

Seizing our Energy Potential: Creating a More Diverse Economy in New Mexico



New Mexico Energy Policy & Implementation Plan



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State of New Mexico Office of the Governor



Susana Martinez, Governor

To the People of New Mexico:

Thank you for taking the time to review this new state energy policy and implementation plan. Fortunately, New Mexico is one of the most energy-rich and energy-diverse states in the nation. Southeast and northwest New Mexico produce large amounts of oil and natural gas. These industries provide much of the revenue we rely on to run state government—for things like public education spending, Medicaid, and critical public safety efforts. The sun also shines brightly and is available for harvest across New Mexico, and the state boasts a thriving solar economy. Additionally, there is an abundance of wind, geothermal, and other renewable energy resources.

A key principle of this plan is that New Mexico cannot afford to exclude any energy asset from our portfolio of development opportunities. With an “all of the above” approach that encourages and prizes energy development of all kinds, New Mexico can better lead economically, create well-paying jobs across our state, and better respond to the changing needs of the future energy marketplace. In addition, this approach allows New Mexico to lead the way in helping our nation become more energy secure and independent, which is critical given the national security challenges we face today.

I can think of no state in the nation better poised than New Mexico to lead in all aspects of energy development. In addition to the abundance and diversity of the resources I have mentioned, we have tremendous intellectual assets, including national laboratories, world-class university research institutions, and community colleges with nationally renowned job training programs for the energy sector.

Despite energy’s integral role in New Mexico’s economy, the state has not had an updated its energy policy since 1991. Needless to say, times have changed, and with it, so has technology. In recent years, for example, the shale oil and gas revolution has transformed the United States energy sector and heralded a new age of energy abundance. Technological improvements are making it easier and more cost-effective each day to produce

wind and solar power. New Mexico needs a new energy plan that reflects today's realities and priorities for energy development.

This energy policy departs from the thinking of 25 years ago, which assumed future energy scarcity in New Mexico and the nation. It begins, instead, by embracing energy abundance and attempts to focus on how to use energy for the general welfare and long-term security of New Mexico's citizens.

I appreciate the contributions and input of all those throughout the State who offered their ideas and opinions about New Mexico's energy future. Together, we can seize our energy potential and create the kind of thriving, diverse economy we need to ensure a brighter future and greater opportunities for our children and families long-term security of our country and the general welfare of New Mexico's citizens.

Sincerely,

A handwritten signature in black ink that reads "Martinez". The signature is fluid and cursive, with the "M" and "a" being particularly prominent.

Susana Martinez
Governor



State of New Mexico

Energy Minerals & Natural Resources Department



David Martin, Secretary

To the People of New Mexico:

New Mexico plays a critical role in supplying energy resources both for our state and our nation. Ensuring our state stays at the forefront of energy production requires forward-looking, cutting-edge planning and a dynamic vision for our future. We seek to achieve this with "Seizing Our Potential – the New Mexico State Energy Plan."

The New Mexico Energy Plan ensures that the state will expand its role as an energy leader, while continuing to provide income and create jobs across energy industries. The New Mexico Energy, Minerals, and Natural Resources Department (EMNRD) worked with hundreds of New Mexicans across the state's geography and stakeholders that represented all energy resources throughout 2014 to develop the plan, the first of its kind in nearly 25 years.

As we look at what energy means to New Mexico, and to the rest of our nation, it's important to know what is happening in our state at this time:

- New Mexico is the 4th highest net energy supplier to the United States, primarily because of petroleum and natural gas production.
- New Mexico currently ranks in the top 10 for production in nearly every major energy category, both fossil and renewable. Petroleum output is reaching the all-time record production of the 1970s, and New Mexico produces more renewable energy now than at any other time in state history.
- New Mexico's resource production potential is world class: the San Juan Basin remains the nation's second largest conventional natural gas reserve, the Permian Basin contains three of the 100 largest oil fields in the United States, and solar and wind energy resource production potential are 3rd and 11th in the nation, respectively.
- An estimated 68,800 jobs, or 9% percent of all employment in New Mexico, are directly or indirectly related to the oil and gas industry.
- Taxes royalties from the oil and gas industry account for over one-third of the state's General Fund.

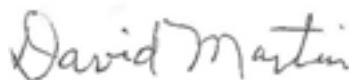
Great strides are being made in every corner of our state, but we know from recent market fluctuations that the energy economy is ever changing. New Mexico must continue to promote energy diversity through investment in all of its energy assets, and strategic planning and key policy leadership are needed to effectively deploy these assets. Within this plan, there are many important actions we can begin to take that will move our state forward, including:

- **Infrastructure** – Creating or improving energy infrastructure will not only create jobs, but also open up new markets for New Mexico’s energy and products. From new rail lines to additional electric transmission, our state can better move our energy and its derived products around New Mexico, the Southwest, and Mexico. Infrastructure in oil and gas development attracts new project capital investment and can help clear export bottlenecks.
- **Education** – Educational institutions—from K-12 schools to junior colleges and research universities—are the biggest benefactors of our state’s energy revenues, and they return scientists, engineers, and other trained workers to the energy industry. New Mexico’s higher education institutions also offer advanced energy research to industries that are dependent on technology innovation.
- **Energy Tax Incentives** – All New Mexicans depend on energy, not only in their homes, businesses, and vehicles, but also for their livelihoods. Our state can remain competitive with neighboring states through additional investment in infrastructure, exploration, and production through smart tax incentives.
- **Regulatory Streamlining** – Removing unnecessary requirements from energy industry operations will expand growth. Regulatory balance and timely actions can be achieved without compromising on health, safety, and environmental standards. We can be prosperous producers while protecting our resources.
- **New Collaboration with Federal Agencies** – New Mexico’s energy resources exist in many jurisdictions, including state, tribal, federal and fee (private). This Administration has established a precedent in assisting federal-tribal agencies with limited means to process permits, helping to promote additional oil and gas development in the San Juan Basin. Building on this precedent, the state can continue to identify opportunities to remove bottlenecks in federal processes and create new pathways for other states and resource owners to follow.

Energy produced in New Mexico is not only essential to powering our daily lives, it also provides essential revenue that supports our schools, hospitals, local governments, and communities. The markets that benefit from New Mexico’s energy products lie within, and outside of, our state’s borders. The responsibility, and the opportunity, for energy resources and products in New Mexico cannot be understated.

We look forward to working together to implement the recommendations contained in the State Energy Plan, to ensure that New Mexico remains competitive in today’s energy markets and continues to meet the needs of the state and nation.

Sincerely,



David Martin
Cabinet Secretary

EXECUTIVE SUMMARY



Growing New Mexico's economy via the energy sector is the core tenet of the new Energy Policy and Implementation Plan for the State of New Mexico. The state has an abundance of energy resources, both fossil-based and renewable, and also an abundance of energy ingenuity in its companies, universities, and national laboratories. With an "all of the above" energy policy (no fuel source is excluded), New Mexico can depend on the future of the energy marketplace. This energy policy departs from the thinking of 25 years ago, which assumed future energy scarcity in New Mexico and the nation. It begins with recognition of energy abundance and attempts to chart a path where New Mexico further harnesses its energy resources to increase general welfare.

Principles that Drove the Development of the New Mexico Energy Policy

The goal of the energy plan revolves around objectives that are comprehensive enough to incorporate all of the state's energy resources but includes definitive opportunities to allow for accountability in success. These include a focus on economic growth and job creation as well as identifying incentives that increase market potential. The plan must consider both near-term and long-term objectives that can be measured and adjusted to conditions in the energy economy.

Developing the Policy

The New Mexico Energy, Minerals, and Natural Resources Department (EMNRD) led this policy

process and, in partnership with local economic development groups, hosted six listening sessions across New Mexico's energy geography. Approximately 450 people representing industry, citizens, non-governmental organizations, and state and local governments attended the listening sessions and provided input. After the majority of the sessions, a diverse group of energy leaders reviewed this input for energy policy considerations that were then submitted to EMNRD. This process provided the foundation for the objectives and content found within this policy.

Twelve Objectives

Twelve objectives provide the framework of the New Mexico Energy Policy and Implementation Plan. Additional recommendations and background information are found within the full policy text for each of these objective areas.

Embrace our Potential — Promote All Sources of Energy to Advance Economic Development & General Welfare in New Mexico

Consideration of the energy assets of different geographic areas of New Mexico, and an inclusion of all energy resources, are fundamental principles of the state's energy policy. Just as investment advisors encourage diverse portfolios to help manage risk, similarly New Mexico's strategy embraces all forms of energy to provide multiple options for economic diversity and to hedge against changes in market conditions.

► Recommendations in this area include:

- Embracing an "all of the above" approach to energy policy for state economic benefit and risk reduction;
- Supporting regional energy policy, infrastructure, and development pathways and solutions;
- Ensuring that sound science and economies, as well as the availability of energy resources drive state energy policy decisions;
- Commissioning comprehensive analyses of state energy tax credits; and
- Providing consistent energy tax policy to provide certainty for industry.

Stimulate Energy Investment in New Mexico through Utilization of Abundant Natural Gas

Horizontal drilling in previously impervious shale formations has resulted in an oversupply of natural gas in the United States. The oversupply has driven the price for natural gas down to the point that drilling new gas wells in New Mexico is down to the point that the economics of drilling new gas wells in New Mexico are marginal, and state revenues, and state revenues and the economy surrounding the natural gas industry have been negatively impacted. New Mexico has an abundance of natural gas, and new market applications are needed to stimulate demand. Increasing the industrial and manufacturing applications for natural gas and natural gas vehicles are promising options to enhance natural gas demand within the state.

► Recommendations in this area include:

- Identifying and attracting petrochemical and manufacturing companies that utilize natural gas as a feedstock to New Mexico, particularly to San Juan County;
- Involving state universities and laboratories in economic research and modeling to assist industry in petrochemical projects; and
- Ensuring that facts and Science as well as economic Studying natural gas vehicle incentives that are competitive with other states, and encouraging development of additional natural gas fueling stations.

Identify the Feasibility of New Energy Markets & Technologies

There are a number of emerging energy technologies that New Mexico can take advantage of. As federal regulations increasingly impact current coal markets across the United States, the state may need to look abroad, or to markets other than power generation, for its coal resources. Conversely, small modular reactors (SMRs) could provide carbon-free, baseload electricity generation, and SMRs contain improvements to cost, safety, and environmental concerns that are present for larger nuclear generation facilities. In addition, energy storage is a rapidly growing and critical industry that can

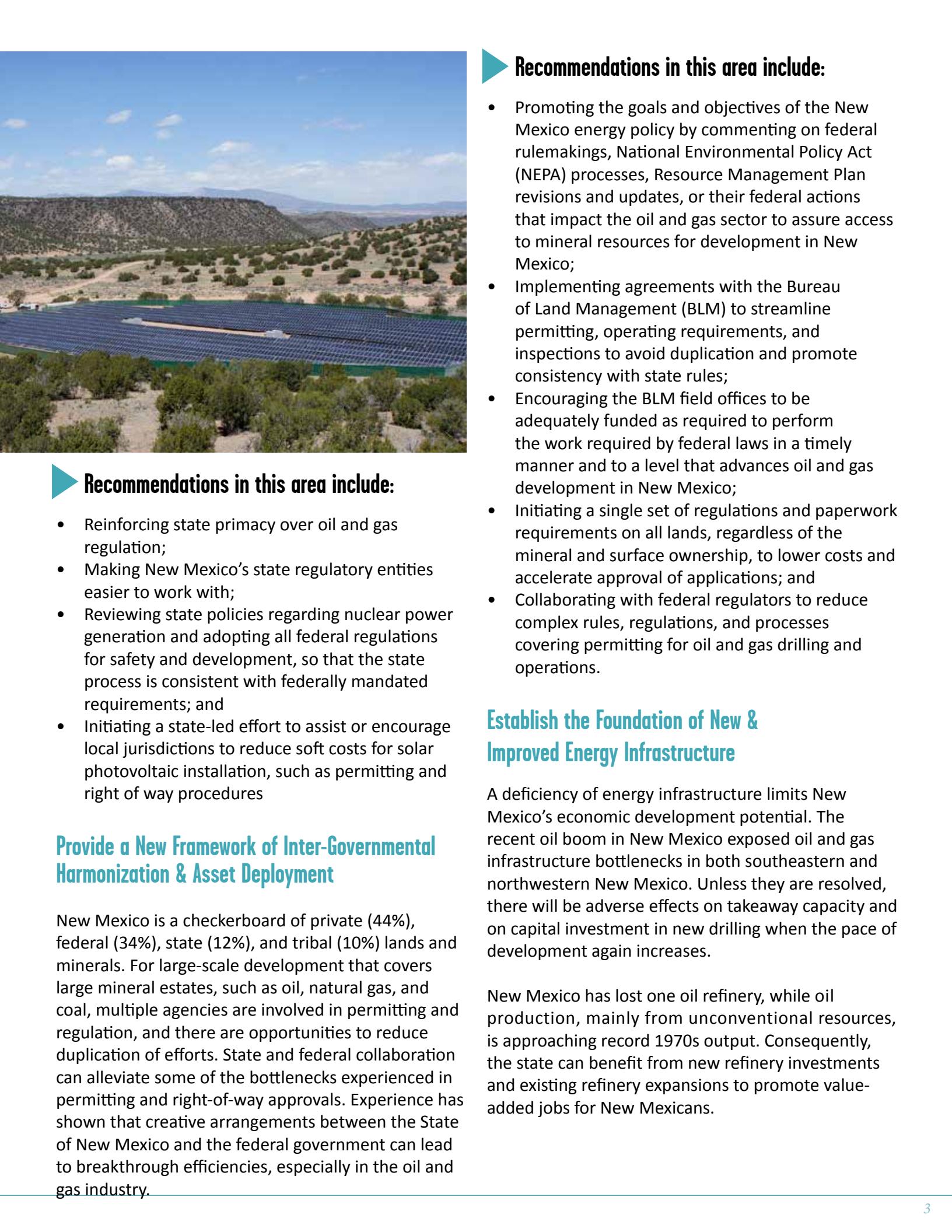
enhance the penetration of intermittent renewable energy resources, such as wind and solar energy. New Mexico's national laboratory energy expertise, its engineering and science public universities, and existing demonstration projects could lead to a robust energy storage industry in the state.

