juan Basin, is a major connection and trading point for interstate pipelines carrying Rocky Mountain natural gas (NMEMNRD, 2015). New Mexico has only two underground storage fields with a small amount of natural gas storage capacity (EIAr, 2015) (EIAs, 2015).

About one-fifth of the natural gas produced in New Mexico is consumed in the state (EIAAt, 2015) (EIAu, 2013). The electric power sector is the largest natural gas consumer in New Mexico, followed by the residential sector (EIAv, 2015). Two-thirds of the state's households use natural gas as their primary

energy source for home heating (Bureau, 2013). New Mexico is among the top 10 states in the nation in per capita natural gas consumption.

### *Uranium*



**Picture of Raw Uranium**

**The Four Corners region is rich in uranium resources.** Uranium was first discovered in New Mexico in 1950. The Grants Mineral Belt was the primary focus of uranium extraction and production activities in the state. The belt extends along the southern margin of the San Juan basin in Cibola, McKinley, Sandoval, and Bernalillo counties; stretching northwest to southeast. (Brookins, 1977). The belt was host to the world's largest open-pit uranium mine of its time: the Jackpile Mine on the Laguna Pueblo, which was in operation from 1953 to 1982. Most production of uranium ore occurred between 1956 and 1998 with the last operational mine ceasing production in 2002. Producers have

extracted roughly 340 million tons of uranium from mines in the Belt (McLemore). From 1953 to 1968 there was an operational uranium mill in Shiprock (San Juan County) that processed uranium-vanadium ore from mines in Arizona and San Juan County, New Mexico (all on Navajo Nation) (McLemore). A mining permit application was submitted in October 2009 for a uranium mine, Roca Honda, in Cibola County. The company owning the project site hopes to complete permitting in 2017. Total measured and indicated production potential may be 1100 tons per year over nine years.

There are two forms of uranium mining currently used. Conventional mining and milling is a process where uranium ore is extracted from the ground in an open pit method, trucks deliver the ore to a mill (the only active one in the US is the White Mesa mill just across the state border in Utah). At the mill the ore is crushed into smaller particles before uranium is extracted. A leaching agent is used (sulfuric acid or alkaline solutions) to extract 90 to 95 percent of the uranium from the ore. The mill then concentrates the extracted uranium to produce 'yellowcake' which contains about 85 percent triuranium octoxide ( $U_3O_8$ ). Producers then transport yellowcake to uranium conversion facilities where this is processed further into uranium hexafluoride for use in nuclear reactors or other applications. (Commission, 2016)

In-Situ recovery is the other primary method used to mine uranium. In-situ recovery facilities extract uranium from low-grade ores where other mining and milling methods may be too expensive or environmentally disruptive. A solution typically containing water mixed with oxygen and or hydrogen peroxide, as well as sodium carbonate or carbon dioxide is injected through a series of wells into a deposit to dissolve uranium. Producers then collect the solution via recovery wells and pump it to a processing plant (sometimes onsite), where uranium is extracted from the solution using an ion exchange process. The uranium extract is then further purified, concentrated, and dried to produce yellowcake. Finally, the yellowcake is packed in 55-gallon drums before it is transported to a uranium conversion facility (US Nuclear Regulatory Commission, 2015).

### *Renewable Energy Resources*

This section describes renewable energy resources in Northwest New Mexico, including solar, wind, geothermal, and hydropower. As described below, wind, hydropower, and geothermal resources exist in the area, but have much lower development potential compared to solar (NMEMNRD, 2015).

The New Mexico renewable portfolio standard requires investor-owned electric utilities to acquire 20 percent of electricity sold in-state from renewable energy sources by 2020. Of that 20 percent, at least half must come from solar and wind energy, and the balance must include shares from several other renewable sources, including those used for distributed generation. Rural electric cooperatives are required to obtain 10 percent of their sales from renewable sources by 2020. New Mexico has regulatory policies that include net metering, solar easements, and interconnection standards, as well as a number of financial incentives that encourage renewable generation.

### Solar

New Mexico's climate is typified by abundant sunshine, giving the state some of the nation's best solar energy potential. The number of utility-scale solar photovoltaic (PV) facilities in New Mexico is increasing, and so is the use of distributed solar generation, including large corporate PV installations. State regulatory policies and incentives encourage the use of distributed solar technologies. On a per-capita basis, New Mexico is among the top 10 states nationally in distributed grid-connected solar PV capacity.

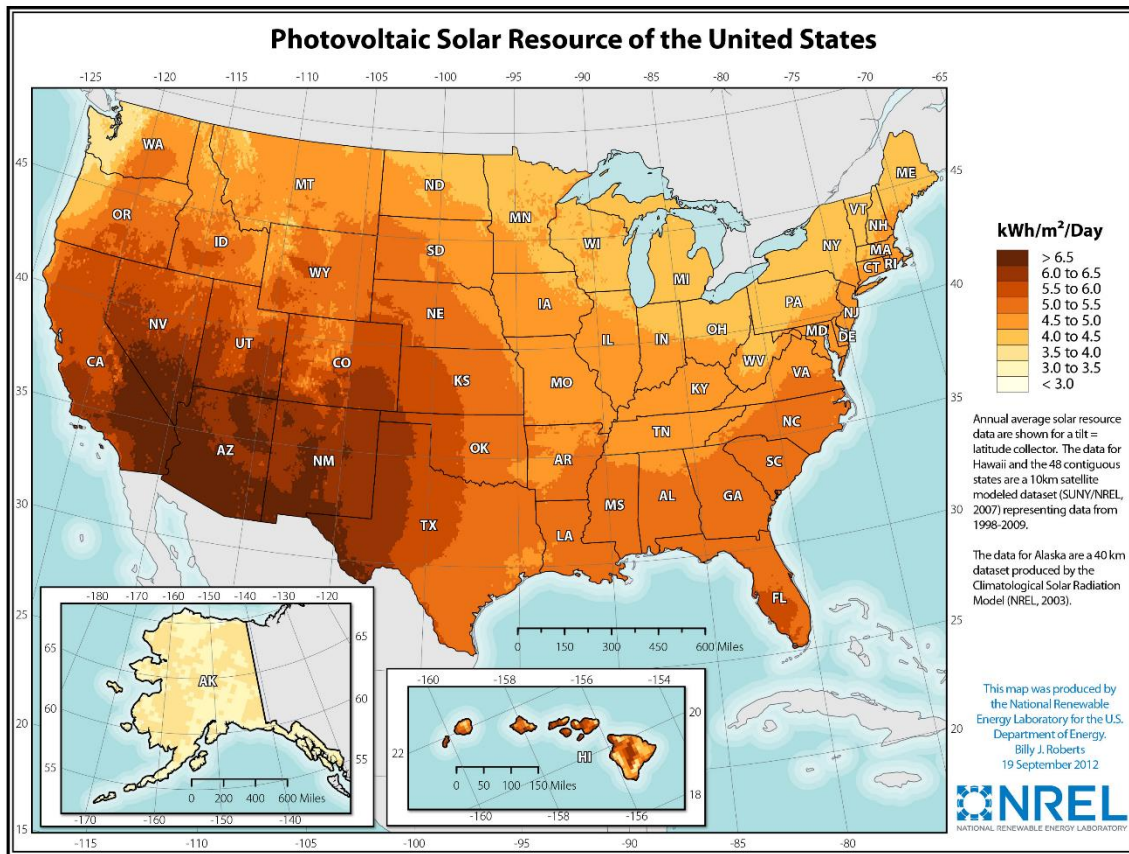


*Picture of PNM Solar Farm in Santa Fe County, NM*

A single solar photovoltaic generation facility is present in the three county area, the PNM Resources 7.6 megawatt Cibola Energy Solar Energy Center in Cibola County. As displayed in **Figure 5-1** below, New Mexico is regarded as one of the states with the most potential to develop solar energy facilities. Specifically, Northwest New Mexico has areas that could generate upwards of 7.5 kWh/day, viable for a commercial sized solar facility (NREL, 2012). With major transmission facilities present throughout the area, energy dissipation along a lengthy transmission route would not be a key concern for developers or

utilities despite the area's distance from a population center. Additionally, regulations and policies require that most western states, including New Mexico, develop Clean Power Plans and meet Renewable Portfolio Standards (RPS), creating a market demand for renewable energy. California, historically been a major purchaser of power generated in the Four Corners region, is one of the states with an RPS requiring that 50 percent of power be derived from renewable energy by 2030. The El Dorado 500kV transmission line from FCPP to southern California likely has significant capacity and SCE has the mandate to incorporate more renewable energy to meet the RPS. While not a large scale job creator, favorable market conditions are present in Northwest New Mexico for solar development.

Figure 5-1: Solar Resource in the US



### Geothermal

Northwest New Mexico is not among the few areas in the state that have been identified to have commercially viable geothermal resources. In December 2013, New Mexico's first utility-scale geothermal power plant came online in the Animas Valley in southwestern New Mexico, at a capacity of 4 megawatts. The main use of geothermal energy in New Mexico had been for greenhouse agriculture, but it has also been used for space heating, district heating, aquaculture, and spas at several locations (Witcher, 2002).

### Biomass

Given the arid desert environment of northwest New Mexico, biomass resources are limited. There are not enough forest lands open to thinning currently in the study area to make a biomass generation facility or commercial operation (i.e. pellet facility) feasible. NAPI does have a small (one section) plot of hybrid poplar that would be ideal for a biomass facility, along with chipped material from forest thinning and sawmill byproducts.

### Wind

Wind maps published by the National Renewable Energy Laboratory indicate that wind resources are relatively poor in northwest New Mexico when compared to the central and eastern portions of the state. There are a few existing wind energy facilities in the three county area, but the resource may

draw limited interest from commercial energy developers. The greatest wind potential in the state is on the high plains and rugged ridges in the eastern half of the state. In 2014, wind energy contributed seven percent of New Mexico's electricity generation from a dozen operating wind farms.

### **Hydropower**

Hydropower in the study area is limited to 30 megawatts of capacity on the Navajo and Farmington dams on the San Juan River in San Juan County. Other hydropower in the state is concentrated in the Rio Grande basin. Local micro-hydropower is possible in the northern mountainous energy regions but is not developed at this point.

#### **5.1.2 Energy Infrastructure**

This section describes the significant energy infrastructure in the region, including power plants, electricity transmission and substation, and natural gas pipeline infrastructure in the region.

##### *Power Plants*

In the Four Corners region, electrical generation comes nearly exclusively from coal combustion. There are three coal-fired power plants in Northwest New Mexico - Four Corners Power Plant, San Juan Generating Station, and Escalante Generating Station. In total, until recently these power plants had capacity of approximately 2,600 megawatts, which provide baseload energy to New Mexico, Arizona, and Utah. Shutdown of two of the four coal-fired generating units at New Mexico's largest power plant (San Juan Generating Station) is scheduled to occur by 2017, while three units have already been shut down at Four Corners Power Plant. Several other older coal-fired units in the state are slated for shutdown in the next few years.

**As of 2015, coal-fired power plants supplied almost two-thirds of New Mexico's net electricity generation** (EIAw, 2015). Natural gas supplies most of the remaining generation, with renewable resources, primarily wind, providing the rest. Almost all of New Mexico's planned new generating capacity will use natural gas or renewable energy, primarily solar. New Mexico uses less electricity per capita than two-thirds of American states. As New Mexico uses less than it produces, it is a net supplier of electricity to neighboring states. The state has recognized an economic interest in selling more electricity to other states, particularly electricity generated from renewable resources.

Below are brief overviews of each coal-fired power plant and a discussion of potential reuse of these industrial facilities.

##### **Four Corners Power Plant**

The Four Corners Power Plant (FCPP) is located on Navajo Nation trust lands in Fruitland, NM. FCPP was initially constructed in the early 1960s and expanded by two additional generating units in the late 1960s. From 1962 to 2013, the nameplate capacity of the plant was 2,040 megawatts and served as a backbone service provider for southern California, Arizona, New Mexico, Utah, and Colorado. In 2013, FCPP shutdown the three original boiler units built in the late 1950s in order to comply with the USEPA's Clean Air Act Title V permitting mandate, **reducing generation capacity to 1,540 megawatts**. The other two units remain active and will have selective catalytic reduction technology installed to also comply with USEPA's Title V ruling. FCPP recently underwent environmental review (i.e. NEPA EIS) for (re)permitting facility operations and is scheduled to remain in operation until 2041.

The Navajo Mine serves as the sole source of coal for FCPP, and FCPP is currently the mine's only client. FCPP's boiler units were custom designed to incinerate the specific chemical makeup of coal from Navajo Mine. To meet this specific requirement, coal from Navajo Mine is mined, stockpiled, tested, and blended to deliver coal that meets this exact specification. Considering that FCPP is designed to only rely upon a specific mix of coal, options for reuse of this facility to burn coal from other sources or to burn natural gas are significantly constrained. The plant would have to undergo an extensive retrofit to utilize another energy source (i.e. natural gas) to continue power production. Much of the original technology employed during construction of FCPP in the late 1950s will be almost 100 years old by the time the power plant is subject to renewal, further limiting options for immediate reuse and elevating the need to significantly retrofit the facility for continued power production.

However, FCPP remains a critical component of service reliability in the Southwest, providing 100,000's of people with power. Further, there are existing assets in the area that could facilitate a retrofit to clean-coal or cogeneration for continued power production, including known natural gas reserves and an existing transmission infrastructure. Options for reuse of FCPP are limited, but given the presence of critical existing assets, including the critical Four Corners Power Trading Hub, a retrofit for continued electricity generation at FCPP should not be entirely dismissed. As mentioned above, FCPP is permitted for operations through 2041, so any reuse concept would not come to fruition until after 25 years.

#### Escalante Generating Station

Escalante Generating Station (EGS) is located in Prewitt, NM, approximately 100 miles west of Albuquerque. **This single unit coal-fired power plant was constructed in the early 1980s and has a nameplate capacity of 245 megawatts.** ESG is exclusively provided coal by the Lee Ranch mine.

In the late 1990s, the power plant tested burning paper sludge waste in combination with coal to fire the boiler unit. The initial firing tests were successful, but the paper company changed the sludge waste composition by adding a polymer which was not compatible with the equipment at EGS. In partnership with the Electric Power Research Institute (EPRI) EGS explored using solar-thermal technology to augment the power plant's steam cycle in 2009. EGS is yet to incorporate this technology but a development guide was provided by EPRI to serve as a roadmap for implementation.

#### San Juan Generating Station



**Picture of PNM SJGS in San Juan County, NM**

San Juan Generation Station (SJGS) is located in Waterflow, San Juan County, and began operations in the early 1970s. **This coal-fired power plant currently has a nameplate capacity of 1,683 megawatts and provides service to approximately 2 million people.**

SJGS is scheduled to shut down two of the plant's four units in 2017 in order to comply with New Mexico's State Implementation Plan (SIP), reducing the overall generation capacity to approximately 850 megawatts.

The remaining two units will have selective non-catalytic reduction technology installed to meet EPA's requirements for a Title V permit. SJGS is permitted to

operate through 2022, when state regulators will revisit the state’s SIP and role of coal-fired generation in New Mexico.

The San Juan underground mine is the exclusive provider of coal to SJGS, with contracts to continue providing it coal through 2022. The mine has applied to OSMRE for an extension. Much like FCPP, SJGS was specifically designed to utilize the chemical composition of coal from the San Juan mine. PNM has stated that it will rely upon a mix of nuclear, gas, and coal to supplement the generation capacity reduction from shutting down the two units in 2017. Considering the nature of the facility and existing assets at/near SJGS, including transmission infrastructure, reuse of the facility is most likely for continued power generation. As PNM has recently withdrawn from consideration construction of a new gas-fired generation station in San Juan County due to downward revised electricity demand projections, at this point it is unlikely that the utility provider would invest substantially in the near-term to retrofit SJGS to be a clean-coal, gas-fired, or cogeneration facility.

#### *Electricity Transmission and Substations*

New Mexico, and the Four Corners region specifically, is at the edge of three major U.S. electrical grids—the Eastern, Western and Texas Interties. It is also home to the Four Corners power trading hub, located at the Four Corners coal complex in Fruitland, New Mexico. Due to the presence of FCPP and SJGS in McKinley County, substantial transmission infrastructure exists throughout Northwest New Mexico that is tied in to several key elements of the western grid. This is a significant asset to region, particularly as planning continues to upgrade and modify the grid to accommodate different power sources and generation profiles.

Currently, as coal-fired electricity is no longer sold to California, there is substantial excess capacity on the major transmission lines headed west from the Four Corners region. As noted above, FCPP provides baseload power to communities in Utah, Colorado, Arizona, and New Mexico. Up until 2013, FCPP also supplied electricity to southern California along the El Dorado 500kV transmission line. Southern California Edison sold its interest in FCPP to Arizona Public Service after California passed Emission Performance Standards that would entirely phase out coal-fired and petcoke-fired baseload energy generation by 2026, and loading on the El Dorado Line was significantly reduced.

Six major transmission lines run from FCPP’s 2,000 megawatt switchyard/substation. With the shutdown of FCPP units 1-3, the power plant generates approximately 1,500 megawatts, leaving a surplus capacity of approximately 500 megawatts. Additionally, SJGS is scheduled to reduce generation by 800 megawatts with the shutdown of two units in 2017. None of the transmission lines from FCPP or SJGS are planned for demolition as result of the operations downsizing; electricity providers will continue to use these facilities to distribute power throughout the region. **The availability of so much existing transmission capacity is an attractive asset to developers and electricity providers considering locations to site a generation facility. This area is an energy hub; a fundamental piece of the Southwest’s electric grid.** SJGS and FCPP’s excess transmission capacity and existing facilities offer

#### Key Finding

Northwest New Mexico is an energy hub. Due to the presence of FCPP and SJGS in McKinley County, substantial transmission infrastructure exists throughout Northwest New Mexico that is tied in to several key elements of the western grid. This is a significant asset to region, particularly as planning continues to upgrade and modify the grid to accommodate different power sources and generation profiles.

developers access to six different utility clients to sell power and greatly reduces the distance to market since a developer would only have to build transmission interties to this existing infrastructure. Utility providers, and thus rate payers, would also benefit from utilizing existing transmission infrastructure by not having to construct or redesign significant transmission infrastructure to accommodate a new generation source.

With respect to transmission targeting an increase in renewable energy generation, the state has created a Renewable Energy Transmission Authority (RETA) to facilitate connecting renewable projects to both the electric grid and energy storage. RETA's goal is to enable New Mexico to send up to 5,200 megawatts of renewable energy to other states. Transmission projects that are under development include the Lucky Corridor, the Western Spirit Clean Line, and the Centennial West Clean Line, all of which are designed to deliver renewably generated electricity to other western states. New Mexico is also home to a major portion of the SunZia Project, a 515-mile transmission corridor designed to transport electricity to western power markets. Developers of another project, the Southline Transmission Project, plan upgrades to current lines where possible and use of existing corridors for new transmission. All of these projects will enable the development of renewable energy resources in New Mexico by providing them with access to the nation's interstate power grids (Authority, 2014).

#### *Natural Gas Pipelines*

**Northwest New Mexico has significant natural gas infrastructure.** The presence of natural gas generation and processing facilities in San Juan and McKinley Counties create a localized demand for natural gas, and the transmission pipelines that parallel I-40 allow for interstate access to markets outside of the region. New Mexico exports approximately 80 percent of the gas it produces, and approximately two-thirds of gas produced in New Mexico is from the San Juan Basin (OCD, 2016). Gas is exported through interstate pipelines to Arizona and Texas and on to markets stretching from the West Coast to the Midwest. The Blanco Hub, located in the San Juan Basin, is a major connection and trading point for interstate pipelines carrying Rocky Mountain natural gas. New Mexico has only two underground storage fields with a small amount of natural gas storage capacity (EIAs, 2015).

Natural gas production across New Mexico has declined from 1.77 trillion BTUs in 2001 to 1.27 in 2015. With this gradual decline in production, there is likely surplus capacity in San Juan Basin transmission pipelines. However, the price of natural gas experienced a sharp decline in 2009, rendering some gas exploration/production projects economically infeasible to development. At the same time, low prices have created an affordable energy source for businesses and residents. **With significant gas infrastructure present throughout the three county area, developers planning an energy-intensive facility could tap into this local network of cost-efficient natural gas.**

## 5.2 ENERGY MARKET AND TRENDS

In this section, we present information on the economic, technological, and regulatory drivers shaping energy markets and the demand (regionally, nationally, and globally) for energy resources from Northwest New Mexico. Our analysis is organized into three subsections that separately identify and discuss the significance of trends in each of these three drivers (economic, technological, and regulatory) on energy use and supply.

This analysis focuses in particular on trends and indicators of future market conditions, as investments in energy development, distribution, and generation typically are capital intensive and require long-term use to be economically justifiable.

### 5.2.1 Energy Technology

This section discusses the current and potential future technological developments that may affect the mix of energy supply sources that are economically and environmentally viable now and in the next 20-plus years. These developments include advances in clean coal technology, hydraulic fracturing, micro-energy production systems, and industrial batteries for storing energy. As discussed in detail below, the following technological advances are expected to permanently and adversely affect market demand for coal:

1. Development of relatively low capital cost and flexible scale of natural gas combined cycle generation plants,
2. Economical methods of fracking that has resulted in abundant and low cost natural gas,
3. Energy storage technologies that increase the share of power that can be generated by renewable energy, and
4. Energy conservation measures and technological advances that increase energy efficiency and thereby reduce the growth in demand for energy resources, including coal.

#### *Clean Coal (Gasification, Carbon Capture and Storage)*

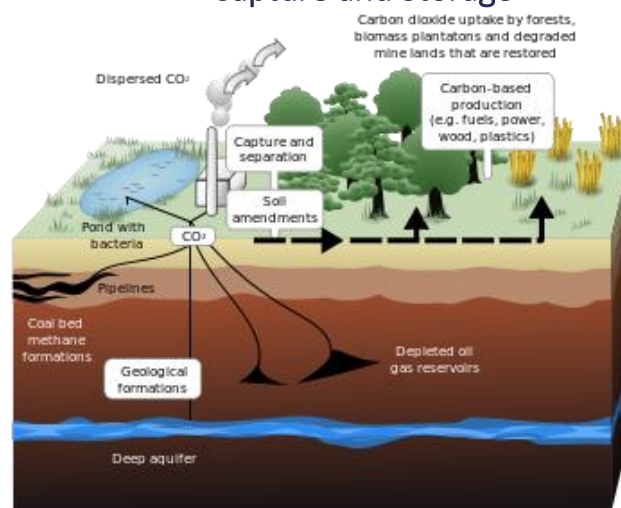
“Clean Coal” refers to technological advances in coal combustion and in carbon capture and storage (CCS) that allow the burning of coal with substantially reduced greenhouse gas emissions.

CSS involves subsurface injection of captured greenhouse gases (primarily CO<sub>2</sub>). Injection can be into deep formations that can isolate or react with the greenhouse gases, or used for enhanced oil and gas recovery, ultimately being isolated in pressure-depleted oil and gas formations.

Carbon capture usually occurs after combustion, but can also occur prior to combustion through coal gasification, wherein coal is exposed to steam, oxygen/air, heat, and pressure to initiate a reaction that yields carbon monoxide, hydrogen, and other gases. After the gasification process but prior to combustion, gases can be captured and either stored or reused.

Carbon capture technologies are still in the early stages of development with few pilot projects in place. **Thus far CCS has proven expensive and been difficult to scale-up to a full-size commercial power plant.** In addition, the power requirements of gasification and of carbon capture and storage are substantial, using up to 25 percent of the electricity produced at the power plant.

Figure 5-2 Conceptual Diagram of Carbon Capture and Storage



The most notable example of the commercial application of clean coal technology is the new Kemper County Energy Facility in Mississippi. The Kemper Project is a 582-MW electric power plant burning Mississippi lignite coal using TRIG™ integrated Gasification Combined Cycle and carbon capture and storage. This first-of-its-kind carbon capture project was scheduled to open in 2014, but has experienced numerous technical issues and setbacks resulting in a current scheduled in-service date for operations of December 31, 2016. The gasification process utilized at the Kemper County Energy Facility will capture at least 65 percent of the CO<sub>2</sub>, which will be used for enhanced oil recovery operations. The cost of the project was originally \$2.4 billion but costs to date are \$6.91 billion (Mississippi Power, 2016). Widely considered the premier pilot project for gasification at new coal-fired and cogeneration energy facilities in the U.S., **the high costs of the Kemper Project likely have caused utilities and investors to be wary of investments in clean coal technologies for commercial power generation.**

A clean coal power plant addition was proposed in 2009 as part of the Desert Rock Energy Project (DREP) in San Juan County, New Mexico. Using coal from Navajo Mine, DREP proposed to utilize a supercritical boiler and advanced flue gas treatments to control over 90 percent of NO<sub>x</sub>, SO<sub>2</sub>, and mercury emissions. The project developer and the Navajo Nation submitted a \$2.9 billion grant application to the federal government to fund an additional clean coal carbon capture system at DREP. However, the application was denied in 2009, resulting in another setback for clean coal technology in the United States.

**Other economic pressures on clean coal include competing with abundant natural gas, from which power can be generated inexpensively and which does not require as costly and time-consuming of a regulatory process that gasification requires.** While selling captured CO<sub>2</sub> to oil and gas developers for enhanced oil recovery has created a market for utilities and provides some incentive to apply clean coal technology, the technologies are still in the development phase. Most of the successful examples of carbon capture and storage have occurred at small to mid-size generation facilities that sell the captured CO<sub>2</sub> to local oil and gas developers. This scale of transaction represents the comfort level of the current market, driven by two key factors: 1) oil and gas operators do not require an endless supply of CO<sub>2</sub> to conduct recovery operations, constraining the feasibility of implementing carbon capture technologies to large-scale energy facilities, and 2) for large commercial energy facilities carbon capture costs far exceed the likely revenue from CO<sub>2</sub> sales, thus requiring public subsidies to be economically feasible.

#### *Natural Gas Combined Cycle*

The rise of natural gas combined cycle (NGCC) capacity over the last several decades has been due to its high efficiency, relatively low capital cost, reduced air quality impacts, and suitability for relatively small-scale power generation.

- New advances in the technology during the 1990's made this form of generation very efficient (capturing waste heat that would otherwise be lost).
- Also, the technology is relatively cheap (roughly \$1,200 per kilowatt of capacity) and easy to construct (two to three years required as compared to five or six to build a coal plant), and is suitable for relatively small scale and modular construction (economical at 100 MW as compared to coal which requires units at several hundred MW).
- Natural gas prices are relatively low, compared to alternative fuel sources, and are expected to remain low in the future. This is largely due to dramatic increases in dry shale gas production

(from less than 5 billion cubic feet per day in 2002 to over 40 billion cubic feet per day in 2016 (EIA, 2016).

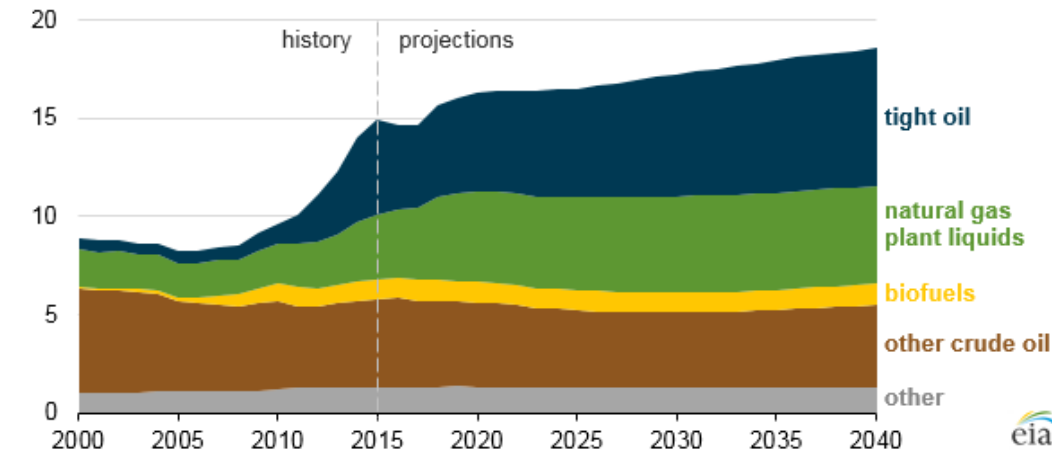
- NGCC plants produce fewer harmful environmental impacts than coal-fired plants, and have been easier to site and permit than coal plants. Fewer air emissions are the result of the nature of the fuel, and greater efficiency in the technology (Kaplan, 2010).

The trend in the utility sector has been separation of electricity generation (power plant construction) and utility function. The 1990's saw Independent Power Producers (IPP) bringing online almost all of the new power capacity. These IPPs were selling into competitive markets and did not have the security of regulated rates so they generally sought to minimize risk by building low cost, quick to build, plants such as NGCC (Kaplan, 2010) rather than capital-intensive coal-fired plants.

#### *Hydraulic Fracturing (Fracking)*

**Oil and gas production has boomed across the U.S. since 2010, with data from the EIA (see Figure 5-3 below) showing production rising by over 50 percent from less than 10 million barrels per day to 15 million barrels per day.** This production boom is attributable to advances in hydraulic fracturing, or “fracking”, which enables access to oil and gas resources that were previously considered unrecoverable.

**Figure 5-3: US Production of Petroleum and Other Liquids 2000-2040, Million Barrels Per Day**



Source: Energy Information Administration

Hydraulic fracturing involves the injection of water, sand, and chemicals into a well that typically runs vertical and then horizontal once at depth. The fluids mix is pressurized to fracture a low-permeability formation and expose otherwise unrecoverable oil and gas reserves. Sand is used as a proppant to hold open the new fissures, allowing oil and gas to flow up the well. These techniques are generally applied to rock formations occurring more than a mile below the surface and sometimes as deep as 8,000 feet. The shale oil and gas deposits are known as “unconventional deposits” because they target the petroleum source rocks. In contrast, “conventional deposits” form when oil and gas migrate from the

source rocks and are trapped in reservoir rocks; oil and gas has historically been extracted from these types of deposits.

Hydraulic fracturing and horizontal drilling are practices that have been employed since the 1950s, but it was not until the mid-2000s that hydraulic fracturing became nearly ubiquitous in new oil and gas production. Between 2001 and 2008, the price of oil per barrel climbed from \$26 to \$151. Thus, while hydraulic fracturing technology had been available for 50 plus years, **the rising cost of crude oil during the mid-2000s served as the driving economic force for an alternative energy resource.** The widespread use of hydraulic fracturing to access new gas reserves was the market's response to a surging oil and gas market.

As a result of the added oil and gas resources from shale source rocks, **the United States now produces the most natural gas of any country in the world, and is projected by 2017 to produce the most oil of any country in the world** (EIA, May 2016). The availability and low cost of abundant natural gas has caused widespread displacement of coal in power generating stations, and has provided reduced raw material and energy costs for the chemical and manufacturing industries. Prior to this boom, the country's oil and gas production was viewed to be mature and declining; after the boom, the country is near energy independence and is considering exporting.

**The San Juan Basin contains one of the largest proved natural gas reserves in the United States, with proven reserves exceeding 1.3 trillion cubic feet.** While oil production is up in the region, gas production is down in the San Juan Basin in response to the large supply increase to the gas market from other regions and the resulting low prices. The San Juan Basin contains both the Lewis and Mancos shale formations, with the Lewis being located in northeast San Juan County and the Mancos primarily in eastern San Juan and McKinley Counties. The Mancos formation is primarily an oil-rich formation that has experienced increased production due to enhanced stimulation and horizontal drilling techniques. In San Juan County, oil production was steadily above 100,000 bbls per month throughout the 1990s and early 2000s. Between 2007 and 2012, production waned at under 100,000 bbls/month, until 2013 when production took off and has steadily climbed to approximately 350,000 bbls per month in 2016. The Lewis shale formation is gas bearing but is yet to experience extensive exploration and development. With gas production at historic highs in other parts of the country (i.e. North Dakota, Pennsylvania), the price of natural gas is relatively low due to abundantly available supply. In response, the number of gas drilling rigs in the San Juan basin have also fallen from 8 in 2014 to 2 in 2015 (Hughes, 2016), indicating that new gas production in northwest New Mexico is less attractive than other shale gas regions. Even though Northwest New Mexico is endowed with resources and supports an existing oil and gas regional economy, complete with companies that specialize in hydraulic fracturing, the price of gas is serving as a market deterrent to explore new prospects. While oil production in Northwest New Mexico has experienced an expansion over the last five years, the price of oil continues to greatly fluctuate, for example, the price per barrel was roughly \$100 in 2013 and dropped all the way to \$30 in early 2016. This volatile marketplace will force operators to weigh the risk of additional exploration versus an uncertain sale price, resulting in a regional oil economy that is vulnerable to the flux of commodity prices.

There is no indication that environmental impacts or associated regulations will limit the practice of fracking and the associated supply of low cost natural gas. The US Environmental Protection Agency

(EPA, 2015) recently released a draft report reviewing the impacts of hydraulic fracturing on drinking water resources, which has been a source of concern and opposition to fracking in some regions. However, the draft executive summary of the EPA report stated that there are no systematic or widespread occurrences of adverse effects to water resources from the practice.

#### *Other Technologies and Trends Enhancing Renewable Power Generation Outlook*

##### 5.2.1.1.1 Small Scale, Distributed Generation

Distributed generation is the dispersed generation of electricity from facilities that are smaller than 50 MW in net generating capacity. Distributed generation is generally connected to the distribution level of the transportation and distribution grid, usually located at or near the intended place of use and typically not produced by a utility. This includes co-generation, wind and solar applications, micro-turbines, small hydro, waste-fired generators, landfill methane generators, and similar methods. Most distributed generation facilities are very small. For example, a fuel cell can provide power in peak demand periods for a single hotel building. Another example of co-generation would be an industrial process that needs heat or steam, and makes use of waste heat or steam to run a generator. Utilities often provide incentives for distributed generation, and offer to purchase any power not used by the consumer.

##### 5.2.1.1.2 Stored Energy Advances

In 2009, the Electricity Advisory Committee recommended that the United States develop energy storage technologies to allow optimum use of existing and new sources of energy.

**Considerable effort is currently being expended on a particular type of storage: battery technologies.**

Other strategies include pumped storage (pumping water in a hydroelectric system to higher elevation at night during low demand, and releasing during the day for power production), other gravity-based storage systems (using rail cars instead of water for arid regions with topography), and molten salts that

can be heated by solar energy during the day, with the heat released and used at night. Finally, in the longer-term, hydrogen is a potential energy storage option: off-peak generation, or alternative generators such as wind and solar could be used to produce hydrogen from water. The hydrogen could then be used to run fuel cells or even internal combustion engines.