► Recommendations in this area include:

- Supporting feasibility studies of exporting coal and including coal export considerations in a rail feasibility study for northwest New Mexico;
- Developing an SMR taskforce to provide technical and legal support for a pre-feasibility study of an SMR prototype reactor in New Mexico;
- Creating a post-2020 Low-Carbon Electricity Portfolio Standard that includes nuclear power;
- Supporting a state initiative to establish an industry partnership for an Advanced Battery Chemistry and Materials Center in New Mexico; and
- Pursuing energy storage development with the private sector, especially new technology projects such as advanced batteries and flywheel/hydraulic energy storage systems.

Provide Regulatory Clarity for Existing & Emerging Energy Industries

Energy entities in New Mexico generally fall into two realms: operating energy providers such as utilities and extractive industries, or developers of "new technologies" such as solar, wind, geothermal, small modular reactors, and biofuels. For New Mexico to attract energy-related economic development opportunities, the state should maintain a reputation of streamlined regulatory processes and state agencies working in partnership with businesses. Regulatory clarity for the energy industries of New Mexico takes many forms. For the oil and gas industry, it requires the state to assert itself as the primary regulator. For newer energy technologies, it requires the state to monitor regulatory obstacles and increase clarity in permitting processes. Timely permitting for energy projects expedites revenue flows and job creation in the state.



► Recommendations in this area include:

- Promoting the goals and objectives of the New Mexico energy policy by commenting on federal rulemakings, National Environmental Policy Act (NEPA) processes, Resource Management Plan revisions and updates, or their federal actions that impact the oil and gas sector to assure access to mineral resources for development in New Mexico;
- Implementing agreements with the Bureau of Land Management (BLM) to streamline permitting, operating requirements, and inspections to avoid duplication and promote consistency with state rules;
- Encouraging the BLM field offices to be adequately funded as required to perform the work required by federal laws in a timely manner and to a level that advances oil and gas development in New Mexico;
- Initiating a single set of regulations and paperwork requirements on all lands, regardless of the mineral and surface ownership, to lower costs and accelerate approval of applications; and
- Collaborating with federal regulators to reduce complex rules, regulations, and processes covering permitting for oil and gas drilling and operations.

Establish the Foundation of New & Improved Energy Infrastructure

A deficiency of energy infrastructure limits New Mexico's economic development potential. The recent oil boom in New Mexico exposed oil and gas infrastructure bottlenecks in both southeastern and northwestern New Mexico. Unless they are resolved, there will be adverse effects on takeaway capacity and on capital investment in new drilling when the pace of development again increases.

New Mexico has lost one oil refinery, while oil production, mainly from unconventional resources, is approaching record 1970s output. Consequently, the state can benefit from new refinery investments and existing refinery expansions to promote value-added jobs for New Mexicans.

► Recommendations in this area include:

- Reinforcing state primacy over oil and gas regulation;
- Making New Mexico's state regulatory entities easier to work with;
- Reviewing state policies regarding nuclear power generation and adopting all federal regulations for safety and development, so that the state process is consistent with federally mandated requirements; and
- Initiating a state-led effort to assist or encourage local jurisdictions to reduce soft costs for solar photovoltaic installation, such as permitting and right of way procedures

Provide a New Framework of Inter-Governmental Harmonization & Asset Deployment

New Mexico is a checkerboard of private (44%), federal (34%), state (12%), and tribal (10%) lands and minerals. For large-scale development that covers large mineral estates, such as oil, natural gas, and coal, multiple agencies are involved in permitting and regulation, and there are opportunities to reduce duplication of efforts. State and federal collaboration can alleviate some of the bottlenecks experienced in permitting and right-of-way approvals. Experience has shown that creative arrangements between the State of New Mexico and the federal government can lead to breakthrough efficiencies, especially in the oil and gas industry.

For electricity delivery, there are a number of reasons to update and expand electricity transmission infrastructure in New Mexico: the state can take advantage of economic development opportunities that require additional power, utilities can continue to provide reliable service to existing homes and industries, and updated transmission and distribution infrastructure helps increase the penetration of renewable energy on the grid.

► Recommendations in this area include:

- Encouraging cooperation among EMNRD, the Department of Finance and Administration, the New Mexico Department of Transportation, and state legislators to mitigate road infrastructure constraints and reallocate existing tax revenues to address public road repair and new construction;
- Prioritizing the streamlining of right-of-way permitting processes on state land and assisting relevant agencies with right-of-way processing on federal and tribal lands;
- Supporting the feasibility study of a rail branch line from I-40 to the Farmington region of the Four Corners;
- Coordinating with multiple state agencies to explore possibilities for new oil refineries or expansion of existing refineries;
- Improving state-controlled aspects of transmission siting and permitting and supporting utilities to make transmission infrastructure investments; and
- Considering the installation of smart meters by utilities to accommodate the needs of a basic “smart grid.”

Maximize Cost-Effective Deployment of Energy Efficiency in Public Buildings

The existing inventory of New Mexico’s public buildings represents a vast amount of square footage and energy efficiency potential. Public buildings that are more energy efficient have lower utility bills, which help to control operating costs that are paid with taxpayer dollars. Obtaining upfront capital to implement energy saving measures in state buildings can be a challenge. When capital funding is not adequate to support energy efficiency projects in state government buildings, energy savings



performance contracting (ESPC) can be used. When implemented, the ESPC projects can result in a major reduction in state energy usage.

► Recommendations in this area include:

- Institutionalizing a program for energy performance in public buildings that includes annual benchmarking, energy use disclosure, energy performance targets, and monitoring; and
- Performing an evaluation of ESPC policies and addressing barriers to expanding this type of financing in New Mexico.

Address Public Concerns Regarding Energy Development & Public Health, Safety, & the Environment with Sound Scientific Evidence

All forms of energy development have impacts, and the public has perceived concerns regarding the environment, public health or safety. Recently, the boom in unconventional oil and gas production across the United States has raised public awareness about possible impacts from development. In particular, there have been concerns about groundwater contamination from oil and gas operations, air quality issues, oil transport, and other issues such as induced seismicity. In other energy sectors, there are also concerns about public health, safety, and the environment, including from power generation and emissions from coal-fired power plants. The legacy of uranium mining and risks associated with nuclear power development are also of concern for some

members of the public. It is important that the state continues to implement and enforce regulatory rules to prevent environmental degradation and protect public health while allowing for energy development to occur.

► **Recommendations in this area include:**

- Encouraging voluntary baseline groundwater testing by the oil and gas industry at private water wells near drilling sites before new well drilling commences;
- Accelerating development of natural gas gathering pipelines to reduce flaring;
- Developing a state plan for Section 111(d) of the Clean Air Act through collaboration among the New Mexico Environment Department (NMED), EMNRD, and the Public Regulation Commission;
- Supporting efforts to capture and sequester CO₂ from energy production and industrial sources, especially for subsequent use in enhanced oil recovery.

Reduce Fresh Water Consumption for Energy Production

This policy marks the first time that water and energy planning have been combined in New Mexico. In the future, as water supplies become increasingly stretched, it will become even more important to consider energy while planning for water as well as consider water supplies while planning for energy development and generation. In general, state policy is to encourage water conservation and reuse.

There are a number of important areas the state can focus on to reduce water consumption in the energy sector. Reducing fresh water use and recycling produced water in oil and gas operations could have major regional impacts. Power generation is another sector that requires large amounts of water for cooling, and alternative sources for fresh water and new technologies could be utilized to reduce water needs. New Mexico also has extensive brackish water resources that could be used for energy development, but also take substantial amounts of energy to treat. Lastly, it may be beneficial to expand state water planning to include water that does not have water rights associated with it (e.g., produced or some



brackish waters) and explicitly address water needs for the energy sector.

► **Recommendations in this area include:**

- Using non-potable water in energy production operations to the maximum extent possible;
- Gathering data on current water usage in the oil and gas industry to better determine facts on the effects of industry activity on groundwater and surface water sources;
- Exploring and evaluating opportunities to reuse produced water, and providing clear regulatory guidance for produced water reuse;
- Promoting technology development for both brackish and produced water treatment;
- Promoting reduced water consumption in the electric power industry;
- Collecting, reviewing, centralizing, and making public information and data on brackish water aquifers; and
- Promoting interagency coordination and communication among the Office of the State Engineer, NMED, and EMNRD on energy/water nexus discussions and brackish water policy development and implementation.

Provide Science & Technology-Based Information & Data about the Energy Sector

To make informed energy decisions, the New Mexico public and elected officials must have accurate

information about pros and cons of energy systems and advances in technologies. The state can assist in providing unbiased information and making it readily accessible. Recently, there have been concerns at the county and local levels about oil and gas development, which called for the state to respond to and assist public officials grappling with aspects of oil and gas production and distribution. There are also opportunities for the state to be a clearinghouse for information on topics such as advances in mining techniques for uranium, nuclear power development, and renewable energy.

► Recommendations in this area include:

- Encouraging colleges and universities to align their curricula with core energy workforce needs;
- Pursuing specialized degree programs and certifications at colleges and universities to meet industry and regulatory needs; and
- Supporting two-year college training programs in applied energy technologies.
- Encouraging Early College High Schools to emphasize Science, Technology, Engineering and Mathematics (STEM) courses and energy technologies.

► Recommendations in this area include:

- Implementing an education campaign to increase citizen knowledge of oil and gas operations, renewable energy development, uranium mining, and nuclear power development;
- Creating a repository of facts available on oil and gas and renewable energy development in New Mexico for the public and media to reference; and
- Creating a strategic alliance of independent experts as qualified rapid response teams to assist New Mexico's counties and municipalities by providing science-based education and technical information regarding oil and gas development.

Improve Workforce Training for the Energy Sector

The energy sector has growing workforce demands that range from highly skilled to entry-level positions. In particular, the oil and gas industry has experienced major growth since 2009, and due to this growth and high levels of retirements, it requires graduates in engineering, geology, and hydrology. Many jobs in the energy industry require science and technology training from the "STEM" (science, technology, engineering, and math) disciplines. Others require specialized training offered by two-year colleges. New Mexico's educational institutions—from two-year colleges to four-year research universities—are capable of keeping the energy workforce pipeline filled if they align curricula with energy industry needs.

► Monitor & Review the Energy Policy

Prior to this effort, the state has not had a formal energy policy in more than 20 years, despite vast changes in oil and gas technology and production and greater penetration of intermittent renewable energy sources. Important policy decisions must be informed by the most up-to-date energy information. In addition to updating the policy at regular, discrete intervals, it is important to evaluate the progress of policy implementation.

► Recommendations in this area include:

- Reviewing the New Mexico Energy Policy and Implementation Plan on a regularly scheduled basis: a full review with public outreach and participation opportunities is required every five years, with more frequent internal review with reference to implementation to address any needed changes.



NEW MEXICO ENERGY BACKGROUND

Nearly every possible energy source exists in New Mexico in relative abundance: coal, oil, natural gas, uranium, solar, wind, and geothermal resources are found across the state's geography. One of the state's greatest assets, the energy sector provides revenue that funds schools, hospitals, and state government and lessens the tax burden on New Mexico's citizens. This wealth of energy resources also creates economic development opportunities for New Mexico, from attracting manufacturing, to using energy in more productive and efficient ways, to additional opportunities for energy export.

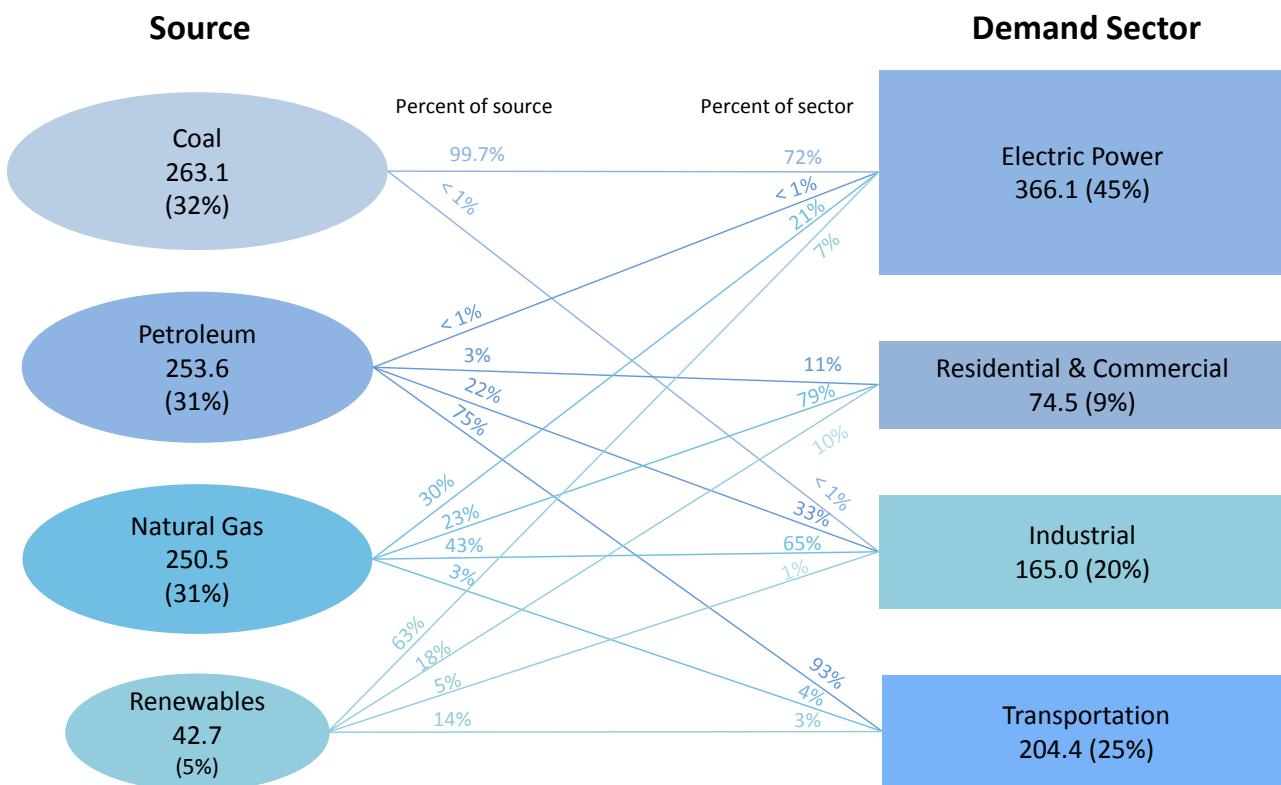
Energy resources and opportunities exist in all of New Mexico's 33 counties. There are rich natural gas deposits in the northwestern (San Juan, Sandoval, and Rio Arriba Counties) and southeastern (Lea, Eddy, and Chaves Counties) corners of New Mexico.



The Permian Basin in the southeast is a principal oil producing region of the United States. Coal is most abundant in the San Juan Basin, and uranium deposits also cluster in northwestern New Mexico (Cibola and McKinley Counties); both are geologically shared with the Navajo Nation. The eastern half of New Mexico has some of the best wind resources in the country, while solar energy statewide has the third highest state resource potential in the nation. Geothermal resources also underlie the southwestern and north-central portions of New Mexico.

New Mexico Primary Energy Consumption by Source and Sector, 2012

(all numbers in Trillion Btu, excluding percentages; total = 809.9 trillion Btu)



Source: U.S. Energy Information Administration State Energy Data Through 2012, Tables C1-C9

Figure 1. New Mexico Primary Energy Consumption by Source and Sector (2012)

Production — Actual & Potential

New Mexico is an energy export state. Natural gas, oil, and electricity are sold outside of the state's borders via pipeline, transmission lines, highways, and rail. In 2012, New Mexico produced 2.4 times the amount of energy it consumed and exported energy primarily to Texas, Arizona, California, and Utah.

Oil

Advancements in oil and gas extraction technologies—primarily in the areas of horizontal drilling and hydraulic fracturing—have created the “shale revolution” in the last decade. This has fundamentally changed the nation’s energy economy and prospects for energy security, while invalidating prior oil projection forecasts.

Between 2007 and 2014, oil production increased 112% in New Mexico (Figure 2). The Permian Basin in southeastern New Mexico is the major oil producing region in the state. Since 1920, 20 major oil plays have been exploited in the basin, which contains 3 of the largest 100 oil fields in the United States. The continued advancements in horizontal drilling technology and horizontal completion techniques have expanded the development of numerous plays within the New Mexico portion of the Permian Basin. These plays include producing zones within the formations of the Delaware Mountain Group, the Avalon Shale, the Bone Spring Formation, the Wolfcamp (Hueco) Formation and the formations of the Yoso Group. While there is currently less oil production in northwestern New Mexico, oil and gas companies have expressed interest in exploring the Mancos Shale and Gallup Sand in the San Juan Basin and indicate there is potential for a significant oil play. With a precipitous oil price decline in late 2014, oil exploration has already slowed and many anticipate that production may decline starting in New Mexico in the latter part of 2015, depending on unknown future variables.

Natural Gas

Total natural gas production in New Mexico declined 20% between 2007 and 2014, primarily because U.S. overproduction of shale gas lowered natural gas prices and discouraged further drilling (Figure 3). The



San Juan Basin, which extends from northwestern New Mexico into Colorado, is one of the largest fields of proved natural gas reserves in the United States. Approximately 20% of the natural gas produced in New Mexico is consumed in the state, while the remainder goes by pipeline to Arizona, Texas, and other natural gas markets across the West and Midwest. Increased New Mexican natural gas output depends on higher prices at the wellhead, which could result from expanded demand for electricity generation and new applications for natural gas.

Table 1. NM energy production

	U.S. Ranking
Net energy supplier to nation	4
Total energy production	10
Oil production	6
Natural gas production	7
Coal production	12
Wind installed capacity	19
Solar installed capacity	10
Renewable power* generation	24

* Excluding hydropower

Table 2. NM energy resource rankings

	U.S. Ranking
Proved oil reserves	5
Proved natural gas reserves	8
Recoverable coal reserves	9
Wind potential	11
Solar potential	3
Geothermal resources	6
Uranium reserves	2

NM Oil Production

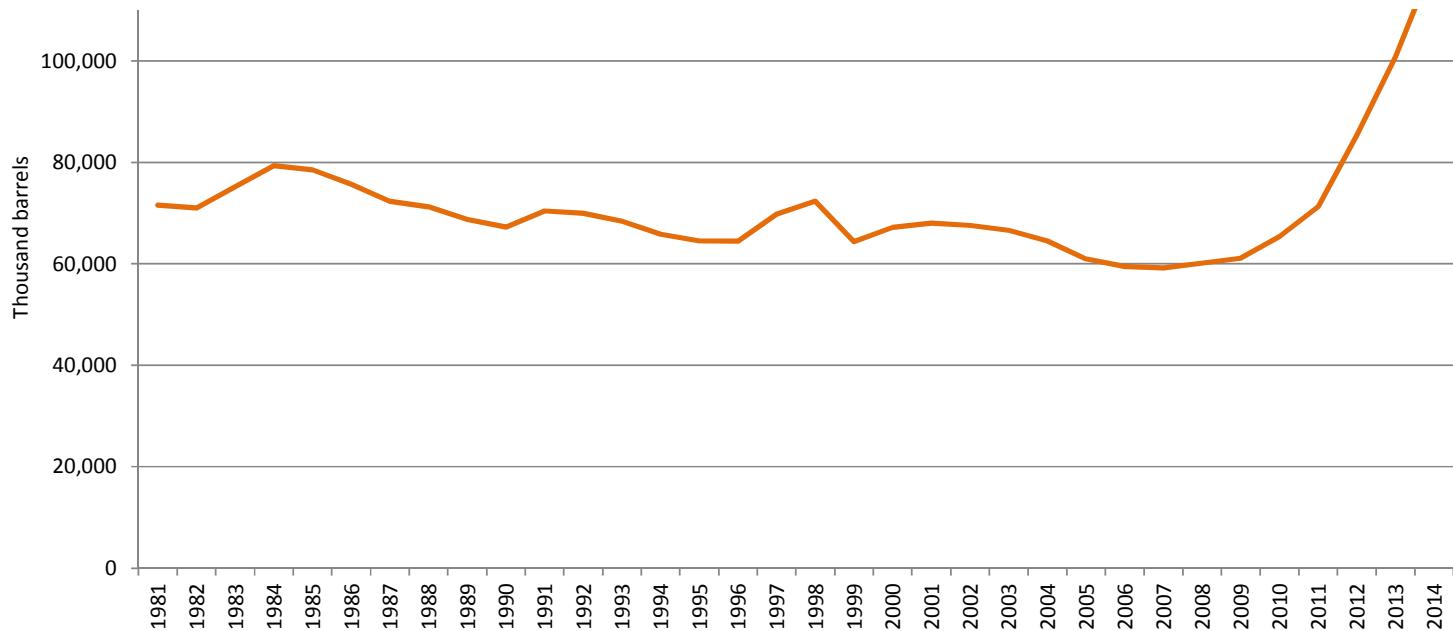


Figure 2. Oil Production in New Mexico (1981–2014)

NM Natural Gas Production

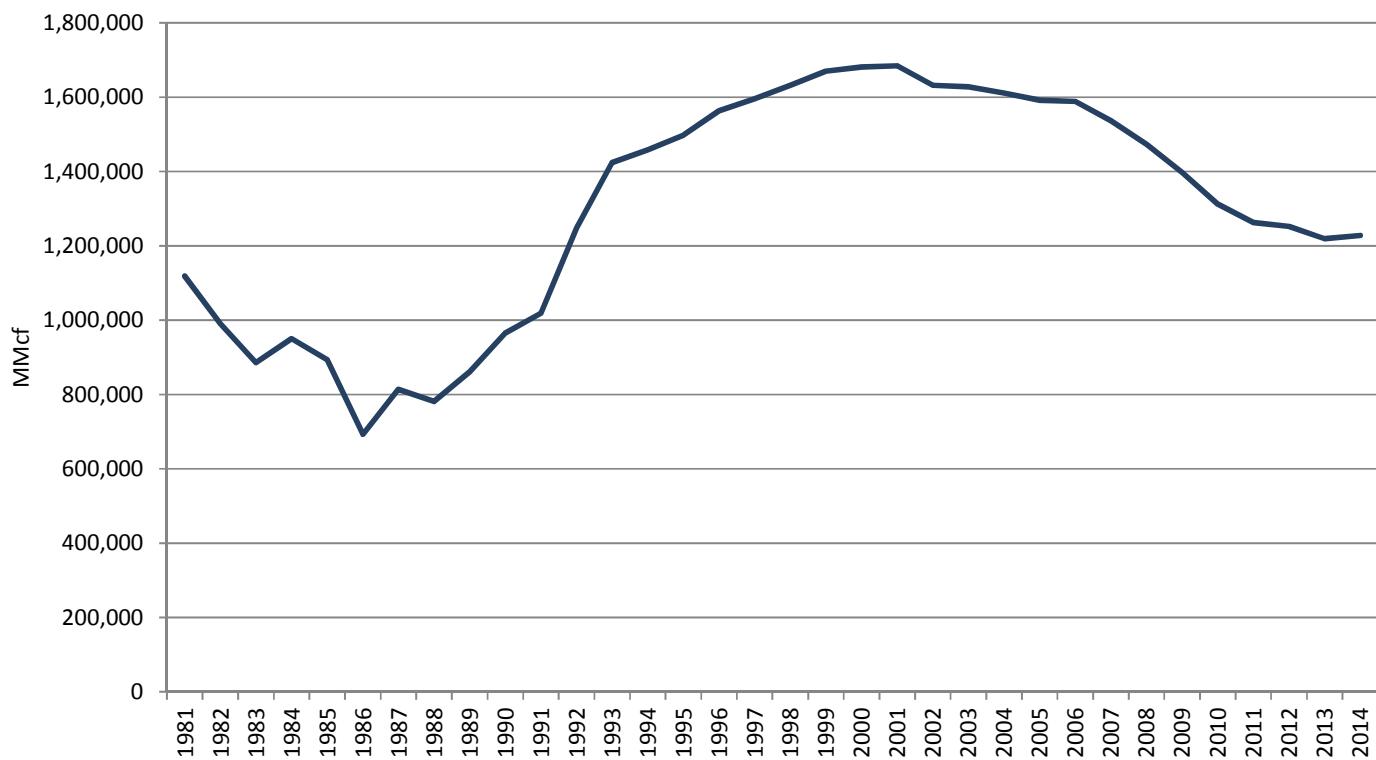


Figure 3. Natural Gas Production in New Mexico (1981–2014)

Uranium

New Mexico has the second largest uranium reserves in the United States, with nearly one-third of all U.S. uranium resources within its borders. The state was the leading producer of uranium from the 1950s to the 1970s, but production plunged in the early 1980s and virtually no uranium has been mined in the state since 1990 (Figure 4). In 2013, there was renewed interest in uranium mining in New Mexico in Cibola County near Grants.