***Example Commercial Battery Storage Park***

Storage technologies are particularly important with wind and solar generation, to store the wind for use at times when the sun is not shining or the wind is not blowing. Intermittent power generation from renewable energy production (i.e., power generation when sun is shining or wind is blowing) creates issues for utilities trying to balance energy supply with energy demand. This issue is particularly pertinent when the share of renewable generation rises, as is the case with the renewable energy portfolio standards (REPS) that set benchmarks and deadlines to bring more renewable energy online, as discussed in Section 1.1.2. Energy storage on a commercial scale is seen as a solution to seamlessly

incorporating additional renewable energy into the grid. Use of storage and batteries can balance loading on the transmission line grid, and provide power at required frequencies for end users. Numerous methods have been researched, including fly-wheel storage, pumped hydroelectric storage, and battery storage. For example, in 2013, the California Public Utilities Commission mandated that utilities add 1.3 gigawatts of energy storage by 2020; this is coupled with California's REPS to rely on renewable energy for 50 percent of total power consumed by 2030.

Beyond commercial energy storage, there is also a growing market for batteries at the commercial and retail levels, which will only serve to enhance the investment in research and subsequent advances in the technology. Facilities such as data centers require backup power in the event that they experience a power outage and are creating their own battery storage facilities. Additionally, the growing demand for electric vehicles has subsequently increased demand for high-efficiency batteries. Significant use of home batteries is also on the rise in response to an increase in homes installing solar panels. Home batteries are seen by some as an answer to balancing renewable energy production fluctuations via distributed generation. For example, Tesla's Powerwall home battery, released in 2015, has enough storage capacity to power a two-bedroom home for a day. In 2005, there was relatively little residential solar panel development, and as of 2015, nearly 2,000 MW were installed across the US on homes (SEIA, 2017).

#### *Demand-Side Management and Conservation Technology*

While the EIA currently estimates growth in total US energy use from electricity of 19 percent between 2014 and 2040 (from 12.84 quadrillion Btu to 15.23 quadrillion Btu in 2040) (Energy Information Administration, 2016), growth in electricity demand may slow in the future partly due to demand side management and conservation technologies. **Demand-side management programs reduce generation capacity needs, and may include such elements as conservation, on-site co-generation, and time of demand shifting.** Demand side management programs in California constitute the most ambitious overall approach to reducing electricity demand administered by any state in the nation, and highlight the potential for demand side management to reduce energy demand. For example, through such programs, California electricity use per capita has been relatively flat over the past 30 years, while per capita electricity consumption in the United States has increased by nearly 50 percent.

This achievement is the result of continued progress in cost-effective building and appliance standards, and ongoing enhancements to efficiency programs implemented by investor-owned utilities, customer-owned utilities, and other entities. Since the mid-1970s, California has regularly increased the energy efficiency requirements for new appliances sold and new buildings constructed in the state. In addition, in a creative and precedent-setting move, the California Public Utilities Commission in the 1980's decoupled the utilities' financial results from their direct energy sales, facilitating utility support for efficiency programs. These efforts have reduced peak capacity needs by more than 12,000 MW and continue to save about 40,000 gigawatt hours (GWh) per year of electricity (Commission, 2011).

Other specific demand side management advances include the smart grid and adjustable speed drives. The smart grid concept is a name given for application of devices to monitor and control loads or to balance loading on power lines. Smart metering systems use a two-way communication system to communicate information from the home to the utility, and back from the utility to the home. Smart grid is primarily a way of reducing peak load, not necessarily total energy consumption; that is, the same

quantity of energy may be used, but the timing and source of electricity will shift, reducing capacity needs. Another demand side-management technology that reduces energy use is adjustable speed drives (ASDs) on large motors in a load center, such as pumps used to move water. Moving water is a significant user of energy in many western states. Adjustable speed drives work by matching the motor speed and torque to the actual load on the motor. This can result in up to 50 percent savings.

### 5.2.2 Energy-Related Regulations

This section discusses the pertinent policies and laws that are guiding energy development both in the U.S. and the State of New Mexico. Current Clean Air Act standards on the federal level, combined with state's Renewable Portfolio Standards (RPS), have increased demand for renewable and low-emission energy sources, reducing demand for coal-based generation sources. These policies will have a strong influence on the type and amount of energy generation over the next 15 to 25 years.

**Both the states and the federal government have enacted policies that seek to “wind down” fossil fuel generation over the next 15 to 25 years (by 2030 to 2040), providing time for utilities to appropriately plan for transitioning away from traditional fossil fuel baseload generation.** This policy framework encourages a robust renewable energy marketplace, while allowing utilities time to transition more generation to renewables. Unless EPA air quality standards are loosened, there will remain a premium on renewable energy generation while states and utilities grapple with the challenges of replacing traditional fossil fuel generation.

#### *Federal Air Emissions Regulations and State Implementation Plans*

Air emissions regulations seek to minimize hazardous and noxious air pollutants and reduce the amount of greenhouse gases emitted. Emissions are regulated at both the state and federal levels, where the federal Environmental Protection Agency sets compliance standards for the states to meet. Federal air quality policy has aimed to reduce reliance on traditional fossil-fuel baseload power sources, such as coal. One recent policy instrument is the national Clean Power Plan, which seeks to reduce CO<sub>2</sub> emissions nationwide by roughly one-third by 2033 (relative to 2005 emissions).



***Emissions from Coal-Fired Power  
Plant Stack***

Administered by the USEPA, the Clean Air Act (CAA) is the federal law that regulates air emissions and pollution by establishing National Ambient Air Quality Standards (NAAQS) to protect public health and welfare. The EPA currently has NAAQS for six criteria pollutants – ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, lead, and particulate matter. Through the development of State Implementation Plans (SIPs), states are required to adopt enforceable plans to comply with NAAQS. The CAA promotes using the *best available technology* for new stationary sources to fit into SIPs, as well as for older facilities to be retrofitted/updated if improved technology exists for emissions abatement.

New stationary sources, such as power plants, are specifically regulated by Title V of CAA. Major sources are considered those that emit more than 25 tons per year of hazardous pollutants. Existing major sources are also subject to New Source Review (NSR) when performing upgrades or expansions. For example, both FCPP and SJGS

are committed to install best available retrofit technology (BART) in selective non/catalytic reduction (SCR; SNCR) to reduce NO<sub>x</sub> emissions.

Power plants, such as FCPP and SJGS, rely on older technology that produces high emissions profiles. When these facilities are up for renewal or performing upgrades, they lose their “grandfathered” protection since they were constructed before the CAA in 1970. Additionally, in April 2016, EPA enacted new Mercury and Air Toxics Standards (MATS) which seek to regulate emissions from those coal and oil fueled power plants that were released from regulation under the CAA grandfather clause. These existing power plants have up to four years to comply and install emissions abatement technology.

When subject to CAA compliance, these facilities are confronted with the choice to invest \$100s of millions in retrofits (i.e. BART) or shutdown. The industry trend is to shut down the older “dirtier” units and apply BART to the remaining units, as FCPP and SJGS did. **Utilities rely upon the baseload generation from fossil fuel power plants that provide flexibility in distributing power across a region. These facilities remain integral to grid reliability throughout the U.S. and utilities will continue to explore the most economical solution to achieve regulatory compliance and continued operations on a case-by-case basis.**

In 2015, EPA published the final ruling on a nationwide Clean Power Plan (CPP) which seeks to combat global climate change by reducing CO<sub>2</sub> emissions from existing fossil fuel-fired electrical generation units. The overall goal of the CPP is to reduce CO<sub>2</sub> emissions in the U.S. by 32 percent by 2030, relative to 2005 emissions levels. Interim and final CO<sub>2</sub> performance goals were developed by EPA for each state, recognizing that each state has a different power generation profile and subsequent greenhouse gas emissions. Each state is allowed to derive its own method of meeting the performance goals. These emissions reduction plans are due to EPA in September 2016, but extensions may be granted until 2018. Implementation of the CPP is presently halted by the U.S. Supreme Court until a lower court’s decision has been issued in response to a lawsuit filed by 18 states against the CPP. The CPP program is likely to remain stayed by the Supreme Court until 2017 (Davenport, 2016).

New Mexico’s CO<sub>2</sub> emissions profile was ranked 34<sup>th</sup> in the U.S. by EPA in 2013 and thus not considered one of the states requiring an aggressive abatement framework (EPA, New Mexico Clean Power Plan, 2015). However, if/when the CPP is implemented, New Mexico and other southwestern states will be seeking ways to reduce their CO<sub>2</sub> emissions profiles. This mandate will increase market demand for renewable energy generation so that states can reduce their CO<sub>2</sub> emissions and drive down the CO<sub>2</sub>/MWh ratio.

States are generally allowed to derive their individual approaches for compliance through the development of State Implementation Plans (SIPs). New Mexico’s SIP was developed in 1970 and serves as the framework for how the state emissions profile complies with the CAA. The plan has been revised numerous times and is currently proposed for revision again. New Mexico generates a total of 1.9 million MWh of electricity across the state, where 40 percent is generated by natural gas, 37 percent by coal, and 22 percent from renewables. Thus, over three-quarters of New Mexico’s energy is from fossil fuel generation. As shown through the legal proceedings of the Desert Rock Energy Project (DREP), adding a new commercial fossil fuel power plant would face regulatory challenges in complying with the SIP. A new natural gas or clean coal power plant would likely have to be in replacement of an existing fossil fuel generating station to comply with the SIP.

### *Carbon Taxes or Cap and Trade Systems*

While the United States does not currently have a national carbon tax or cap and trade system, such a market-based mechanism is in place in other countries, and as such, play a role in prices paid in global markets for energy resources. **In 2014, approximately 40 countries had a price on carbon (through either a carbon tax or ETS) covering nearly six gigatons of carbon dioxide equivalent (CO<sub>2</sub>e) (about 12 percent of annual global GHG emissions)** (The World Bank, 2014). Carbon tax prices range from \$1/tCO<sub>2</sub>e in Mexico for certain types of emission to \$168/tCO<sub>2</sub>e in Sweden for certain types of emissions. The taxes apply to different economic sectors and sources of emissions in each country (e.g. heating fuels, gasoline) (The World Bank, 2014). For example, Mexico's carbon tax is applied to fossil fuels sales or imports by manufacturers, producers, and importers, while Sweden's carbon tax applies to fossil fuels used for heating and motor fuels.

Further indication of the long-term role that carbon emission considerations will likely have on future energy prices is the fact that many private, large energy companies have established internal carbon prices based on their expectation of future taxation of carbon. Many such companies have begun incorporating an internal cost of carbon into profitability projections for long-term investments in certain areas. This helps them assess whether future projects will still be profitable if carbon costs rise. For example, oil companies such as BP (formally British Petroleum) and Royal Dutch Shell assume that future investments (sources are not clear on the time horizon) in industrialized countries will be subject to a carbon cost of \$40/tCO<sub>2</sub>e (Partnership for Market Readiness, 2015) (BP, 2015). Exxon Mobil assumes that the cost of CO<sub>2</sub>e emissions in countries belonging to the Organization for Economic Cooperation and Development (OECD) will reach \$60/tCO<sub>2</sub>e by 2030 and \$80/tCO<sub>2</sub>e in 2040. Thus, Exxon's projections assume that the politically-determined cost of emissions, in the form of taxes or cap and trade systems, will increase with time. Other prominent US companies that use an internal carbon cost include: Chevron, ConocoPhillips, Microsoft, General Electric, Walt Disney, ConAgra Foods, Wells Fargo, DuPont, Duke Energy, Google, Delta Air Lines, Walmart, and PG&E (Hertsgaard, 2014).

### *Renewable Energy Generation Requirements & the Interstate Energy Market for Renewables*

New Mexico, California, Arizona, Texas, and Colorado have enacted state Renewable Portfolio Standards (RPS) that require utilities to use a specific percentage of renewable energy in their power mix. Most of these states have set ambitious long-term goals. For example, California has set a standard to rely on up to 50 percent renewable energy by 2030, with the belief that a 25-year adjustment period will allow utilities to plan appropriately for the reconfiguration of their receptive energy portfolios. **New Mexico RPS requires investor owned utilities to generate 20 percent of total retail sales from renewable energy sources by 2020** (rural electric cooperatives are required to generate 10 percent of retail sales from renewable energy sources). **New Mexico has already met the RPS, relying on renewables for approximately 22 percent of net electrical output** (EIAV, New Mexico Profile Data, Supply, 2016). It is unknown if New Mexico will add another performance goal post 2020, but if one is established, the market demand for renewable energy will continue to grow.

Northwest New Mexico has viable commercial solar resources, as well as existing transmission infrastructure that provides access to six utilities, including PNM. The transmission infrastructure in place throughout northwest New Mexico would facilitate delivering power to an out-of-state utility, such as California and Arizona. These states will be seeking new sources of renewable energy generation, creating a market demand for solar, geothermal, and wind energy. With its electrical

transmission node at FCPP with transmission capacity to interstate markets, northwest New Mexico has transmission infrastructure to offer to renewable energy developers and utilities.

Considering most renewable resources are located in rural areas, a key component in determining the feasibility of a renewable energy project is transmission dissipation; the energy that is lost in transmission as it travels. With significant transmission resources present in Northwest New Mexico, a solar energy facility, for example, would not have to send power very far to access large transmission lines that connect to large markets such as Phoenix and Los Angeles. Transmitting power to these markets would result in some loss of energy to dissipation. Other areas of the Southwest are also poised to develop solar energy facilities to meet the market demand created by the RPSs; however, **Northwest New Mexico solves a big part of the renewable equation in offering existing transmission infrastructure in a rural setting that offers commercial-grade solar resources. These assets make Northwest New Mexico very competitive when compared to other areas in the Southwest that may have excellent solar resources but no infrastructure access to market.**

This increase in renewable energy development will also require the procurement of specific electrical components and parts. With access to major interstate rail lines and highways, northwest New Mexico could also be a potential supplier of renewable energy parts to support the coming renewable energy increased demand (see **Section 5.2.3**).

#### *Hydraulic Fracturing Regulation*

The rapidity of shale oil and shale gas development has led to heightened public concern, particularly in geographic areas in which the oil and gas industry is new or where oil and gas activity was low prior to development of these resources. Stakeholder engagement from the public and non-governmental organizations (NGOs) led the US Congress to urge the EPA to “...carry out a study on the relationship between hydraulic fracturing and drinking water, using a credible approach that relies on the best available science, as well as independent sources of information” (EPA, 2010). The EPA issued the draft of these results in 2015, and concluded that the practice has minor effects to water supply and water quality.

State governments have also initiated independent analyses of the potential environmental impacts of hydraulic fracturing, with an emphasis on water quality. Many states and some local governments have enacted or revised laws or ordinances specifically addressing hydraulic fracturing, including in some cases moratoria or bans on further use of the technique. **New Mexico promulgated chemical disclosure regulations in 2012.** Where there are regulations specific to hydraulic fracturing, the focus is on water quality, chemical disclosure, and public notification. In addition, numerous US federal and state laws and regulations establish requirements and expectations for safeguards against potential environmental impacts of all aspects of oil and gas development, including hydraulic fracturing. These governmental requirements have kept oil and gas development as one of the most highly regulated industry sectors in the US. Industry practice continues to focus on reducing the risks associated with all stages of oil and gas development, including hydraulic fracturing.

In 2015, the US Department of the Interior released a final rule on applying hydraulic fracturing techniques on public lands. The key components of the rule are to protect groundwater resources through validation of well integrity and cement casings; increasing transparency on the disclosure of

chemicals used in hydraulic fracturing to FracFocus.com; higher standards for waste stream storage and recovery; and, management of cross-well contamination with other wells in the same field (BLM, 2015).

BLM estimates that the new rule will cost less than ¼ of 1 percent of the cost of drilling a well, a nominal amount of additional investment that will not serve as a significant regulatory burden on oil and gas development (BLM, 2015). Both the state and federal regulations do not constrain the use of hydraulic fracturing, rather they put emphasis on the monitoring and reporting aspects of managing the liability of the fracturing fluids mix. These regulations are not likely to be rolled back in the near or far term and seem acceptable to the oil and gas industry to date. However, in response to a well-supplied market, many energy companies have found prices too low to merit developing new exploration/production wellfields.

#### *Uranium Extraction and Nuclear Energy Generation*

Nuclear energy accounts for roughly 20 percent of the overall power generated in the US. The presence of uranium and significant transmission infrastructure in the area could be a draw for a nuclear energy generation facility. A uranium processing center could be constructed in the local area to refine the raw uranium into yellowcake, and having the fuel source in close proximity to the power plant would reduce the transportation cost of this highly-sensitive product. The region's significant transmission infrastructure could serve as the initial framework for distribution.

Just as in FCPP, **utilities across the southwest could partner to build a nuclear energy facility, sharing the burden of finance as opposed to a single utility. A nuclear plant could provide a baseload power source that could substitute for FCPP and SJGS when those plants go offline.** Presently, six utilities have an ownership share in FCPP. Those utilities will need to find a new source of baseload when FCPP shuts down. This type of low emissions facility would also assist in meeting Clean Power Plan requirements by reducing the state's CO<sub>2</sub> emissions.

Despite these advantages, public concern regarding nuclear power and uranium mining indicate that the potential for a new nuclear power plant in Northwest New Mexico are likely very limited. No new power plants have been constructed in the United States since the Three Mile Island accident in 1979 (the last constructed in the US was in 1977). As demand for nuclear fuel declined, inventories of uranium ore were stockpiled in the early 1980's. Nuclear arms reduction treaties between the US and Russia (i.e. START) further decreased demand and added more uranium to the stockpiles as the weapons were dismantled. During this same time, mine and mill reclamation requirements were increasing costs (McLemore V. , 2007). More recently, the Fukushima accident in Japan in 2011 served to reinforce public concerns regarding nuclear energy in the US. With no new nuclear power plants constructed in over 30 years in the US, there is little support for nuclear to provide increased baseload electricity generation.

As mentioned above, **the ore grades of uranium in the Grants Mineral belt are some of the highest in the world; estimated at 0.4% U** (World Nuclear Association, 2016). For reference, the majority of uranium ore deposits in the world averages 0.1% U (World Nuclear Association, 2016). Even at these high rates, for every ton of ore extracted there is only 8 pounds of uranium for every ton extracted and shipped to White Mesa mill. At 8 pounds per ton, the expected production from the currently proposed mine would produce nearly 274,000 ton of waste per year over the next nine years. It is estimated that New Mexico currently has about 100 million tons of waste at existing sites (Power, Renewed Uranium

Mining Boom in New Mexico, 2008) that will be addressed through the US DOJ funding (World Nuclear Association, 2016).

The history of uranium mining in Northwest New Mexico may particularly influence the local area's interest in nuclear energy-related development. The Grants Belt represents a significant uranium deposit in Northwest New Mexico, including on the Navajo Reservation and in McKinley and Cibola Counties. Nearly four million tons of uranium was mined on Navajo Nation lands from 1944 – 1986. In northern Cibola County and southeastern McKinley County, the Ambrosia Lake uranium mine was operated from 1958 to 1963. Due to the presence of contaminated materials in the local soils and water, US DOE remediated the Ambrosia Lake site between 1987 and 1995, and the site remains under DOE monitoring.

On the Navajo Nation, uranium mining operations went largely unregulated until 1969 and operations left behind large spoils of uranium contamination, creating a complicated and wide spread environmental liability. Further, many Navajos worked in the mines without the appropriate personal protection equipment and were exposed to harmful levels of radiation that lead to increased rates of lung cancer.

The Church Rock uranium mill spill occurred in New Mexico on July 16, 1979, when United Nuclear Corporation's Church Rock uranium mill tailings disposal pond breached its dam. Over 1,000 tons of solid radioactive mill waste and 93 million gallons of acidic, radioactive tailings solution flowed into the Puerco River, and contaminants traveled 80 miles (130 km) downstream to Navajo County, Arizona and onto the Navajo Nation. The mill was located on privately owned land approximately 17 miles north of Gallup, New Mexico, and bordered to the north and southwest by Navajo Nation Tribal Trust lands. The accident is frequently described as having released more radioactivity than the Three Mile Island accident that occurred four months earlier and was the largest release of radioactive material in U.S. history. The spill contaminated groundwater and rendered the Puerco River unusable by local residents.

In 2003, the Church Rock Chapter of the Navajo Nation began the Church Rock Uranium Monitoring Project to assess environmental impacts of abandoned uranium mines; it found significant radiation from both natural and mined sources in the area. The EPA National Priorities List currently includes the Church Rock tailings storage site, where "groundwater migration is not under control."

The Navajo Nation began receiving payment from a \$5.15 billion settlement in the Tronox bankruptcy settlement in 2014. According to terms of the settlement, the U.S. EPA will receive \$985 million for cleanup of 49 sites on the Navajo Nation. The Navajo Environmental Protection Agency is also receiving funding from the settlement, a total of \$43 million. In total, funds at work on the Navajo Nation are approximately \$1.2 billion dollars. There are additional claims associated with cleanup of former uranium mines and uranium processing site located in Cove, Ariz. and Shiprock, N.M.

In response to concerns related to the past development of its uranium reserves, the Navajo Nation passed a moratorium on uranium mining in 2005. The Navajo Nation has also worked with EPA since 1994 in mapping 500 uranium sites as Superfund Sites under CERCLA for remediation.

Considering the lingering health and environmental effects of uranium mining on the Reservation, it is unlikely that the Navajo Nation will repeal the uranium ban in the foreseeable future. There is a licensed in-situ uranium recovery operation in Crownpoint, NM, owned by Hydro Resources. While permitted by

the federal Nuclear Regulatory Commission (NRC), this in-situ mine has never been activated as it is located on Navajo trust lands. Experiences on the Navajo Reservation may affect public sentiment and tribal views on uranium mining in other areas of Northwest New Mexico, such as in Cibola County.

### 5.2.3 Energy Economics

This section provides a brief overview of the economics of energy supply and demand. On the supply side, we discuss the relative economic costs of producing electricity from different energy sources, while on the demand side we discuss forecasts of future electricity and energy demand growth.

#### *Supply Side: Production Costs by Energy Source*

**Table 5-2** presents the estimated levelized cost of energy (LCOE) on a cost per MWh basis for various energy sources (Lazard, 2016). The values do not include federal tax subsidies, social and environmental costs, network upgrade or transmission costs, permitting costs, or costs with complying with different environmental regulations (such as carbon emissions).

**Table 5-2 Unsubsidized Levelized Cost of Energy, \$/MWh**

Technology	Levelized Cost of Energy, \$/MWh	Base Load
Commercial Solar PV	\$46-\$92	No
Microturbine	\$76-\$89	Yes
Geothermal	\$79-\$117	Yes
Biomass Direct	\$77-\$110	Yes
Onshore Wind	\$32-\$62	No
Integrated Gas Combined Cycle	\$94-\$210	Yes
Nuclear	\$97-\$136	Yes
Coal	\$60-\$143	Yes
Gas Combined Cycle	\$48-\$78	Yes

*Source: Lazard, 2016, "Lazard's Levelized Cost of Energy Analysis, Version 10.0."*

The levelized energy costs in **Table 5-2** highlight two very important factors that are expected to limit current and future demand for coal as an energy source:

1. Renewable generation technologies are becoming cost competitive with fossil fuel technologies, even without federal tax subsidies. Several sources even suggest that with the improvements in solar PV technology and considering investment incentives we will see Power Purchase Agreements (PPA) for solar of less than \$50 per MWh in the near future (Bolinger, 2015). The cost of wind power is in the same ballpark as the cost of natural gas combined cycle generation

(depending on natural gas prices). Premium prices paid for wind power and tax incentives make this a viable part of the energy portfolio.

2. Among fossil fuel technologies, natural gas combined cycle power generation stands out as likely the least expensive technology. With low natural gas prices, natural gas combined cycle generation is less expensive than coal and emits fewer pollutants. Further, NGCC has lower capital costs, and is more flexible in size, with smaller (more modular) plants requiring less investment overall.

As discussed in previous sections, U.S. domestic production of natural gas boomed in 2006, almost adding 50 percent more gas to the market in a five-year period. This inundation of supply drove gas prices down, falling from \$14 per million BTU in 2005 to \$2 in 2012. The majority of new gas is from the Marcellus shale play in West Virginia, Pennsylvania, and New York, which increased from 2 billion cubic feet per day in 2010 to 17 billion cubic feet per day in 2015. The market response in northwest New Mexico has followed the other traditional gas bearing regions in the U.S.: development of new wells has halted as prices remain at historical lows. Gas production is forecasted to continue to grow slowly over the next 10-15 years, locking in lower prices (EIAw, 2016). Additionally, as discussed above, regulatory trends and instruments, such as the Clean Power Plan, have put a premium on non-fossil fuel energy sources through the regulation of CO<sub>2</sub> and other gas emissions. **Utilities will continue to balance reliable baseload generation with the introduction of more renewable energy in the grid, so while there will remain a demand for fossil-fuel generation, the market is trending towards natural gas.**

In terms of Clean Coal technology, as discussed in **Section 1.2.1** above, the implementation of Clean Coal technology has proven costly and has utilities/investors taking a wait-and-see position before making substantial investments in developing new coal-fired power plants with gasification technology. Additional economic pressures on Clean Coal include competing with a saturated natural gas market where power can be generated from an economical resource and without the additional regulatory, and subsequent financial, burden that gasification represents. Most of the successes for carbon capture and storage have occurred at the small to mid-size generation facilities that sell the capture CO<sub>2</sub> to local oil and gas developers. This size of transaction represents the current market's comfort level, driven by two key factors – 1) oil and gas operators do not require an endless supply of CO<sub>2</sub> to conduct recovery operations, constraining the feasibility of implementing carbon capture technologies to large scale energy facilities; 2) for large commercial energy facilities, the cost of carbon capture relative to CO<sub>2</sub> sales revenue likely requires public subsidies to achieve feasibility.

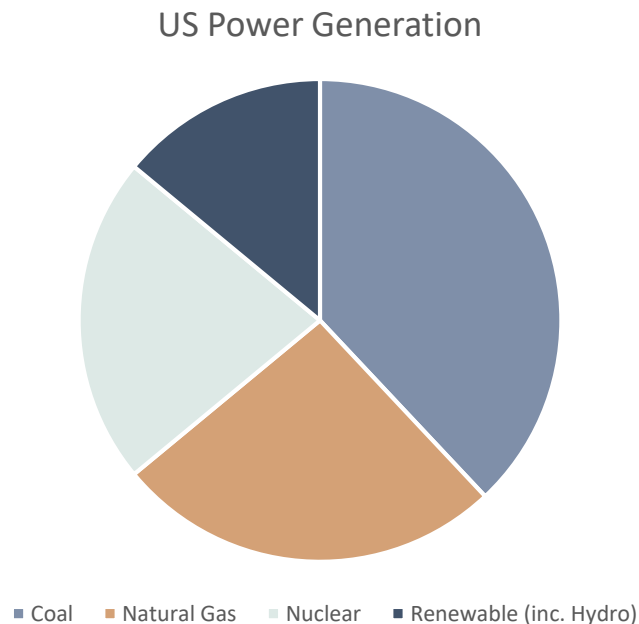
Finally, in terms of competitiveness with other suppliers of coal, **San Juan Basin coal is more expensive than many other coal sources nationally and internationally.** The financial costs of extracting coal out of the ground depend on several factors including the stripping ratios (how much overburden must be dealt with), permitting costs, labor costs, size and depth of pit, etc. In general, coal in the study area (Fruitland formation) is mined at ratios of 5:1 or 7:1 (Fassett, 1989). Productivity is the measure of average production of short tons per employee per hour. New Mexico's productivity is estimated at one-quarter that of Powder River Basin (PRB) coal (Lucero, 2009). In the San Juan basin, coal fired power plants developed in close proximity to the mines because of the high cost of mining and transportation. The cost of coal mining in the San Juan basin was estimated at \$22.23 per short ton in 1999, and when adjusted to 2016 dollars this would be approximately \$32 per ton (using CPI index)

(Rohrbacher). To put this into perspective, in 2015 Indonesia shipped coal at a price point of \$22 per ton (Els, 2015); cheaper than extractions costs in the San Juan basin 16 years prior.

#### *Energy Demand*

As shown in **Figure 5-4**, data developed in 2015 by Lawrence Livermore National Laboratory indicate that nationwide, coal was the energy source for 38 percent of electricity generation, natural gas accounted for 26 percent of electricity generation, nuclear accounted for 22 percent, and all other sources accounted for 14 percent. In 2015 demand for electricity came from residential 38 percent); commercial (36.7 percent); and industrial (26 percent) users (Lawrence Livermore National Laboratory, 2015). However, only 33 percent of total electricity generated was consumed by residential, commercial and industrial users, whereas 67 percent was classified as ‘rejected energy’, or heat generated during the combustion process that is wasted.

**Figure 5-4 Nationwide Power Generation By Source (2015)**



Electricity demand growth (including retail sales and direct use) has slowed in every decade since the 1950's, from 9.8 percent per year from 1949-1950 to 0.5 percent per year from 2000 – 2015. In the as part of its 2016 Annual Energy Outlook, the EIA projects that electricity demand growth will remain relatively slow, as rising demand for electric services is offset by efficiency gains from new appliance standards and investments in energy-efficient equipment. Still, the total amount of electricity demand projected in 2040 is 24 percent higher than in 2015 (US Energy Information Administration, 2016).

Electricity demand is determined primarily by population growth and economic activity. However, electricity demand growth has been significantly slower than GDP growth in recent years and continues to be slower in the EIA projections. Further, electricity sales are expected to grow at a slower rate than electricity use, given the increasing role of self-generation in all end-use sectors. Thus, in the EIA

projection, total electricity sales grow by 20 percent through 2040 compared to the 24percent growth in electricity demand (US Energy Information Administration, 2016).

**EIA projections through 2040 anticipate that increases in renewable capacity will help offset the retirement of 100 GW of coal fired capacity.** EIA also anticipates natural gas prices to continue to be relatively low, with projected significant increases in natural gas fired capacity.

### 5.3 OPPORTUNITIES FOR COAL

Based on the sections above, this section examines new market opportunities for coal mined in the region, including international export, clean coal power production, and local industrial use.

#### 5.3.1 Export of NWNM Coal

Domestic demand for coal has lessened as more coal-fired power plants go offline, with US coal production falling from 1.2 billion short tons in 2008 to 900 million in 2015 (EIAx, 2016). In response, **energy companies have found buyers outside the U.S. and net coal exports rose from 23 million tons in 2007 to 117 million tons in 2012. The export market has leveled off since 2012 with a total of 63 million tons exported in 2015 (EIA 2016).**



*Picture of Coal Being Shipped Via Rail*

**Coal is inherently bulky and commercial power plants require millions of tons per year for generation; most coal in the US is transported in bulk via rail or barge.** Thus, transportation cost is a significant factor in the feasibility of coal-fired generation, for example both FCPP, SJGS, and Navajo Generating Station (NGS) have exclusive and adjacent mines to minimize transportation costs. Another advantage of having coal in close proximity to the power plant is that the combustion units can be engineered to

operate on the specific chemical makeup of the locally-sourced coal. This design constraint limits the pool of potential buyers of northwest New Mexico coal outside the US. Additional infrastructure (rail or slurry line) from coal mines to the Class I Carrier line in Gallup would be required for exporting coal from the study area; or truck transportation would be needed to the Gallup rail port.

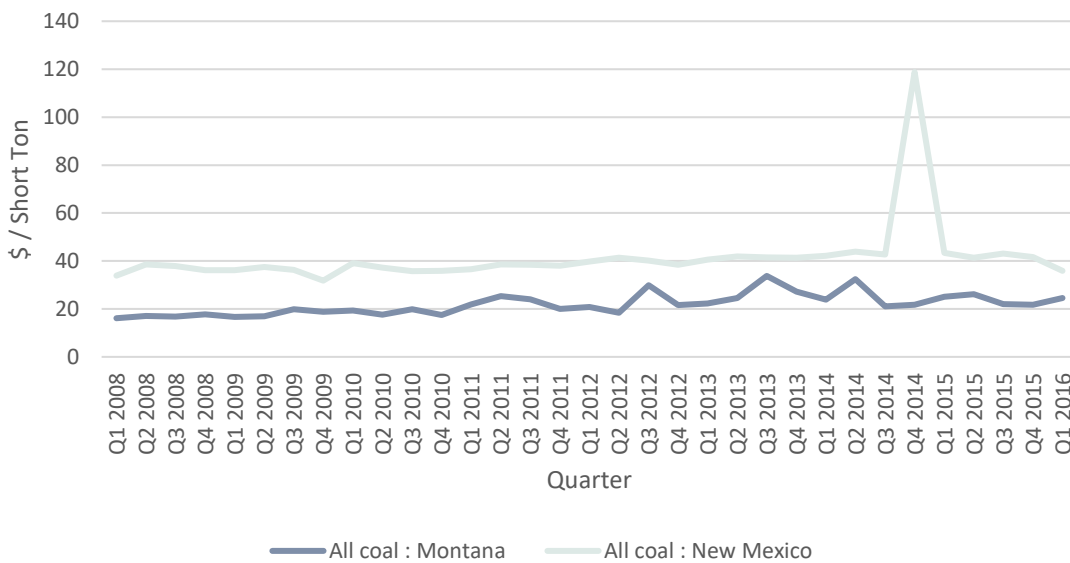
A logistics hub is planned on the Gamerco site, a privately owned property on the Defiance Subdivision roughly five miles northwest of downtown Gallup, which could become an inland port facility for BNSF serving New Mexico, Arizona, and parts of Utah and Colorado. There is an existing rail loop on the property that can be used for loading unit trains of coal, and the potential for building three or four additional loops as well as spur tracks for loading smaller numbers of rail cars. The facility would be used as a loading point for coal extracted from the San Juan Basin that is being exported to China and other markets. (New Mexico Department of Transportation, 2016)

The nearest ports with capabilities to export coal are in California (Long Beach, Stockton and Richmond) with a combined capacity of around 6 million ton annually (US Coal Exports, 2016). The next closest

export terminals for coal are the Gulf States of Louisiana (ports: Greater Baton Rouge, South Louisiana, New Orleans, and Plaquemines), Texas (ports: Deepwater Terminal, Houston, and Corpus Christi), Alabama (Mobile) with a combined capacity of 75.5 million ton; of which 50 million ton was utilized last year (two-thirds) (US Coal Exports, 2016) (Sanzillo, 2014).

The wide range in mine-mouth coal prices (see **Figure 5-5**) and transportation distances across the United States create significant variation in the impact of transportation rates on overall coal costs, with different basins affected to significantly differing degrees. Fruitland Basin coal can supply local New Mexico power plants or other users with minimal transportation costs, providing it an edge over PRB coal. However, given the mine price advantage of PRB coal and the relatively high transportation costs to ship coal to other locations, it is not feasible to market Fruitland coal to other areas of the United States.