NM Uranium Production



Figure 4. Uranium Production in New Mexico (1955–2013)

Renewable Energy

Renewable electricity production in New Mexico has grown steadily over the last decade, driven in part by the state's Renewable Portfolio Standard, which requires investor-owned utilities to supply 20% of electricity from renewable energy by 2020 and rural electric cooperatives to source 10% of electricity from renewable energy in the same time frame. In 2013, New Mexico's wind resources generated 6% of all electricity consumed in the state. Of the total renewable electricity produced, nearly 80% is from wind and the rest is largely solar and hydropower (Figure 6). On a per capita basis, New Mexico is among the top states in distributed grid-connected solar photovoltaic (PV) capacity. In addition, the first commercial geothermal electricity facility opened in late 2013 near Lordsburg in the state's boot heel, adding 4 MW of baseload geothermal capacity to the state's renewable electricity mix, with another 6 MW planned.

Coal

New Mexico's coal production has fluctuated over the years, but for the past decade the general trend has been downward (Figure 5). There are four operating coal mines in the state, all of which are located in the San Juan Basin. Two of the mines are dedicated to supplying major coal-fired electricity generation stations: the Four Corners (1,540 megawatts [MW]) and San Juan Generating (1,683 MW) Stations. The Navajo coal mine attached to the Four Corners Generating Station has reserves and resources of over 6 billion tons of coal for electricity generation. New Mexico coal that is not used in the state is sent to Arizona for power generation.

NM Coal Production

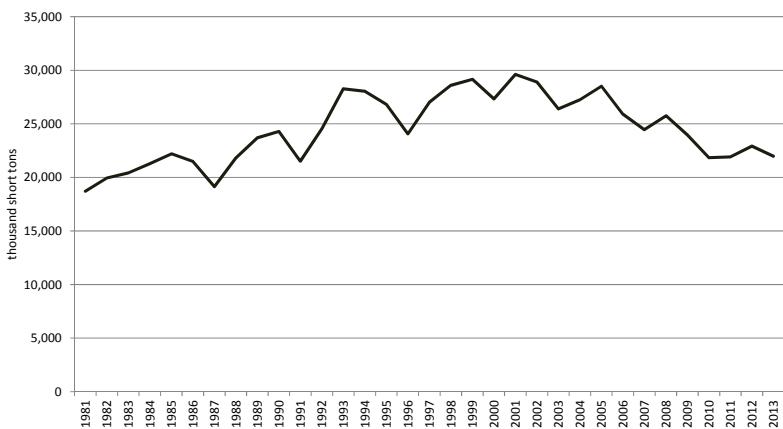


Figure 5. Coal Production in New Mexico (1981–2013)

NM Renewable Power Generation

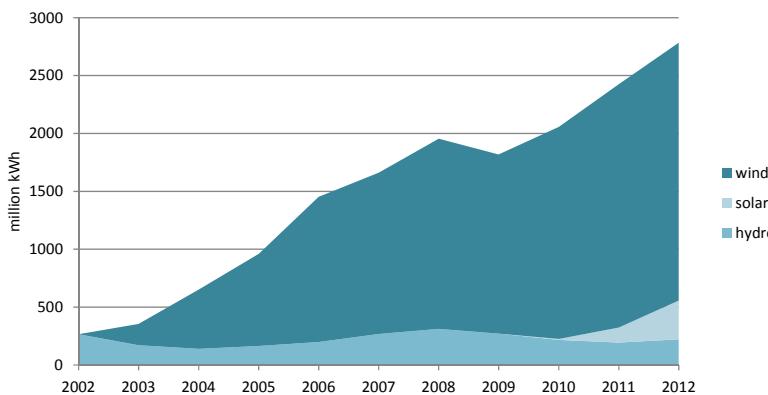


Figure 6. New Mexico utility-scale renewable energy power generation (2002–2012)

Consumption by Source & Sector

New Mexicans primarily consume coal, natural gas, and oil in the form of gasoline (Figure 7). The majority of oil is used in the transportation sector, while coal is dedicated to electricity generation. Tightening federal air quality regulations have impacted coal-fired electricity generation facilities, and coal's overall percentage of national electricity generation is declining, a trend also seen in New Mexico (see Box 1). Natural gas is used both for heating and an increasing proportion of electricity generation, growing from 14% to 21% of New Mexico's electricity generation between 2001 and 2012. While nearly 70% of New Mexico's buildings are heated with natural gas, rural areas without access to natural gas pipelines generally use electricity, propane, or wood for heating. New Mexico's consumption of renewable energy is relatively small and largely confined to the electricity sector, but growth in the sector has been large, with renewable energy generation quintupling over the last decade (Figure 6).

When looked at by end-user, the industrial and transportation sectors consume the most energy in New Mexico, followed by the commercial and residential sectors (Figure 8). Compared to national



Box 1. San Juan Generating Station

Across the nation, many coal-fired power plants are undergoing major retrofits or shutting down to meet federal Clean Air Act standards. To comply with regional haze requirements, in 2013 the State of New Mexico, Public Service Company of New Mexico (PNM), and the U.S. Environmental Protection Agency (EPA) reached an agreement to retire two of the four units at northwestern New Mexico's San Juan Generating Station by 2017. PNM proposes to install nitrogen oxide emissions reduction technology on the remaining two units. This plan is pending final approval by the New Mexico Public Regulation

averages, residential users use less energy per capita and all other sectors use more energy per capita, particularly the transportation sector (Table 3). Because of its small population, New Mexico's overall demand for energy is relatively low (37th in the nation), but the state is in the top half for per capita energy usage (20th).

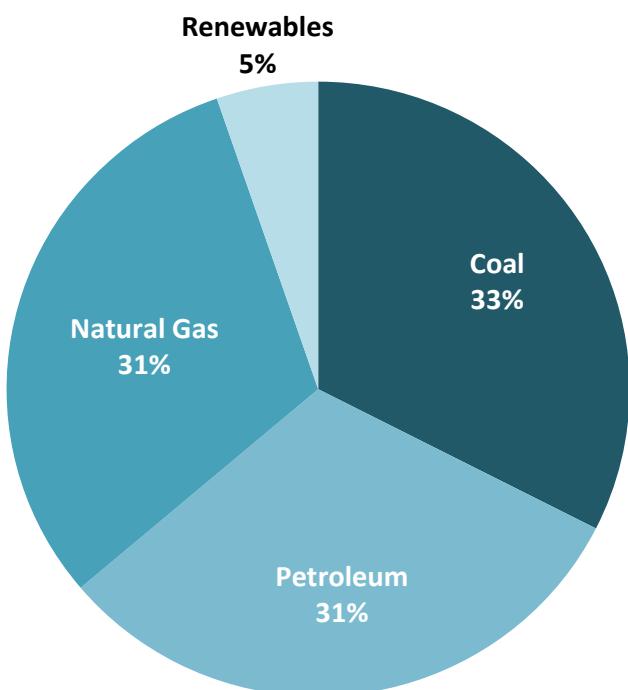


Figure 7. 2012 Estimated New Mexico energy consumption by source, including fuels consumed in-state for electricity generation that is exported (total=810 trillion Btu)

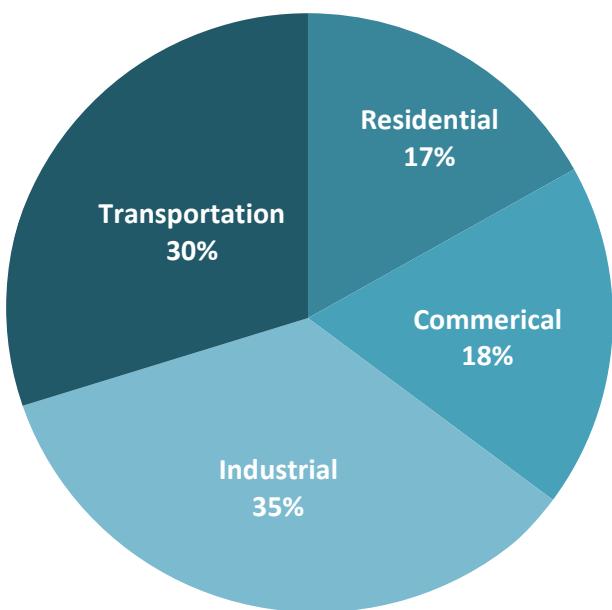


Figure 8. 2012 New Mexico energy consumption by end-use sector (total=687 trillion Btu)

Table 3. 2012 New Mexico energy consumption per capita by sector, compared to national averages

Energy Consumption Per Capita	New Mexico (million Btu)	National Average (million Btu)	Difference from National Average	National Rank*
Residential	55.7	63.5	-12%	47
Commercial	60.3	55.3	+9%	18
Industrial	115.7	98.8	+17%	20
Transportation	98.1	85.1	+15%	14
Total consumption	329.7	302.6	+9%	20

* For the national rank category, number 1 uses the most energy per capita (number 51 would be the lowest per capita energy user, as rankings include the District of Columbia).

Energy Infrastructure

Energy infrastructure includes the network of pipelines and transmission lines that transport energy to consumers and facilities that turn raw energy resources into useful products. Transportation corridors such as roads and railways are critical energy infrastructure networks. Record oil production and increased activity has stressed road and rail infrastructure networks in New Mexico's oil and gas producing regions.

Electricity Transmission

The majority of electricity transmission lines in New Mexico were built in the 1960s and 1970s, with some system improvements made since that time. Inadequate transmission access has long been cited at the primary hindrance to New Mexico renewable energy development, as some of the best wind resources, in particular, are located far away from electricity markets.

There are a number of electricity transmission projects on the drawing board in New Mexico, though planning times are lengthy and it is unclear how many projects will be built.

Pipelines, Refineries, Hubs, & Nuclear Infrastructure

There are nearly 13,700 miles of oil, gas, and other pipelines in New Mexico (not including gas distribution lines). These pipelines carry oil and gas to refineries and markets. While some oil is transported via truck or rail, virtually all natural gas is transported

via pipeline. There are two oil refineries in New Mexico—the Gallup Refinery (~26,000 barrels per day) and the Navajo Refinery in Artesia (~100,000 barrels per day). There is also a 2,000 barrel per day ethanol production facility in operation in Portales.

Other energy facilities of note in New Mexico include the significant natural gas connection and trading point, the Blanco Hub in the San Juan Basin, through which a large percentage of Rocky Mountain natural gas passes. Although there is currently no uranium mining or nuclear power generation facility in New Mexico, there is some nuclear infrastructure: the only domestic operating uranium enrichment plant in the United States is located in Lea County (URENCO USA), and the Waste Isolation Pilot Plant (WIPP), a defense-generated transuranic nuclear waste disposal facility, is also located in southeastern New Mexico.

Efficiency

Nationwide, cars and appliances are becoming more efficient, largely due to national fuel economy and appliance standards. In 2013, national electricity consumption fell to 2001 levels, and this trend is expected to continue. Energy efficiency gains in New Mexico over the past decade are due to both the influence of the national standards and to energy efficiency standards required by the 2005 New Mexico Efficient Use of Energy Act. The act requires investor-owned utilities to reduce energy use by 8% by 2020. Each year, electricity and natural gas utilities develop energy efficiency plans that include a number of programs designed to reduce energy use and costs to residential, commercial, and industrial consumers.

An important component of energy efficiency is building codes, which set minimum energy efficiency provisions for commercial and residential buildings. New Mexico has energy codes that are based on the International Energy Conservation Code (IECC) 2009 standards. A state Sustainable Building Tax Credit has also incentivized growth of energy efficient home and commercial building construction. This credit requires homes be 40% more efficient than the national average, whereas commercial buildings are required to be 60% more efficient.

Energy Prices in New Mexico

In 2012, New Mexico's total energy expenditures were \$8.9 billion, or \$4,250 per person. The majority of these expenditures were for gasoline and other petroleum products, followed by electricity. New Mexican consumers enjoy relatively low energy prices, with its gasoline prices consistently in the bottom 20% in the nation and natural gas and electricity prices that are less than the national average.

Energy & the Economy

Total energy revenue in New Mexico, specifically revenue derived from the oil and gas sector, has grown over the past decade, as has energy revenue's relative proportion of the state General Fund. This demonstrates increased reliance upon natural resource development, which can be challenging for the state during cycles of low prices and decreased production.

In Fiscal Year (FY) 2013, production taxes, royalties, and other direct sources of state revenue from the oil and gas industry accounted for 31.5% of New Mexico's General Fund. This is a conservative estimate, as it does not include induced or secondary effects. Oil and gas was directly responsible for 86% of the Severance Tax Permanent Fund and 96.6% of the Land Grand Permanent Fund. In FY 2014 the New Mexico State Land Office generated a record \$726 million in revenue from oil and gas royalties alone for the state's public schools, universities, and hospitals.

However, with an unanticipated decline in oil prices at the end of 2014, and therefore oil exploration and production activities, the state budget has been adversely impacted for FY 2015 and 2016.



In late 2014, the Organization of Petroleum Exporting Countries (OPEC), with Saudi Arabia at its core, drove down oil prices to protect against its losses in market share to U.S. shale oil production. Between the second quarter of 2014 and the first quarter of 2015, the three-year West Texas Intermediate (WTI) average per barrel price for oil dropped from approximately \$100 to \$48 (a price that is further discounted for New Mexico producers due to transportation bottlenecks that raise the cost of transporting oil to market). Breakeven costs for oil producers are estimated to range from \$52 to \$70 in the San Juan Basin and \$40 to \$55 in Southeast New Mexico. Oil producers respond to these market signals by reducing the number of new wells drilled, potentially shutting in some producing wells, and stopping production on marginally producing wells; all of these activities have implications for New Mexico's economy (see Appendix 1).

The relative importance of oil revenues compared to natural gas revenues for the state budget has reversed in recent years; in 2007 natural gas accounted for nearly 70% of all state oil and gas revenues, while in 2013, oil accounted for 70%. While oil and gas production revenue is primarily generated in the southeastern and northwestern regions of the state, the revenue from oil and gas production benefits all reaches of New Mexico through General Fund disbursements, capital funding projects, gross receipts taxes, and ad valorem taxes that go to the counties (Figure 9).

The oil industry expansion between 2010 and 2014 accounted for unprecedented job growth in the state. It is estimated that in 2012 9% of all employment in New Mexico, or 68,800 jobs, were directly or indirectly related to the oil and gas industry. In oil-producing counties such as Lea and Eddy Counties, the December 2014 unemployment rates were 3.1% and 3.0%, respectively, compared to the statewide December average of 6.0%. However, with the recent downturn in the oil market, there have been layoffs in the oil and gas industry. Energy sector jobs are well-paying, private sector jobs, and the New Mexico Department of Workforce Solutions reports that the mining (oil and gas) and utility industries supply the first and second highest wages of all private industries in New Mexico.

Beyond oil and gas, there are other sources of revenue and jobs in the energy sector. Coal mining has traditionally been a significant source of revenue and jobs for northwestern New Mexico, and in 2013 the coal industry returned \$23 million in revenue to New Mexico and employed 1,600 people. Renewable energy and energy efficiency industries are also contributing to New Mexico's economy: in 2013, \$131 million was invested in New Mexico to install solar energy for home, business, and utility use through 87 solar companies that employed 1,900 workers. Annual land lease payments from wind energy generation in New Mexico—which primarily is paid to the State Land Office or rural landowners—is estimated to be over \$2.9 million.

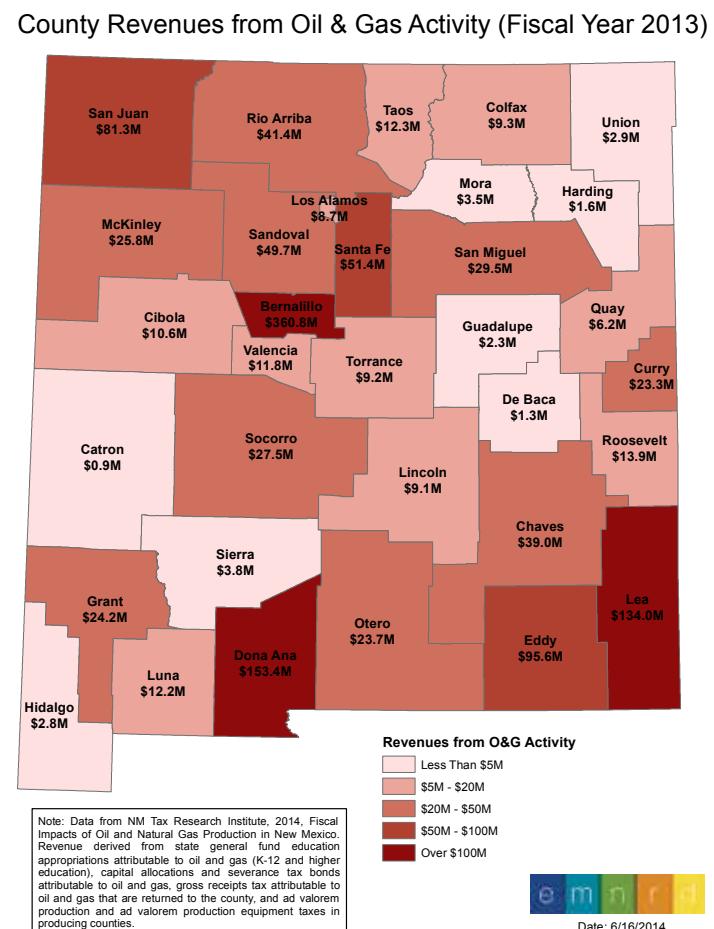
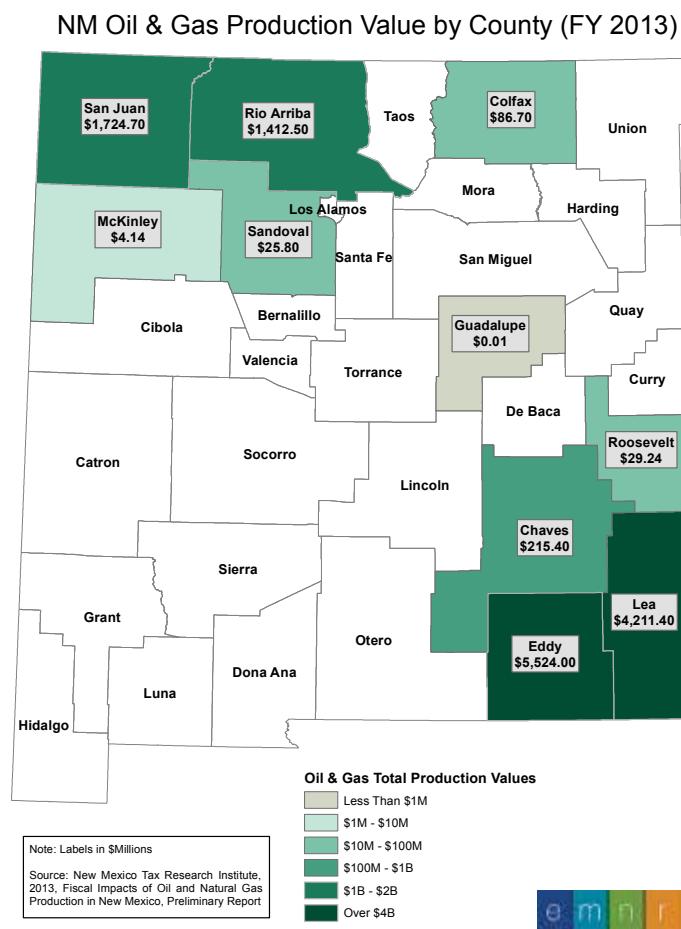


Figure 9. Oil & gas production value (left) and revenue distribution by county (FY 2013)

In contrast to its high national rankings for energy resources and production, New Mexico consistently ranks at the very bottom of national economic indicators such as poverty level, job growth, and average per capita income with the exception of natural resource producing counties.

New Mexico also remains highly dependent on federal funding and contracts, and a large proportion of jobs in the state are tied to federal dollars—a challenging position in times of federal budget sequestration.

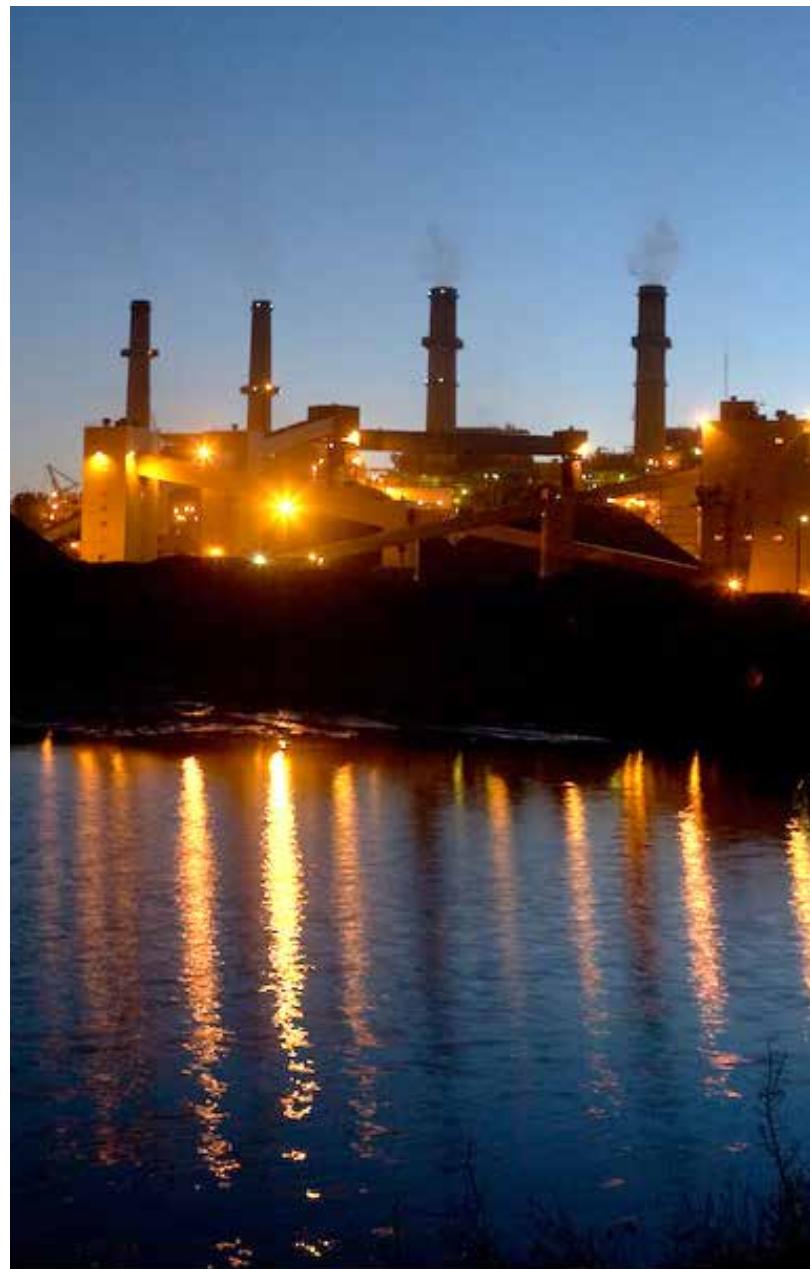
Water & Energy

Water and energy are inextricably linked and mutually dependent, with each affecting the other's availability. Water is needed for energy development and generation, and energy is required to supply, use, and treat drinking water and wastewater. Water and energy are also essential to health, quality of life, and economic growth, and demand for both of these resources continues to rise.

For the oil and gas industry, water is used for drilling and hydraulic fracturing. The growing practice of multi-stage hydraulic fracturing has increased the amount of water used per well in recent years, which in New Mexico can range from 500,000 gallons (~1 acre foot) to 8,000,000 gallons (~24 acre feet) per well. While this amount of water used by the oil and gas industry represents a small fraction of overall water use in New Mexico (~0.5%), there can be localized strain on fresh water supply in high production areas.

When oil and gas are produced, water is also extracted from the well, and this water is known as “produced water.” Produced water quality varies between wells and regions, but generally is highly brackish. In 2014, nearly 37 billion gallons (about 114,000 acre feet) of water were produced from oil and gas wells, primarily in southeastern New Mexico (Figure 10). Most of this water is reinjected underground for disposal. As water becomes increasingly scarce, this produced water may become an important new supply that industry could treat and reuse to meet some of its water needs. The oil and gas industry, in particular, is voluntarily turning toward recycling and reusing produced water in its drilling and completion operations.

The electricity sector uses 1.5% of the state's fresh water for cooling of thermal (coal and natural gas) generation facilities. While there are no nuclear generating facilities in New Mexico, Public Service Company of New Mexico (PNM) and El Paso Electric (EPE) own and purchase power from Palo Verde, a nuclear generating station in Arizona. Investor-owned utilities report water use through their Integrated Resource Planning process. Natural gas steam turbine plants (generally peaking plants) consume the most gallons per megawatt-hour (MWh) of electricity generated, with nuclear and coal-fired electricity generating stations the second and third largest consumers (Figure 11). Solar and wind technologies do not require any water for operation.