**Figure 5-5 Price comparison between PRB and New Mexico - \$ per short ton (f.o.b. mine)**



Source: (Energy Information Administration - Price, 2016)

In the fall of 2015, coal futures were trading at \$50 per ton (lowest price since 2003). The highest point was above \$200 per ton in 2008. Goldman Sachs issued a statement that the coal resource will never gain enough traction again to lift out of its slump, saying “Peak coal is coming sooner than expected.” They went further to predict that consumption of coal would peak before the end of the decade. “The industry does not require new investment given the ability of existing assets to satisfy demand, so prices will remain under pressure as the deflationary cycle continues.” Futures forecasts by Goldman Sachs were for essentially no change in price for the foreseeable future. (Reuters, 2015)

While coal still accounts for 35 percent of worldwide energy production, it has decreased 9 percent of market share since 2009 (Karooshy, 2015, November). **Recent trends in market capitalization indicate a very quickly shrinking market.** The combined market cap of the four largest US coal producers has

declined by over 90 percent since 2011 (approximately \$33 billion to less than \$3 billion) (Karooshy, 2015, November).

Analysts with Goldman Sachs anticipate further declines in coal usage by 2018 as many aging coal-fired power plants face accelerated retirement due to tightening emission regulations and growing competitive pressures from cheap gas and rapidly growing renewable sources (Karooshy, 2015, November). Further declines are expected due to financing constraints, as large banks and investors (e.g. Deutsche Bank) announce vows to end coal financing, citing commitments to international climate change treaty, the Paris Agreement (Murray, 2017).

#### 5.3.1 Clean Coal Technology

Clean Coal technologies, such as gasification and carbon capture, have not been widely implemented mainly because of the lack of new coal-fired power plants being built. A Clean Coal power plant was proposed in San Juan County in the Desert Rock Energy Project (DREP) in 2006. Relying on coal from Navajo Mine, DREP proposed to utilize a supercritical boiler and advanced flue gas treatments to control over 90 percent of NO<sub>x</sub>, SO<sub>2</sub>, and mercury emissions. The project stalled due to escalating cost estimates to implement carbon capture technology, and in 2009, the Navajo Nation was denied a \$2.9 billion request from the federal government to fund carbon capture and storage at DREP. The only Clean Coal power plant in development is the Kemper Energy Facility in Mississippi, which has experienced substantial cost overruns and technical setbacks.

**Considering that Clean Coal technology is still in the research-and-development phase and being outcompeted by natural gas for baseload generation, there is little demand for Clean Coal equipment and supplies currently.** There is significant uncertainty if Clean Coal technology will grow to become commercially feasible. However, the technology may be mature by the time SJGS and FCPP go offline, and in that instance a Clean Coal power plant may serve as a viable baseload replacement.

#### 5.3.2 Local Industrial Use

Coal is used in the heating of various industrial products and in the study area coal is transported for regional use in a cement manufacturing plant from the King Coal mine in Utah. In this specific case the owners of the mine are also the owners of the cement plant, so there is vertical integration occurring. Other uses of coal for industrial use is unlikely given the regulations on emissions and technological advances in other industrial uses.

Future market, resource, or technology conditions may present themselves that would provide economically justified use of coal for deriving other products such as liquid fuels, asphalts, tar paving mixtures, roofing cements, petroleum jelly, and other lubricants. In 2012, for the first time in recorded history, the US became a net exporter of products in the petroleum and coal products sector, largely due to price changes for end products and not changes in supply. Principal export markets were Mexico, Canada and the Netherlands. Today most of the manufacturing comprised in this sector are made through the distillation of crude oil, and not coal (Hawk, 2012).

### 5.4 OTHER ENERGY RESOURCE DEVELOPMENT STRATEGIES

The above sections identify and evaluate potential business opportunities for Northwest New Mexico (Cibola, McKinley, and San Juan counties) related to energy development. Through an iterative process

with the POWER grant leaders at the NWNMCOG we focused the research in the previous section on opportunities for coal, including coal export and clean coal. In this section, we also explore potential development opportunities associated with natural gas combined cycle power generation, solar power production, battery storage, and uranium.

#### 5.4.1 Combined Cycle Natural Gas

**With existing transmission infrastructure in place, multi-unit gas-fired power plants could serve as a replacement to SJGS or FCPP when those plants are decommissioned. Adding to the feasibility of a gas power plant is the proximity and known reserves of the San Juan Basin, providing a large natural gas source with existing pipeline infrastructure throughout northwest New Mexico.** While renewable energy projects are the focus of many southwestern states, utilities will continue to rely on baseload fossil fuel energy generation to maintain grid reliability and flexibility in distribution. As Clean Coal technologies continue to be researched and developed, natural gas is proving to be an attractive option for utilities looking to maintain the balance of baseload generation and environmental compliance.

An example of such a facility in the area is the Farmington Electric Utility System Bluffview plant which was constructed in 2004 and has a 64,000 KW capacity. This plant comprises roughly 1/3 of the Farmington Electric Utility System's generating capacity (Farmington Electric Utility System, 2015). Current technology has improved to capture even greater amount of energy produced from these types of plants over the past decade.

While Northwest New Mexico has great assets and strengths that make it an attractive location for natural gas-fired power plants, the recent action by PNM to withdraw its plans for a natural gas and solar plant in San Juan County are a short term setback for this type of activity. This could be an indication that any such construction would possibly be a long-term option rather than a near-term economic development. (In late October of 2016, PNM announced that it has withdrawn from the New Mexico Public Regulation Commission its plan to build a natural gas plant and pipeline in San Juan County due to lower than expected energy demand projections (Irvin, 2016)).

#### 5.4.2 Solar Production

As discussed in Section 5.1.1 above, Northwest New Mexico has abundant solar resources, with a particularly good cell in southern San Juan County and northern McKinley County that has recorded solar measurements that show potential to generate above 6.5 kWh/m<sup>2</sup>/day (NREL 2012). Existing solar facilities in the region include the 8 MW Cibola County facility owned by PNM. With states throughout the Southwest US implementing RPSs, there is a burgeoning marketplace for renewable energy development. Northwest New Mexico also is also endowed with significant transmission facilities, which provides access to market for renewable energy.

**The cost of a megawatt hour of solar generation has steadily declined with improvements to PV materials, manufacturing, and technology.** A measurement referred to as the Levelized Cost of Electricity (LCOE) is used to compare the cost of energy generation per type by taking into account the costs of the facility divided by the overall amount of electricity produced. The EIA estimates that by 2022 the LCOE for PV solar energy will be \$85/MWh and, for reference, coal will be at \$140/MWh (EIAz, 2016). The falling cost of energy generated by solar facilities bodes well for the feasibility of solar facilities being developed in Northwest New Mexico.

The State of New Mexico offers solar developers a Renewable Energy Production Tax Credit (REPTC). For solar, the credit increases from 1.5¢/KWh in the first year of production to 4¢/KWh in the sixth year of production, and then gradually decreases until the tenth year of production. These credits are available for any solar project over 1 MW in output, but only projects that produce electric before 2018 are eligible. This incentive program further bolsters the feasibility of commercial solar energy generation in Northwest New Mexico.

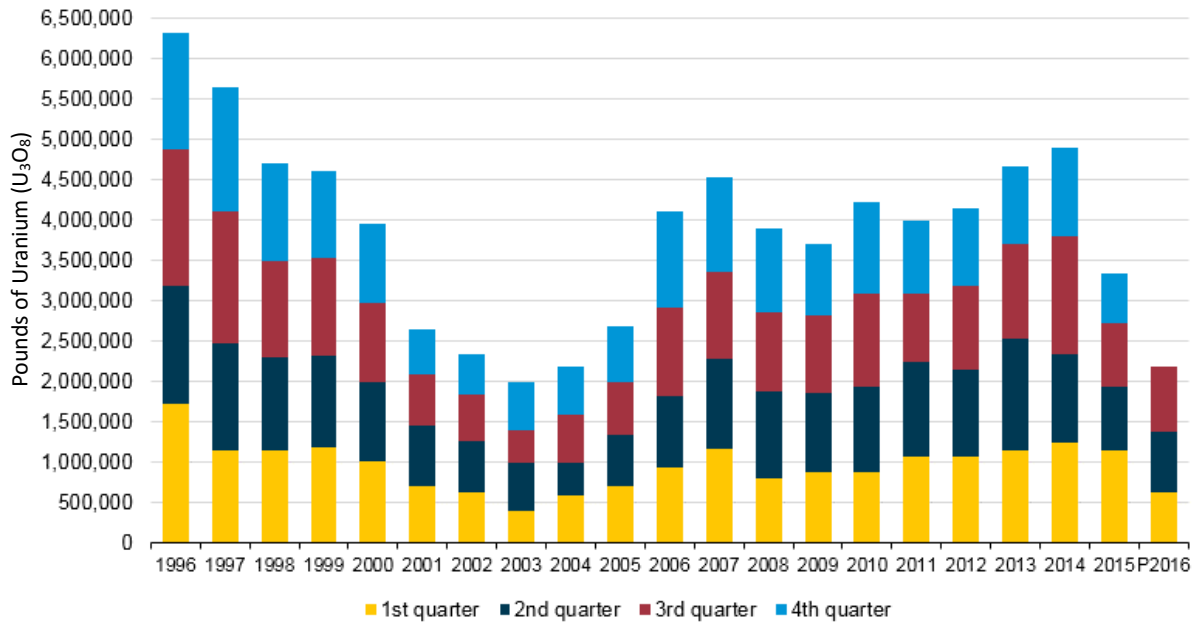
#### 5.4.3 Uranium

There is a proposed uranium mine in Cibola County. A recent study of uranium mining in the state found that **if all of the uranium reserves in New Mexico were to be extracted over the next 30 years it is estimated that this will generate 1,575 jobs in mining and processing in the state** (Power, 2008). As such, uranium mining could be an economic driver in the region. However, recent uranium prices indicate that uranium mining may not be as economically viable as originally expected by the mine developer.

News articles from 2013 quoting the developer of the proposed uranium mine indicate revenue could reach \$2.2 billion over the life of the mine (estimated at 28 million pounds) (Hartranft, 2013). While this is possible, it would require uranium prices of nearly \$80 per pound; the uranium spot price has not reached this level since 2011 and is currently at \$20.25 (as of December 2016), which falls significantly short of the reported estimate. As such, a more reasonable estimate of gross revenue may be \$600 million. Even when calculating the prospective value with the future value of \$30.00 per pound, the gross revenue would still be less than half of the reported \$2.2b estimate at \$840 million.

From the late 1980's to early 2000's the spot prices for uranium were more or less flat. Then from 2002-2007 there was a fivefold increase in price, associated with a marked decrease in production (see **Figure 5-6**).

Figure 5-6: US Uranium Production

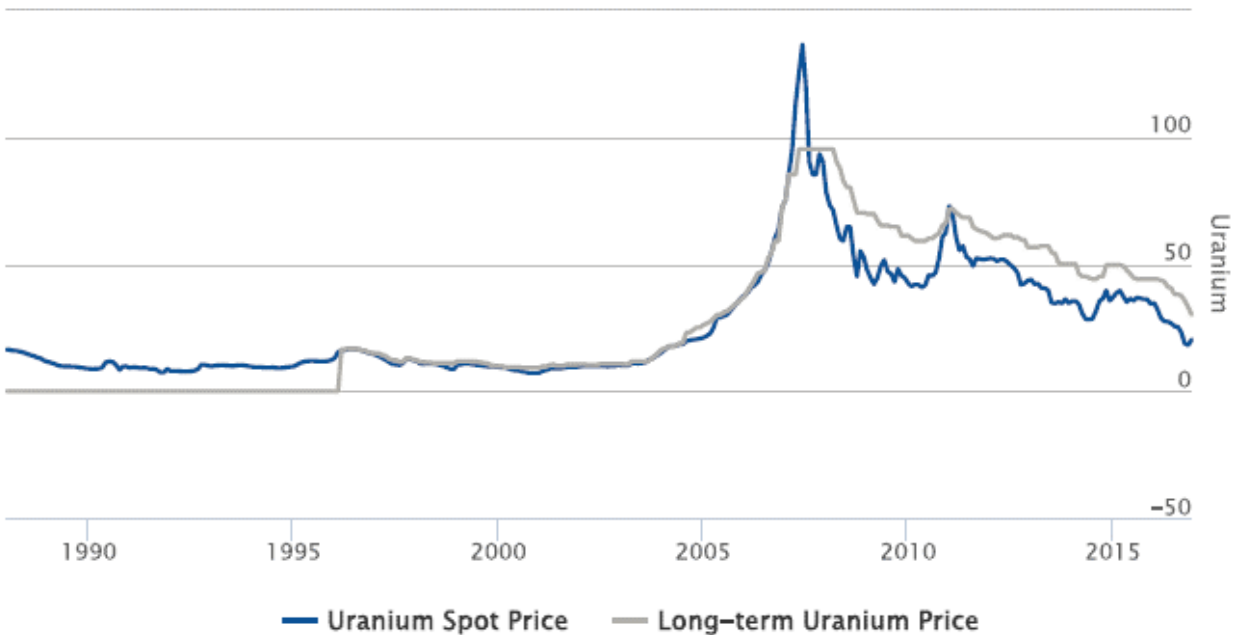


Source: (EIAy, 2016)

As with most commodities, prices retreated in response to the global financial crisis in 2008 and 2009. Prices began to recover in 2010, but dropped again in 2011 as a result of the incident at the Fukushima reactor in Japan. Immediately before the quake and tsunami, spot prices of uranium were \$67.75 per pound and then plummeted to \$49 per pound on news of the partial meltdown at Fukushima. Prices have remained in the mid \$30 to mid-\$40 per pound range since that time; and historic experience indicates that public perception on nuclear energy is slow to change following accidents such as Fukushima.

As shown in **Figure 5-6**, uranium production in the US dropped by nearly one-third from 2014 to 2015. The last market contraction in the early 2000s resulted in uranium prices increasing from \$10.15 per pound in 2013 to \$136 in 2017, the peak price in recent history. The delay in market response is likely due to stockpiles accrued at power plants, providing planned fuel for energy generation. When facilities worked through their stockpiles, there was a heightened demand that peaked and gradually stabilized towards the historic price around \$10 per pound, as shown in **Figure 5-7** below. If uranium, as a commodity, experiences a sustained shortage in production, the spot and long term prices will react by going up. In the instance of a market shortage, uranium mining becomes more feasible. Of the seven operating uranium mills/mines in the US, only one is an operating mill and the remaining six are in-situ leach plants. Five of the six in-situ facilities are located in Wyoming.

Figure 5-7: Uranium Spot Price and Long-Term Price



Source: (Cameco, 2017)

While uranium prices are currently depressed due to weak global demand and over-supply, new nuclear power plant construction throughout the world may cause prices to rise within the next five years. China, India, and Russia all have ambitious plans to increase their use of nuclear power. According to the World Nuclear Association, by 2030 China plans to increase their nuclear power capacity by fivefold and India by fourfold. This will require the two countries to add a combined average of 7-8 reactors each year for the next 15 years (Uranium Participation Corporation, 2016). High inventories could satisfy supply needs over the next few years, but increased demand could be seen as early as 2021 (Green, 2015). Global demand for uranium is expected to increase over 50 percent by 2025, while production is projected to increase by less than five percent. This is causing some industry analysts to predict a supply shortage beginning in the next three to six years, and that utilities will increasingly seek long term supply contracts with mines in that time (Uranium Participation Corporation, 2016).

**If global demand for uranium does increase while supply lags behind, uranium prices will naturally rise, making new mines in Northwest New Mexico potentially more lucrative. However, the demand for New Mexico uranium will depend not just on global demand and supply, but also the relative strength of the U.S. dollar compared to the currencies of other major exporters of uranium, such as Kazakhstan, Canada, and Australia.** While the US dollar has been strong recently, uranium prices have been flat in US dollar terms while increasing in foreign currency terms (Uranium Participation Corporation, 2016). This bodes well for uranium producers in the US in the short term, but how this will change in the long term depends on a variety economic forces both directly and indirectly associated with the uranium industry. The economic prospects for a new uranium mine in Northwest New Mexico seem likely to improve in the coming years, but the degree of that advance depends on global factors that are still very uncertain.

Even if uranium mining in Cibola County proves economically viable it may face political barriers. In 2007, the Pueblo of Laguna declared a moratorium on uranium mining on their tribal land. The suspension came after a long history of uranium mining on the Pueblo's tribal lands that left a legacy of public health and environmental problems. In addition to the mining ban on their lands, the Pueblos of Laguna, Acoma, and Zuni in the area are guaranteed the right to tribal consultation to protect their lands from adverse impacts from mining, as provided under the National Historic Preservation Act and the National Environmental Policy Act. The Laguna Pueblo has already stated their opposition to the proposed Roca Honda mine in Cibola County. Thus, **both political opposition and market conditions may be barriers to uranium mining in Cibola County.**

#### 5.4.4 Battery Storage Facility

As discussed in **Section 5.1.2**, the existing transmission infrastructure in the area that serves FCPP and SJGS is a significant asset for both utilities and developers considering power plant or renewable energy project construction. Being located near the borders of three other states, **San Juan County is well positioned to build a commercial scale energy storage facility (i.e. 100s of MW of storage) to serve as a trading hub for southwest utilities.** New renewable energy projects throughout the Four Corners region could feed power to the storage facility where utilities could buy and transmit renewable energy through existing/upgraded transmission lines from FCPP. FCPP is owned and operated by six utilities in the southwest – APS, PNM, El Paso Electric, Tucson Electric, and Salt River Project – and also has transmission lines to southern California, Nevada, and Utah. This collection of power purchasers and existing infrastructure creates an instant marketplace for selling power. The key issue with an energy storage project is the rate of development of renewable energy projects in the Four Corners region. The area does have potentially viable commercial solar resources but it is difficult to forecast exactly how much or when these types of projects will be built. In order to address that uncertainty, a storage facility that could be scaled up as more renewable projects come online would be preferable, such as a lithium-ion battery storage or molten-salt facility.

#### 5.4.5 Power Plant Re-Use Options

Options for reusing large power plants are limited. The only redevelopment examples identified during this study were historic powerhouses and structures being converted to office or commercial space. For example, the Ottawa Street Station in Lansing, Michigan was converted into a corporate headquarters/campus for the Accident Fund Insurance Company of America and the Pratt Street Power Plant in Baltimore, Maryland was converted into a commercial center. These projects were lauded for preserving historic structures and required a substantial redevelopment effort, partially or wholly funded by the public sector. All other power plants researched for this study were found to be abandoned and dismantled, largely due to the cost and liability. The common theme for power plants that were reused is that they were historic buildings in commercial urban centers, and the State provided funding/incentive for these buildings to be redeveloped. **Given the remote locations of SJGS, FCPP, and Escalante Generating Station, it is unlikely that a commercial redevelopment of the facility would be feasible. Furthermore, these power plants are expected to continue operations for another 25 years.**

Many of the power plant repurposing examples involve the facility being designated as a brownfield site under EPA's CERCLA program. Being dedicated as a brownfield site allows for federal funding to be

made available for the remediation of any residual contamination at the industrial site. After clean up, the power plants are converted to a facility that will serve as an economic boon or public asset, such as a public park, industrial park, or commercial center. Some examples of this program include the Glorious Ruin Gas Plant which is now a public park in Seattle, and the PG&E Station B Plant which is now a Science Center in Sacramento.

## 6 ECONOMIC OPPORTUNITY: DIVERSIFICATION

Economic diversification is a term that describes an economy containing several different employment and income producing sectors that provide the region with the ability to sustain growth. In the event that one sector should fail or falter, the diverse economy provides a buffer of economic stability and resiliency. Economic diversification has particular importance where extractive industries make up a large percentage of economic activity; as these industries tend to follow ‘boom and bust’ cycles that mirror commodity prices. Other factors that can impact the health of specific sectors include business cycles and competition nationally or internationally, new technologies, government policies, and shifts in demography; all of which can be disruptive and force change on the sectors in the local economy.

### Diversification Benefits

Economic diversification has particular importance where extractive industries make up a large percentage of economic activity; as these industries tend to follow ‘boom and bust’ cycles that mirror commodity prices.

This section focuses on the growth potential for several industries that have been previously identified as target industries for Northwest New Mexico. Specifically, it presents information on the potential for logistics, manufacturing, natural resource, and tourism sectors in the study area. While some of the manufacturing sectors are linked to the energy sector, our intent with the research was to identify and evaluate those activities that enhance economic diversification, which would in turn lead to additional security and reliability in jobs and income opportunities for residents.

This section also presents research on ventures that may have not been considered before or possibly are under-represented in the local economy. While we do not explore all possible ventures that could

promote additional economic activity, this chapter presents a first-cut or reconnaissance level evaluation of enterprises across a wide range of economic sectors. Our evaluation considered the current market conditions and expected trends in the sector, the key characteristics and input needs of the venture in question and if these could be met in the study area, and potential economic impacts if the venture were to be developed (jobs, income, and other). Where possible, we identify specific recommended actions along with key players in the industry for recruitment and/or retention efforts.

In general, the analysis finds many opportunities to expand and diversify the Northwest New Mexico economy. However, **most of the enterprises with the greatest opportunity for immediate or mid-term development have relatively low number of jobs that would be created, but these jobs would provide relatively high levels of income generation potential.** This is especially true for **dimension stone mining**. Several sectors evaluated were seen as likely viable industries for the region largely because of the existing infrastructure in place today because of existing enterprises. This is especially true with petrochemical manufacturing, industrial gas manufacturing, and electronic component manufacturing.

**Large scale agricultural production and food processing are well-suited to the region** largely because of the irrigation potential and existing food processing and distribution at Navajo Agricultural Products Industries (NAPI) in San Juan County. On a small or medium scale there are also opportunities in specialty food products. However, unlike the other industries evaluated, these sectors tend to have seasonal workforce needs with low wage earning potential. The possible exception to this are large-scale greenhouses producing high-end food or medicinal products. There are also significant synergies

that could be explored between the agricultural / food processing sectors and both industrial gas and trans-loading (inland port) sectors.

The forest restoration and mine reclamation enterprises evaluated were found to be heavily reliant on federal funding or federal action in order to expand. Also, both were found to have the potential to provide significant social and environmental benefits to the region.

**The transloading and warehousing enterprise evaluated appears to have high potential in the near term;** especially as ports in the coastal states struggle with logistics and capacity. An inland port at the Gallup location could alleviate these pressures and provide full-time employment opportunities in the region, as well as provide a key asset that will likely attract other manufacturing related ventures. In order to capitalize on this recruitment potential we identify several areas of coordination between ocean carriers, port operators, and the railroad (BNSF) that could lead to competitive advantages for future tenants in the form of cost and time savings.

Finally, **the region has extraordinary cultural, historic, and outdoor recreation assets** that can attract increasing numbers of visitors, domestic and international, and enhance economic development through additional tourism.

The analysis first presents an evaluation that summarizes each industry's Strengths, Weaknesses, Opportunities and Threats (SWOT), followed by an explanation of the key findings by sector. **Appendix A** contains additional details of research findings in bullet form.

## 6.1 PETROCHEMICAL MANUFACTURING

Figure 6-1 Petrochemical Manufacturing SWOT

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Cheap and abundant feedstocks locally available</li> <li>• NGL pipeline running through the region, connecting it with CO, WY, and TX</li> <li>• Large petrochemical companies already produce natural gas in the region</li> <li>• NM offers a number of tax incentives for this kind of development</li> </ul>	<ul style="list-style-type: none"> <li>• Chemical plants can require thousands of acre feet of water annually, which may be difficult to procure over the long term in NW NM</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>• A recent study showed strong market potential for both urea and polypropylene plants in Northwest New Mexico</li> <li>• Strong demand for petrochemical products is forecasted in the short term</li> <li>• US natural gas is expected to grow in the short term, making inputs for the industry abundant and cheap</li> <li>• Large petrochemical companies have been expanding in recent years, and have been more willing to expand outside the Gulf area</li> <li>• This industry typically employs a large number of workers and pays high salaries</li> </ul>	<ul style="list-style-type: none"> <li>• Petrochemical plants are significant polluters and are subject to increasingly stringent environmental regulations</li> <li>• Recent petrochemical expansions could be a source of greater competition</li> </ul>

Petrochemicals are chemicals derived from refined petroleum or liquid hydrocarbons (e.g. natural gas). Petrochemicals are used in the production of a wide variety of industrial processes and consumer products. The abundant supply of natural gas in the nearby San Juan Basin, as well as the relatively low price of that natural gas, make the Four Corners area (primarily Northwest New Mexico and Southwest Colorado) an attractive location for a petrochemical facility (DeRosa *et al.*, 2016). Over the last two years, natural gas at the San Juan Basin has been 14 percent cheaper than at the Henry Hub, on average (U.S. DOI ONRR, 2016; U.S. EIA, 2016). A 2016 study indicated strong market potential for urea and polypropylene production from a plant in the Four Corners area. The study indicated that **urea produced in Four Corners would have a market advantage supplying consumers all over the Western U.S., who would use it for fertilizer**. Additionally, the Four Corners Power Plant requires a large amount of urea to operate emissions control equipment, creating a local industrial client. The study also found strong market potential for polypropylene both in the Midwest and Western U.S., and international markets (DeRosa *et al.*, 2016). Polypropylene is a feedstock used to manufacture a wide variety of products, including packaging and textiles.



*Picture of Petrochemical Plant in Saudi Arabia*

Historically, petrochemical facilities have been clustered around the Gulf Coast to take advantage of feedstock supply, plentiful water resources, access to sea transportation, and to supply intermediate products to other petrochemical facilities (University of York, 2013). However, there has been a trend recently toward more dispersed manufacturing; about 30 percent of the expansions announced in the last few years have been for facilities outside of the Gulf Coast states. One of the more recent examples is Shell's decision to build a facility northwest of Pittsburgh. The location was

chosen because of its proximity to feedstocks and customers (Shell, 2016). State tax incentives (estimated at \$1.65 billion) also likely influenced the siting decision. Shell's facility is projected to create 6,000 construction jobs and employ 600 people permanently (StateImpact, 2016). **Petrochemical facilities have strong economic impacts, employing an average of 160 workers per facility at salaries of \$116,000 per year** (U.S. Census Bureau, 2016).

The recommended action step for the EDO's in the region, primarily those in San Juan and McKinley counties, is to **use the DeRosa publication (DeRosa *et al.*, 2016) as a starting point in recruitment efforts**. A logical next step would be to share the findings of this publication with companies considering expansion or development in the petrochemical sector. Chevron Phillips Chemical Company is an example of a company that could be targeted for recruitment in this sector. Chevron Phillips is one of the largest chemical companies in the US and is owned by two companies with a presence in New Mexico: Chevron and Phillips 66. Other potential chemical companies could be identified at trade shows such as the American Fuel & Petrochemical Manufacturers (to be held in March 2017 in San Antonio, Texas) or the World Petrochemical Conference (also in March 2017 in Houston, Texas).

A second step involving the EDO, specific to novel or startup ventures in this sector, is to **assist companies with interests in expanding or re-locating to the area** with finding research funding to conduct a feasibility study of their specific development concept. While the DeRosa study provides valuable information, further details would be needed to test the viability of an individual venture and prepare pro formas for financing. In instances involving novel products or small businesses, grant funds could be relevant for this type of research would include:

- Rural Business Development Grants (for businesses with fewer than 50 employees and less than \$1 million in gross revenue) (USDA, Rural Development)
- National Science Foundation (NSF) for novel chemical products (Foundation)

## 6.2 DIMENSION STONE

Figure 6-2 Dimension Stone SWOT

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>All three counties have areas with “high potential” to produce dimension stone</li> <li>The 4C area already has the business, logistical, and workforce capabilities to conduct mining operations</li> <li>The dimension stone being mined in 4C has been described as “high quality”</li> </ul>	<ul style="list-style-type: none"> <li>A burdensome permitting process and lack of private land pose barriers to mining new areas</li> <li>Stone would have to be trucked out of the area, which is more expensive than movement by rail</li> <li>There is strong international competition from Turkey, India and Mexico for some stone</li> <li>Much of NW NM is public land, which is harder to access for stone mining</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>High transportation costs makes it more economically viable to supply local markets</li> <li>Permits for new housing units in Albuquerque have increased significantly in the last five years</li> <li>Sales of dimension stone have increased steadily in the last five years</li> <li>A recovering housing market is expected to increase demand for stone</li> </ul>	<ul style="list-style-type: none"> <li>AZ and TX were the largest producers of dimension sandstone in the US in 2014</li> </ul>

Dimension stone is primarily used as a natural, durable, and attractive building material with a wide range of applications including (but not limited to) tiles, step stones, counters, and landscape rock. In 1986, studies by the New Mexico Bureau of Mines and Mineral Resources found large deposits of dimension stone in the three county study area with “high potential,” meaning they were economically extractable and potentially of marketable quality (McLemore *et al.*, 1986). Exploited deposits have been described as being very high quality and, in some cases, having rare and desirable color (Vunjerovic, 2016; Winer, 2016). For an area that already has the workforce and logistical infrastructure to conduct mining operations, **expanding stone mining in the three county study area could be a natural fit for future economic development.**

Despite Northwest New Mexico’s advantages, there appear to be only two quarries currently mining dimension stone: the Ray Claims and Neff Trust. Individuals familiar with the stone industry have offered a number of explanations for why the region’s deposits have not been exploited more fully: High up-front capital costs, competition from low-cost producing countries such as Turkey and India, federal government regulation and bureaucracy, lack of entrepreneurship in the industry, and difficulty in securing buyers for the stone (McLemore, 2016; Vunjerovic, 2016; Winer, 2016). According to local reports, the most significant barrier appears to be regulation. The environmental permitting process required to gain access to public land is complex, time-consuming, and often



Picture of Dimension Stone in Colorado

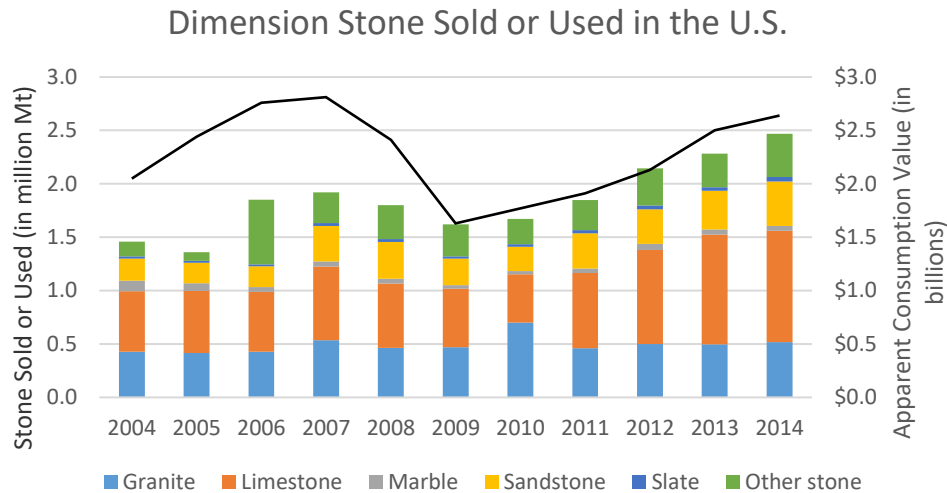
expensive, as most firms have to hire an environmental consulting company to guide them through the application process (Hewitt, 2016; Winer, 2016). According to BLM representatives, the NEPA requirements for stone mining on public land would require an Environmental Assessment (EA). An EA for this type of operation may cost a developer around \$50,000. While the environmental review process can be avoided by mining on private land, many of the deposits with ‘high potential’ are on public land, making the process an important limiting factor to expanding dimension stone mining in the area.

Because buildings are the primary use for dimension stone, construction is the principal driver of demand. Demand for New Mexico dimension stone extends into Texas, Colorado, and California, potentially giving new quarries to the three county study area a large market (Vunjerovic, 2016; Winer, 2016). In the five states surrounding New Mexico, plus California, the pace of new housing units being constructed has more than doubled in the last five years. Housing starts in the counties in and around the Four Corners region have increased over 150% in that same time period, primarily as a result of growth in Albuquerque (U.S. Census Bureau, 2016). Nationally, commercial and residential construction is expected to increase demand for stone in the short term (IBIS World, 2016). These markets may be source of demand for stone from the three county study area. Existing distributors in the Albuquerque area, such as New Mexico Travertine and Rocky Mountain Stone, may be able to supply local markets for new stone should it become available. While current mining operations are relying on truck transport, a railroad line connecting San Juan County to the BNSF line near Gallup or Grants would allow stone producers to reach more distant markets at a lower cost (Winer, 2016). One recommended expansion strategy is for the regional EDO’s to **further explore the rail line concept, keeping in mind the stone products and their specific transportation needs.**<sup>10</sup>

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<sup>10</sup> During the meeting on November 9<sup>th</sup>, 2016 there was discussion on a regional transportation steering committee. This issue of transporting stone products is an issue that could be explored through this committee.

Figure 6-3 Historical Use of Stone in United States



Source: (U.S. Geological Survey, 2016)

Based on County Business Pattern (CBD) data it appears that there are generally 30 to 40 employees per enterprise related to dimension stone mining for large enterprises. Nationally, the US Census Bureau reports an average of less than 10 employees per enterprise. Average pay per employee is reported to be above \$24 per hour. While these appear to be well compensated jobs the number of jobs per enterprise is not large due to the reliance on specialized equipment in the mining process.

Major producers in this sector include: Gordon Stone Co. LLC; Harley Gray Stone Co.; MBK Associates LLC; Schaefer Enterprises of Deposit, Inc.; and TBK Materials LLC. These leading producers accounted for about 30% of the tonnage and 13% of the value of domestic production (Dolley, 2016). In the second quarter of 2016 companies with the most reported employee hours in mining dimension stone included: Continental Cement Company, Cobra Stone Inc, Dos Rios Stone Products Operations LLC, Rock-it Natural Stone Inc, and Champion Stone Co.

**We recommend recruitment efforts focus on a targeted marketing campaign to locate and assist companies in identifying and developing the stone resources in the region.** The National Stone, Sand and Gravel Association (NSSGA) members would be a target population for such an outreach. Preliminary conversations with NSSGA indicate that it may be possible to work with them in implementing a marketing campaign to identify companies with an interest in expanding or relocating to the three county region (Dunne, 2016). The marketing campaign should extoll the virtues of the region that are critical to a developer, such as the intermodal transportation options being developed, proximity to key growth markets, mining heritage / culture, and abundant stone resources.