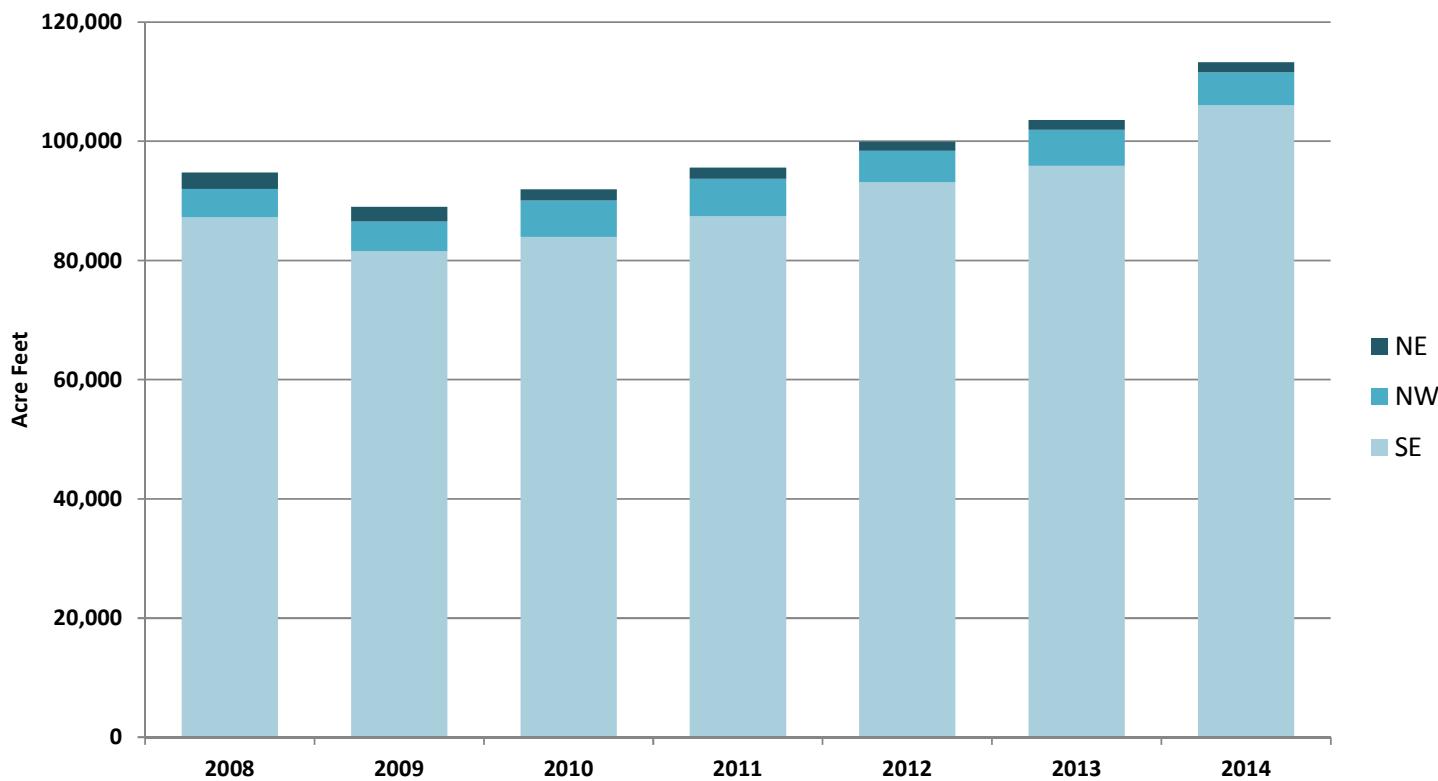
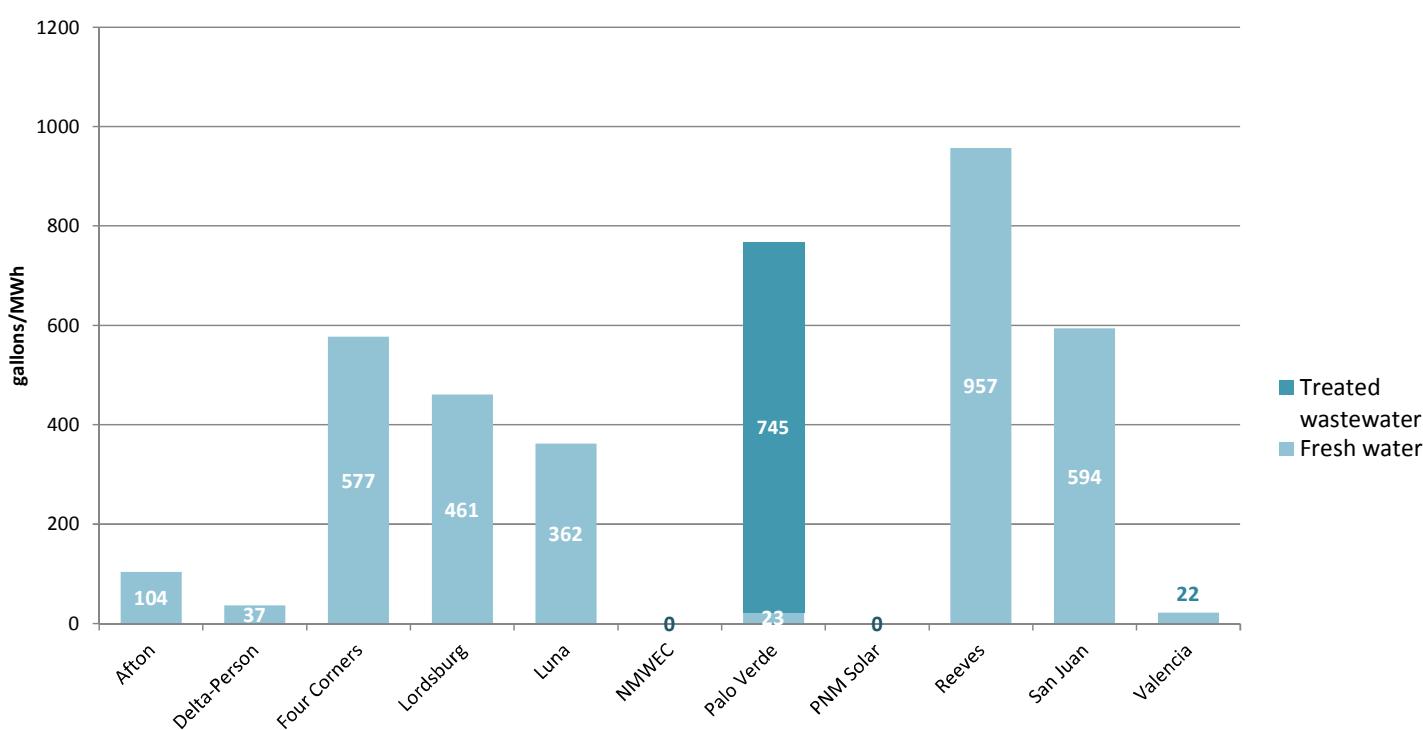


Figure 10. Produced water volumes in New Mexico from oil and gas extraction, 2008–2014 (NW = McKinley, Sandoval, Rio Arriba, and San Juan Counties; NE = Colfax County; SE = Chaves, Lea, Eddy, and Roosevelt Counties)



Note: The plants employ the following technologies: Afton and Luna (combined cycle natural gas); Delta and Valencia (natural gas peaking plants); Four Corners and San Juan (coal); Lordsburg (natural gas combustion); NMWEC (wind); Palo Verde (nuclear, located in Arizona); PNM Solar (photovoltaics); Reeves (natural gas steam turbine)

Figure 11. Water use intensity for PNM's existing generation resources (2011–2013, average gallons/MWh)

PRINCIPLES & GOALS

The principles and goals of the New Mexico Energy Policy and Implementation Plan are:

- Sustain responsible economic development of energy resources while protecting the environment, public health and safety
- Focus on economic growth, diversification, and private sector job creation
- Include all energy sources
- Encourage energy technology innovation
- Identify opportunities for more efficient and effective regulation
- Consider appropriate incentives that would increase market potential and competitiveness with other states in the West
- Accelerate reduction of fresh water consumption in the energy sector
- Base recommendations on facts and science
- Obtain input from regional listening sessions
- Consider near-term and long-term goals and objectives

OBJECTIVES

The objectives of the New Mexico State Energy Policy are:

- Promote all sources of energy to advance economic development and general welfare in New Mexico
- Stimulate energy investment in New Mexico through utilization of abundant natural gas reserves via “value-added” sectors such as petrochemicals, natural gas vehicles, and in-state manufacturing
- Identify the feasibility of new energy markets for coal, small modular nuclear reactors for electricity generation, and energy storage technologies for wind and solar
- Provide regulatory clarity for existing and emerging energy industries
- Collaborate with state agencies, federal agencies, and tribes to provide a new framework of inter-governmental harmonization and asset deployment

- Establish the energy foundation of new and improved infrastructure in rail, roads, pipelines, petroleum refining, gas processing, and electric power transmission
- Maximize cost-effective deployment of energy efficiency in public buildings
- Address public concerns regarding energy development and public health, safety, and the environment
- Reduce fresh water consumption for energy production
- Provide science and technology-based information and data about the energy sector to the public and elected officials
- Develop initiatives with state and local colleges and universities to improve workforce training for the energy sector
- Review the energy policy at regular intervals and monitor state energy policy implementation

APPROACH

In late 2013, Cabinet Secretary of the Energy, Minerals and Natural Resources Department (EMNRD), David Martin, established a Core Project Team to work toward creating a New Mexico Energy Policy and Implementation Plan. The team began by reviewing all existing state policies regarding energy development. The team also studied efforts by surrounding states, states with similar energy profiles, and regional planning organizations to develop and implement energy policies. The team identified the energy geography and trends of New Mexico’s energy sector, studying the state’s resources, production, infrastructure, distribution, and consumption.

Specific initial planning actions included:

- Reviewing the most recent New Mexico Energy Policy (1991)
- Identifying recent New Mexico Executive Orders related to energy policy
- Reviewing the federal Energy Policy Acts of 1992, 2005, and 2007 as well as recent positions by federal agencies, such as the Department of Energy and the Environmental Protection Agency
- Evaluating energy policies and plans developed by key states (i.e., those located in the region or with

- similar energy profiles to New Mexico)
- Examining the July 2013 National Association of State Energy Officials report, "An Overview of Statewide Comprehensive Energy Plans, From 2002 to 2012"
- Assessing the June 2013 report from the Western Governors' Association, "10-Year Energy Vision, Goals & Objectives"

Listening Sessions

With regional economic development organizations as hosts and partners, listening sessions were held across New Mexico to gather input from diverse stakeholders about existing energy production conditions and future opportunities for enhancing energy development and deployment in New Mexico. These listening sessions drew approximately 450 attendees and focused on specific topics of relevance to the region in which they were held.

Farmington: November 13, 2013

- Fuels, fuel stocks, and power generation
- Natural gas, crude oil, and coal

Santa Fe: November 19, 2013

- Renewable power generation
- Energy efficiency and conservation
- Transmission

Hobbs: January 14, 2014

- Fuels, transportation, and power generation
- Crude oil, natural gas, water, and nuclear power
- State and federal oil and gas regulation

Las Cruces: March 19, 2014

- Renewable energy: biofuels, solar, geothermal energy
- Water/energy nexus
- Commercialization, infrastructure, financing

Socorro: March 27, 2014

- Technical and science-based input on concerns related to energy development
- Water use and water recycling
- Science and technology assistance to New Mexico counties and municipalities

Albuquerque: May 29, 2014

- Energy technology innovation
- Energy innovation and business opportunities for New Mexico

Topics common to all sessions included:

- Responsible energy development, state and local economic growth, private sector jobs
- Water requirements for energy development
- Economic development and manufacturing
- Infrastructure (e.g., transmission, pipeline, rail)
- Workforce training and education

In addition, EMNRD convened experts from Los Alamos and Sandia National Laboratories in the areas of fossil fuel extraction, renewable power generation, electricity infrastructure, energy storage, advanced manufacturing, the energy/water nexus, and biofuels. The department solicited input from these renowned energy experts on how the state can grow its economy from the energy sector and harness the expertise of the national laboratories.

Many of the listening sessions had a diverse group comprising industry and community leaders of the topical areas of interest. These groups met after the sessions to compile priorities that emerged from the sessions and submit recommendations to EMNRD on what in the listening session should be included in the state energy policy.

Development & Implementation of the Energy Plan

Drawing from reports and input received at all Listening Sessions, the Core Team at EMNRD prepared a draft plan in consultation with the Governor's Office. The final plan will be implemented 1) by Executive Order, where authority resides; 2) voluntarily by executive agencies, where possible; and 3) through Legislative action, where needed. The state energy plan will be reviewed and updated at regular intervals.

ENERGY DIVERSITY

Promote all sources of energy to advance economic development and general welfare in New Mexico

New Mexico is fortunate to have a diverse and abundant amount of energy-producing natural resources within its borders. These resources are spread across the state's geography, with different energy assets benefiting different regions. Consideration of New Mexico's unique energy geography and inclusion of all energy resources are fundamentals of the state's energy policy and a path toward economic progress.

Investment advisors encourage diverse portfolios to help manage risk. Similarly, New Mexico's strategy to develop its energy resources in a way that benefits the state's economy, and its citizens, embraces all forms of energy to provide multiple pathways for economic success and hedge against changes in market conditions.

A sound state energy policy has mechanisms to recognize changing market conditions and appropriately value the economics and availability of different energy resources. In the past, states and the federal government have made policy decisions to support "infant" industries with non-market incentives or targets until they become competitive with the costs of conventional technologies, or become "mature" industries. Throughout the past decade, renewable energy industries have succeeded in moving toward this transition because of a number of federal and state tax incentives and portfolio targets. It is important for New Mexico to look at changing market conditions, consistently evaluate



incentives and their relative costs and benefits, and modify them throughout time to adequately incentive desired energy outcomes.

In late 2014 EMNRD commissioned an analysis of the state renewable energy production tax credits that considered both the costs (estimated foregone tax revenue) incurred since the inception of the tax credits and the benefits, including temporary and permanent jobs and tax income. These types of analyses can help inform future policy decisions.

Energy Diversity Recommendations

Embrace an "all of the above" approach to energy policy for state economic benefit and risk reduction.

Recognize the unique energy geographies of New Mexico and support regional energy policy, infrastructure, and development pathways and solutions.

Ensure the economics and availability of energy resources drive state energy policy decisions.

Enact consistent tax policy to provide certainty for industry. In all sectors, to attract financing, developers should have a solid understanding of what incentives are available and the criteria for accessing them.

NATURAL GAS MARKET ENHANCEMENT

Stimulate energy investment through utilization of abundant natural gas reserves via “value-added” sectors such as petrochemicals, in-state manufacturing, and natural gas vehicles

Horizontal drilling in previously impervious shale formations has resulted in a glut of natural gas in the United States. The oversupply has driven the prices for natural gas down to the point that drilling new gas wells in New Mexico is uneconomic and state revenues and the economy surrounding the natural gas industry has been negatively impacted. New Mexico has an abundance of natural gas, and new markets are needed to drive demand of this resource. Increasing the industrial and manufacturing applications for natural gas and natural gas vehicles are promising pathways to bolster natural gas demand.

Petrochemical and manufacturing potential in New Mexico, particularly in the San Juan Basin, is based on these “stranded” natural gas reserves and low prices. Natural gas can be used as a feedstock for urea, which is needed for catalytic emissions reduction processes in coal-fired power plants, a number of which are clustered in the Four Corners Region. Natural gas-to-liquids is another area with potential. It is an established technology that offers a gas conversion to a syngas and then to diesel fuel; however, economics need to be closely evaluated at anticipated future crude oil prices. The low cost of

natural gas feedstock and infrastructure in San Juan County has attracted investor interest. Another strategy to add additional value to the natural gas resource is to promote its use in the manufacturing sector. In Northwest New Mexico, all of these value-added industries would benefit from rail expansion. Petrochemical manufacturers, attracted to New Mexico surplus natural gas, require rail-to-market supply chain capability.

The low cost of abundant, under-produced New Mexico natural gas also sets the stage for expansion into the transportation sector. Partnerships with economic development groups, industry, and government have helped catalyze interest in natural gas vehicles (NGVs) and related infrastructure in the state. As of July 2015, there were 15 compressed natural gas (CNG) stations in New Mexico (10 of which were public or open to fleet access). Two Liquefied Natural Gas (LNG) stations are poised to open along I-10 (Lordsburg) and I-40 (Albuquerque) once demand increases in over-the-road trucking. However, New Mexico has fallen behind neighboring states in NGV infrastructure and incentives and should explore the potential for NGV tax credits, vouchers, and procurement of state fleet vehicles.

Natural Gas Market Enhancement Recommendations

Identify and attract petrochemical and manufacturing companies that utilize natural gas to New Mexico, particularly to San Juan County.

Involve state universities and laboratories in economic research and modeling to assist industry in petrochemical projects.

Study NGV incentives competitive with other states, such as removing sales tax on the incremental cost of a natural gas vehicle or providing NGV vouchers.

Extend weight limits to allow an additional 2,000 pounds for heavy duty NGVs, using either CNG or LNG.

Study the Petroleum Standards Act to determine if the LNG and CNG tax structure can be more nearly equalized in a manner that will be revenue neutral for the New Mexico Department of Transportation.

ENERGY MARKET EXPANSION

Identify the feasibility of new energy markets for coal, small modular nuclear reactors for electricity generation, and energy storage technologies for wind and solar

There are a number of emerging energy technologies that New Mexico can take advantage of. As federal regulations increasingly impact coal-fired electricity markets across the United States, the state may need to look abroad, or to markets other than power generation, for its coal resources. Conversely, small modular reactors could provide carbon-free, baseload electricity generation and small modular reactors contain improvements to cost, safety, and environmental considerations that are of concern for larger nuclear generation facilities. In addition, energy storage is a rapidly growing and critical industry that can enhance the penetration of intermittent renewable energy resources, such as wind and solar energy.

Another potential area for energy market expansion is to export crude oil from the United States to other countries. Exporting crude oil from the United States is currently not allowable under federal law. Given that New Mexico's 2015 Energy Plan is dedicated to policies and actions that can be undertaken at the state level, there is not a great deal of time spent on the issue of crude oil exports in this policy document. However, New Mexico supports changing the law at the national level to allow for crude oil produced in the state to be exported to world markets. This position is consistent with the overriding principles of the 2015 Energy Plan to promote greater production of all types of energy resources in New Mexico, as a means of developing our energy economy, diversifying the state's economy as a whole, and contributing to the effort to make our nation more energy independent. To sum up these points, in a recent letter to President Obama on the issue of crude oil exports, Governor Susana Martinez and nine other governors stated the following:

"The federal government's current approach to energy exports was set in motion when domestic production was down, imported energy was dominating our resource mix and the global market was threatened by hostile international players. The United States now stands as the world's top producer of oil and natural gas, though we continue to import energy from nations adverse to American interests. This approach is impractical

and dangerous. American ingenuity and advances in technology have unlocked vast reserves of crude oil and natural gas here at home. We should be seeking new opportunities for these energy resources by providing customers around the globe unblocked access – driving investment in American energy."

New Coal Markets

New Mexico has vast coal reserves and large coal-fired electric generating facilities that provide electricity to New Mexicans and also export electricity to other states. The coal mining and power generation industries are important economic engines in the Four Corners region. In 2014, the Four Corners Power Plant and Navajo Mine employed over 750 people, with 400 at the mine alone.

In New Mexico, the coal mining and coal-fired power generation industries are under pressure on several fronts. The Environmental Protection Agency's 111(d) rule, which sets carbon dioxide emissions targets for states from existing electricity generating units, is foremost. This rule has major implications for the power sector. California's decision to end the purchase of coal-generated electricity in 2014 is also eroding the market base for New Mexico-supplied power from the San Juan Generating Station and Four Corners Power Plant, as well as for New Mexico-coal supplied power plants in Arizona.

As electric utilities reduce coal consumption because of regulatory cost and transition to non-solid fuels, it is necessary to investigate alternative markets for coal, or find other means to support the economies of communities that host coal mines and coal-fired power plants. Within the coal sector, possibilities include converting coal to liquid fuels or gases, adopting clean coal technologies, and international coal exports. Coal-to-liquids is technically possible, but not cost-effective at current low natural gas prices. U.S. Department of Energy support for large-scale clean coal projects is also waning.

Carbon capture and sequestration at power plants is

not economic and is not anticipated to be until 2020 at the earliest, though there have been encouraging applications of carbon capture at industrial facilities and use in enhanced oil recovery operations. The most promising pathways for coal-producing communities are to export coal or find alternative economic activities to support jobs and revenue.

San Juan Basin coal could be transported to foreign markets, including the European Union and Mexico, if an infrastructure project to extend freight rail service to San Juan County were realized.

Transportation costs and quality ranking indicate that New Mexico coal could not compete in Asian markets.

Coal Market Expansion Recommendations

Support feasibility studies of exporting coal to the European Union or Mexico, and include consideration in a rail feasibility study for northwest New Mexico.

The Economic Development Department and regional economic development organizations should convene and consider alternative economic activities for Farmington and the Navajo Nation if alternative coal markets to power generation cannot be found.

Coal should be kept as a portion of the electric generation mix to maintain a diversity of baseload supply. Price and supply risk is generally lower with portfolios that have a diverse mix of power generation sources.

Monitor carbon capture and sequestration technology developments and promote cost-effective capture of carbon dioxide from power generation facilities that is used for enhanced oil recovery operations.



Mexico for defense-generated transuranic waste. Many of the state's high-income communities and highly educated residents have direct ties to the nuclear industry. Nuclear power generation, however, does not yet exist in New Mexico, though some nuclear power is imported from Arizona's Palo Verde Station.

Nuclear power is carbon-free and provides baseload electricity capacity that operates 24 hours a day, seven days a week. As coal is phased out of utility generation portfolios, utilities are looking for alternatives to provide low-carbon baseload capacity. In addition, there are growing power needs in southeast New Mexico from oil and gas development. Though new nuclear energy technologies offer promise, legacy issues from uranium mining, safety, nuclear waste storage, capital costs and nuclear power plant water consumption are all significant issues that must be addressed for nuclear energy development in New Mexico.

Small modular reactors (SMRs) are one possible pathway to provide needed carbon-free power in a way that reduces issues presented by larger-scale nuclear power plants. SMRs are 185–385 MW nuclear power plants that are compact in design and have minimal surface impact. They are modular in that they are fabricated at a factory and shipped to the point of use, and multiple units can be pieced together to create the desired load size. This design promotes domestic factory assembly, and there is a potential for partial manufacturing of SMRs in New Mexico. They are less expensive, have more flexible siting, and use less water than traditional large nuclear power plants. Many of the new designs use air cooling, are sited in-ground, and turn themselves off automatically if there is a high temperature

Small Modular Reactors

New Mexico has benefited from the pivotal role it has played in the nation's nuclear history. Los Alamos National Laboratory and Sandia National Laboratory each employ thousands of New Mexicans and are global leaders in fields related to nuclear research. URENCO in Eunice is the only domestic operating uranium enrichment plant in the United States. Another state resource is the Waste Isolation Pilot Plant (WIPP), a disposal site in southeastern New

event. These features add to the overall safety of the reactors.

Despite the reduced impacts anticipated from SMRs when compared to large-scale nuclear power facilities, SMRs still have safety and environmental concerns, such as the need for effective containment systems, nuclear waste storage considerations, and decommissioning plans. As of yet, there are no SMRs built; therefore, their true costs and impacts remain unknown. There are federal and state regulatory considerations for SMRs. The federal Nuclear Regulatory Commission (NRC) regulates SMRs and has not yet approved a final design for licensing, construction, and operation. Various companies have designs ready for submittal to the NRC. Most companies indicate the NRC process will take approximately four years from the date of design submittal. In order for licensing to occur, a site must be chosen and meet the NRC standards. In New Mexico, the regulatory pathways and requirements for SMRs are not yet established.

One way to facilitate SMR development is to include nuclear energy as part of a “Low-Carbon Portfolio Standard,” which would follow the state’s existing Renewable Portfolio Standard (RPS). Such an approach would provide an additional pathway for the state to meet federal carbon dioxide emissions mandates.

SMR Recommendations

Develop an SMR taskforce comprised of national laboratory, research university, and utility representatives and vendors to provide technical and legal support for a pre-feasibility study of an SMR prototype reactor in New Mexico. Siting and connection to the grid should be studied and plans completed for prospective sites with community support for SMRs. The taskforce should also include experts in NRC licensing and siting.

Develop hypothetical incentive benefits for an SMR developer, based on projected costs and employment from the pre-feasibility study.

Solicit input on establishing a post-2020 Low-Carbon Energy Portfolio Standard

Energy Storage

Globally, growing amounts of variable renewable energy generation along with a movement toward grid modernization are driving expansion of the energy storage industry. Solutions are needed to even out electricity loads, provide energy when renewables are not available, and ramp quickly when renewables go offline. In addition, aging electric infrastructure designed for centralized large generation facilities is not keeping pace with demands of the current system.

By any measure, the energy storage industry is growing. According to a Cambridge Energy Research Associates report, the energy storage sector could grow from a \$200 million industry in 2012 to a \$19 billion industry by 2017. Greater penetration of renewable energy, particularly wind and solar, has created demand for energy storage services, as have state mandates such as California’s to provide 1.3 gigawatts (GW) of grid-tied energy storage by 2020. Energy storage is a possible sector for economic growth in New Mexico because the state has all the technical resources to implement several forms of storage. New Mexico’s national laboratories have extensive expertise in energy storage technologies and testing, and the state is an ideal test bed for different storage technologies.

In New Mexico, there are two existing battery energy storage demonstration projects: Public Service Company of New Mexico’s (PNM) Prosperity Project and Los Alamos National Laboratory (LANL) and Los Alamos Department of Public Utilities’ smart grid demonstration with NEDO, a Japanese government organization.

The state can capture a portion of the growing energy storage sector and deploy these technologies. It is important at this stage that the state remains open to a variety of energy storage technologies, as there is a need to foster a diversity of energy storage approaches and different technologies have different strengths. However, there are specific energy storage areas, such as advanced battery technologies, that can be areas of potential manufacturing growth in New Mexico.

Energy Storage Recommendations

Promote New Mexico as “the” place to develop and test energy storage technologies. With its existing test beds, relatively inexpensive electricity, national laboratory expertise, and successful record with demonstration projects, the state could become a hub for energy storage testing, encouraging companies to move here.