### 6.3 INDUSTRIAL GAS MANUFACTURING

Figure 6-4 Industrial Gas Manufacturing SWOT

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>The largest company in N. America, Praxair, already has facilities in the region and has expanded those facilities in recent years.</li> <li>The oil and gas industry in the Four Corners region provides a significant source of demand for industrial gas</li> <li>The costs of electricity are low relative to the rest of the nation</li> <li>NM offers tax breaks to manufactures opening new facilities or expanding existing operations</li> </ul>	<ul style="list-style-type: none"> <li>Praxair has recently expanded facilities in the area, which may satisfy any unmet demand</li> <li>Manufacturing industries that typically require industrial gases are not abundant in the three county study area</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>This industry is dominated by a few companies with large and protected market shares. If they open or expand facilities in the three county study area, this could be a secure source of jobs.</li> <li>The oil and gas industry, if maintained, could offer a reliable source of demand</li> <li>This industry pays relatively high wages and employs a fair number of people.</li> <li>Nitrogen produced in NW NM could be helpful to a nearby food processing industry</li> </ul>	<ul style="list-style-type: none"> <li>This industry is dominated by a few companies with large and protected market shares. If these companies do not choose to expand in the area, there is a high barrier to entry in the industry.</li> <li>Demand for gas produced by Praxair's facilities is driven by the oil and gas industry in the Four Corners area. If industry production falls, this would impact Praxair's future demand.</li> </ul>

Industrial gases are manufactured for use in a wide range of industrial processes. In the Four Corners area, one important source of demand for industrial gas comes from the oil and gas industry in the San Juan Basin, which uses nitrogen gas to assist in hydraulic fracturing. In the U.S., production of industrial gases are dominated by a small number of large companies; four firms control 80 percent of the industry revenue (Silver, 2015). Because of this, any expansion of industrial gas production in the Four Corners region would likely have to come from these companies. Fortunately for the region, the largest of industrial gas producer in the U.S., Praxair, already has a presence in the area. In 2014, Praxair announced that it would be expanding its nitrogen-producing facilities in Kirtland in order to meet demand by the oil and gas industry (Praxair, 2014). This is overall a positive development for local economy. This and/or additional expansion in this sector could provide additional capacity to supply gases to other potential local industries, such as hydrogen, carbon dioxide, and nitrogen for the food processing industry (existing in and around Albuquerque, as well as potential industries at NAPI); and oxygen for the medical industry. Expansions of these other industries locally could motivate Praxair to expand their operations further. Therefore, as an expansion strategy for this sector we recommend focusing on recruitment of the industries that are users of industrial gas.

The three county study area does offer a few advantages to an industrial gas company looking to expand in the area. Electricity, the largest operating cost for some industrial gases, is cheaper locally than the national average (Electricity Local; Universal Industrial Gases, Inc.). Also, the state offers tax incentives for manufacturing, which if combined with local tax incentives similar to those given to Praxair, could

make the three county study area more attractive for industrial gas development (NMEDD, 2016; Schwartz, 2014). If there were further industrial gas development in the area, it could bring valuable economic benefits. **On average, industrial gas facilities employ about 31 people and provide an average annual pay of \$73,000 per employee** (U.S. Census Bureau, 2016). However, as mentioned above, due to the presence of Praxair we recommend focusing efforts on retention and expansion, and not recruitment of other industrial gas manufacturers.

## 6.4 CROP PRODUCTION

Figure 6-5 Crop Production SWOT

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>Climate is suitable for wide range of crops to be produced</li> <li>There is infrastructure in place to irrigate approximately 200,000 acres in the three county region (Mostly concentrated in San Juan county)</li> <li>Strong demand in the state from dairies (forage)</li> <li>Existing processing at NAPI, Bernalillo and other places also contributes to demand for crops; as does large metropolitan areas (e.g. Gallup / Albuquerque) for fresh market produce</li> <li>Proximity to LA area ports for export</li> <li>Cost of and access to natural gas for heated greenhouse production</li> </ul>	<ul style="list-style-type: none"> <li>Some tree fruit crops may have agronomic limitations due to spring frost</li> <li>Smaller, and older irrigation systems may be unreliable, with outdated infrastructure for water delivery.</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>Recruitment of greenhouse operations given competitive advantage in cost of natural gas, climate, and proximity to research institutions</li> <li>Increasing demand from Asian countries for forages</li> <li>Jujube research by NMSU indicates this is an ideal crop for the study area. The market for this crop is mainly Asian cultures.</li> </ul>	<ul style="list-style-type: none"> <li>Strength of US currency will likely work against expanding export markets</li> <li>Port capacity could also be a barrier to increasing export activity</li> </ul>

Crop production is defined here as activities involving either horticulture or row crop production; as well as indoor high tunnel and greenhouse activities. Currently, production in the study area is concentrated in San Juan County, near Farmington at the Navajo Agricultural Products Industry (NAPI). The crop mix at NAPI consists of a variety of crops including alfalfa, wheat, dry beans, popcorn, pumpkin, hybrid poplar, dent corn, and chipping potatoes. Other crop production in the study area consists of forage crops for livestock, largely for personal use (e.g., for horses, cows, and sheep).

New Mexico is home to six of the seven life zones in the world. The long growing seasons and mild winters allow crops to be produced year-round in some areas of the state. The abundant sunshine and dry weather also produce less mud and fewer diseases for farm animals; which has been a reason for the increases in the number of dairies over the past two decades.

Large scale fruit and vegetable production could provide high valued crop regionally and, as demonstrated at NAPI, is suitable for the region. Vegetables (which include melons) are the most valuable sector of San Juan County's agricultural industry (\$21 million in 2012), consisting of watermelons, squash, and sweet corn among others. These three crops generally go toward direct sales markets (U.S. Department of Agriculture, 2012).

However, many of the soils in the region are extremely sandy which can be problematic (depending on coarseness and loam content) in that they do not have the water holding capacity. To mitigate this, commercial vegetable producers like NAPI use center pivot technology so water can be applied uniformly and often. Cover crops are also used to retain soils from wind erosion. (Stout, 2016).

Recent research released from NMSU indicates two fruit crops that hold promise for the region include grapes (table and wine) as well as Jujube. In addition, berries (such as blackberries and raspberries) are also prolific producers, especially when produced inside a high tunnel system (Yao, 2016).

The study area has plentiful resources of natural gas that could be used in heating controlled environments for a wide variety of fruit, vegetable, and nursery plant structures. Recently there was a large (160 acre) greenhouse development project announced with Acoma Pueblo and Bright Green Group (former greenhouse in Grants). The facility will focus on medicinal uses of plants (Bright Green Group of Companies, 2016).

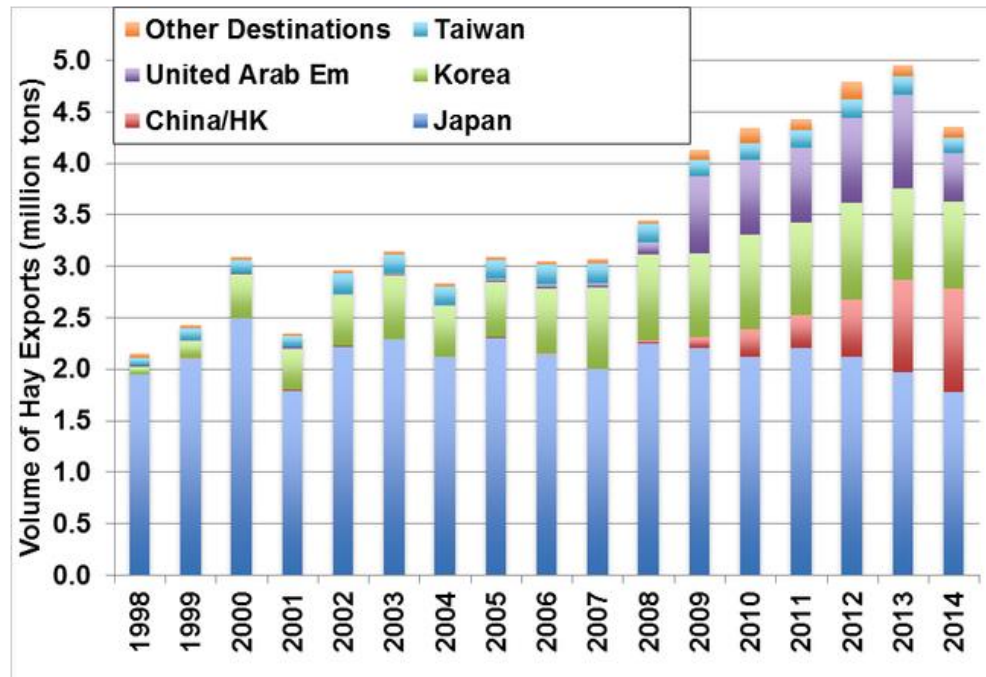
The market for crops used in processing is explored further below (food processing). The market for forage production in the southwest is driven by two main factors: One, is the increasing trend of dairies expanding and relocating in New Mexico. New Mexico has around 150 dairies averaging over 2,000 cows per dairy (which is the largest average herd size in the country). Dairies require high quality alfalfa feed, generally first or second cutting (New Mexico Dairy Association, 2016). Two, is the increasing trend of increased exports from western ports to Asian countries, as depicted in the following figure.<sup>11</sup>

Another signal of growth in this sector is that Anderson Hay (private company involved in hay exports) doubled their production of alfalfa at NAPI from 4,000 to 8,000 acres between 2015 and 2016 (Larson, 2016). For exports of forage, the southern ports of Long Beach and Los Angeles tend to be favored due to the high volume of trade there, and the resulting large volume of 'empties' sent back to Asia from that port, resulting in less expensive shipping costs (Putnam, 2015). Primary siting factors for crop production include availability of water; land availability; soil productivity and development costs (e.g. clearing, roads, etc. for new irrigation); access to necessary equipment and infrastructure; workforce and markets. One challenge with large scale agricultural production is finding an available supply of seasonal workers. Also, while profit potential is strong for proprietors of certain crops the wages earned by employees in this sector are relatively low compared to other industries.

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<sup>11</sup> 2014 showed reduction in export activity for forage due strong US currency and reduced port capacity;

Figure 6-6 Volume of Hay Exported from Western Ports



Source: (Putnam, 2015)

Entrepreneurship opportunities in the high tunnel and greenhouse sector exist for small to mid-scale producers with specialty crops. Programs offered by NRCS cover a significant portion of costs and offer technical support for start-up ventures. **We do not see a need to further incentivize entrepreneurship efforts in the crop production sector.**

Expansion strategies for greenhouse sector are most relevant to Cibola County, where Bright Green Group has announced intentions to develop a greenhouse for medicinal plants on the Acoma Pueblo. Cibola County has already passed a Local Economic Development Act (LEDA); so one expansion strategy would entail securing LEDA funds to fill gaps for the proposed economic development, where relevant. An example of where LEDA funds were used in greenhouse development in New Mexico was the 2015 development of a large greenhouse in Las Cruces (Gibbs, 2015).

Expansion strategies for open field production sector are most relevant to San Juan County where NAPI has water rights for and federal settlement funding to develop additional blocks of irrigation (amounting to between 20,000 and 30,000 acres). However, limitations in federal funding, specifically with Bureau of Reclamation, have hampered development. One action that could help NAPI achieve full-build out would be for **the local economic development organizations to join with Navajo Nation in lobbying the federal government or otherwise bringing attention to this matter at a federal level.** Since 2010, alfalfa grown in San Juan County has yielded an average of 5.5 tons per acre (NASS, 2016). At \$226 per ton (the average price in New Mexico since 2010), the additional irrigation from full-build out of Navajo's irrigation system could generate between \$25 and \$38 million. This would be new output to the area, as the current use of this land is not generating income currently.

**Recruitment strategies regarding crop production are most relevant to the greenhouse sector, and are applicable to all three counties. One recommended recruitment strategy is to develop a marketing brochure that touts the regions mild winter weather, natural gas price advantage, land availability, and proximity to research institutions and seasonal workforce (e.g. college students), along with access to rail and road infrastructure, and ease of permitting.** These brochures could then be targeted at Canadian greenhouse growers<sup>12</sup> as well as the top 100 greenhouse producers in the United States.<sup>13</sup> **For every mid to large scale greenhouse recruited to the area there could be approximately 100 jobs created.**

## 6.5 FOOD PROCESSING

Figure 6-7 Food Processing SWOT

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>Foods products would have two-day access to markets in California, Texas, and Mexico; plus distributors have a presence locally</li> <li>The costs of electricity are low relative to the rest of the nation</li> <li>Current production of food crops in the region (NAPI)</li> <li>Pueblo and Navajo traditional foods provide an unique marketing angle</li> <li>Existing processing in the region for wine grapes, dry beans, grain corn, popcorn</li> </ul>	<ul style="list-style-type: none"> <li>Crop production in the region is low relative to other areas of New Mexico</li> <li>Additional feedstock inventories would be needed before expanding meat processing</li> <li>Transportation in and out of the region is limited to trucking, which is more expensive than rail</li> <li>Labor costs can make food products more expensive than products imported from international regions</li> <li>Unless a niche product profit margins are generally thin per unit</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>A large portion of New Mexico's agricultural products are sent out of state for processing; opportunities exist to add value and recirculate the local food money in the region and reduce environmental impact of foods consumed.</li> <li>Processors and retailers with emphases on locally sourced foods could significantly increase economic impacts regionally</li> <li>Major international opportunities exist for jujube drying and packaging</li> <li>Entrepreneurship opportunities in the form of business incubator</li> <li>Possible link with frozen (IQF) food processing with Praxair nitrogen gas.</li> </ul>	<ul style="list-style-type: none"> <li>Other areas (e.g. Bernalillo and Hatch) have established food processing clusters.</li> <li>Large scale food processors internationally may hold a cost advantage due to labor</li> <li>Additional regulation expected soon with Food Modernization Act</li> </ul>

Food processing includes any procedure that takes raw agricultural products and modifies them to be more marketable to consumers or other food manufactures. When evaluating the potential for

<sup>12</sup> See <http://www.flowerscanadagrowers.com/flower-growers/canadian-greenhouse-growers-directory>

<sup>13</sup> See <http://www.greenhousegrower.com/business-management/2016-greenhouse-grower-top-100-growers-the-complete-list/>

expanding food processing in the area, the critical factors are similar for other manufacturing industries: Access to inputs (i.e. raw agricultural goods), access to consumer markets, and local infrastructure. In the study area, **NAPI offers significant advantages in terms of inputs. Further, the study area's proximity to transportation corridors and international ports make it ideal for access to consumer markets.**

In terms of raw agricultural products that could be processed into value-added goods, current production and storage of potatoes, dry beans, popcorn, and wine grapes offer potential immediately. Crops that are being researched now and hold processing potential in the mid-term include berries, jujube and various vegetable crops (including chile). By far the largest portion of cropland is dedicated to forage crops (45 percent), which is used to support the region's livestock production. If additional meat processing on a large scale were to be considered; additional inventory and capacity in the feedlots regionally would be required (Crawford *et al.*, 2008). A study by Crawford *et al.* found that additional New Mexico slaughtering facilities would be met with stiff competition from Texan facilities. An economic analysis conducted as part of the water right investigation (2012) showed several food processing ventures that held strong potential, including a dairy and dairy product manufacturing, feedlot and meat processing, and potato processing (Cardno ENTRIX).

An entrepreneurship focused strategy that local EDO's could implement related to food processing is to **invest in or develop a food venture incubator.** There are several examples of food incubators identified in Appendix A (5 are identified in the state of New Mexico alone). The advantage that incubators provide processors is lower overhead costs through offering commercially licensed food processing space. Thus, small startups can avoid the costly and often time consuming process of investing in their own space and going through the licensing and permitting process individually. This could be particularly useful for small startups, food trucks, and food caterers. The impact of a food business incubator will likely be felt in terms of jobs or income but also supporting crop production sectors, further recirculation of money in the local economy that would have been spent outside the region, and reducing the environmental impact (mainly in the form of energy used to transport) of food products consumed locally.

A recruitment strategy for large scale food processors is most relevant to San Juan County due to the presence of NAPI (raw crop production capability) and Praxair (nitrogen gas supplier for processing). However, this is also possibly the most challenging environment to recruit food processors as most of the land is in trust status controlled by Navajo Nation. Large food processing companies may be attracted to the region, but they would also likely require Navajo Nation to waive their sovereign immunity in order to relocate to the trust lands. One possible solution would be to **identify private land near NAPI in the Farmington area that would have easy access to raw material and other necessary inputs from NAPI as well as other production areas of Colorado within close proximity to Farmington.** Alternatively, private food processors could be attracted to the transportation options at Gallup but would have to weigh the tradeoffs with this location in proximity to the major production zone at NAPI (120 miles away). According to the 2014 Quarterly Census of Employment and Wages, Northwest New Mexico food manufacturing facilities employed 52 people and paid over \$1 million in annual wages (U.S. Census Bureau, 2016). One new medium to large scale food processor in the area would likely double this employment and wage level for the region.

**Recruitment efforts are suggested for potato processors such as Frito Lay and Poore Brothers (Inventure Foods) that already rely on potatoes produced and stored at NAPI.** Further, compressed alfalfa bales processed by Anderson Hay, designed to fit into shipping containers for overseas export could be a good fit for the Gallup Land Partners. Currently, Anderson Hay leases ground from NAPI for alfalfa production. Processing the bales in Gallup for overseas export could potentially reduce shipping costs if conditions at Gallup Land Partners were adequate to handle their needs. Through conversation with Anderson Hay it was revealed that they've looked into the possibility of using rail to transport their containers of compressed hay but the port options that they've explored have not provided the cost savings or convenience they were hoping to achieve for one reason or another. The key characteristics that may be attractive to Anderson Hay are: 1) the ability to load a container with hay and not paying drayage or other fees before it arrives at the ship dock in one of the LA ports; 2) 24 hour access to load containers; and 3) low or no minimum number of container orders (Larson, 2016).

## 6.6 FOREST RESTORATION & FOREST PRODUCTS

**Figure 6-8 Forest Restoration & Forest Products SWOT**

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>Restoration/harvesting arrangements have received funding support in the three county study area recently</li> <li>The U.S. timber industry has seen growth in production of some timber products</li> <li>One facility in the study area is currently manufacturing a number of wood products, demonstrating some market demand</li> </ul>	<ul style="list-style-type: none"> <li>Forested area is limited in NW NM</li> <li>Efforts to open access for forest restoration have failed in the past</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>The Mt. Taylor forest has strong potential to support restoration and forest products</li> <li>In recent years, NM sawmills have been operating far below capacity</li> <li>The Southwest U.S. does not have an OSB manufacturing facility, which would give an future facility a transportation cost advantage</li> <li>Multi-stakeholder approach to funding forest restoration with the aim of preserving recreation, industry, wildlife habitat, water quality, and other functions of a healthy forest</li> </ul>	<ul style="list-style-type: none"> <li>Restoration is heavily-dependent upon federal funding, which is subject to political uncertainty</li> <li>Pueblos in the region may want to preserve culturally-significant forests</li> <li>Very little timber has been harvested in the three county study area in recent years</li> <li>The demand for many timber products, including printing and writing paper, newsprint, wood pulp, has been dropping off for about 15 years</li> </ul>

Forest restoration and forest product manufacturing has the potential bring multiple benefits to Northwest New Mexico. Restoring forests can increase wildlife habitat and restore culturally-important landscapes to historic conditions. Thinning operations, which facilitate the forest's restoration, can supply timber to wood manufacturing facilities, provide firewood to local communities, while also reducing the risk of catastrophic fires (U.S. Forest Service, 2016).

Northwest New Mexico has seen a recent example of partnership between forest restoration and manufacturing forest products. Beginning in 2012, the Zuni Mountain Collaborative Forest Landscape Restoration Program (ZMCFL) began restoring forests in the Mt. Taylor Ranger District within Cibola National Forest. Thinning efforts over 2,700 acres have produced 6,350 hundred cubic feet of timber, which is processed by a sawmill in Milan owned by Mt. Taylor Manufacturing (MTM). These operations support 45 full-time harvesting and processing jobs (The Nature Conservancy, 2016).

The forests surrounding Mt. Taylor are suitable for restoration and timber harvest, and the timber is reportedly higher quality than what is currently being harvested in the Zuni Mountains. Additionally, the site has a build-up of fuels, making it very susceptible to devastating wildfire. Currently, there is no access developed to the site to conduct harvesting, but a plan has been developed to build a road for such operations. **If all local stakeholders and tribes support the initiative to thin forests on Mt. Taylor, it could justify the establishment of a new sawmill to process the timber.** The addition of a kiln and planer would allow the production of higher-value wood products than those currently being produced at MTM, which could be sold to more distant markets. **Such a mill is estimated to cost about \$30 million, employ about 50 people, and support another 70 – 80 jobs in harvesting and trucking** (Allen, 2016). According to national data, employees in wood product manufacturing receive average wages of \$39,000 per year (U.S. Census Bureau, 2016). In Northwest New Mexico, employees in truck transportation receive average wages of \$51,700 per year (Bureau of Labor Statistics, 2016). If the above projections of employment are accurate, a new sawmill could bring in \$5.5 - \$6.1 million in additional income to the region.

**Unfortunately, the economics of forest restoration make it dependent upon public funding support.** This puts the industry on an uncertain funding basis. Current funding for the ZMCFL is set to expire in 2019, and it is unclear whether Congress will choose to re-fund, expand, or eliminate the program (Krasilovsky, 2016).

**Figure 6-9** below displays how employment in forest and timber occupations dropped dramatically over the past thirty years.

Figure 6-9 Employment in Forestry and Wood Product Occupations, United States

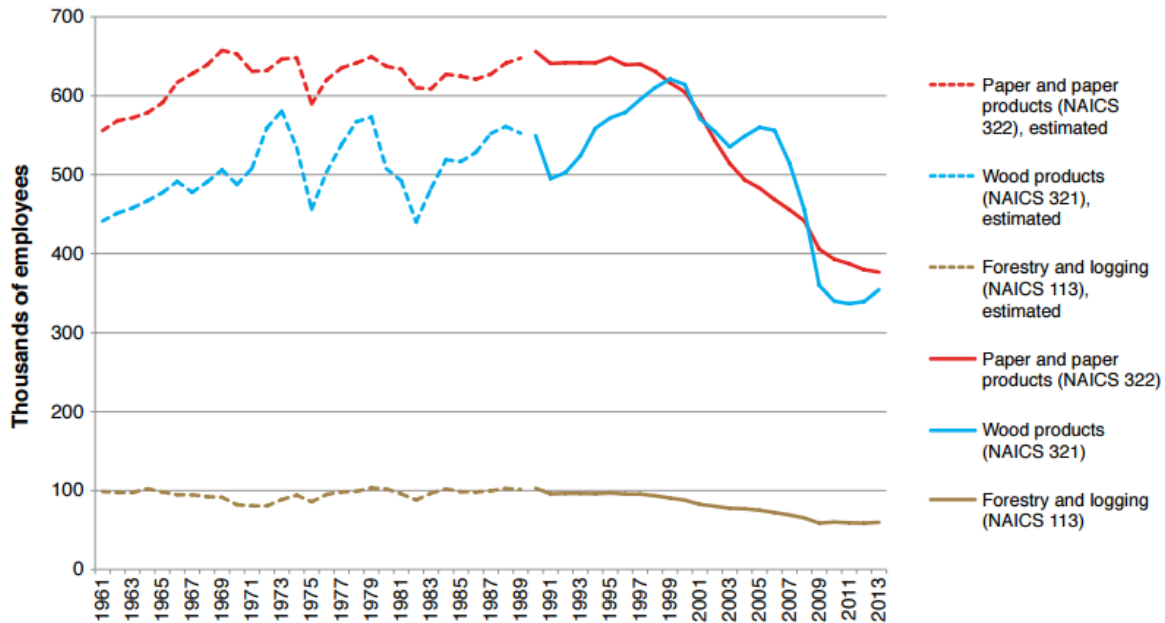


Figure 18—Employment in the forest products sector in the United States, 1961-2013  
(Source: U.S. Bureau of Labor Statistics 2014a, 2014b, 2014c).

Today, logging is a necessary component of forest health as many recognize that without management of the forest, it is prone to unhealthy ecological conditions prone to severe high temperature wildfire (Logan, 2016). The recommended expansion strategy related to forest restoration is mostly relevant to Cibola county. **The suggested action items for this sector are to 1) Facilitate further discussion with the stakeholders (pueblos, Forest Service, and Mt. Taylor Manufacturing) to identify challenges and solutions associated with the plan to expand thinning operations 2) Work with local federal representatives and local non-governmental organizations' (NGOs) efforts (including Forest Stewards Guild) to lobby for federal funding to renew the ZMCFL post 2019.**

## 6.7 MINE RECLAMATION

Figure 6-10 Mine Reclamation SWOT

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>Northwest New Mexico has roughly 30 active mines that may require reclamation in the future</li> <li>There is already an existing reclamation industry in the Four Corners region</li> </ul>	<ul style="list-style-type: none"> <li>The reclamation industry does not have steady employment, as NM has seen recently</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>Programs at the state and federal level have the potential to provide large amounts of funding for this kind of activity</li> <li>New Mexico has over \$21 million worth of AML reclamation outstanding</li> <li>There are six Superfund sites in the region that could qualify for funding</li> </ul>	<ul style="list-style-type: none"> <li>There is strong competition for federal funding</li> <li>Sustained economic activity largely depends on government funding, which can be unreliable</li> </ul>

Like forest restoration, reclaiming mined areas provides multiple benefits. Reclamation efforts can protect water resources, restore wildlife habitat, and make the land usable for development. At the same time, it supports jobs and economic activity. Four Corner's legacy of mining has left substantial room for reclamation efforts. As of 2014, there were 29 active mines in the three-county area with 960 acres disturbed by mining (Martinez & Sheperd, 2014; NM EMNRD, 2014). As of 2008, nearly 600 abandoned uranium mines were identified in McKinley, Cibola, and Sandoval Counties, with damages totaling hundreds of millions of dollars (Power, 2008). Additionally, Northwestern New Mexico has six sites on the National Priorities List (NPL; more commonly referred to as Superfund sites) and at least 15 sites in various stages of development under the state-level Abandoned Mine Land (AML) program (EPA, 2016; NM MMD, 2016).

From an economic development standpoint, **mining reclamation has the advantage of keeping mining revenue in the area or bringing in money from outside the area.** Reclamation funded by the company responsible for the mine brings mining revenue back into the local economy (assuming local firms and labor are used). Northwest New Mexico has a history of conducting mine reclamation using local firms. In 1988, Laguna Pueblo created the Laguna Construction Company to reclaim the Jackpile Mine in Cibola County. The company went on to reclaim other sites in the region, as well as other states (Lorenzo, 2010). While the company is no longer operating today, it demonstrates the region's ability to develop a local mine reclamation industry.

Other programs can bring money in from state or federal levels, including the AML program, CERCLA (Superfund), and Clean Water Act Grant Program. Unfortunately, the need for funding far outweighs the available resources, so competition for these funds is high. There are more than 1,300 sites that are currently on the NPL (EPA, 2016). Under the Superfund program, sites are prioritized to protect human health and guard against significant environment threats (EPA, 2016). The state-level AML program also gives priority to mines that pose extreme danger to public health (Kretzmann, 2016). The statuses of the

Northwestern New Mexico sites indicate no eminent threats, and so are less likely to receive funding unless substantial local and political support is mustered.

Mine reclamation can have positive economic impacts. In 2014, mine reclamation employed 324 people statewide. However, the industry has not offered steady employment, fluctuating widely from year-to-year over the last decade (NM EMNRD, 2015). Still, average pay for workers in the industry is substantial: nearly \$70,000 per year (U.S. Census Bureau, 2016). While the three county study area could benefit both economically and environmentally from a larger mine reclamation industry, the difficulty in securing outside funding make it a tenuous source of economic development.

To expand mine reclamation activity in the area, one **recommended action item is for local governments to work with organizations that have a mutual interest in reclamation**. One example is the New Mexico Environmental Law Center in Santa Fe, where Eric Jantz specializes in the legal issues surrounding uranium mining. He recommends that local government leaders can pressure state and federal agencies to increase reclamation funding, hold responsible parties accountable for mine damages, and act more quickly to complete reclamation projects.

## 6.8 RENEWABLE ENERGY COMPONENT MANUFACTURING

Figure 6-11 Renewable Energy Component Manufacturing SWOT

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>The three county study area is located near both solar and wind resources, making it a good candidate to supply these markets</li> <li>New, taller wind turbines have recently made areas in and around Four Corners viable for wind power generation</li> <li>NM offers tax benefits for the production of wind power components</li> </ul>	<ul style="list-style-type: none"> <li>Weak wind resources in area limit the local demand for wind power components</li> <li>Other areas of New Mexico are located closer to wind resources, making it likely that a company manufacturing large components in the state would choose to do so elsewhere</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>Solar and wind power consumption is expected to grow in the short term</li> <li>Both federal and state policies supporting renewable energy help increase demand for these industries</li> <li>The DOE expects wind capacity to grow substantially in NM, TX, AZ, and CO in the near and long term</li> </ul>	<ul style="list-style-type: none"> <li>A wind turbine manufacturing facility in NM would likely have to compete with existing facilities in TX, AZ, and CO</li> <li>The near-term prospects for expanding the solar industry do not look good, as inventories are high, manufacturing is highly competitive, and prices expected to continue to decline, making it difficult for manufacturers to make a profit</li> </ul>

The three county study area is situated in the middle of considerable solar resources and near wind resources, making it a potentially advantageous location to produce renewable energy components. The State of New Mexico, along with each of its neighboring states, and even some municipalities, have set goals for growth in renewable energy, assuring a source of regional demand for these goods in the next five to ten years (DSIRE). Installations of both wind and solar resources are expected to grow steadily in

the next five years, with demand for solar remaining strong through 2040 (US EIA, 2016). The costs of both solar and wind power have fallen significantly in recent years and are expected to fall further in the coming decades, making it increasingly likely that demand for components will grow in the long-term (Parkinson, 2016).

While demand for renewable components may be strong, supplying that demand with a facility located in the three county study area may be challenging. In the solar industry, overproduction of photovoltaic (PV) modules has resulted in steep price declines in recent years. Fierce global competition, especially from China, has forced some PV manufactures in the U.S. to close, downsize operations, or consolidate to cut costs (Platzer, 2015; Potheary, 2016; Solar Foundation, 2015). In the wind industry, there is a trend toward larger wind turbines that are able to make use of wind resources that were previously too costly (US DOE, 2015). This has made new wind resources available in and around New Mexico. Producing components for these extra-large wind turbines requires overcoming major challenges in transportation, including highway constraints, special equipment, and support vehicles (U.S. DOE, n.d.). Because of this, it is important to locate manufacturing facilities near the site of installation. If a wind power manufacturer chose to build large components in New Mexico, they would likely chose a location in the eastern part of the state where the facility would be closer to more abundant wind resources, as well as Eastern Colorado, Western Texas, Oklahoma, and Kansas.

A more reasonable expectation for Northwest New Mexico is to **focus recruitment efforts on smaller electronic manufacturing firms that build components for wind turbines**. This would avoid the substantial transportation costs and barriers of building larger components, while taking advantage of the area's skilled workforce, which is reported to be especially adept at manufacturing electronic components (Ryan, 2016). Turbine nacelles require a variety of electrical components, and a facility in Northwest New Mexico would be well-positioned to supply the large wind manufacturing industries in Colorado and Texas (NREL, 2010). The fact that New Mexico gives special tax breaks to wind power manufacturing facilities could make the three county study area a more attractive location for development. Wind component facilities tend to employ large numbers of people (250-300) (NREL, 2010).

Major players in the wind turbine industry include GE Wind, Vestas, and Siemens. Major producers in the solar panel sector include Trina Solar, JinkoSolar, Canadian Solar and JA Solar. A small handful of manufacturers dominate the polysilicon production for photovoltaic solar panels. The largest manufacturer is GLC Poly (china), followed by Wacker-Chemie (Germany), Hemlock (US), and OCI (South Korea). SolarWorld's Oregon facility is the largest solar cell and module plant in the United States, with the capacity to produce 500 MW of solar cells per year at full production. Other foreign-based firms, such as Sanyo Solar and SMA Solar, also operate PV primary component plants in the United States (Platzer, 2015).

**A recommended strategy for recruitment includes preparing marketing materials for wind power manufacturers on the benefits of locating their manufacturing in Northwest New Mexico**, and distributing these materials in person to attendees of the American Wind Energy Association (AWEA) Wind Power Conference & Exhibit in Anaheim, California during May of 2017. In 2016 this conference attracted 7,150 attendees; of which nearly 860 attendees (12 percent) were in the 'component supplier' sector (AWEA Wind Power, 2016).

## 6.9 ELECTRONIC COMPONENT MANUFACTURING

Figure 6-12 Electronic Component Manufacturing SWOT

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>The workforce in the 4C area has been praised for its skill in this industry</li> <li>Computer and electronic manufacturing is the largest manufacturing industry in NM</li> <li>Major electronics companies, including Intel and Raytheon, already have facilities in nearby</li> <li>Nearby colleges offer degrees specifically targeting electronics and manufacturing</li> <li>Common raw materials for this industry, including copper, are mined in the region</li> <li>NM offers tax incentives for this type of industry</li> </ul>	<ul style="list-style-type: none"> <li>Electronics manufacturing can demand large amounts of water, which could be a challenge in the study area</li> <li>Electronics manufacturing facilities often cluster together in areas such as Silicon Valley and San Jose, putting NW NM at a disadvantage</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>Analysis indicates potential for industry growth with the increasing use of electronics in consumer products, automobiles, and the defense and medical sectors</li> <li>Intel recently reduced the size of its workforce in NM, which may have increased the amount of available skilled labor in the area</li> </ul>	<ul style="list-style-type: none"> <li>The industry shows signs of slow growth in the near term</li> <li>Foreign competition in this industry is very strong</li> <li>Component production is often done in other countries to take advantage of low labor costs</li> </ul>

The three county study area offers a number of advantages for manufacturing electronic components. First, there is a sizable and skilled workforce in this industry. Major electronics manufacturers, including Intel and Delta Group Electronics, are located in nearby Bernalillo County. Raytheon, which has an existing and recently-expanded facility in Farmington, has praised the local Navajo workforce for having exceptional hand-crafting skills, making it especially suitable to electronics manufacturing (Ryan, 2016). Computer and electronic manufacturing happens to be the largest manufacturing industry in the state (NAM, 2015). The area also has better access than most of the country to an essential input: copper. The vast majority of U.S. copper mines are located in Arizona, Utah, and New Mexico (Brininstool, 2014). Finally, the State of New Mexico offers multiple tax benefits for new manufacturing development (NM EDD, 2016). A number of sectors are poised to increase their demand for electronics, including: defense, healthcare, automotive, manufacturing, and building/home automation (Global Industry Analysts, Inc., 2015).

Unfortunately, **industry and market dynamics create some substantial barriers to growing the electronics manufacturing industry** in Northwest New Mexico. For example, the most common business model in the industry has been to conduct research and development (R&D) domestically, but outsource production overseas to save on labor costs. R&D tends to be clustered in areas such as Silicon Valley and the Santa Clara Valley in California (CollegeGrad, 2008). The primary driver for the location of this industry cluster is related to quality of life factors, and not traditional cost considerations related to

manufacturing. Electronic manufacturing for defense is the exception to these rules, as there would likely be security issues with locating production overseas and possible budget constraints that would preclude locating in extremely expensive location like Silicon Valley.

Competition with foreign companies is strong in electronics manufacturing, which is expected to keep prices and profits low over the next five years (IBIS World, 2016). Slow growth overall has been predicted for this industry in the short-term (IPC, 2016). Additionally, electronics components often require large amounts of water (thousands of acre feet annually) to manufacture, which may prove difficult to secure over the long term in the three county study area (Gonzalez, 2015). Still, if the industry were to expand in the area, it could have substantially positive economic impacts. Raytheon's local operations currently employ about 200 people, and nationwide employees in this industry receive an average annual payroll of around \$75,000 (Raytheon, 2015; U.S. Census Bureau, 2016).

In summary, **the region offers significant workforce advantages in electronic manufacturing, but there is also significant overseas competition in most sub-sectors.** Our recommendations are to focus recruitment options on the wind energy (see renewable energy component manufacturing section) as well as the defense sector, building on of the presence of Raytheon to establish an electronic manufacturing cluster.

## 6.10 TRANSLOADING/WAREHOUSE

Figure 6-13 Transloading / Warehouse SWOT

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>The area has good access to major highways and railways, to ports on the Pacific and Gulf Coasts, and air carrier services</li> <li>A 2015 feasibility study into an inland port near Gallup found a number of suitable sites and strong potential for demand for this type of facility</li> <li>A facility near Gallup would have good access to markets in LA, Dallas, and Chicago</li> </ul>	<ul style="list-style-type: none"> <li>There is already an existing regional hub nearby in Albuquerque</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>A number of industries relevant to this kind of facility have experienced growth in the Four Corners region in recent years, including warehouse/distribution, oil/gas, petrochemical, and food processing</li> <li>This industry has potential to employ a large number of workers at fair wages</li> </ul>	<ul style="list-style-type: none"> <li>If production in extractive industries declined, it could curtail the demand for a transloading facility in study area</li> </ul>

A transloading facility will provide the three county study area with a more efficient system for transporting goods. Goods can be moved from one transportation mode to another more easily, with the possibility to reduce costs for both consumers and producers. Warehousing on site is a natural, value-added extension of transloading, as it allows shipments the flexibility in delivery timing while also

generating more revenue for the site. The presence of two major and distinct transportation systems through the area, Interstate 40 and the BNSF Class I railroad, make such a facility especially useful. In particular, the large extraction sectors in Four Corners, which currently rely on trucking to move products out of the region, could benefit from easier access to rail, saving transportation costs.

An additional **value of a transloading facility is its ability to benefit and enable other industries in the region.** In our list of potential industries, a transloading facility is unique in the sense that it could facilitate the development of each of the other industries. The ability to move inputs into an area and move products out is an important factor in any industry that deals in physical goods. The presence of a transloading facility may encourage new firms to develop in Northwest New Mexico and local firms to expand their operations, thereby compounding the economic benefits of the facility.



***Example Inland Port/Transloading Facility***

The inland port at Santa Teresa, NM demonstrates the variety of economic development a transloading facility can attract. In addition to the expected storage and logistics companies, a range of manufacturing firms have grown around the port, whose products include electronics, medical supplies, glass, foam, home goods, metal, paper products, wire and cable, and ceramics. Hotels and restaurants have sprouted up in the area, providing services to workers and visitors and further expanding the economic impact of the hub.

On October 17, 2016, there was a groundbreaking ceremony related to the Gallup Energy Logistics Park, a \$4-million project that will expand railroad infrastructure and facilitate the movement of crude oil out of the San Juan Basin (Dotson, 2016; NWNMCOG, 2014). This facility could provide an important service to Northwest New Mexico, acting as the best link between the major thoroughfares of Interstate 10 and Interstate 70 between Albuquerque and Phoenix. The New Mexico Transloading inland port in Albuquerque was recently completed (NM EDD, 2015). While this new inland port is in close proximity and could compete for certain new entrants to the marketplace, it is likely that the Gallup inland port would largely focus on serving the existing energy and agricultural industries in the Four Corners region.

The recommended action step that would likely benefit the recently announced transloading facility with Gallup Land Partners is to **continue recruitment and expansion efforts for the other industries evaluated in this diversification chapters above that may rely on intermodal transportation.** This includes coal (local market), oil, agricultural products (most likely compressed hay bales for export), food processing, and dimension stone. As mentioned above, the main benefits to these industries of having a transloading facility at Gallup would be paying less to transport their goods. Reduction in transport costs are accomplished where goods are transferred less than they are currently. In order to decrease the number of touches or moves that materials make from their point of origin to their destination a significant amount of coordination is needed with ocean carriers and the railroads. If, for example, a

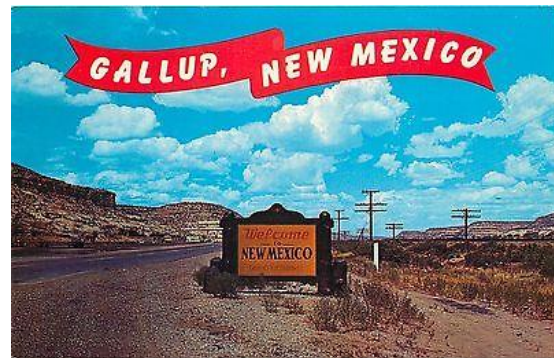
manufacturer from the industries identified above were able to load a container at Gallup, and send it directly to a ship dock at the LA area ports without paying drayage, takeoff, pure pass, or other fees this would likely be a significant incentive (cost and time-wise) for them to locate in the area. Where negotiations of this nature between ocean carriers<sup>14</sup> and BNSF have occurred it could be useful recruitment material for other industries to locate at the Gallup inland port.

Other key features of the operations of the port that could be attractive to industries interested in relocating to the area include the hours of operation, and minimum quantities. Some businesses that are shipping perishable goods (e.g. fresh cut alfalfa hay) would prefer to have the ability to load containers 24 hours per day, if possible. Also, in some ports there are minimum quantities necessary to ship containers (e.g. 20 containers minimum), thus limiting the type and volume of goods that could go through the inland port (Larson, 2016). Allowing flexibility in the operations of the port to match the requirements of interested parties could likely spur additional interest from industries. Again, this will require significant coordination with port operators, service providers, ocean carriers and BNSF.

Recruitment efforts associated with the manufacturing and service related ventures for the intermodal transportation options would also be a natural fit for the expanded services of the transloading facility. While we did not evaluate this sector extensively, we did locate four container manufacturers with a presence in the United States, including: American Intermodal Container Manufacturing (based in Northern Alabama); BSL Containers (based in China with a presence in Houston, Texas); W&K Container (based in Mill Valley, California); and Seabox (based in Cinnaminson, New Jersey).

## 6.11 TOURISM

Tourism is an industry that spans numerous types of businesses, primarily in the services and retail sectors, including lodging, restaurants, entertainment and cultural activities, outfitters/guide services, gas stations, grocery and retail stores, and transportation services. As such, we first provide an overview of the role and significance of the tourism economy in Northwest New Mexico, and areas of potential growth before conducting SWOT and market research analysis on a few development options in this industry.



As highlighted in **Table 6-1**, in 2014, tourism spending in the three counties of Northwest New Mexico supported approximately \$291 million in annual regional income and 12,900 jobs, or an estimated 8 percent of the region's total employment base (Tourism Economics, 2015). While the income per job is relatively low, averaging between \$20,000 and \$25,000 per year, efforts to increase tourism visitation and spending in the region, particularly by higher income travelers, may give the economy a substantial boost. For example, **increasing tourism spending and visitation by 5 percent in the area could enhance the regional economy by 645 jobs or \$14.5 million in total annual income** (derived by assuming a five

<sup>14</sup> Ocean Carriers at the Longbeach Port in January 2017 include: Maersk, MSC, ANL, Hambard Sud, Hapag-Lloyd, Polynesia Lines, CCNL, OOCL, APL, Matson, Hyundai, Mitsui, OSK, MOL, Yang Ming, Cosco, Evergreen, NYK

percent increase in tourism spending would result in a five percent increase in employment and income supported). As such, tourism should be recognized as a powerful current and future economic base for the regional economy.

**Table 6-1: Tourism Economy In Northwest New Mexico, 2014**

Location	% of Jobs in Region	Total Jobs (Direct, Indirect, Induced)	Total Tourism Industry Income (Millions \$, 2014)	Income Per Job
San Juan County	6%	6,900	\$170	\$24,750
McKinley County	12%	5,100	\$103	\$20,300
Cibola County	10%	900	\$18	\$19,300
<b>NW NM Region</b>	<b>8%</b>	<b>12,900</b>	<b>\$291</b>	<b>\$22,600</b>
State of New Mexico	8%	88,900	\$2,330	\$26,200

*Source: Highland Economics Analysis of Tourism Economics, 2015 report on the Economic Impact of Tourism Spending in New Mexico.*

Table 6-2 presented estimated tourism spending in Northwest New Mexico, and the proportion by spending category. The figures highlight the differences in the tourism sectors between the three counties and the relative tourism industry strengths and weaknesses in the area. Compared to the state average spending pattern, San Juan County and Cibola County both receive a relatively low proportion of expenditure on lodging, indicating that many travelers may pass through these locales without overnighting. In McKinley County, expenditures on lodging and food and beverage are slightly higher than state averages, but spending on recreation is relatively low, indicating that travelers may be staying overnight as they pass through the area (likely driving through on I-40), but are not spending much time in the area. Cibola County appears to be the opposite: approximately one-third of tourist expenditures in Cibola County are recreation-related, with relatively little spent on overnight lodging, food and beverage, or retail. All of these findings resonate with the comments from the focus groups in each county: McKinley County can grow its tourist industry by marketing and developing destination attractions to become more than a stop-over point; Cibola County can enhance its tourism sector by better leveraging its recreational and cultural assets by offering more visitor services and amenities; and San Juan County can grow its tourism sector by focusing on becoming more of a destination location with services and marketing that encourage visitors to linger in the area to enjoy the numerous recreation and cultural opportunities on offer.

Table 6-2: Tourism Spending by Category in Northwest New Mexico, 2014

Location	Total Spending, Millions \$, 2014	Percent Spending by Category					
		Lodging	Food and Beverage	Retail	Recreation	Transport	Second Homes
San Juan County	\$278	16%	21%	21%	12%	20%	9%
McKinley County	\$47	23%	25%	20%	8%	15%	10%
Cibola County	\$12	13%	16%	14%	33%	15%	8%
NW NM Region	\$337	18%	22%	19%	14%	17%	9%
State of New Mexico	\$6,080	20%	22%	18%	12%	17%	11%

Source: Highland Economics Analysis of Tourism Economics, 2015 report on the Economic Impact of Tourism Spending in New Mexico.

Thus, although visitor spending already plays a large role in the economy of Northwest New Mexico, there is room for growth. This is highlighted through a perusal of the New Mexico True website, which reveals that most of the marketing of New Mexico to tourists focuses on attractions located within Central to North Central New Mexico, which includes the Albuquerque to Taos corridor. The focus on this area by tourists is acknowledged by the New Mexico Tourism Department. As stated in its 2015 report, an analysis of TripAdvisor’s “things to do” in New Mexico showed that 74 percent of the state’s highlighted attractions occur in the general Albuquerque to Taos corridor (New Mexico Tourism Department, 2015). As many tourists use the web as their primary information source, a stronger online presence at the state and regional tourism level that highlights attractions in Northwest New Mexico would help to increase tourism revenues in Northwest New Mexico.

In terms of popular tourist activities, research from the New Mexico Tourism Department (New Mexico Tourism Department, 2015) indicates that **overnight visitors to New Mexico and the other three states in the Four Corners region participate in both cultural and outdoor recreation activities at a higher rate than overnight tourists in other states**. Within the four states comprising the Four Corners region, New Mexico overnight visitors are equally likely to participate in outdoor recreation (including hiking, backpacking, camping, fishing, mountain climbing, golfing, skiing/snowboarding, hunting, biking, or rafting) as overnight visitors to neighboring states, but are much more likely to participate in cultural activities (including visiting a museum, landmark/historic site, art gallery, winery, theater, fair/exhibition/festival/rodeo, or musical concert). Recognizing the importance to New Mexico visitors of both cultural and outdoor recreation experiences, New Mexico Tourism Department has begun targeting ‘venturesome’ travelers, who seek “authentic, unusual, and adventurous experiences” corridor (New Mexico Tourism Department, 2015). These travelers often have higher than average household income and education levels. Accordingly, the New Mexico Tourism Department brand’s promise is to deliver “adventure steeped in culture”.

**Table 6-3: Outdoor and Cultural Activity Participation Levels:  
Primary Overnight Visitors to New Mexico Compared to Other Destinations**

Year	Outdoor Activities % Participation			Cultural Activities % Participation		
	New Mexico	Utah, Arizona, Colorado	United States	New Mexico	Utah, Arizona, Colorado	United States
2010	33.6	44.0	24.1	60.2	44.2	39.0
2011	34.6	44.4	24.1	56.7	44.0	39.2
2012	52.9	57.0	33.4	63.0	50.6	48.0
<b>2013</b>	<b>51.9</b>	<b>54.6</b>	<b>32.6</b>	68.0	51.2	49.4
2014	62.0	62.0	32.0	90.0	65.0	50.0

*Source: Adapted from 2015 New Mexico Tourism Department Annual Report*

Regarding such tourist attractions, Northwest New Mexico and the broader Four Corners region has extraordinary cultural and outdoor recreation assets that offer ‘adventure steeped in culture’. The Four Corners area is the homeland of several Native American tribes, and the region is rich in Indian culture, art, and history. Cultural experiences include opportunities to visit national monuments and parks with ancient ruins, rock art, and beautiful geological formations and vistas. Tribes in the area also offer opportunities to see traditional Indian dances and engage in cultural activities at tribal museums and cultural centers. Travelers to the area can also visit area trading posts that specialize in Native arts and crafts, including jewelry, paintings, pottery, sculpture, Kachina dolls, rugs and blankets. In terms of outdoor recreation, the region abounds with beautiful natural settings that provide opportunities for hiking, biking, fishing, boating, golfing, and rock climbing.

**The size of the tourist market for cultural and outdoor experiences within the broader interstate Four Corners region is evident from visitation data at National Parks and National Monuments in the area that provide opportunities related to cultural and archaeological history as well as outdoor recreation.** As shown in **Table 6-4**, there is significant tourist visitation at these National Park Service administered sites in nearly all directions proximate to Northwest New Mexico. **North of Farmington in Colorado, Mesa Verde National Park attracts over 500,000 visits annually, west of Gallup in Arizona on I-40, Petrified Forest National Park attracts approximately 600,000 to 800,000 visits annually, and Canyon de Chelly National Monument in the Navajo Nation located just west of the Arizona-New Mexico state border attracts over 800,000 visits on average annually** (National Park Service , 2016). This compares to annual visitation at the three national monuments within Northwest New Mexico ranging from approximately 40,000 to 175,000.

Table 6-4: Visitation Levels at National Parks and Monuments in Four Corners Region

Park Name	State	Visitation Year: 2015	10-Year Visitation Average (2006 – 2015)	Overnight Stays: 2015	10-Year Overnight Stay Average (2006-2015)
Aztec Ruins NM	New Mexico	53,165	41,975	-	-
Canyon de Chelly NM	Arizona	813,686	826,808	19,543	41,774
Chaco Culture NHP	New Mexico	38,914	40,035	12,987	10,823
El Malpais NM	New Mexico	174,433	128,788	-	320
El Morro NM	New Mexico	49,390	47,862	3,565	2,712
Hubbell Trading Post NHS	Arizona	66,324	77,030	-	-
Mesa Verde NP	Colorado	547,325	533,020	78,426	79,682
Navajo NM	Arizona	71,370	72,070	3,362	2,730
Petrified Forest NP	Arizona	793,225	653,891	437	2,301

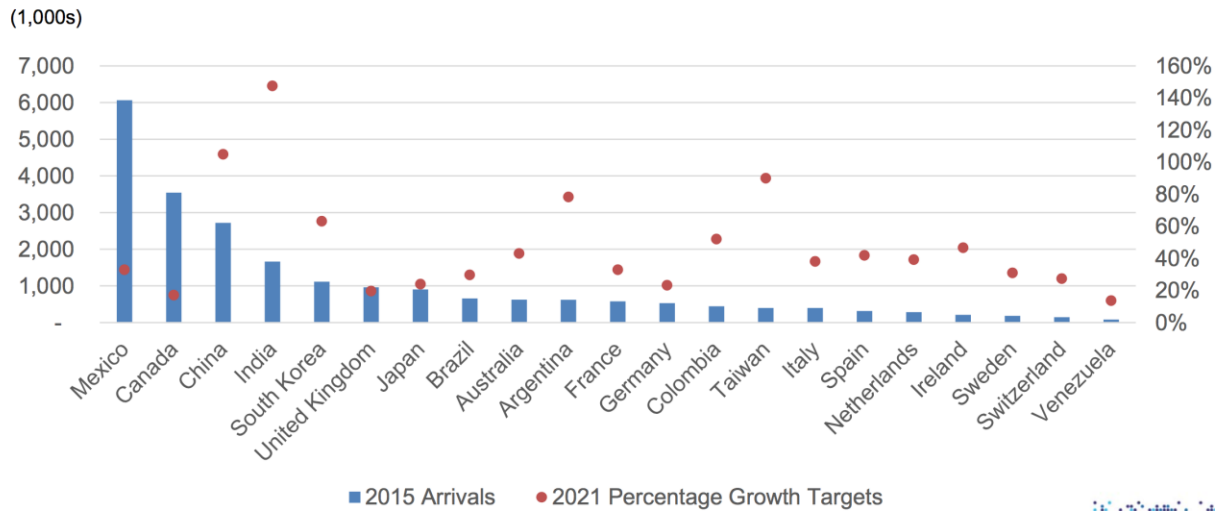
Source: National Park Service Visitor Use Statistics.

While other Four Corners monuments and parks offer specific attractions that differ from the attractions at the archaeological, cultural, and outdoor recreation sites within Northwest New Mexico, tourist visitation in the surrounding areas is a useful indicator of the level of tourism interest in the region and the potential tourism market size for the attractions in each of the three counties.

**In addition to domestic travelers, another important component to consider in tourism marketing is international tourist visitation from Mexico, Canada, European and Asian countries.** Interest in cultural activities, particularly those relating to Native American culture, is high and growing amongst international tourists. According to the National Center for American Indian Enterprise Development, international tourist visitation to Indian country across the United States rose from 1.6 million to 1.9 million visitors (19 percent increase). While tourism from Mexico and Canada are the largest share of current visitors, international tourism from Asian countries is particularly expected to grow in the next five years (See **Figure 6-14**), and Asians appear to be very interested in cultural tourism. In particular, Chinese tourists will be a particularly crucial market for US tourism destinations in the future. In 2012, nearly 1.5 million Chinese visitors traveled to the United States, and more than 10 percent (160,000) of those travelers visited Indian Country (Native News Online, 2014). Interest in cultural tourism continues to grow and the American Indian Alaska Native Tourism Association is traveling to China to raise awareness of Native American destinations (Native News Online, 2014).

Figure 6-14 Anticipated Growth of International Visitors versus 2015 Arrivals

**Path to 100 Million International Arrivals:  
2021 Percentage Growth Targets versus 2015 Arrivals**



Source: (Sheivachman, 2016)

Building on the focus of New Mexico True brand on adventure tourism, the interest in cultural tourism by international travelers, and the cultural and outdoor recreation assets of the Northwest New Mexico region, the research in this section focused on the potential economic development potential of two signature tourist attractions (1) a cultural experience center and (2) an outdoor education camp.

## 6.11.1 Cultural Tourism

Figure 6-15 Cultural Tourism SWOT

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• 4 National Parks Service sites with cultural attractions</li> <li>• Ancient Ways Arts Trail</li> <li>• Trail of the Ancients Scenic Byway</li> <li>• Diverse array of cultural resources and attractions of interest to visitors</li> <li>• Domestic and international visitors to the SW are highly interested in cultural experiences</li> <li>• The Southwest had the second highest percentage of adults visiting museums nationwide</li> <li>• A majority of New Mexico leisure travelers participate in cultural and heritage activities</li> </ul>	<ul style="list-style-type: none"> <li>• There does not seem to be one unifying brand to market the various cultural or overall tourism offerings in the region</li> <li>• Lack of visitor services to cater to tourists in many areas of the region</li> <li>• Limited visitor information/signs/interpretation to facilitate independent travel in many areas of the region</li> <li>• Lack of coordination intra-regionally and inter-regionally to market tourism</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>• Market the region's cultural offerings under one brand</li> <li>• Focus on social media marketing to millennials</li> <li>• Increasing marketing to foreign tourists</li> <li>• Brand USA marketing internationally</li> <li>• NATIVE Act funding for tourism in Indian Country</li> </ul>	<ul style="list-style-type: none"> <li>• Saturation of offerings and other cultural designations in the Southwestern market</li> <li>• Failing to connect with the target market</li> <li>• Nationally renowned and similar attractions elsewhere in NM and the Four Corners region</li> </ul>

As noted above, overnight travelers to New Mexico participate in cultural activities at a very high rate, and interest is also high amongst international travelers. Currently serving the cultural tourist market in Northwest New Mexico are a large and diverse array of cultural centers and museums, including: the Sky City Cultural Center and Haak'u Museum at the Pueblo of Acoma (showcases the history, art and lifeway of the Acoma people), New Mexico Mining Museum in Grants, Salmon Ruins Museum showcasing historical and cultural history and artefacts in Bloomfield, the Farmington Museum (museum, store, exhibits, and visitor center), and the Gallup Cultural Center (museum, lectures, forums, and diverse heritage celebrations). Across the state border in Window Rock, Arizona west of Gallup off of Interstate-40 is the Navajo Nation Museum with art, historical, and cultural exhibits. Farther afield in Albuquerque, the Indian Pueblo Cultural Center features a museum, restaurant, gift shop, regular dance performances and exhibits of weaving, pottery, jewelry, clothing and photography from each of the 19 New Mexico pueblos.

Key cultural attractions in Northwest New Mexico are at numerous National Park Service sites in the region: Chaco Culture NHP, Aztec Ruins NM, El Malpais NM, and El Morro NM. Other existing cultural tourism offerings include guiding companies that provide all-inclusive cultural experience in the Southwest, including with a focus on Native culture. Relevant companies offering cultural tours to international clientele include ITB Berlin, the second largest travel trade marketplace in world. Offerings include tours of Southern Utah by Navajo guides who teach visitors about Navajo culture. The business

welcomes between 80 and 100 people on average each summer night—mostly foreign tourists – and employees about 30 people year-round (Rupert, 2014). Tauck Inc is another international tour company that is adding Native attractions and Native interpretation to their itineraries (Rupert, 2014).

Specific to museums and galleries, New Mexico and surrounding states in the southwest region have a higher than average demand for such attractions, with almost 26 percent of resident adults visiting an art museum or gallery in the previous year, according to a 2012 study. The southwest region had the second highest percentage of adults visiting museums nationwide, second only to the Pacific region at just over 28 percent (National Endowment for the Arts, 2015).

However, the market for museum cultural activities has been declining over the past thirty years. This decrease is present across all demographic groups except those Americans 75 and over, who were actually more likely to visit museums than a decade ago (National Endowment for the Arts, 2015). In a 2014 study, eighty-three percent of visitor serving-organizations indicated flat or declining attendance. (Dilenschneider, Signs of Trouble for the Museum Industry, 2013).

While serving an important role in cultural tourism, visiting museums and national parks may not be the only key experience that cultural tourists now desire. As noted in a 2014 report on attracting cultural visitors and their spending, Baby Boomer cultural travelers want to engage with locals through immersive experiences. Over two-thirds of Millennials (born 1977-1994, the largest generation since the Baby Boomers) want to experience a destination’s arts and cultural assets and rate authenticity in experiences as extremely important (Hargrove, 2014). Such immersive and authentic experiences may best be attained through alternative tourism offerings.



*Navajo Gourd Dance*

While there are some higher-end tour companies with set itineraries that visit Indian Country in the Southwest, there appears to be a gap in the offerings available for visitors who are traveling on their own through the region and are interested in authentic experiences and exposure to Native culture, art, and lands rather than (or in addition to) visiting a museum or National

**Park Service site. Developing authentic cultural opportunities for independent travelers to the area that respects and safeguards Native culture and lands appears to be a key opportunity that would enhance the tourism appeal of the region, increase the length of time people stay in the area, and provide a source of additional income and jobs, particularly to tribes.**

More interactive experiences, such as that recently offered at the Navajo Village Heritage Center in Page, Arizona, could enhance tourism in Northwest New Mexico. The Heritage Center provided visitors with an experiential window into Navajo culture, including weaving demonstrations, Native American Pow Wow dancing, tours of traditional structures, and presentations by Navajo of their history and culture. Another example of a potential memorable cultural experience is a homestay program, with an organized mechanism whereby Native families can welcome a visitor to their home when it is convenient for them (for example, there could be an established meeting time and location every day where visitors and ‘host families’ could sign up and be matched for the night such that each host family

can decide on a daily basis whether to open up their home). Other types of sought after experiences for ‘venturesome’ travelers could include a day with a local guide, who could provide personalized interpretive tours of local sites and lands of cultural or historical significance.

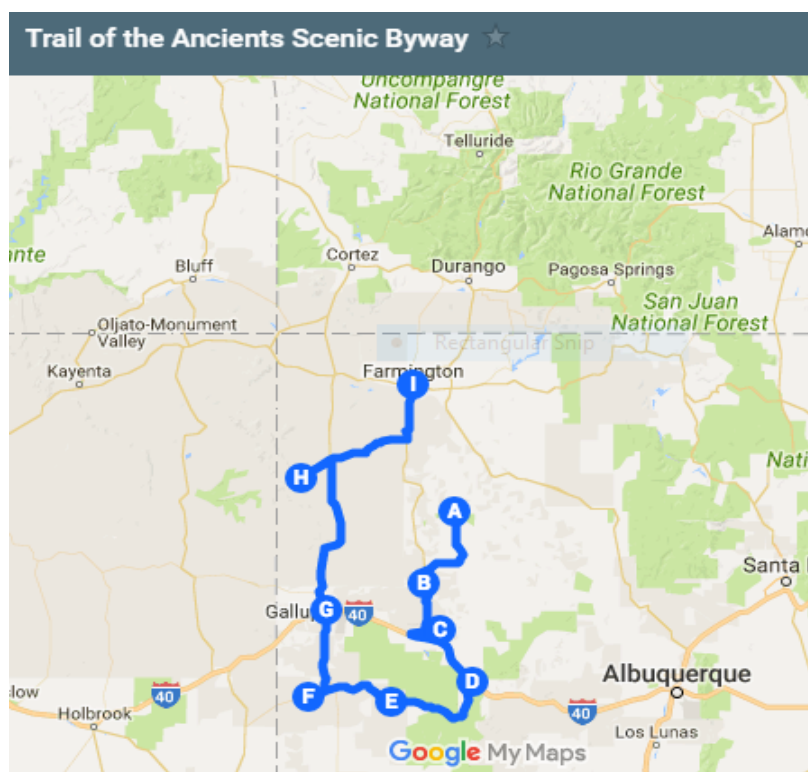
In addition to offering more opportunities for visitors to engage culturally, additional marketing is needed. To leverage the full economic development potential of the existing and potential future cultural experiences in the region, it would be helpful to **develop a unifying brand for the region** that identifies the Northwest New Mexico region overall as a tourist destination, and as a key component of an itinerary for the broader Four Corners area. **Collaborative marketing and communication with tourism towns and destinations throughout the broader interstate Four Corners area is also critical;** this collaboration could include joint social media and website marketing as well as word of mouth from staff and print brochures available at key tourism attractions throughout the area that highlight attractions throughout the Four Corners region, including Northwest New Mexico.

As one example, increasing the marketing of the existing Trail of the Ancient Scenic Byway which runs through nine historical and cultural sites in Northwest New Mexico, and collaborating with the marketing of the adjoining 470-mile National Trail of the Ancients Scenic Byway that passes through Utah and Colorado (including Mesa Verde National Park, Monument Valley Tribal Park, and Four Corners Monument), could be an effective way to increase cultural tourism in Northwest New Mexico. Other trails with high potential tourism interest that could benefit from increased promotion are the Native Heritage Trail (route historically used by Pueblo, Navajo, and Spanish peoples that runs from the Colorado border on Highway 491 through Shiprock and Farmington on Highway 64 then back to the Colorado border on Highway 550), Historic Route 66 (runs the entire length of the state on Highway 40), and the Ancient Ways Arts Trail (regional arts trail through over 27 participating arts sites through Grants, Ramah, Pine Hill, Zuni and Gallup).

**Another key factor is to specifically market to venturesome travelers, including the millennial group, which is the demographic group representing the most likely to come back within the year, most likely to recommend a visit to a friend, and are the most connected to the web** (Dilenschneider, The Hidden Value of Millennial Visitors to Cultural Organizations (DATA), 2016). Social media is the primary information source for high-propensity visitors to cultural organizations followed by websites accessed by mobile devices, websites accessed by traditional methods, and word of mouth (Dilenschneider, Leisure Activity Motivation: How People Decide to Attend Your Museum or Visitor Serving Organization, 2013).

**Finally, a key opportunity for marketing and enhancing cultural tourism in the region is the Native American Tourism and Improving Visitor Experience Act” (NATIVE) Act.** This recent law will increase coordination and collaboration between Federal tourism assets, and expand heritage and cultural tourism opportunities in the US (Congress.Gov, 2016). The NATIVE Act is intended to attract more visitors, and lead to more income and more investment in Indian Country tourism (Rupert, 2014). The intent of the ACT is to organize federal resources that currently exist for tourism to be used collaboratively and made available to tribal governments, communities and businesses, ultimately resulting in more income and more investment in Indian Country tourism. This act represents an opportunity for the Navajo Nation and the Pueblos of Laguna and Acoma to leverage federal resources and collaborate with federal agencies to increase tourism opportunities and economic development.

Figure 6-16 New Mexico Trail of the Ancients State Scenic Byway



Source: New Mexico True Website

## 6.11.2 Outdoor Recreation Tourism

Figure 6-16 Outdoor and Cultural Experiential Tourism SWOT

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• The area has many well established outdoor recreation activities and venues</li> <li>• Scenic southwestern landscape</li> <li>• Desirable climate</li> <li>• Existing Adventure Camp: Cottonwood Gulch</li> <li>• National monuments and public lands accessible to recreationists</li> <li>• Within 3-hour drive from Albuquerque</li> <li>• Water-based recreation, particularly in San Juan County</li> </ul>	<ul style="list-style-type: none"> <li>• Possibly conflicting land uses with extractive industries</li> <li>• Availability of private or tribal land sites for lodging or other tourism venues</li> <li>• Limited trail signage, interpretation, and visitor overnight facilities in many areas of interest to outdoor recreationists</li> <li>• Challenges to connect with the target market</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>• Offer education programs and overnight lodging accommodations to clients seeking a unique recreation or outdoor adventure</li> <li>• High tourist visitation to broader 4C region, including Durango, Mesa Verde, Monument Valley</li> <li>• Collaboration with public land management agencies</li> <li>• Collaboration or internship programs with college outdoor recreation programs to develop outfitting / outdoor recreation resources and businesses</li> </ul>	<ul style="list-style-type: none"> <li>• Saturation in the market, similar outdoor recreation offerings elsewhere throughout New Mexico</li> <li>• Nearby well-known and well-marketed outdoor recreation destinations such as Durango, CO</li> </ul>

**Interest in outdoor-based recreation is increasing.** Recent data regarding trips taken, camping, visitation to federal lands, and spending in New Mexico suggest significant growth recently. There are a plethora of outdoor recreation opportunities in the region including bird watching, climbing, fishing, rafting, hiking, biking, and off-road vehicle riding to name a few. The area is fairly unique in offering diverse water-based recreation on rivers and lakes (particularly in the Farmington area) as well as opportunities for recreation in iconic southwestern landscapes. Outdoor recreation enterprises in the area could offer recreation and outdoor education outfitting, programs to adults and / or youth, as well as potential overnight trips with lodging accommodations. An existing overnight destination outdoor recreation offering in the region is the Cottonwood Gulch Outdoor Adventure Camp. The camp provides educational wilderness ventures for youth, school groups, and adults that include such activities as adventure–backpacking, rock climbing, exploring ghost towns, spelunking through dried lava tubes, and hiking.

**Given the quality and quantity of outdoor recreation lands and opportunities in the region, lodges with a focus on outdoor recreation could be very successful. Additionally, development of more outfitters and guides for specific outdoor activities could serve the area well,** particularly as currently there are limited information sources and signage for many high quality recreation areas. To enhance the development of outdoor recreation entrepreneurship, **local organizations may want to consider partnering with area schools specializing in outdoor recreation,** such as Prescott College in Arizona that has a nationally renowned outdoor experiential education program.



*Mountain Biking*

**Collaboration with public lands management agencies is a key marketing and development opportunity.** For example, in Sedona, Arizona, the city has actively encouraged the development of itself as a mountain biking destination. The community has worked collaboratively with the Forest Service to retrofit old trails to better suit cyclists needs and also worked with riders and the city to build 60 miles of new trails (Gulley, 2016). Sedona also just established the Annual Sedona Mountain Bike festival; such festivals are often very effective marketing tools that draw mountain bikers not just for the event but also for return visits. Strategies to develop outdoor recreation tourism should be coordinated with the cultural tourism development strategies discussed above: a unifying regional brand, collaborative planning and marketing within Northwest New Mexico and through the broader Four Corners region, development of visitor services and information, and targeted marketing.

One potential threat to this type of venture in the study area is the potential for conflicting land use with extractive industries. One potential site with that may result in land use conflict is the Mount Taylor area. Mount Taylor has significance to tribes in the region; is an interesting geological formation (volcanology); and is home to large populations of elk, deer and other wildlife. These features make it an ideal location for an outdoor experiential education camp. However, Mount Taylor is also home to rich reserves of uranium that are proposed to be mined. The large scale mining effort may be a deterrent to guests, or it could also serve as a component of the education experience if carefully developed. Location of such a venture, a safe distance from extractive industries, is a necessary consideration for siting.

## 7 RECOMMENDATIONS AND NEXT STEPS

### Key Point

The POWER initiative seeks to help communities such as those in Northwest New Mexico that have historically coal-dependent economies to make these changes and investments in response to evolving energy markets and policy environments. The goal is to minimize the adverse effects of these changes and to build a more resilient, diverse economic future.

The energy sector has long played a key economic role in Northwest New Mexico. Changes in energy markets as well as state and federal energy policy, as discussed at length in **Section 5**, have recently resulted in decreased economic activity and associated reduced employment, income, and tax receipts supported by these sectors (see **Section 2**). In the short-term, the economic and social impacts of coal and power plant industry decline combined with reduced tax receipts, have caused significant economic hardship. While reductions in coal mining and power generation in Northwest New Mexico clearly have a negative short-term impact for many area families and businesses, with the proper planning, in the long-term a reduced reliance on the energy sector may provide an opportunity for the area to enhance long-term economic resiliency through increased investments in economic diversification, ecosystem restoration, and workforce training.

A key purpose of the POWER initiative is to help communities such as those in Northwest New Mexico that have historically coal-dependent economies to make these changes and investments in response to evolving energy markets and policy environments. The goal is to minimize the adverse effects of these changes and to build a more resilient, diverse economic future. As discussed throughout this document, Northwest New Mexico has made good progress on this path of investment and diversification, but still has work to do to strengthen its economy to make it less susceptible to resource boom and bust cycles and potential future reductions in the energy sector. Northwest New Mexico's strategy should be twofold:

1. Continue to support existing businesses and enterprises in the energy sector, as well as encouraging promising new energy developments such as in the solar energy generation and energy storage industries (see **Section 5**), and
2. Further develop and leverage its cultural, geographic, natural resource, and community leadership assets through targeted investments and efforts to diversify its economy (see **Section 6**).

This section of the report highlights the overall strategies that the region as a whole should engage, while also identifying for each of the three counties several key target diversification industries and associated marketing and investment actions. For each county, the target industries were selected from the set of industries evaluated based on the following factors: economic contribution potential (jobs and income generated), success potential, and extent to which economic development efforts in the region would help to foster the industry (versus industries, such as solar energy generation or natural gas combined cycle power production, where industry growth rates will likely depend much more on market conditions than on local economic development efforts).

**Section 8** provides an overview of potential funding sources for these investment actions.

## 7.1 NORTHWEST NEW MEXICO REGION

As indicated by success stories from other regions around the country (see **Section 3**), as well as efforts already underway in Northwest New Mexico, economic development efforts across the region should include a focus on the following four elements: 1) workforce and business development; 2) quality of life improvements; 3) local, regional, and statewide partnerships; and 4) regional marketing. Each of these strategies is discussed in detail in **Section 4**, and each is key for the regions' successful, long-term economic development and diversification. The focus for each of these strategies will depend on community priorities, which should become well defined through a community visioning process. We briefly summarize each of these strategies and associated action items here.

### 7.1.1 Workforce and Business Development

**Addressing human capital needs is critical in successfully assisting dislocated workers and in developing a new industry or enhancing an existing one.** For dislocated workers, overcoming obstacles to pursuing retraining or additional education is critical (see **Section 4.1**). As experienced in other areas of the country, many miners transition into healthcare, information technology, and advanced manufacturing fields, so training programs in these fields (as already implemented in the Four Corners region) are appropriate. Other regional growth industries for which miners' skillsets are well suited, such as outdoor recreation, may need additional workforce training and small business development support.

Furthermore, community and regional economic development organizations in Northwest New Mexico can further support business development in **targeted** local growth industries through training workshops (focusing on small business skills, opportunities in local industries, and entrepreneurship), business support services (one-one-one technical assistance, downtown relocation services, and loan/funding programs), funding a small business ombudsman and outreach specialist, developing mentorship programs and economic networks that connect existing business owners with new ones, and developing support facilities for small businesses, such as incubator spaces or commercial kitchen facilities that can be shared by multiple new businesses. Potential targeted local growth industries for each of the three counties are highlighted in **Sections 7.2, 7.3, and 7.4** below.

### 7.1.2 Quality of Life

Investments in quality of life are key to long-term, resilient economic development. **Regions with high quality of life are better able to attract and retain residents and businesses, as well as be an attractive destination for tourists.** Residents and visitors alike are drawn to live and to recreate in areas with nice amenities – including cultural, natural, and built environment amenities. Northwest New Mexico has strong assets in these areas, but quality of life remains an impediment to economic growth in Northwest New Mexico, as noted in every focus group meeting (in June 2016) in each area of the region.

**Investments in quality of life can benefit and aid in developing all sectors of an economy, and thus support a more diversified, self-reliant, and resilient economy less subject to and dependent upon outside market forces** by:

- Keeping young people and retirees in the area,

- Growing the high-paying and geographically mobile professional, technical, and businesses service sectors, as well as
- Attracting industrial and manufacturing employers.
- Benefiting the tourism and visitor services sectors.

As discussed in detail with specific action items identified in **Section 4.2**, two primary weaknesses that the counties and cities in the region could collectively and individually address are:

1. Increasing offerings and accessibility of arts, entertainment and recreation (a sector that is currently under-represented across the region), and
2. Enhancing the attractiveness and vibrancy of downtown core areas.

**Additionally, the region should consider engaging in a concerted effort to identify key, quantitative quality of life indicators to measure current conditions, community quality of life goals, and measurement of progress in achieving those goals.** Identifying key indicators makes it possible for policymakers and interested citizens to look at a more manageable set of numbers when assessing changes in quality of life over time. The process of choosing key indicators also helps citizens and policymakers realize gaps in their current information (See **Section 4.2** for further discussion and indicator examples).

#### 7.1.3 Partnerships and Regional Marketing

**Developing relationships within a community and across community and county boundaries can enhance economic development efforts in many ways and is critically important for the Northwest New Mexico region.** Specifically, partnerships can benefit all parties by leveraging assets, increasing outside funding, limiting counterproductive competition, enhancing efficiency and reducing redundancy of efforts and investments, and facilitating communication across industries and agencies to coordinate and enhance mutually beneficial efforts. Partnerships between local businesses have also been critical. Development of networks and clusters of local businesses, has connected their products with the regional brand and enabled collaboration and information sharing amongst related businesses. Businesses can work together to support and promote each other. It is also **critically important to engage with each Native community, recognizing the diverse viewpoints among and between tribes, and address the history of tension and distrust in order to help foster a supportive atmosphere for constructive engagement and development of a shared vision and partnership for the path forward.** Building on past successful efforts, such as those developed through work on the Navajo-Gallup water supply project, is one path forward.

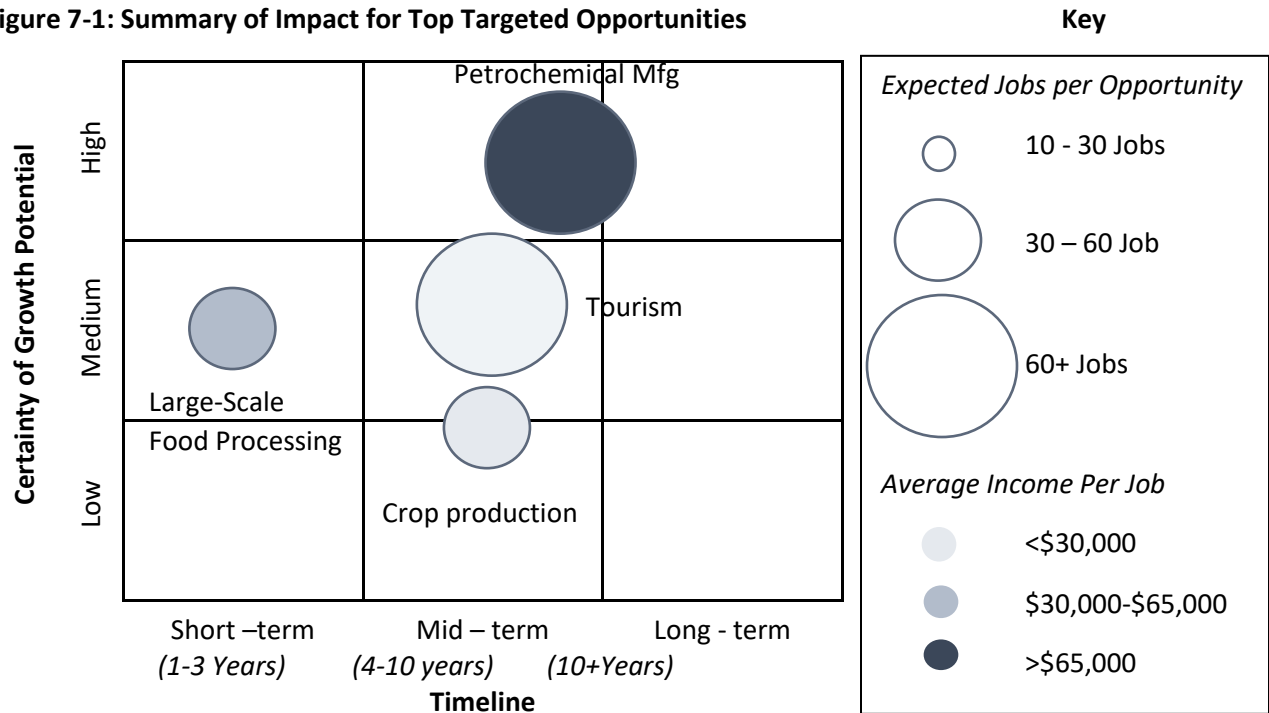
Finally, as discussed in several of the diversification industries, **regional marketing is a critical component of success, particularly for tourism.** Regional marketing, by covering a greater area and more businesses, increases visibility and effectiveness. Also, by pooling resources, regional marketing can enable larger-scale marketing of an area. A regional marketing plan can identify and include such elements as:

- Regional identity and key destinations, events, or products to highlight
- Regional brand and logo
- Signage design and grant programs for businesses and community centers and gateways
- Regional ‘trails’ that link cultural, historic, natural, or retail attractions

## 7.2 SAN JUAN COUNTY

**Priority opportunities for economic development in San Juan County are large-scale food processing, petrochemical manufacturing, tourism, and crop production.** The timeline for growth in these industries and their potential economic contribution to the region in terms of number of jobs and income per job are highlighted in **Figure 7-1**.

**Figure 7-1: Summary of Impact for Top Targeted Opportunities**



**Table 7-1** summarizes a 'to-do' list of key actions and resources for economic development organizations (EDO's) to make the most of these opportunities including those related to: competitive differentiation, marketing strategies, key contacts, and priority investments.

Table 7-1: San Juan County Target Growth Areas and Actions

Topic	Tourism	Petrochemical	Food Processing	Crop Production
Competitive Differentiation for Marketing	<p>Shiprock landmark and Navajo cultural assets</p> <p>Chaco Cultural NHP and Aztec Ruins NM</p> <p>River and lake-based recreation</p> <p>Urban amenities in close proximity to world-class cultural and outdoor recreation opportunities</p>	<p>Abundant supply of relatively cheap natural gas feedstock</p> <p>Companies involved in petrochemical manufacturing are already operating in the basin</p> <p>San Juan College has well developed educational programs producing graduates with skillsets well-suited to the industry</p>	<p>Existing large production base and storage infrastructure for key crop inputs</p> <p>Industry clustering benefits, as NAPI already has existing food processing facilities in the area</p> <p>Praxair facility in the area offers a reliable supply of nitrogen gas, often used in food processing</p> <p>Gallup transloading facility may offer a cost-effective method of transporting goods</p>	<p>NAPI has a proven successful track record</p> <p>Funding available for irrigation infrastructure through a settlement</p> <p>Transloading facility in Gallup offers a cost-effective method of transporting goods</p>
Marketing Strategies	<p>Market the state tax advantages (Consumables Gross Receipts Tax Deduction for Manufacturers, Investment Tax Credit for Manufacturers, Rural Jobs Tax Credits, Job Training Incentive Program)</p> <p>Offer local financial incentives to attract firms (property tax exemptions, Industrial Revenue Bonds, Local Economic Development Act, Local Options Gross Receipts Tax, New Mexico Community Capital)</p>			
	<p>Develop unifying brand for the region</p> <p>Collaborative marketing and communication throughout the broader interstate Four Corners area, EDO's and National Park Service (NPS) sites. Highlight existing cultural trails in region, such as with National Trail of the Ancients Scenic Byway</p>	<p>Appeal to local firms such as Chevron Phillips Chemical Company</p> <p>Promote the DeRosa study demonstrating high economic feasibility</p>	<p>Start by appealing to firms that rely on feedstocks produced in the area: e.g. Frito Lay and Poore Brothers (Inventure Foods)</p>	

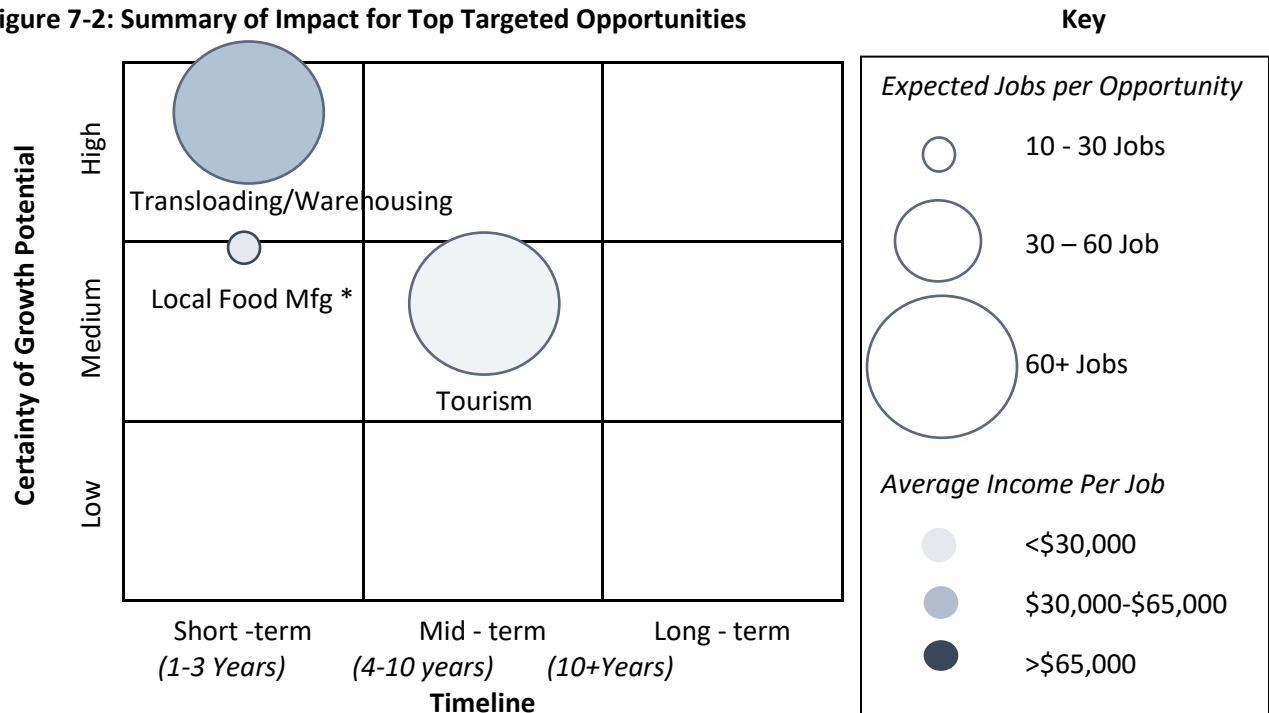
## Northwest New Mexico Economic Assessment & Strategy

Topic	Tourism	Petrochemical	Food Processing	Crop Production
Priority Infrastructure or Workforce Investments	<p>Fund a focused feasibility study to analyze ‘authentic experiential tourism’ concepts such as tribal homestay programs, an experiential heritage village, or a full-service lodge</p> <p>Support business development for cultural tourism and outdoor recreation entrepreneurs, including on Reservation</p>	<p>Pursue additional feasibility analysis with PRISM Analytics and Sean DeRosa</p> <p>Attend upcoming events for the petrochemical industry to market to potential companies (Annual Meeting, American Fuel &amp; Petrochemical Manufacturers, International Petrochemical Conference, American Fuel &amp; Petrochemical Manufacturers, World Petrochemical Conference)</p>	<p>Further explore rail line concept connecting Farmington area to BNSF</p>	<p>Join with Navajo and NAPI to push for full implementation of Navajo irrigation infrastructure funding</p>
Partnerships / Key Contacts	<p>New Mexico True, New Mexico Department of Tourism</p> <p>NPS and other Federal land management agencies</p> <p>Navajo Nation</p> <p>Tourism organizations across Four Corners region</p>	<p>Sean DeRosa, Sandia National Laboratories, 480-313-1228, sean.derosa@utexas.edu</p>	<p>Frito Lay</p> <p>Poore Brothers (Inventure Foods)</p>	<p>Anderson Hay - they ship alfalfa grown at NAPI all over the world and may be interested in transloading and expanding crop production (Craig Larson, Director of Operations PSW Division, 310-513-4230)</p> <p>NAPI - Hal Thomas, Marketing Director of NAPI, 505-566-2613</p>

### 7.2.1 McKinley County

Priority opportunities for economic development efforts in McKinley County are large-scale food processing, transloading/warehousing, local food manufacturing, and tourism. The timeline for growth in these industries and their potential economic contribution to the region in terms of number of jobs and income per job are highlighted in **Figure 7-2**.

**Figure 7-2: Summary of Impact for Top Targeted Opportunities**



**Table 7-2** summarizes a ‘to do’ list of key actions and resources to make the most of these opportunities including those related to: competitive differentiation, marketing strategies, key contacts, and priority investments.

Table 7-2: McKinley County Target Growth Areas and Actions

Topic	Tourism	Transportation/Logistics	Local Food Manufacturing
<b>Competitive Differentiation</b>	<p>Proximity to I-40</p> <p>Navajo Nation, Trading Posts, Crownpoint Navajo Rug Auction</p> <p>Gallup Cultural Center</p> <p>El Morro National Monument</p> <p>Ancient Ways Art Trail</p> <p>Route 66</p>	<p>Gallup is at the confluence of major transportation lines and centers of economic activity:</p> <ul style="list-style-type: none"> <li>• U.S. Interstate 1-40</li> <li>• BNSF Class I Railway</li> <li>• Connects Four Corners, California, Texas, and the Midwest</li> </ul> <p>Gallup could service the broader interstate Four Corners region due to dearth of other major transloading and transportation hubs in region</p>	<p>Historic and cultural heritage is a source of unique foods</p> <p>Location provides two-day access to large markets</p> <p>Short term excess water from Navajo-Gallup may be well-suited to specialty crop production and associated local food manufacturing</p>
<b>Marketing Strategies</b>	<p>Develop unifying brand for the Northwest New Mexico Region. Collaborative marketing and communication throughout the broader interstate Four Corners area. Highlight existing cultural trails, particularly in connection with National Trail of the Ancients Scenic Byway.</p> <p>NM True Cooperative Marketing Grant</p>	<p>Gallup can service the broader interstate Four Corners region due to dearth of other major transloading and transportation hubs in region</p>	<p>Historic and cultural heritage offers unique marketing opportunities</p> <p>Regional food brand</p> <p>Buy local campaigns</p>

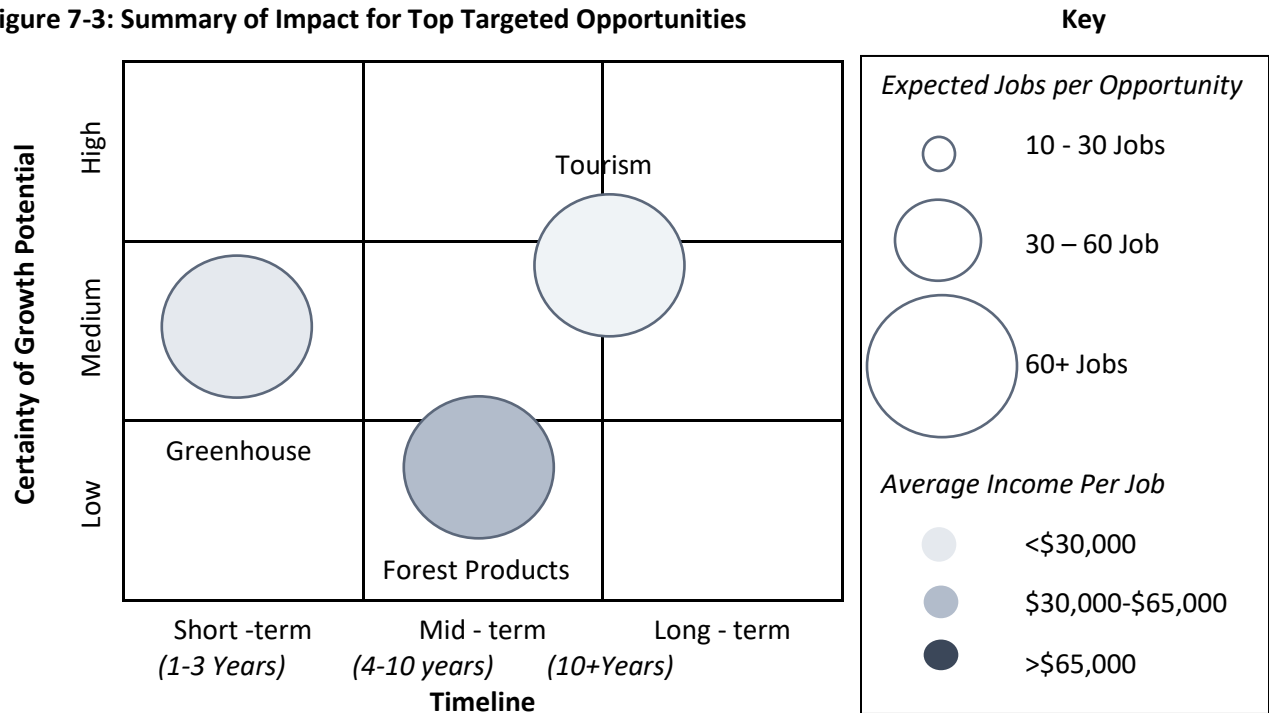
## Northwest New Mexico Economic Assessment & Strategy

Topic	Tourism	Transportation/Logistics	Local Food Manufacturing
Priority Infrastructure or Workforce Investments	<p>Fund a focused feasibility study to analyze ‘authentic experiential tourism’ concepts such as tribal homestay programs, an experiential heritage village, or a full-service lodge.</p> <p>Support business development for cultural tourism and outdoor recreation entrepreneurs, including on Reservation.</p>	<p>LEDA and Job Training Incentive program to encourage expansion and job training</p> <p>Free trade zone.</p> <p>Establish agreements between BNSF, Gallup port, and ocean carriers so that fees for transportation overseas are minimized, thus increasing attractiveness of location for exporters</p> <p>Need sufficient supply of commercial truck drivers and heavy equipment operators</p>	<p>Training and development:</p> <ul style="list-style-type: none"> <li>• USDA Rural Microenterprise Grants</li> <li>• USDA Rural Development Grants</li> </ul>
Partnerships / Key Contacts	<p>New Mexico True, New Mexico Department of Tourism</p> <p>Mitzi Frank, El Malpais National Monument</p> <p>Navajo Nation</p> <p>Tourism organizations across Four Corners region</p>	<p>Appalachian Center for Economic Networks (ACEnet) - a community development network in Appalachian Ohio has helped to start more than 50 kitchen incubators. Contact Leslie Schaller, Director of Programs, at 740-592-3854 ext. 115 or <a href="mailto:leslies@acenetworks.org">leslies@acenetworks.org</a></p>	<p>Gallup Land Partners</p> <p>BNSF</p> <p>Local export companies</p>

### 7.2.2 Cibola County

Priority opportunities for economic development efforts in Cibola County are greenhouse industry, tourism, and forest products. The timeline for growth in these industries and their potential economic contribution to the region in terms of number of jobs and income per job are highlighted in **Figure 7-3**.

**Figure 7-3: Summary of Impact for Top Targeted Opportunities**



**Table 7-3** summarizes a 'to-do' list of key actions and resources to make the most of these opportunities including those related to: competitive differentiation, marketing strategies, key contacts, and priority investments.

\* Industry evaluation is based on the assumption that the forests around Mt. Taylor will be opened to commercial thinning, which will justify the construction of a new sawmill that will produce high-quality wood products.

Table 7-3: Cibola County Target Growth Areas and Actions

Topic	Tourism	Greenhouse Agriculture	Forest Products
Competitive Differentiation	<p>Proximity to I-40 and Albuquerque</p> <p>Pueblo of Acoma and Pueblo of Laguna</p> <p>Mining Museum</p> <p>El Morro National Monument, El Malpais National Monument</p> <p>Route 66</p> <p>Ancient Ways Art Trail</p>	<p>Mild climate</p> <p>Access to cheap natural gas allow for low heating costs</p> <p>Proximity to large markets</p> <p>I-40 and airport access</p>	<p>The forests around Mt. Taylor are overgrown and are at serious risk of wildfire</p> <p>Thinning operations could provide both economic and environmental benefits</p>
Marketing Strategies	<p>Develop unifying brand for the Northwest New Mexico Region.</p> <p>Collaborative marketing and communication with broader region.</p> <p>Highlight existing cultural trails, National Monuments.</p> <p>Ensure all local attractions are well represented at El Malpais Visitor Center</p> <p>Expand on Mt. Taylor Quadrathlon</p>	<p>Develop a marketing brochure that touts the regions mild winter weather, natural gas price advantage, land availability, and proximity to research institutions and seasonal workforce (e.g. college students), along with access to rail and road infrastructure, and ease of permitting. Targets could be Canadian greenhouse growers as well as the top 100 greenhouse producers in the United States<sup>16</sup></p>	<p>With partners, lobby Congressional representatives for the renewal of CFLRP funding for the Zuni Mountains and additional funding for the Mt. Taylor forests</p> <p>Facilitate discussion with the stakeholders (Pueblos, Forest Service, and Mt. Taylor Manufacturing) to identify and resolve challenges associated with thinning operations</p>

<sup>16</sup> See <http://www.greenhousegrower.com/business-management/2016-greenhouse-grower-top-100-growers-the-complete-list/>

## Northwest New Mexico Economic Assessment & Strategy

Topic	Tourism	Greenhouse Agriculture	Forest Products
Priority Infrastructure or Workforce Investments	<p>Focus on developing ‘authentic experiential tourism’ concepts such as tribal homestay programs, an experiential heritage village, or a full-service lodge.</p> <p>Support business development for cultural tourism and outdoor recreation entrepreneurs and small businesses that provide visitor services, including on Pueblos.</p> <p>Develop better signage</p>	LEDA and Job Training Incentive program to encourage expansion and job training	TA new mill will require a stable feedstock in order to attract investors. This will require a high likelihood of continued CFLRP funding.
Partnerships / Key Contacts	<p>New Mexico True, New Mexico Department of Tourism</p> <p>Mitzi Frank, El Malpais National Monument</p> <p>Pueblo of Acoma, Pueblo of Laguna</p> <p>Tourism organizations across Four Corners region</p>	Existing greenhouse growers (see lists provided in the footnotes of the Diversification chapter)	<p>Matt Allen, Owner of Mt. Taylor Manufacturing, 505-287-9469 (harvesting and processing of wood products)</p> <p>Eytan Krasilovsky, Southwest Regional Director at the Forest Guild, 505-470-0185 (Collaborative Forest Landscape Restoration Project, CFLRP, grants)</p> <p>Entities involved with Zuni Mt. CFLRP</p>

## 8 SOURCES OF FUNDING

This section briefly outlines sources of funding that could potentially help the Northwest New Mexico Council of Governments achieve their economic development goals. **Table 8-1** summarizes these funding sources, and provides basic information on deadlines and eligibility requirements. As the table shows, there are a number of grants at the state and federal level that could support the economic diversification opportunities outlined in this report. For example, New Mexico's tourism department, New Mexico True, offers matching funds for marketing efforts aimed at promoting tourism opportunities.

Many of the grants are targeted at the initial stages of economic development, providing resources for technical assistance and planning. The Frontier Communities Initiative run by New Mexico MainStreet offers technical assistance for projects that have both historical and commercial significance. While the regions' largest cities are ineligible due to their participation in the MainStreet program, smaller cities in Northwest New Mexico could still benefit from it. Future funding for this program is contingent upon legislative support.

The U.S. Department of Agriculture (USDA) and U.S. Economic Development Administration (EDA) also offer funding for technical assistance. USDA's Rural Business Development Grants (RBDG) funds training and feasibility studies to support small, rural business development, which could include a greenhouse, community kitchen, food processing facility, transloading or warehouse facility, or dimension stone mining company. RBDG-approved projects that have a regional focus can receive further funding under the Strategic Economic and Community Development program. USDA's Community Facilities Technical Assistance and Training Grant (CFTATG) helps to identify and plan for essential community facilities in rural areas, which can include community kitchens, food hubs, and greenhouses. EDA's Local Technical Assistance Program offers matching funds for feasibility and impact studies, but without the USDA's restrictions on population or business size. This could be useful for businesses in larger cities, such as Farmington and Gallup, and for bigger businesses, such as a petrochemical facility, sawmill, or a manufacturing facility for electronic or renewable energy components.

Other programs are aimed at assisting projects farther along in the development process. USDA's Community Facilities Direct Loan & Grant Program provides funding to purchase, construct, and/or improve the same kind of community facilities supported by CFTATG planning funds. New Mexico FUNDIT provides monetary support to business, community, and infrastructure development projects, but much of the project planning, financial pro forma, and economic impact assessments must be completed prior to submitting an application. Similarly, New Mexico's Local Economic Assistance & Development Support Program (LEADS) requires project planning before applying, as well as passing an

### Key Finding

There are grant opportunities available that can provide a jumpstart to diversifying local economies. Many of these grant programs target the initial stages of economic development, providing resources for technical assistance and planning. For example, the Frontier Communities Initiative, USDA Rural Business Development Grants, USDA Community Facilities Technical Assistance and Training Grant, and the New Mexico Local Economic Assistance & Development Support Program.

economic development financing tool (such as the Local Economic Development Act). LEADS is designed to reimburse applicant costs after a project has been completed.

Table 8-1: Funding Sources to Support Economic Development

Purpose	Program	Organization	Application Deadline	Important Requirements
Tourism Marketing	Cooperative Marketing Grant	NM True	Contact Jordan Guenther at 505-695-6605	Matching funds; must attend an informational webinar; adhere to NM True's brand guidelines
Technical assistance for economic development	Frontier Communities Initiative	NM EDD	Contact Daniel Gutierrez at 505-827-0151	Cannot be affiliated with NM MainStreet or NM Arts & Cultural District Program.
Business, community, infrastructure development	FUNDIT	NM EDD	February 17, 2017	Projects must be listed in official planning documents; economic and financial details must be outlined
Business development	Local Economic Assistance & Development Support Program	NM EDD	Dependent on legislation; if passed, likely May 1, 2017	Public/private participation; up-to-date community development plan; have passed a LEDA or other economic development financing tool
Technical assistance for development of small businesses	Rural Business Development Grants (RBDG)	USDA	April 28, 2017	Rural area, <50 employees, <\$1 million in gross revenues
Regional economic development	Strategic Economic and Community Development	USDA	April 28, 2017	Must be applied for with RBDG; carried out solely in a rural area; support a multi-jurisdictional strategic economic community development plan
Development of community facilities	Community Facilities Direct Loan & Grant Program	USDA	Contact Kathy Pfiffner at 505-761-4956	Rural area, grant size depends on population and median household income
Technical assistance for community facilities	Community Facilities Technical Assistance and Training Grant	USDA	Contact Kathy Pfiffner at 505-761-4956	Rural area (<20,000 people)
Feasibility/ Impact Studies	Local Technical Assistance Program	EDA	Continuous	Matching funds 20 - 50% depending on unemployment rate and income

## 9 PROCESS DOCUMENTATION

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This section documents the steps, methods, and sources of information used in this planning process. The COG established a POWER committee to oversee the project and provide project direction and feedback to the planning process. The membership of the POWER committee continued to evolve over the course of the project, but was consistently comprised of economic development leaders, tribal representatives, and energy sector leaders.

The first subsection, **Section 9.1**, provides an overview of the project timeline and key meetings/public outreach. **Section 9.2** provides detail on outreach to the general public, while **Section 9.3** provides detail on each of the meetings and key stakeholder outreach components, including agenda and meeting notes as well as representative interview questions.

### 9.1 PROJECT TIMELINE

**Table 9-1** summarizes the overall project process and timeline. The planning process was a nearly one-year effort, begun in late March of 2016, with final presentation on February 8, 2017. Engagement with the POWER committee, the COG, and key stakeholders and industries was ongoing throughout the project. Particular project milestones, meetings, and outreach of note include:

- **Initial data collection and project interviews** in April and March of 2016. Through interviews with key stakeholders and economic development organizations throughout the Northwest New Mexico region, the consultant team gathered existing economic development and planning documents, information on current economic conditions and plans, and insight into local assets and challenges relating to economic development.
- **Initial set of focus group meetings held in each of the three counties** (in Grants, Gallup, and Farmington) and with the Navajo Nation in Farmington on June 8-10, 2016. (A representative of the Pueblo of Acoma attended the Cibola County meeting, but no representatives of the Pueblo of Acoma were able to attend the focus group meetings, although the Pueblo of Laguna provided several comment letters on the draft report in November 2016 and January 2017).
- **Mid-project meeting with the POWER committee** on July 7, 2016. This meeting served two purposes: 1) update committee on preliminary findings regarding adverse impacts and best practices for coal-impacted regions, and 2) review and receive feedback on a potential list of diversification opportunities to analyze as part of the planning process.
- **Continued project interviews and data collection** in August, September, and October. These interviews included discussions with industry representatives in each of the targeted sectors, economic development organizations and specialists in coal-impacted regions across the country, as well as with adversely affected coal and power generation sectors in Northwest New Mexico.
- **Draft results meeting with POWER committee** on November 9, 2016. Draft results from all elements of the analysis, including adverse impacts, best practices, mitigation strategies, energy sector opportunities, and diversification opportunities were reviewed and discussed at this meeting. This input was used to identify final recommendations.

- **Final plan presentation with economic development organizations from each county and the COG Board** on February 8, 2017.
- **Public input solicited through a project website and online survey** that were advertised via radio public service announcements and flyers; no responses to the survey were received through the website.

Table 9-1 Overall Project Timeline

Public Involvement Component	Participating Entities	Date Completed
Notice of Award, Notice to Proceed	COG, Highland Economics team	March 21, 2016
Initial Data Gathering and Interviews	Highland Economics team, Key Stakeholders/Community Leaders	April, May
Focus Group Participants Finalized, Invitation Letters Sent	COG, POWER Committee, Highland Economics team	May 4, 2016
Public Service Announcements on radio	Highland Economics team, Public	May, 2016
Website & Survey 'Live' for Public Comments	Highland Economics team, Public	April 25, 2016 through January 31, 2017
Focus Group Meetings	COG, Key Stakeholders, Highland Economics team	June 8-10, 2016
Selection of Energy Sector and Diversification Opportunities for Analysis	Highland Economics team, POWER Committee	July 7, 2016
Data Collection and Analysis, Including Interviews in Target Industries	Highland Economics team, Key Stakeholders/Industries/Leaders in 4C region	August, September, October
Review of Draft Findings	Highland Economics team, POWER Committee	November 9, 2016
Finalization of Analysis and Plan	Highland Economics	December, January
Presentation of Final Plan	Highland Economics team, POWER Committee, COG Board of Directors	February 8, 2017

## 9.2 PUBLIC INPUT

This section provides information on the public service announcements, project website, and flyers that were used to engage the general public. As noted above, little feedback from the general public was received.

### 9.2.1 Public Service Announcements

In mid-April and late-May, the following public service announcement was read on KNDN (Farmington) which is broadcast throughout the Four Corners Region:

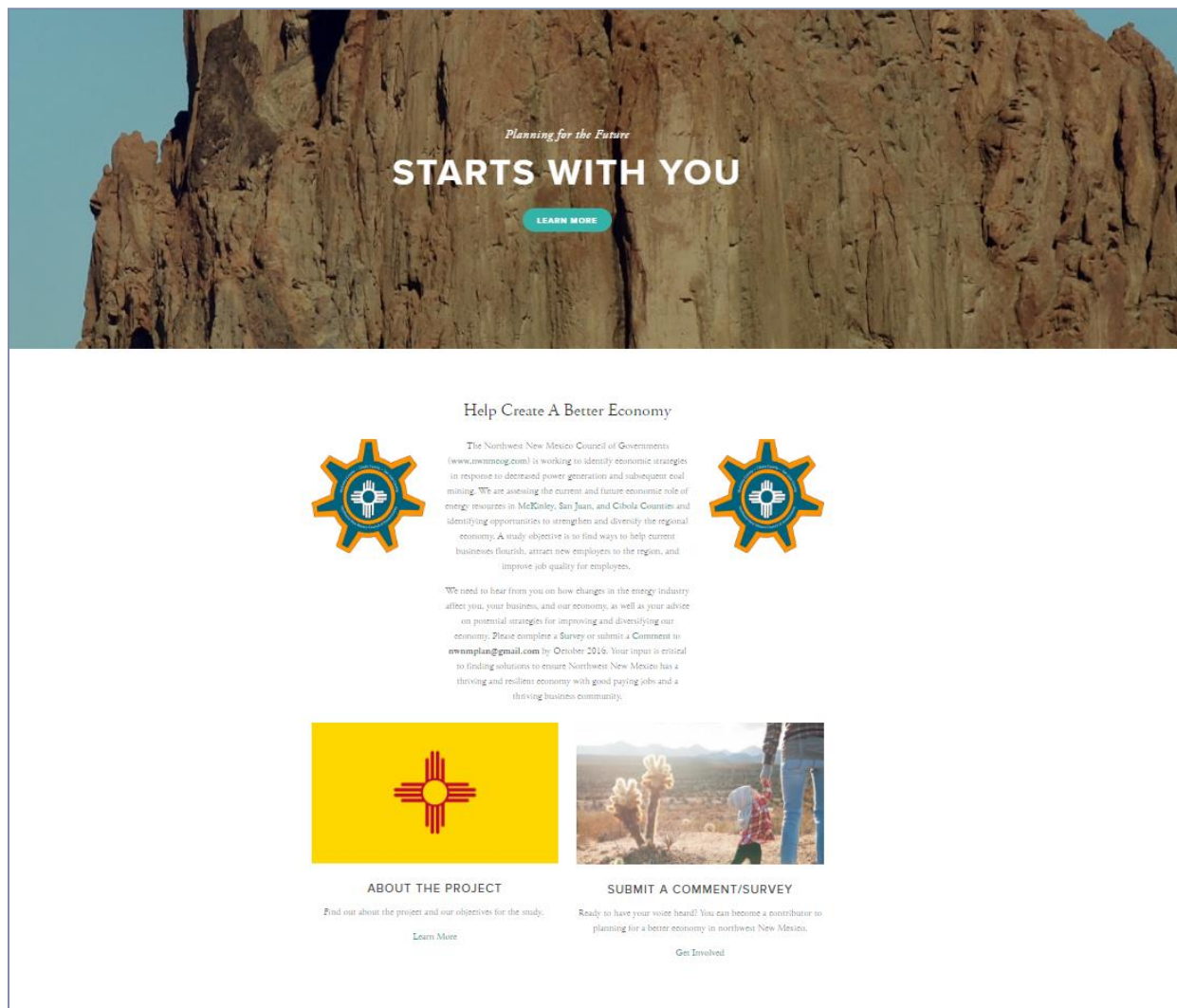
“The Northwestern New Mexico Council of Governments is working to identify economic strategies in response to decreased power generation and coal mining in the Four Corners region. The purpose of the project is to assess the economic role of coal in McKinley, San Juan, and Cibola counties and identify opportunities to strengthen the regional economy. We need to hear from you on how changes in the

energy industry affect you and our economy, as well as your advice on potential strategies for improving the economy. Please visit [www.nwnmplan.com](http://www.nwnmplan.com) for information on the project and to submit a comment or complete a project survey. Your input will directly inform the planning process. Again, please visit [www.nwnmplan.com](http://www.nwnmplan.com) for additional information and to allow your voice to be heard. “

### 9.2.2 Website

A project website (see **Figure 9-1**), nwnmplan.com, remained online throughout the duration of the project, and included the following pages: Home, Project Information, and Submit a Comment/Complete a Survey.

Figure 9-1 Project Website Homepage



### 9.2.3 Website Survey/Comment Opportunity

The following is the survey that was circulated to solicit public input:

Thank you for your interest and input on the Northwest New Mexico Council of Governments' regional economic assessment and strategy for San Juan, Cibola, and McKinley counties (hereafter, 'region'). The purpose of the study is to assess current and future impacts of the region's coal industry, and to formulate economic development strategies that capitalize on the region's assets. The purpose of this survey is to collect information from the public to provide information for the study, including identifying 1) the range of economic impacts of changes in the coal industry, 2) potential future direction of the region's energy industry, and 3) steps the region can take to diversify and strengthen the regional economy. Your contributions are an important piece in planning for the future. Please submit your completed survey to [nwnmplan@gmail.com](mailto:nwnmplan@gmail.com).

1. Is your income/job related directly, or indirectly, to the region's power generation or coal mining industry? Y/N If yes, what is your occupation?
2. Please identify any regional economic or social impacts that you think may result from reduced power generation in the region. For each identified impact, please also circle the size (big or small) and type (decrease or increase) of the impact you expect in the region.

a. Employment Opportunities	Big/Small	Increase/Decrease
b. Income	Big/Small	Increase/Decrease
c. Population	Big/Small	Increase/Decrease
d. Housing Prices	Big/Small	Increase/Decrease
e. Local Tax Revenues	Big/Small	Increase/Decrease
f. Environmental Quality	Big/Small	Increase/Decrease
g. Overall Community Well-Being	Big/Small	Increase/Decrease
h. Public Health	Big/Small	Increase/Decrease
3. What role do you see for power generation and coal mining in the region 20 years from now?
  - a. Continued, primary economic driver
  - b. Reduced, supporting economic driver
  - c. Phased out
4. What are the key strengths and assets of the region (including natural resource, cultural, social, geographic, political, infrastructure, education characteristics) that you think could drive economic development? Be as specific as possible.
5. What industries could benefit from these strengths and become strong economic drivers in 20 years?
6. What are the weaknesses, barriers, or threats to a thriving, resilient regional economy? Be as specific as possible.

7. Please suggest actions that local economic development organizations can take to increase economic development in the region. What would be good strategies for attracting or retaining new businesses and industries?
8. Please provide any other comments you would like to add.

### 9.3 KEY STAKEHOLDER ENGAGEMENT AND INPUT

This section describes the initial data collection effort, which included interviews of key stakeholders, affected industries, and economic development organizations, as well as focus groups in each of the three counties. It also describes tribal outreach efforts.

#### 9.3.1 Initial Project Interviews and Data Collection

At project initiation we interviewed representatives of at least one economic development organization in each county and at the COG regarding existing conditions, existing analysis/documents, current activities and economic development efforts, opportunities and assets in the region, and tribal relations.

Below is a list of representative questions asked at the time of these interviews.

#### Existing Documents

- Studies of target industries
- Studies of infrastructure upgrades – transportation, communication, etc.
- Documentation of public involvement efforts or business input on economic development strategies

#### Existing Conditions General Info

- How is (San Juan / McKinley / Cibola) county unique among the other counties of the region?
- What efforts/initiatives are underway in the county to enhance job / industry base?
- What is timeline and magnitude of effects anticipated at power plants/coal mines in area?
- What can you tell me about expansion / retention of the major employers in county?
- Are there any new industries/employers anticipated in the near future?

#### Adverse impacts of reduced power generation

- What information do you have on changes in the coal mining / power plant sectors?
  - Change in production MWh annually
  - Jobs at power plants
  - Coal tonnage used annually
  - Coal mining jobs
  - Contacts at power plants or mines to obtain more information
- What is happening with oil/gas production and associated jobs?
- What other sectors are being (or will be) affected indirectly in the county and regional economy based on power reductions? What do you see as the distribution of these impacts within the three county region?
- What social effects are you seeing/ anticipate? What are people doing that have been affected – moving away, going back to school? Community well-being/cohesion?

- Who do you recommend we contact about adverse impacts?

#### Opportunities

- What do you see as key assets in the region (people, natural resources, infrastructure, culture, etc)? Are these being tapped currently to their full potential? What other opportunities could make use of these assets?
- What are weaknesses in the region? What is being done to address these weaknesses and associated barriers?

#### Tribal Relations

- Are there mechanisms/initiatives for collaboration between local government/economic development organizations and the tribal governments?
- What has been the history of engagement between tribal governments and local economic development efforts?
- To what extent do tribal governments share tribal planning efforts with other local entities?

#### 9.3.2 Tribal Outreach

Tribal outreach included invitations to participate in focus groups and POWER committee meetings, as well as email and phone contact regarding economic assets and development plans/goals. Flyers translated into Navajo were posted in the Navajo chapter houses in New Mexico. Flyers were also posted in Pueblo administration buildings. Provided below is a list of questions that were included in email and phone outreach to the Navajo Nation, Pueblo of Laguna and Pueblo of Acoma.

#### Existing Documents

- Any existing studies you can provide on economic planning, land use, capital investment planning for infrastructure, demographic studies, and any public involvement efforts or business input on economic development or community development strategies?

Figure 9-2 Project Poster Translated Into Navajo



#### Adverse impacts of reduced power generation

- For Acoma/Laguna: How tied is Pueblo economy with coal / power generation? Other energy resources? How many tribal members employed at El Segundo and Escalante? How many people affected by layoffs at El Segundo?
- Are there any businesses at the Pueblo that will be affected by reduced coal/power generation?
- How tied is the Pueblo economy with Grants/rest of Cibola economy? Do people go to Grants or to Albuquerque for shopping and groceries?
- What social effects are you seeing/ anticipate? What do you foresee tribal members doing that have been affected – moving away, going back to school? Community well-being/cohesion?
- Who else do you recommend we contact about adverse impacts?

#### Opportunities/Strengths/Weaknesses

- Is population decline an issue? If so, why? If jobs, what types of jobs would keep tribal youth in the area? What pay rate /types of opportunities would keep people here?
- What types of jobs training/skills do tribal members need/want? Are those available to them now?
- In what types of jobs are most tribal members currently employed? What types of jobs do people want that would be a good fit?
- What do you see as key assets in the region and the Nation/Pueblo (people, natural resources, infrastructure, culture, etc)? Are these being tapped currently to their full potential? What other opportunities could make use of these assets?
- What are weaknesses to business development/retention on the Pueblo/Nation and in the general region? What is being done/could be done to address these weaknesses and associated barriers?
- Mine reclamation has been mentioned as a potential economic opportunity. What are your thoughts on that? Are there tribal businesses that would be able to take advantage of that opportunity?
- Agriculture has also been mentioned as an opportunity – what potential do you see for this on the Nation/Pueblo? What level of farming is currently done? What is future potential for increased subsistence or commercial scale ag? For what crops?
- Does the Nation/Tribe support/desire increased tourism / recreation in the area? What type – what would be the tribe's vision for Pueblo or regional tourism? Visitors to the reservation or just the area? What businesses/activities would attract them and would tribal members embrace this? Would the tribe be interested in collaborating with other regional entities on this? Are there any areas that the Tribe would like to restrict for recreation/tourism uses?
- How is your (Reservation/Pueblo) unique compared to other areas in the Four Corners region?
- What efforts/initiatives are underway in the (Reservation/Pueblo) with aim to enhance job / industry base? What departments/people are leading these efforts – and can you provide contact information for them?
- What can you tell me about expansion / retention of employers in the area/Pueblo/Nation?
- Are there any new industries/employers anticipated in the near future? Past success stories?

#### Tribal Relations with Surrounding Communities

- Are there mechanisms/initiatives for collaboration between local government/economic development organizations and the Nation/Pueblo?
- What opportunities do you see for collaboration on economic development that would benefit all?
- What has been the history of engagement between the Nation/Pueblo and local economic development efforts?
- To what extent does the Nation/Pueblo share tribal planning efforts with other local entities?

### 9.3.3 Focus Groups

After initial data collection and interviews were complete, the COG with its consultants, Highland Economics and Catalyst Environmental Solutions, convened focus groups throughout the region. Four focus groups were held throughout the region, one for each county, and one for the Navajo Nation (held in Farmington). The focus groups were designed to reflect the economic composition of the three county area, comprised of community and business leaders from each county and from the Navajo Nation. The focus groups included leaders from the private and public sectors, energy industry representatives, and tribal representatives.

The purpose of the focus groups was to collect information on issues and concerns regarding changes in the coal industry, as well as to develop a thorough understanding of the region's key economic assets, attractions, and resources on which to base future economic development strategies.

#### 9.3.3.1 Agenda

The following is the agenda for the focus group sessions.

#### ***Focus Group Meeting Agenda***

June 8-10, 2016

#### **Welcome & Introductions (5 minutes)**

- Moderators - Ben Pogue and Barbara Wyse
- Round the Room

#### **Why We Are Here (5 minutes)**

- Grant Provided By US Economic Development Administration
- Planning For Reduced Coal Economy
- Information Collection & Community Input
- Economic Assessment & Strategies

#### **Meeting Objectives & Format (5 minutes)**

- Solicit Perspectives on Past and Present Issues
- Not A Debate – Not Trying to Persuade Others
- Can't Linger Too Long On An Issue (15 Minutes Each)
- Open Forum, Raised Hands If Necessary

#### **Topic #1 – Role of Coal and Other Energy Assets in Northwest New Mexico – Past, Present, and Future**

**Topic #2 – What Are the Key Strengths & Assets of the Region with Potential to Drive Economic Development?**

**Topic #3 – What Are The Key Weaknesses, Barriers, Or Threats To A Thriving Regional Economy?**

**Topic #4 – Strategies For Attracting & Retaining Businesses/Industries**

**Meeting Recap**

*9.3.3.2 Focus Meeting Notes*

Below are the notes from each of the four focus group sessions.

*9.3.3.2.1 San Juan County (in Farmington)*

Provided below is a summary of the input received at the focus group held in Farmington on June 9 and attended by concerned citizens and leaders from economic development organizations, local government, and local businesses. Input from the focus group is informing the economic assessment regarding how changes in the energy industry affect our citizens, businesses, and economy; focus group input is also providing a foundation for identifying potential strategies for improving and diversifying our economy. As the next step in the process, the ideas put forth at the focus group are being examined in further detail to develop a core set of local and regional strategies to help current businesses flourish, attract new employers to the region, and improve the quality of our job base and workforce.

**Coal /Energy Economy**

- 1/3 of Navajo government revenue is tied to coal mines.
- 1500 people in Farmington, primary income is from coal or power (\$90 million payroll)
- Crux of problem: Coal is the most labor intensive energy industry. 700 MW at San Juan Generating Station, took 350 jobs. Gas combined cycle turbine plant provides 40 jobs. Coal is an industry for which there is no replacement. Huge hill to climb to re-employ with similar skills at same wages (\$88,000-\$100,000 average salary).
- Westmoreland, \$100,000 power plant and mining average salary
- Oil and gas 2011 study – 70,000 (?) people making over 100,000 annually
  - Load payroll by 50% when add in the benefits
- Navajo Nation (NN) is critical to energy future – both coal plants are on Reservation. Need to form a partnership with NN
- Coal is a valuable resource with a future.
- Four Corners Power Plant operating for another 15 years. San Juan not as much certainty – have to start the process with public regulatory commission at state level. Ownership issues arise in 5 years, so beyond 5 years operation is uncertain. Need to explore exporting coal, which is related to rail infrastructure.
- Regulations are the problem. Making it uneconomical for businesses to stay in business.

**Strengths/Opportunities**

- San Juan College is tremendous asset and been really responsive to workforce training needs; also possible to get 4 year degree through San Juan CC and through Fort Lewis college in Durango 35 miles away.

- Center for Workforce Development
  - Energy CDL program
  - IBM investing in program
  - Work Keys for community and state
- Regional healthcare hub – San Juan Regional Center. Good place for medical research, particularly on issues such as diabetes.
- Ton of communication capacity – ABQ to Grand Junction to Denver, fiber loops around county
- Group of highly motivated community leaders.
- Lots of 4CED workshops, lots of speakers educate business owners; very active retention program to have a good sense of what is going on in business community.
- Huge natural gas reserves (methane, butane, natural gas liquids). Have infrastructure pipeline to CA and El Paso (Kinder Morgan).
- Have all support industries for oil and gas – engineering, construction, machine shops (database of services/products produced – they are being encouraged to obtain ISO 9000 certification).
- 70% of surface water in NM flows through San Juan County.
- AG/Food processors, NAPI.
- Transportation: Two four-lane highways; 3 points of access to I-40 and rail, can get from Durango to Denver and from Denver anywhere.
- Durango center for adventure – attracts lots of tourists; we could do that too.
- Large laborshed (access to all parts of Four Corners region).
- Rail spur through Navajo Nation to Thoreau. BNSF – need 100 cars/ week. Shortline company would need 100 cars/month. Feasibility study was done (NM Tech), 4CED has not met with NN on this potential project.
- East Texas distillation process possible at power plant. Extracted liquid economically feasible at \$85/barrel. Could make pellets of coal for shipping - no dust. Had the \$ to build the plant, but not political support at NN.
- Low utility rates (b/c of coal powered plants) and independently owned utility companies.
- Native American workforce skilled in detail work.
- ACT workforce community.
- Tourist attractions: Mesa Verde, Chaco, Aztec Ruins; places you can market globally. National Geographic. Fly fishing. Five local golf courses (highly ranked). Connie Mac Baseball Tournament and Stadium. NM True.
- Opportunity: Petrochemical companies that need cheap electricity or oil/gas (see U of T at Austin preliminary study). High value, low volume product. Necessary natural resources present in area.
- General opportunities: tourism, manufacturing, health, education, location neutral workers
- Opportunity: urea plant to service Four Corners Power Plant and San Juan Generating Station for air quality retrofit technology.
- Opportunity: expansion of Raytheon type manufacturing.
- #2 in nation for clean air.
- Beautiful weather.
- No natural disasters.

- Incubator programs – entrepreneurial ecosystem. Opened small business incubator space in Aztec. Rural incubator.
- Mid cap companies, CEO's choose location based on where they would vacation.

### **Weaknesses/Threats**

- Tax system is an obstacle. GRT designed to be broadband tax, but the effective base is only 1.8% out of 5.3%. Very complicated and disproportionately affects low income.
- Almost half of population, 800,000 out of 2 million in NM, on Medicaid.
- We're not the same region as NM – we're AZUNMCO – border is a pain for us, hampers collaboration.
- Farmington is two economies – service/products/trade serving 3 states with population of 300,000. Daytime population is 80,000 when resident population is just 46,000.
- Big difference in tax structure b/w AZ and NM – simpler in AZ, businesses know what they will pay.
- Only 6% land available as private land.
- Aesthetics – rough around the edges; too many chain link fences.
- Rail transport.
- Losing teachers. Teacher shortage. Hard to attract teachers.

### **Strategies**

- Community should continue to promote use of coal to state and federal legislators. Create coalitions to defend and promote coal and natural gas industries. Form partnerships with other regions of NM (SE part of state took stand on some of the issues on oil and gas).
- Explore all energy options – need a mix of coal and all other sources.
- Downtown Revitalization (Model after Durango) – locate courthouse and other buildings downtown and getting multi-use out of them to revitalize downtown.
- Education – provide balanced energy education in schools with info on what fossil fuels provide and what they mean for the economy.
- Import substitution – make some of the things locally that we retail here.
- Develop urea plant to respond to demand at Four Corners Power Plant and San Juan Generating Station.
- Support rebirth of agriculture – model off the major coops that are in Southern CO.
- Zone some areas for industrial growth.
- Tourism: Form regional tourism partnership with southern CO; Partnership with Gallup and Grants. Need to band together to combine resources. (Scenic byway connects all three counties. There are times when there is good cohesion between groups, and then times when it all falls apart.)
- Develop business incubator / expander to help businesses identify how to export to other states and internationally – how to deal with regulations, and help with identifying markets out of NM and out of US. Teach basic business skills for entrepreneurs.

### 9.3.3.2.2 McKinley County (in Gallup)

Provided below is a summary of the input received at the focus group held in Gallup on June 8 and attended by concerned citizens and leaders from economic development organizations, local government, and local businesses. Input from the focus group is informing the economic assessment regarding how changes in the energy industry affect our citizens, businesses, and economy; focus group input is also providing a foundation for identifying potential strategies for improving and diversifying our economy. As the next step in the process, the ideas put forth at the focus group are being examined in further detail to develop a core set of local and regional strategies to help current businesses flourish, attract new employers to the region, and improve the quality of our job base and workforce.

#### **Coal /Energy Economy**

- Adverse effects of decreased production: Reduced jobs, income, multiplier effects, revenues to Navajo Nation, GRT Tax, NM state severance tax income.
- Coal trains are down 50%, mostly freight trains running through area.
- Escalante power plant most at risk in area – electricity is sold on the grid and not for local consumption; property tax of Escalante Plant is \$1.4 to \$1.5 million.
- So much regulatory burden with fossil fuels, it won't change and we need to plan for that.
- Green coal – economics aren't there, it's physically feasible but too expensive. 1/3 of Navajo Nation government revenue is from fossil fuels. \$50/barrel is investment level that needs to be maintained for a year to allow for investment to come back. NTEC is seeking investments in green coal. Navajo Nation is interested in both fossil fuel and renewable energy developments.

#### **Strengths/Opportunities**

- Transportation Infrastructure – I-40, 491, rail.
- Tourism is low hanging fruit, especially given the cultural resources in the area.
- Lots of R&D assets in the area with the labs.
- Excellent hiking and biking trails in area.
- Gallup Land Partners developing 27,000 acres western side of town.
- Gallup Water Pipeline, wastewater treatment plant investments.
- UNM – Gallup workforce division with many ties to Navajo.
- A lot of trade in Native American jewelry and art.

#### **Weaknesses/Threats**

- Overall NM Economy lacks diversification and is very extractive based, so entire state is hurting and tax receipts down.
- Hard to attract/retain professionals if they have to travel elsewhere for services (Example of difficulty filling positions for professional medical providers).
- Panhandling is an issue in commercial areas.
- Retail trade hub is in decline as coal is leaving, leading people to leave (projection of 7,000 leaving in next 5 years).

#### **Strategies**

- Become a transportation hub via the GLP
  - Trucking super center
  - Transloader facility (see Santa Teresa)

- Potential manufacture of the building materials working with construction tech program.
- Tourism, especially jewelry, recreation, and natural resources.
- Develop a workforce profile to attract businesses.
- Formulate private-public partnerships to foster business environment.
- Improve advertising, especially on highway offramps so that people see County as destination and not pass-through.

#### 9.3.3.2.3 Cibola County (in Grants)

Provided below is a summary of the input received at the focus group held in Grants on June 9 and attended by concerned citizens and leaders from economic development organizations, local government, and local businesses. Input from the focus group is informing the economic assessment regarding how changes in the energy industry affect our citizens, businesses, and economy; focus group input is also providing a foundation for identifying potential strategies for improving and diversifying our economy. As the next step in the process, the ideas put forth at the focus group are being examined in further detail to develop a core set of local and regional strategies to help current businesses flourish, attract new employers to the region, and improve the quality of our job base and workforce.

#### **Coal /Energy Economy**

- Coal is foundation of economy and the electric grid – safe and reliable supply of electricity.
- Starting salary of miners is \$65,000 to \$75,000; what is next step for them? How can we keep people here?
- Revenues/commodity prices down worldwide. Federal government causing the problem.
- Peabody had layoffs last week, layoffs again today. Need something long term to replace these jobs.
- Experienced downturns in the past when uranium mines closed; corrections industry kept local economy going and saved this area before. What are we going to do now?
- Federal energy policy is the issue (flash rule, haze rules, carbon etc); we need to do what we can as a state to support extractive industries and renewable and fossil fuel energy.
- Need to change political dialogue – there is lots of coal in New Mexico (discussion of whether high or low Sulphur). Potential change in dialogue about nuclear – lots of uranium reserves. Potential for shift in dialogue on nuclear power? Not wise to walk away from energy resources.
- Downturn in coal industry is affecting everyone; we want to survive.
- Hosting rapid response meeting on Monday due to recent layoffs.
- Transition from coal to renewable – have a wind farm and a solar farm in area. 2<sup>nd</sup> solar farm may come; need high tech skills – wind farm training center elsewhere.

#### **Strengths/Opportunities**

- Outdoor recreation opportunities: hiking (Continental Divide Trail), hunting, wildlife, canoeing, night skies, mountain biking, ATV (ordinance to ride on roads in area this month at state level). Opportunities similar to Moab.
- Reconstruction of Library – has nice, modern IT facilities
- Coaching/financial center in the works, completion in February 2017
- 1 hour from airport and ABQ with a population of 1 million.

- Cibola County has an airstrip that can handle planes up to a 707 or C130.
- Longest stretch of Route 66. There are 86 miles in the state of Route 66.
- Easy commute to work.
- Awesome weather.
- Scenic byway to the top of La Masca.
- Natural Attractions: El Malpais has 167,000 visitors per year and El Morro has 60,000 visitors per year.
- Races in area: Mt. Taylor 50K Quadrathon (170 people), Bike races (400 people).
- New Mexico Workforce Connection – provide community with skill sets. Main focus is training in sustainable energy. 8 training program sin sustainable energy, welding, drafting, nurse assistant, etc. Can get IT skills up to bachelor’s level.
- New Mexico State University in Grants – working together in partnership with New Mexico Workforce Connection. Need to focus the aim of retraining efforts and collaborate across entities.
- Group of committed citizens.
- Chamber of Commerce working hard on New Mexico True.
- Corrections facilities in area provide a steady source of income, raised starting wages to \$13-\$16 per hour. Have a training academy from the state Corrections department in area at times to train local hires. Have three prisons and detention center in county.
- Training center for corrections personnel may be in the works.
- Cottage industry, online work likely won’t go away.
- Transportation – I-40 infrastructure, railroad, airport capacity for larger aircraft
- Continental Divide Trail use increasing.
- Healthcare – NMSU, hospital.
- Forecast that uranium prices will be up by 2024.
- Uranium mines/tailings need to be reclaimed at Acoma and elsewhere; Superfund at Acoma. \$1 billion in mine reclamation funds available.
- IT/Telecom industry – rural areas are vast, lots of opportunities for jobs/revenue to supply rural areas with communication services (5G, access to fiber cable, # towers, etc). Navajo College to train in field technology, but enrollment numbers not high enough to develop curriculum.
- BNSF Transload facility –
  - Within 90 mile radius of ABQ (Milan is 82 miles from spur to airport), opportunity to get free trade zone status. Cibola is priority site but is currently not in proposed free trade zone – need to have public comment on this – this is critical.
  - Bring raw materials here and ship out and get taxes as one item. Huge opportunity.
  - Get several hundred trucks from Farmington each day.
  - Good weather – always clear roads and rail.
- Tribal 8a businesses at Laguna and Acoma
- Existing strengths in IT and computer tech and engineering.

#### **Weaknesses/Threats**

- Limited housing.
- Aesthetics of town.

- Limited number of things to do for ‘trailing spouse.’
- Labor pool may be diminished and quality of life and education all suffer if there is depopulation; becomes harder and harder to retain employees
- We have lost 1/3 of jobs, need to retain the 2/3 that are left.
- Very difficult to keep our young adults here. Difficult to raise a family on service sector jobs.
- Shortage of professional medical providers at hospital.
- High expense in starting new jobs skills training programs – need 12-20 people attending and also need volumes of jobs. For example, tried to get line worker certificate program – but investments are high to get necessary equipment and need high enrollment. Have to have the numbers of students to get the necessary funding.
- Potential impacts on oil refinery in Gallup? Potential rise in electricity rates?
- Renewable energy doesn’t require many workers (wind farm with 6 workers), and the people who are hired often live in ABQ.
- East side of town is swampy area.
- Hard to retain employers – platform bedding, plastics companies, call centers (State level incentives to stay for only 6 months).

#### **Strategies**

- Collaboration, communication is key. Unified regional political voice.
- Tourism: Work together as a community to increase the economic benefit of Monument tourism. Get people to stay longer in area to have bigger impact. Tell people what there is to do in area at El Malpais visitor center.
- Develop industrial park in Milan.
- Equip local workers / develop local businesses to do uranium mine reclamation work (need heavy equipment operators). Show that there is no need to bring in people from outside to do this work.
- Job retraining – online work; CDL program for here and oil and gas industry in Farmington.
- Develop a strategic, regional infrastructure investment plan. We know the gaps; need to develop partnerships to develop plan for all types of infrastructure: technology, water, wastewater, housing.
- Develop forest restoration / logging / biomass industries (used to be 4-5 sawmills).
- Greenhouse industry - in the sweet spot for that industry. Build upon value added agriculture. Expand the 20-acre greenhouse.
- Pilot solo work program (received several grants).
- Incubator IT program for kids to learn how to create jobs out of computer technology/IT knowledge (paying minimum of \$15/hour on Navajo Reservation for communications tech jobs).
- Make east side of town a shovel ready site with trash/water/sewer/gas infrastructure.

#### 9.3.3.2.4 Navajo Nation (in Farmington)

Provided below is a summary of the input received at the focus group held in Farmington on June 10 and attended by concerned tribal members and leaders from the Navajo Nation. Input from the focus group is informing the economic assessment regarding how changes in the energy industry affect our youth, our families, and our economy; focus group input is also providing a foundation for identifying potential strategies for improving and diversifying our economy. As the next step in the process, the ideas put forth

at the focus group are being examined in further detail to develop a core set of local and regional strategies to help current businesses flourish, attract new employers to the region, and improve the quality of our job base and workforce.

### **Coal /Energy Economy**

- San Juan coal mine is laying off workers right now, continues to shrink. Can't have these swings.
- Community has taken it for granted that power plant and coal mine will always be there – 4<sup>th</sup> generation of families working at the power plant. Nobody ever thought coal would go away.
- Stress and tension to families with transition –breadwinner may leave to seek work elsewhere and family stays behind. Coal mines in TX, WY, elsewhere in NM may provide work. This is what happened at Kayenta mine – families stayed and breadwinner left. Social problems with family breakdown and drop out rates.
- Once 4C shutdown complete there will be 350-375 employees at power plant and 250-275 employees at Navajo Mine.
- Budget cuts to Navajo are \$5 million this year. Shortfall next year is projected at \$27 million. Really devastating to cut programs. Often do a set % across the board to all programs; some are affected more by this type of cut than others.
- Financial impacts to lower economy are very big. 300+ contractors at 4CPP and Navajo Mine - \$90 million in power plant and mine direct incomes. Many contractors are in Farmington, few Navajo despite Navajo Business Opportunities Act
- Average salary at 4CPP and San Juan Generating Station is \$100,000 with salary and benefits. Employment multiplier of 4 – 4.5 for every employee.
- High income earners have ability to volunteer also to support community
- BHP/4CPP have provided a lot of community support, including to charities (\$1.5 million to local United Way) and scholarship funds – funds things such as youth athletics, education. Without these funds younger generation won't have as many opportunities.
- NTEC planning to continue Community Investment Fund of scholarships to chapters
- Total royalties and taxes of \$100 million a year to the NN.
- 8 million tons of coal a year to the 4C power plant; have 150 years of recoverable coal. Similar situation at San Juan Generating Station.
- Collaboration between companies on new coal technology-what are other options for energy development?
- How do we continue mining?
- What is effect on electricity rates if power plants close?
- APS and other utilities are transitioning from coal. Looking at rate structure, how to bring in renewable, and what is energy source of future. Nuclear, natural gas, coal. Baseload is coal b/c cheapest and most reliable. Slowly bringing in renewables and natural gas plants.
- If power plant shuts down, next viable option is natural gas. 80% cut in jobs and income from natural gas compared to coal for producing same kWh. Also, not much gas produced on Reservation. Even fewer jobs/income from renewable in comparison to natural gas power production on a per kWh basis.

- Should be looking at gasification- continue to mine coal, use next generation plant. Cleaner than CC units, but need \$8-\$10 billion to build to scale, emergent technology. Still need regulatory process, remains a possibility to bring back Desert Rock, but politics and regulation a problem.
- Politics barrier – lots of pros and cons about purchase of mine. Desert Rock also political/competitive. We need to work together.
- Need to tap into power of discovery – what else can coal be used for?

#### **Strengths/Opportunities**

- No natural disasters in this area.
- Opportunities with I-40.
- Tourism is an opportunity.
- Skilled labor in area.
- Gallup Water line – tap into water and invest in water development / ag.
- We have lots of water – electronic work requires a lot of water.
- We are successful at electronic assembly – several small electronic companies at Economic Summit.
- Science labs in area – we are in a natural position to take that as an opportunity.
- Navajo Nation Forestry – tree planting operation.
- Data industry needs storage. Sovereign nation – benefits relating to legal access to data. Google/others have growing data storage needs and we have lots of fiber optic lines in the area.
- Farmington is a regional hub for services – located in the middle of Phoenix, Denver, ABQ; on trade route.
- Close economic ties between Nation and communities off-Reservation providing services.

#### **Weaknesses/Threats**

- 110 chapters, only 12 have tax base to operate on their own. At the local government level, 110 economies is not realistic to operate separately. Lack of collaboration between chapters is a tremendous weakness.
- Tribal government – so many chapters, moves so slowly.
- Decades of issues between border towns and Nation – need to start collaborating. Airport collaboration has been a starting point.
- 2000 annual high-school graduates and only 40 new jobs created – exporting kids and culture.
- APS here through 2031, not a given that 4C power plant will be open past 2031.
- Lack of infrastructure to export coal and ag products– no rail.
- Government doesn't listen to community – example of Gallup water line that went through community and can't use the road now, despite community leaders' opposition.
- No economic development is in place for future generations.
- Lack of access to capital. Often small business owners get access to capital through equity in homes – but there is zero equity in homes on Navajo Nation.
- Tribal land ownership – land governed by code of federal regulations – issues with leases on federal lands and hard to make investments when don't own the land. Also environmental assessment costs are huge.
- King mine contaminated water into river – not farming this year b/c don't want to contaminate land.

- Few people with training in business development.

#### **Strategies**

- Collaborate with local communities, maybe start small – start collaboration with Kirtland, work with them to begin learning how to collaborate.
- Form partnerships with electronics/software/computer firms.
- Chapters can invest in organic farming and tie to eating healthy initiatives.
- Create more regional economies (rather than 110 separate chapter economies).
- Export coal; need to collaborate with county/region/Nation to get infrastructure.
- Develop Shiprock museum - Old Indian Health Service hospital is a unique place for a museum.
- Develop Regional Master Plan for economic development that identifies the ‘what if’ scenarios.
- Develop autonomy at local level – Local Government Act.
- Work with Small Business Administration to develop businesses and help people understand how to establish LLC’s and develop pro formas. Need to stimulate business growth.
- Seek outside help – get US Director of Tribal Energy to inform us about how other tribal nations are moving forward and ideas for Navajo.
- Focus on education and train for future job market.
- Revenue from coal in the present should be used for investment for the future.

#### **9.3.4 Project Interviews: Adverse Impacts, Best Practices and Targeted Industry Analysis**

Throughout the analysis, we conducted numerous interviews with economic development leaders and industry leaders in target growth industries and adversely affected industries in Northwest New Mexico and elsewhere in the Country. This section describes the types of organizations we interviewed and representative questions we asked these organizations.

To assess adverse impacts in the Northwest New Mexico region, we reviewed existing analyses of impact pertinent to coal mining and power generation in New Mexico and elsewhere in the United States. We also contacted representatives of each of the coal mines and coal-fired power generation plants in the region. However, most of these representatives did not respond to our requests for information or were not able to provide information. Questions that we posed to these industry representatives include:

- What information can you share regarding the effects of changes in power generation on the number jobs and associated income at the power plant?
- What is the long-term outlook for coal-fired power generation? Coal mining in the region?
- What opportunities do you see for other forms of electricity generation in Four Corners (more natural gas, combined cycle, etc) or alternative use of coal resources for energy?
- What are the potential effects of reduced power plant generation on the mine?
- What information can you share on past, current, and likely future workforce at the mine?
- What information can you share on past, current, and likely future royalties/revenues to the Navajo Nation?

To learn how communities can mitigate the impacts of industry loss, our research on best practices relied on interviews with organizations that have faced similar challenges. Because the Appalachian region has extensive experience with the loss of coal jobs, we sought out organizations operating in this

region and contacted 14 offices in 11 organizations to learn what strategies have helped to reinvigorate and diversify their economy. These included non-profits organizations (NGOs) with economic development missions (e.g. business incubators), government-supported economic development organizations (e.g. workforce development boards), and educational institutions focused on retraining out-of-work coal miners. From the NGOs and economic development organizations, our baseline questions included:

- What are some best practices that you could recommend for economic development in areas hit hard by reduced coal extraction?
- What case studies do you know of that could serve as effective examples?
- What challenges is Northwest New Mexico likely to encounter and what would you recommend to overcome them?
- How do you determine which programs/investments will have the greatest chance of success?
- What strategies can be used to increase the chances of a program's success?
- What sources of funding support are available for communities facing these challenges?
- What specific actions are needed to get initiatives going?
- What positive outcomes have resulted from your work on similar issues?
- What other advice do you have for others trying to duplicate such a best practice?

For educational institutions, our questions focused on programs aimed at reemploying coal miners:

- When was the retraining program started?
- What funding sources were available to get the program started?
- Please describe the length of the program and the type of training/education involved.
- What links does the program have with the local business community? (i.e. Can local businesses communicate the types of skills they're seeking from workers, and do they hire graduates of the program?)
- How many students have been enrolled in the program?
- What is the job placement rate?
- What advice do you have on development and running training programs for miners?

Our investigation into opportunities for economic diversification also relied on interviews, which helped to inform, guide, and supplement our research on markets and industries. In this portion of our study, we contacted more than 36 offices in 31 organizations that included: State and federal agencies, academic institutions, industry organizations, private companies, and local economic development and tourism organizations. Our questions for each organization changed depending on the industry of interest and the experience and perspective of the representative. However, in general, each interview sought to answer the same basic questions about each prospective economic opportunity:

- What potential do you see for this industry to expand in Northwest New Mexico?
- What advantages does the region have for growing this industry, and how can these be harnessed?
- What disadvantages does the region have for growing this industry, and how can these be mitigated?
- What other barriers exist to expanding this industry in the area, and how can they be overcome?

- What are the current and projected market conditions for this industry's product or service? (i.e. supply, demand, changing technology, and industry trends)
- What can local and state governments do to further support this industry's growth in Northwest New Mexico?

### 9.3.5 Mid-Project POWER Committee Check-in

The purpose of the mid-project check-in was to update the POWER Committee on the status of the economic impact analysis and assessment and to refine the list of potential economic development opportunities to be analyzed in-depth. The list was developed based on information from the focus groups, existing regional economic development documents, and preliminary research. Prior to the meeting, the POWER committee was presented a memo (presented in Section 1.3.4.1 below) listing potential strategies/opportunities. The POWER Committee provided feedback on this list, and assisted in narrowing the list down to the final list of economic development opportunities (see Section 1.3.4.3 for the final list). Below, Section 1.3.4.1 provides a copy of the memo distributed to the POWER committee prior to the mid project check-in that describes the framework and provides the preliminary list of economic development opportunities, this memo also includes the agenda for the meeting. Section 1.3.4.2 provides the summary memo documenting the list of opportunities for analysis.

#### 9.3.5.1 Mid-Project Meeting Memo

The purpose of this memo is to update the POWER Committee on the status of the economic impact analysis and assessment and to refine the list of potential economic development opportunities to be analyzed in-depth by Highland Economics. An extensive list of economic development opportunities have been identified through the focus groups, existing regional economic development documents, and our own preliminary research. We have distilled this information into a comprehensive list of strategies/opportunities that is intended to inform and guide our discussion on July 7<sup>th</sup> with the POWER Committee. We are seeking input from the POWER Committee on this list, to assist us in narrowing this preliminary list down to approximately five energy-related opportunities and up to ten non-energy related opportunities.

There are three sections to the memo. The first section briefly outlines our proposed, general framework for the analysis of economic development opportunities. The second section the memo presents a preliminary list of energy-related opportunities/industries, while the third section presents a preliminary list of non-energy diversification industries.

#### November 7<sup>th</sup> Mid-Project Meeting Agenda

1. Brief overview of call: update on project status and refine list to approximately 15 opportunities.
2. Status overview.
3. Feedback on Framework questions and approach
  - a. Any comments on approach – suitability, market demand, outlook for industries, economic development potential?
4. Process Overview of Refinement
  - a. Throughout our report we will be describing current activities and acknowledging existing research on potential future opportunities. Our purpose is to build on that firm foundation. This report does not exist in a vacuum.

- b. So for today, our goal is refinement of the list of opportunities.
    - i. Go through list of reasons to eliminate (as outlined in survey document)
- 5. Go through list, discussing strategies one at a time: Note to group first that our process will cover each strategy briefly- we will ask people to chime in with any fatal flaws, then any reasons the strategy may be low priority, and then if opportunity may pass suitability/priority screening, the key contact people in the region on this opportunity
- 6. Additional key opportunities we missed?

#### General Framework of the Analysis

The objective of industry screening and targeting is to identify businesses or industries with profit potential and long-term sustainability. For all proposed industry concepts, we proposed to identify the following:

1. Suitability of the Northwest New Mexico (NWNM) region for the industry
  - a. Are the key resources and input requirements present, or relatively cheap to import?
  - b. How well does workforce skills in NWNM match these industries?
  - c. Does the region have the other key characteristics that determine where these industries locate?
  - d. What are the primary siting factors for the industry?
    - i. Are there sites in NWNM region that can accommodate these industries?
2. Market Demand
  - a. What is the local, regional, national, international market for these products?
  - b. What are the product or service characteristics sought by the target market?
  - c. How competitive would a NWNM industry be compared to existing industry locations?
3. Identification & Outlook
  - a. Who are the key players in the industry and where are they operating currently?
  - b. Is the industry growing or shrinking?
4. What is the economic development potential of this industry?
  - a. What are wage levels for the main workforce?
  - b. How job intensive is the industry?
  - c. What is the multiplier effect of industry?

Other factors to be considered specific to the industries in question are identified below.

#### Energy-Related Industry Concepts

Our preliminary list includes four main categories of energy-related activities to explore further: opportunities for coal, electricity from natural gas, renewable energy, and uranium extraction. These strategies aim to expand or diversify the existing energy economy. The list is varied and further refinement will be required before we begin our more in-depth analysis.

#### *Opportunities for Coal*

- Export of coal
- Clean coal technology (gasification / liquefaction)
- Use of coal by energy-intensive industries (see below)

Additional questions we will consider:

1. Quality of coal relative to competitors for export market.
2. Demand/supply in export market, taking into consideration carbon policy.
3. Transportation costs and other factors in transporting coal to the export markets.

#### *Electricity Generation with Natural Gas*

- Natural Gas Combined Cycle (NGCC) plant(s)

Additional questions we will consider:

1. How does NGCC fit into the new policies regarding emissions?

#### *Renewable Energy Developments*

- Wind Power
- Solar (Parabolic / Photovoltaic)
- Geothermal

Additional questions we will consider:

1. Where are the best locations for these renewable energy project?
2. What is the appropriate scale of renewable energy development project given the target markets and existing infrastructure in place?

#### *Uranium Extraction*

- In-Situ Uranium Extraction

Additional question we will consider:

1. Is uranium extraction desirable/feasible given regulatory, cultural, political factors?

#### Non-Energy Related Industries

Our preliminary list includes nine non-energy related categories of activities to explore further: forest restoration cluster, mining reclamation, logistics, agriculture and food processing, energy intensive manufacturing, heavy mineral mining and processing, dimension stone extraction, recreation / tourism, and general quality of life enhancement. These industries/strategies are varied and further refinement of this preliminary list is needed before we begin our more in-depth analysis.

#### *Forest restoration cluster*<sup>17</sup>

- Sawmills

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<sup>17</sup> Tapping into forest & energy resources with transportation links and building on BioPappel's success.

- Paperboard mills
- Pulp mills
- Veneer and plywood manufacturing

Additional questions we will consider:

1. Legal/political access to timber resources on public lands
2. State/federal funding support for restoration activities
3. Quantity of timber that could be harvested annually compared to economies of scale needed by timber / paper industries

#### *Mining Reclamation*

- Reclamation at old uranium sites

Additional questions we will consider:

1. Funding availability from federal government
2. Political priorities for use of reclamation dollars – priority level for NWNM sites
3. Timeframe of cleanup (how short-term would projects and associated dollars be?)

#### *Logistics*

- Trans loader/warehousing and distribution centers
- Trucking super center on I-40

#### *Agriculture and Food Processing Cluster<sup>18</sup>*

- Crop production – greenhouse and field
- Livestock feedlots
- Food processing
- Farmers markets

Additional questions we will consider:

1. Availability of water
2. Economic development potential of agriculture for local regional consumption vs agriculture for export out of the area

#### *Energy Intensive Manufacturing<sup>19</sup>*

- Industrial gas manufacturing
- Cement manufacturing
- Other basic inorganic chemical manufacturing
- Petrochemical manufacturing
- Lime manufacturing

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<sup>18</sup> Building on agricultural past, NAPI, transportation links, and energy resources

<sup>19</sup> These types of manufacturing would require transportation links found in the NWNM region

- Glass container/flat glass manufacturing
- Brick, tile, and other structural clay product manufacturing

*Heavy Mineral Mining & Processing*

- Zirconium
- Titanium
- Other rare earth elements

Additional questions we will consider:

1. Where have heavy mineral deposits been documented in the study area?
2. What companies would have the capital resources to consider developing these resources in the future?

*Dimension Stone Mining*

- Dolomite
- Limestone
- Silica Materials
- Travertine
- Other stones

Additional question we will consider:

1. Where have dimension stone deposits been documented in the study area?

*Recreation / Tourism*

- Cultural center(s) showcasing Navajo and local history, culture, artisans (workshop)
- Downtown revitalization strategies
- Outdoor education / adventure camps for families and youth that showcase local geology / history / culture

*General Quality of Life Enhancement*

- Attraction/Retention of Retirees
- Attraction/Retention of Professionals
- Attraction/Retention of Young People

Additional questions we will consider:

- What regional assets do we have that we can develop further to enhance quality of life?
- What services do we lack that we can provide locally?
- What are strategies to revitalize our downtowns?

*9.3.5.2 Mid-Project Identified Diversification Opportunities for Analysis*

Based on the July 7, 2016 mid-project meeting with the POWER committee, this memo identifies the potential business opportunities for Northwest New Mexico (Cibola, McKinley, and San Juan counties)

that will be analyzed for market and economic feasibility by Highland Economics as part of the POWER initiative grant. Highland Economics, with assistance from Catalyst Environmental Solutions, implemented a five step-process to identify and select final business opportunities for analysis:

- 1) Identify existing community and regional economic development and business attraction/retention efforts and initiatives through interviews, review of websites, and economic development planning documents.
- 2) Solicit local input through interviews and focus groups with key economic development, tribal, and community leaders in the region, including a total of four focus groups in Cibola, McKinley, and San Juan Counties.
- 3) Compile a preliminary list of potential business opportunities (see Table 1), including additional, previously unidentified, business opportunities.
- 4) Solicit regional feedback on the preliminary list of potential business opportunities, focusing on the relative suitability of the opportunity for the region and the relative priority (and need) for further analysis. This step included a teleconference call with approximately 15 regional leaders to discuss the suitability and research priority of each of the opportunities identified in Table 1 (notes from this call are provided in Table 1).
- 5) Finalize the list of opportunities for further analysis via a follow-up call with POWER grant leaders at the NWNMCOG.

Through this process we have identified the 16 business opportunities to focus on in the POWER grant analysis, including four opportunities related to energy generation/energy generation inputs, five logistics and manufacturing opportunities, five natural resource-based opportunities, and two tourism opportunities. These opportunities are:

**Industries to be Analyzed: Energy Generation / Energy Generation Key Inputs**

1. Export of Coal
2. Clean Coal Power Generation
3. Natural Gas Combined Cycle Power Generation
4. Uranium Extraction

**Industries to be Analyzed: Logistics / Manufacturing**

5. Renewable Energy Generation Component Manufacturing
6. Petrochemical Manufacturing
7. Industrial Gas Manufacturing
8. Electronic Assembly and Parts Manufacturing
9. Transloader / Warehousing and distribution

**Industries to be Analyzed: Natural Resource Industries**

10. Forest Restoration & Forest Products
11. Crop Production (Greenhouse and Field)
12. Food Processing
13. Dimension Stone Mining
14. Mine Reclamation

**Industries to be Analyzed: Tourism**

15. Cultural Centers

16. Youth/Family Adventure and Outdoor Experiential Education Camps

**Table 1: Preliminary List of Business Opportunities for Analysis in POWER Grant Initiative**

Opportunity #	Business Opportunity	Comments from July 7, 2016 Teleconference with Regional Leaders
1	Export of Coal	<p>New energy economy meeting, now opportunities for communities across the nation who are actually deciding how to procure energy for their communities as a growing trends - communities determining where and what energy they are using (Community Choice Aggregation). There is opportunity overseas to move ash and byproducts. The purpose of this POWER initiative is to re-employ jobs we've lost in coal industry. We need to seriously explore export opportunities to the point but also outline some of the stumbling blocks, such as our ash content.</p> <p>There are a number of coal plants across country shutting down, but there are still operations that are working on a viable basis. In terms of export, need an inland rail port.</p>
2	Clean coal technology (e.g., gasification, carbon capture and storage)	Looking at technology around the coal to liquids process. Started by South Africans. Process been improving there. May be some possibilities. Development of synthetic gas. Eliminate some of the pollutants and non-combustible areas within that product. Good opportunity for coal through 2031 and what opportunities arising as far as coal to liquid. Syngas now have a whole line of different products liquid and non-liquid. What opportunities are there?
3	Burning of coal by energy-intensive industries	
4	Natural gas combined cycle plants	As move to renewables, have to have baseload ability. Coal is baseload energy and if get rid of baseload, need to replace with something else. Jobs- CC plants is about 1/10 of coal power plants. Looking at natural gas, there are some real possibilities there

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Opportunity #	Business Opportunity	Comments from July 7, 2016 Teleconference with Regional Leaders
		given cost of oil and natural gas, could be some push in looking at it in base load units; wanting to utilize natural gas plants in AZ valley.
5	Solar power generation	Got plenty of sun but doesn't create much jobs. We have wind and solar in Cibola County but job creation is minimal.
6	Wind power generation	San Juan problem is there are no opportunities for wind power; one area on the mountains in AZ where wind is favorable enough. We have wind and solar in Cibola County but job creation is minimal.
7	Geothermal power generation	There is talk about geothermal in Cibola, nothing concrete. There are conversations with Pueblo of Laguna.
8	Uranium Extraction	<p>Cibola County has only permit in the state for uranium extraction and not an active permit; on stand-by but put in a request for active status that is still being reviewed by state. Would likely mean 100-150 construction jobs for 18-24 months; 100-200 permanent jobs. Possibly up to 2 shifts. Some objection uranium mining.</p> <p>If we keep moving to eliminate fossil fuels, need to have nuclear. Should be high priority to be ready when time comes. See it as viable even though some opposition. Job creator, sustainable for 20-30 years. Replace what is happening with coal. Traditional. In-situ - McKinley County permit request Churchrock area request for in-situ, lot of chemical movement. .</p>
9	Urea plant (input to coal power plants & other)	Don't need more research – we're beyond research arena and have people who are interested in pursuing it and it's happening. Other opportunity with that is petrochemical process and along with urea there may be other materials that could be manufactured. Some research in that area – may be

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Opportunity #	Business Opportunity	Comments from July 7, 2016 Teleconference with Regional Leaders
		interrelated. Other potential petrochemical opportunities.
10	Dolomite (input to coal power plants for scrubbers)	Dolomite is a form of limestone that's shipped in; don't know where it's procured from. Most of the lime that is transported into the 4C power plant comes in from rail from Arizona. On those lime trucks, backhaul is fly ash on trucks to NV and AZ for making cement. Potentially there is currently hauling of limestone from Gallup back to Colorado? There is some of that raw material transport taking place in Gallup region.
11	Forest Restoration Cluster: Sawmills, Paperboard mills, pulp mills, veneer and plywood manufacturing	For Cibola County suitability is high; in dire need of restoration and product from restoration could be viable for many of these things here. Several meetings with Forest Service, Forest Guild, pursuing all avenues to get access/funding to that product. Still necessary to convince the federal agencies to allow us to pursue forest restoration. Federal funds are limited to offer contracts for restoration, but if implemented could provide 2 to 3 fold reduction in fires.
12	Manufacturing: petrochemicals (other, non-urea)	Clustering is a major initiative for San Juan area. One of companies met with looking at petrochemical clustering – quite a bit of work already done looking at this cluster. Methane derivatives – polypropylene, propylene.
13	Manufacturing: cement	R&E meeting with Escalante, they are talking about a project using fly ash, he's interested in moving ahead with a company he's working with on something else in the expansion portfolio. Potentially very viable to expand cement manufacturing locally.
14	Manufacturing: industrial gas	PraxAir in area, nitrogen used for mining industry and also fracking part of oil and gas. They've pulled back b/c of current status of oil and gas industry have had discussion on expanding.

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Opportunity #	Business Opportunity	Comments from July 7, 2016 Teleconference with Regional Leaders
15	Manufacturing: inorganic chemical manufacturing	
16	Manufacturing: lime	Have a facility in Cibola that supports the cement and concrete industry.
17	Manufacturing: glass	In the past had a couple of inquiries on glass recycling b/c are on BN transcontinental line, looking at industrial park for recycle and reuse glass, going on a tour at recycling and sorting plant in ABQ. Anytime glass intermingled, it basically makes the plastic and cardboard recycling unusable. Lots of glass into landfill, way to take it and recycle and reuse.
18	Manufacturing: brick, tile, and other clay products	
19	Manufacturing: electronic assembly and parts	Lots of opportunity, Raytheon is expanding substantially, based on excellent skills of workers and they are expanding. 4C econ development manufacturing subgroup meets quite often, and Raytheon part of that group. Further analysis needed: inventory of all mfg in San Juan County, future trends and what been going on. Other electronics manufacturing opportunities would be very useful to identify and investigate for all of the region.
20	Logistics: transloader/warehousing and distribution	Already on the path for that in McKinley and Cibola counties, and we hope to make that happen. Supercenter and focus on logistics. Direct connection with coal mine and coal mines and workforce, how many skills are transferable. Need a good analysis of labor force. So. Get a sense from coal mines and power plant and how many of those positions would be transferable to logistics and distribution. Certified BNSF rail site. Be done by August. Industrial park eligible. If find other markets for coal, move by rail, there are some operational concepts for moving coal out of existing loop now, trucked from Colorado. Transloaded from mini point in Thoreau, needs to

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Opportunity #	Business Opportunity	Comments from July 7, 2016 Teleconference with Regional Leaders
		be some synergy with logistics park and coal. Look at big picture how does that help with San Juan County. Regional level outlook. Understand what freight is now, what suppliers look like now – supply chain and have to keep that in business. Don't want to see multiplier effect of losing supply chain. Not sure what Navajo position is on that – most has been trucked now. Synergy with inland port, 3 navajo chapters, complementary project to the energy/logistics park, all on Navajo land.
21	Logistics: trucking super center on I-40	
22	Mining: Zirconium, titanium, other rare earth elements	
23	Mining: Dimension stone mining (limestone, silica materials, travertine, other stones)	Humate found where there is coal mining; is that is an opportunity that this region should explore? Possibly look into opportunities to market as agricultural amendment.
24	Agriculture: Crop production greenhouse/in-field	<p>Good location in SW for greenhouses. Greenhouse in Cibola County, it's not been in operation for quite some time b/c of the operator. Canadian greenhouse industry interested in locating in Cibola. They are out of Canada, so capital acquisition is the issue. Benefit of operations in US is that if borders are closed then they can continue to provide produce to US market.</p> <p>Aside from NAPI and farming activity along rivers, ag has gone way down. Very low percentage of gross regional product, but growing interest in growing and local food systems and use a boost to see what particular opportunities there are available. But do we have Markets? Infrastructure? Rainfall, Knowhow. Specialty foods with diabetes.</p>
25	Agriculture: livestock feedlots	We have seen a decline in sheep and horses and cattle. Some of the folks who deal with that sector of

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Opportunity #	Business Opportunity	Comments from July 7, 2016 Teleconference with Regional Leaders
		<p>economy, in particular sheep, numbers of those who are grazing sheep is slimmer partly because the federal wool subsidy went away.</p> <p>Initiatives regarding feral horse populations. See declines here. There isn't a lot of will to round up those animals and take them somewhere else. Leads to declining population of cattle; so it strips grazing opportunities. Competition.</p>
26	Agriculture: Food processing	There is a real opportunity for food processing, have NAPI and several hundreds of thousands of acres in SW Colorado that are farmed. Real viable job creator.
27	Agriculture: Farmers markets and local product branding	Agricultural tourism. Want to experience how things are grown. Pay more attention to it, make it part of tourism play. Specialty crop production research. Sheep jerky. South valley incubator in ABQ – Tim Eisley, overarching brand for food processors, without creating their own. Pooling resources.
28	Mining Reclamation	Multi-billion need for legacy cleanup for uranium industry but federal resources are a fraction of that. Several years ago, USGS had a partnership with NMState Grants to start looking into green mining, keeping mining going but doing sustainably and teaching tech to students about stuff in cleanup. Need and opportunity and learning professions involved in cleaning up past mining activity. Any efforts we can put towards mining reclamation to support future mining efforts, particularly in uranium industry. Funding limited but would be a good opportunity and would be the right thing to do. Question of funding.
29	Tourism: cultural centers	Gallup and Farmington implementing branding initiatives. Definitely needed. Can promote the region but

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Opportunity #	Business Opportunity	Comments from July 7, 2016 Teleconference with Regional Leaders
		<p>we're not giving visitors a clear path to successful experience in the region. Challenging. Need a place as a beginning of a journey. Come to us and we'll set you on a course to have a great experience. Durango CO provides a good experience, they have a welcome center on the main street in Durango. Fort Lewis, taking the train, living – realtors, answers all the questions about a community. Versatile to accommodate the needs for living, working, and visiting. Great outdoor/access sports industry. Where outdoor lovers thrive. Ft Lewis college and outdoor adventure program and outdoor adventure gear. JOLT adventure summer camps for kids. San Juan College.</p>
30	Tourism: Camps for outdoor education /adventure for youth and families	<p>We've been struggling for a number of years with getting people to stop and stay in Gallup area. NM has a high pass through rate. State trying to combat it as a whole. Geographically is an asset being on I-40, convenient place to stop and eat, but we become a stop of convenience not a destination; trends in tourism, today's traveler is looking for that life altering experience, I want more of that, I want to stay longer. We are lacking the developed guide services. When family gets here, there is no central place they can go and book somebody to take them into a deeper dive in that experience. Somebody to take you through geology and history and how craftsmen work and cultural aspects in symbolism to provide a tangible tourism experience. Navajo woman starting a tangible tourism experience in Coyote Canyon – Navajo Hogan where up to 10 can stay and eat traditional meals, go on horseback riding ventures and get a real taste of the culture. We need to identify the experiences that we need to offer and become less a stop of</p>

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Opportunity #	Business Opportunity	Comments from July 7, 2016 Teleconference with Regional Leaders
		<p>convenience. Very little in NWNM region is highlighted. Extend stays and capitalize on market that is one of the fastest growing sectors – tangible tourism. Staycations – 2 nights and 3 days. Local people stay and experience the community and area as mini vacations. Packages available when get bites from different industries. If have families and friends come, more likely to keep them in the area to stay longer. Done regionally.</p> <p>Farmington this summer, JOLT your summer, created 30 things for people to do in the community, even locals not familiar with all of the things people can see and do in the area. Passport cards – stamps – for prizes. Customer service – NM Hospitality training.</p> <p>Could region create incentives for those types of tourism start-ups? Come to our community we've got incentives for adventure guides.</p>
31	Retirement / Assisted Living Communities	<p>One of areas that our county would like to explore and expand on, our infrastructure is not updated enough to accommodate retirement communities, but moving forward is with this in mind. A lot to offer retirees. Want to capture that market. Climate is the issue - can have biting cold winters, even though don't see snowfall. Temperatures below 30 degrees on a regular basis. Highs of 45 throughout the day. Brutal for retirees.</p>

Other notes: Gallup is looking at healthcare cluster – services provided that are unique: hope would be development of light manufacturing. Plastics and instruments for diabetes and plastics and molding. Medical supplies, light manufacturing to service the health cluster. Bioscience incubator in Albuquerque. Federal hospital presence attracts research because part of public health corps. Local hospital second to UNM for teaching hospital. Lots of intern docs in there. Infrastructure for teaching and primarily able to

leverage federal hospital. McKinley location quotients over 1: mining (1.15), retail (1.07), education / healthcare (1.47), arts and entertainment (1.24).

#### 9.3.6 Review of Draft Findings

On November 9, 2016 Northwest New Mexico Council of Governments (NWNMCOG) organized a meeting in Gallup of the regional POWER committee.

This memorandum documents the discussion at the meeting. Draft findings as presented by Barbara Wyse and Travis Greenwalt are not recorded in these notes as these are documented in the draft, partial report distributed to meeting attendees. Notes are organized by topic, in the order discussed at the meeting: Adverse Impacts, Best Practices/Strategies, Energy Sectors, and Diversification Opportunities.

#### **Adverse Impacts**

- Regional problem with coal-fired power plants shutting down or reducing generation all over the region: Cholla Power Plant in Arizona; Navajo Generating Station in Arizona; Mohave Power Station in Nevada. Are there sister groups we can partner with on these same issues in the broader region? (Winslow, Show Low, Joseph city, Holbrook, Pinetop)?
- There is a broader POWER conversation that is possible that encompasses SE Utah, SW Colorado, Arizona, and East Texas.
- Escalante – while no known reduction in generation now, based on regional trends it may reduce production or close in the future
- Navajo Nation is seeing 5-8% cuts across the board due to diminished taxes/royalties etc

#### **Best Practices / Strategies**

- Need to show benefits each party will receive from a specific initiative or project Show them: “What’s in it for me”?
- Find low-lying fruit and jumpstart process with a success
- Find a local success story in NM – maybe a success story with Chevron site repurpose and reuse. However, there were no specific plans for utilizing the infrastructure put in place after industry offered to leave it in place. Now, the site is used for grazing and has ‘award winning’ reclamation.
- Need a strategy to bring/continue middle class in region. Creating an economy to move into the future.
- Workforce training - Need to collaborate with industry and develop curriculum that meets industry needs. Example of new construction technology with Horton panels.
- Bringing in people from regions who have successfully made economic transitions and successfully formed partnerships across multiple jurisdictions and communities (Example of leadership from Minnesota who presented at WV conference)
- Research by academic Gary Greene at University of Wisconsin Madison (Rural economic development researcher) may be insightful and pertinent
- People need to move from a mindset of scarcity to a mindset of abundance – and that partnerships can result in greater abundance for all
- We need to demonstrate that the pie can get bigger – we’re not fighting over pieces of a particular pie that is static in size.
- Need a mindset of a culture of success

- Move beyond needs based thinking and into ‘action’:
- Public & private investment (pulling people together)
- Needs based thinking leads to complaining and arguing, action leads to unity
- Resources and skills and industry success are self-reinforcing
- Need to engage private businesses
- Partnership opportunities for collaborating over infrastructure
- Partnerships – good example is the Navajo - Gallup water line.
  - We have memories and experience from the past that may challenge our ability to trust and work together. We need to identify how to get past those
  - Need to acknowledge sensitivities
  - Trust and relationship building necessary for sharing of information and to work together took years to build
  - Need to talk and meet regularly
  - Need to start small and then build on successes.
- Another example of partnerships that are working in the region are the 6 chapters working together on the Navajo Nation (6 Chapter Economic Group).
  - Historically, there has been competition between tribal communities
  - Starting to experience that they have more power working together than going it alone
- Communication and partnership networks exist in the corridor from Windowrock, Gallup, and Grants. Also in the corridor between Shiprock, Farmington, Aztec, and Bloomfield.
- Also important to recognize the transportation and water pipeline corridors that make natural foundations for partnerships and linkages between communities. For example, Shiprock to Gallup water line. Shiprock to Farmington water line. Gallup to Grants and Thoreau.
- There are partnerships for sharing resources and aligning curriculums between the colleges in the region –UNM Gallup, Navajo Technical University, San Juan Community College, NMSU Grants, Western New Mexico Economic Development Initiative (Silver City)
- College can serve as a basis for building networks as well as offering opportunities for exchanges of ideas following from the POWER effort.
- Need to identify which strategies and initiatives are important to focus on at the local level and/or the regional level.
- Even for some initiatives that are optimally at regional level, may want to start process at local level in several areas of the region on parallel tracks, then join these tracks into one overall partnership and initiative.
- Rail spur
  - Can we move forward with rail spur up through Navajo Reservation and into San Juan County and Farmington?
  - Set up a committee of ~8 people to meet in Farmington at College to get momentum and communication going between the Navajo Nation and other local and regional leaders

### **Energy**

- Coal Export
  - It is not surprising that coal export is not competitive, as there is a lot of waste in San Juan coal – have ash that is waste weight when you ship or burn it. Similarly, PRB coal has high moisture

content that is also wasted weight. When remove moisture, can turn it into powder without the ash, but then it's highly combustible.

- Clean Coal
  - Once you begin the liquefaction or gasification process with coal it is 'easy' to then convert the syngas to a specific product, such as diesel fuel, aeronautical fuel, cosmetics, petrochemicals, Vaseline, paraffin, etc, not to generate power. "Power to grid is gravy"
- Solar
  - APS interested in having development as close to market as possible due to capacity for infrastructure and transmission loss, and having it immediately during time of need during the day.
  - 7 state coalition of power utilities working together on how to react to push for renewables and how to meet energy imbalances in the grid. Can we get better at predicting when / where we need power and when/where it is produced. Better coordination.
  - Energy demand forecasting, moving from 1 hour demand window to 5 minute demand forecasting window. Energy Imbalance Market (EIM)

#### **Diversification opportunities**

- Petrochemical Industry
  - Strong potential for urea and polypropylene in the area
- Agricultural processing
  - Value added processing has potential in the area, taking advantage of the production at NAPI and possibly in SW Colorado
  - If private investors in processing (vs tribal ownership), advantages to locating plant off of Navajo Reservation given the Navajo Nation's reluctance to waive sovereign immunity. Also, home site leasing regulation limits what you can build on trust lands.
  - Success example of small scale processing: Chili chip producer in Milan
  - Possibility of pumpkin products with all of the #2 grade pumpkins grown at NAPI
- Forest Restoration & Forest Products
  - See Snowflake AZ for an example of a public – private partnership in forest restoration.
- Mine Reclamation
  - Activity largely tied to federal funding for these activities.
- Renewable Energy Component Manufacturing / Electronic Component Manufacturing
  - The area offers competitive advantage with skilled labor, and access to materials. However, foreign competition is very strong and trend has been to do R&D in the US and outsource the manufacturing.
- Tourism
  - Assets: Heritage (mining history and historic downtowns), cultural, artistic, world class archeological sites, fly fishing, mountain biking.
  - People can visit the archaeological sites and study and help to conserve artifacts in conjunction with scholars
  - Needs: hotels and visitor services (such as restroom facilities), interpretive information; signage; directions to trails, etc. Applied for Byway Program; failed due to lack of visitor services and interpretive information – can look at that list to see requirements for these types of areas.

- 4CED developed a list of infrastructure and visitors service needs that need to be addressed in Farmington area to further develop tourism. Who can implement? Who can fund? What is the cost?

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