Support a state initiative to establish an Advanced Battery Chemistry and Materials Center in New Mexico within the framework of a technology industry partnership.

Pursue energy storage technology development and demonstration projects such as in advanced batteries and flywheel/hydraulic energy storage systems.

Encourage companies that develop energy storage software and controls to locate in New Mexico. Few energy storage software and controls that maximize dispatch and charge efficiency is an emerging area where there are few commercialized products. This area has the potential to create high-wage tech jobs in the state.

Minimize the “soft costs” (regulatory and permitting) of energy storage financing and/or grid interconnection.

Promote batteries coupled with solar PV in residences. With increasing numbers of solar panels being installed on homes, the distribution grid may eventually reach a saturation point where additional power can no longer be fed safely back on the grid. To ameliorate this issue, homeowners could utilize advanced batteries to store unused energy rather than feeding unused solar power back on the grid, thus precluding the need for upgrades to the distribution grid. New Mexico should also explore leasing programs to provide off-grid families with standalone electric systems of PV coupled with battery storage.

REGULATORY CLARITY FOR EXISTING & EMERGING INDUSTRIES

Provide regulatory clarity for existing and emerging energy industries

Clarify Oil & Gas Regulatory Jurisdiction

There are many aspects of the oil and gas industry that are regulated, and these are best managed, from both a policy and regulatory standpoint, at the state level. Counties attempting to regulate oil and gas development create redundant and conflicting regulations, and counties are ill-equipped to fund and administer regulation. The state not only has more advanced systems in place required to regulate the industry, but the revenue benefits of oil and gas development are spread across the state, supporting a statewide, systematic approach to regulation that ensures benefits for all of New Mexico’s citizens.

Streamline & Clarify Regulatory Pathways for All Energy Technologies

Energy entities in New Mexico generally fall into two realms: operating energy providers, such as utilities and extractive industries, or developers of “new technologies,” such as solar, wind, geothermal, small modular reactors, and biofuels. For New Mexico to attract energy economic development opportunities in both established and new areas, the state should maintain a reputation of streamlined regulatory processes and state agencies working in partnership with businesses. The state has received feedback that New Mexico regulatory agencies at times act as impediments to project development. While it is important to have procedures and bodies in place that protect the public interest and enforce laws and

regulations, in some areas permitting and regulatory processes appear ad hoc, making it difficult to project accurate development timelines and ultimately secure project financing. Though some confusion about geothermal energy development was addressed with 2012 legislation that affirmed EMNRD's Oil Conservation Division primacy over permitting processes, there are still additional points of regulatory ambiguity in that sector to be addressed. Timely permitting for energy projects is required to finance and operate businesses and also expedites revenue flows and job creation for the state.

Reduce Solar “Soft Costs”

The price for solar photovoltaic (PV) panels has decreased markedly over the past decade, but as costs for hardware have gone down, “soft costs” such as permitting and other local regulatory process costs have not always followed suit. Studies have shown that after labor and materials, these soft costs now comprise the majority of the solar installation costs for residential PV systems. Currently, there are many programs nationwide seeking to reduce solar installation soft costs through establishing and enacting permitting best practices, but there has been no concerted effort in New Mexico.

Regulatory Clarity Recommendations

Reinforce state primacy in regards to oil and gas regulation.

Update state geothermal energy regulations to help streamline and target them to geothermal operations.

Convene “permitting roundtables” of relevant agencies to chart the regulatory process for new projects.

Map regulatory pathways for different energy technologies and create a process for how the state will deal with new technologies that have not yet been regulated in New Mexico.

Make New Mexico’s state regulatory entities easier to work with and have a specific point of contact for energy-related businesses to identify required permitting and approvals for each technology.

Initiate a state-led effort that assists or encourages local jurisdictions to reduce soft costs for solar PV installation.

STATE, FEDERAL & TRIBAL COOPERATION

Collaborate with state agencies, federal agencies, and tribes to provide a new framework of inter-governmental harmonization and asset deployment

New Mexico is a checkerboard of private (44%), federal (34%), state (12%), and tribal (10%) lands and minerals. For large-scale development that covers large mineral estates, such as oil, natural gas, and coal development, multiple agencies are involved in development. Possibilities exist to reduce duplication of efforts. Leveraging synergies among organizations can help alleviate some of the bottlenecks experienced in permitting and right-of-way approvals.

Federal & State Authority, Regulations, Operation & Management

A significant portion of both the surface and mineral estate in New Mexico is owned by the United States and managed by the Bureau of Land Management (BLM). Specifically, at least 40% of the oil production in southeast New Mexico comes from federal lands; therefore, actions or inactions by the BLM have a significant impact on the amount of oil and gas that can be produced and therefore the revenue from royalties returned to the state.

Access to the mineral resource is a fundamental need for the oil and gas industry. Access can be denied in a number of ways: 1) delays in issuing permits from inadequate staffing or efficiency; 2) implementing burdensome requirements for operations, particularly when resources are not provided to support increased workload on the agency side to enforce regulations; and 3) placing prohibitions on development of certain areas.

Subject to reasonable environmental and safety concerns, it is in the best interest of the state to assure the oil and gas industry access to develop mineral resources. The state has an important role in this regard with both local and federal governmental entities in order to protect a primary source of state revenues. In addition, the federal government provides for the Governor of New Mexico to review



proposed Resource Management Plans to determine if the details of the plan are consistent with state policies. It is a statutorily created opportunity for the state to make sure its policy goals are not overlooked as part of federal planning efforts.

There is considerable overlap in the responsibilities of the various state and federal agencies overseeing oil and gas operations. In part this depends on whether the lands involved are federal, state, or privately owned. BLM has authority to impose rules on federal lands in addition to the rules adopted by the New Mexico Oil Conservation Division (OCD). Having both the federal and state agencies oversee the same operations increases costs, duplication, delay, and confusion for the regulated community. In addition, land ownership and lease records are now maintained by the BLM Office of Natural Resources Revenue, the State of New Mexico, and at each county courthouse.

The state must also coordinate with tribal authorities on aspects of energy development, including oil and gas, coal, and right-of-way issues. Expanding oil production in northwest New Mexico has led to increased activity on allotment tribal lands. There is a very large backlog and slow process for permitting oil and gas drilling on Navajo allotted lands in the San Juan Basin, where there is oil industry exploration and production on a start-up scale. The state must work closely with tribes to sustain regional economic development in New Mexico.

In early 2014, the Navajo allottees (Navajo descendants with land allocations from the federal government apart from tribal ownership), represented by the U.S. Bureau of Indian Affairs (BIA), sought and received direct assistance from the State of New Mexico Energy, Minerals and Natural Resources Department (EMNRD).

The state funded the School of Energy at San Juan College to provide students and adjunct faculty to process Navajo allottee leases under BIA assignment. Consequently, the BIA offered career positions to San Juan College students and recognized School of Energy students as an employment pool. These types of creative arrangements between New Mexico and the federal government can lead to additional economic activity in the energy sector as well as reduce development risk.

State, Federal & Tribal Regulatory Efficiency & Cooperation Recommendations

Promote the goals and objectives of the New Mexico energy policy by evaluating federal rulemakings, National Environmental Policy Act (NEPA) processes, Resource Management Plan revisions and updates, or other federal actions that impact the oil and gas sector to ensure access to mineral resources for development in New Mexico.

Implement memoranda of understanding (MOUs) or other agreements with the BLM to streamline permitting, operating requirements, and inspections in order to avoid duplication and promote consistency with state OCD rules.

Encourage the BLM and BIA field offices to be adequately funded to hire the staff necessary to perform the work required by federal laws in a timely manner and be staffed at a level that reflects the amount of oil development in southeast New Mexico.

Revise how land ownership and lease records are maintained to centralize and streamline record keeping in one agency, and provide online access to these records.

Initiate a single set of regulations and paperwork requirements, regardless of the mineral and surface ownership, on all lands, to simplify and streamline development application approval.

Collaborate with tribal, Federal Indian Minerals Office (FIMO), BIA, and federal regulators to reduce complex rules, regulations, and processes covering permitting for oil and gas drilling and ongoing operations on allotted and tribal lands. Assist San Juan College to provide support to these agencies.

INFRASTRUCTURE

Establish the energy foundation of new and improved infrastructure in rail, roads, pipelines, petroleum refining, gas processing, and electric power transmission

Infrastructure development, from oil and gas pipelines to electricity generation, storage, and transmission, is critical to all aspects of the energy supply chain. A lack of energy infrastructure will limit New Mexico's economic development potential.

Oil & Gas

Oil and gas infrastructure includes pipelines, roads, rail, processing and refining facilities, and electricity infrastructure. The current infrastructure for unconventional fuel production in New Mexico was designed and constructed for low levels of activity and is not adequate for a time of higher oil output. Prices drop quickly if there is no way to get gas or oil to market. For natural gas, that includes gathering lines and gas treatment facilities as well as pipelines. For oil, it includes refining capacities and rail as well as pipelines.

Southeast New Mexico experienced a massive increase in oil and gas production from 2010–2014, and infrastructure has not kept pace. Road infrastructure is of particular concern in the region, as there is road congestion and safety vulnerabilities. Roads in areas of heavy oil and gas development receive extraordinary use and need to be improved and maintained in order to be safe.

In southeast New Mexico, there is also a premium on take-away pipeline capacity, which lowers the revenue that oil companies, and therefore the state, receives on sales. This contributes to the discount price for New Mexico crude oil from the Permian and Delaware basins. A lack of natural gas gathering lines in the region leads to flaring of natural gas at the wellhead, and additional pipeline infrastructure would reduce air emissions while providing a new revenue stream. Pipelines are also needed for delivering water, and they are a less expensive water delivery method that also would reduce trucking and traffic on the roads. Lastly, electricity infrastructure in southeastern New



Mexico is strained, and the region will need additional generating capacity and transmission lines to accommodate continuing oil development.

Lack of access to rail and pipeline increases transportation costs and limits ability to import/export certain products. Pipeline expansion is one option for oil transportation, and siting and constructing new pipelines may take less time than building new rail corridors. However, rail expansion through the Navajo Nation and New Mexico's oil producing areas in northwest New Mexico may act as a regional catalyst for economic development, as the rail system can be used to transport a number of goods and materials.

With two major natural gas pipeline networks opening exports to the State of Sonora in Mexico from Arizona, New Mexico should facilitate a San Juan natural and associated gas direct pipeline to the Santa Teresa connector to the State of Chihuahua in Mexico. The San Juan Basin gas will offer Mexican power generation a low-cost and low-carbon supply option. San Juan natural gas could also provide Mexico part of the supply for its LNG export market to Asia from the Baja coast.

Developing new infrastructure projects is challenging: there are often significant permitting and siting requirements, right of way issues, and approvals needed from various levels of government. In New Mexico, there is a "soft" infrastructure (regulatory) constraint statewide; in particular, the BLM offices in New Mexico are deficient in budget and staffing resources. It is difficult for BLM and state regulatory entities to recruit staff when competing with higher industry compensation.

With the recent decline in oil prices since late 2014 and anticipated future decline in production, the state has additional time to address these known infrastructure bottlenecks. Unless they are resolved, there will not only be an adverse effect on takeaway capacity but there can be a significant adverse effect on crude oil development when oil prices again increase. The inability to get product to market, coupled with the regionally lower oil price, will slow down drilling plans which can result in lower production forecasts and the resulting decreased revenue to the state. Thus, there is a critical need for in-state delivery systems to get the crude to interstate markets.

Oil & Gas Infrastructure Recommendations

Encourage cooperation among EMNRD, the Department of Finance and Administration, the New Mexico Department of Transportation, and state legislators to mitigate road infrastructure constraints and reallocate existing tax revenues to address public road repair and new construction, particularly for southeast New Mexico.

Support the feasibility study of a rail branch line from Interstate 40 to the Farmington Four Corners Region. If it is found to be a viable with private funding partners venture, the state should rank it as a top priority in the state rail plan, and encourage investment.

Prioritize the streamlining of right-of-way permitting processes on state land and assist relevant agencies with right-of-way processing on federal and tribal lands. To alleviate these "soft" infrastructure constraints and reduce permitting time, support state universities and two-year colleges to provide assistance with realty and environmental assessments.

Encourage additional oil refining, gas processing, rail, pipeline, and electricity infrastructure development and promote an integrated, coordinated approach to development that reduces bottlenecks and delays.

Support additional pipeline infrastructure in New Mexico to supply natural gas to the Mexican State of Chihuahua and for LNG export to the Mexican west coast.

Coordinate with multiple state agencies to explore possibilities for new oil refineries or expansion of existing refineries.

Electricity Delivery

The major electricity transmission lines in New Mexico were built in the 1960s and 1970s. Many smaller-scale system improvements have been made since that time. There are a number of reasons to expand electricity transmission infrastructure in New Mexico: the state can take advantage of economic development opportunities that require additional power, utilities can continue to provide reliable service to existing homes and industries, and updated transmission and intelligent distribution infrastructure helps increase the penetration of renewable energy on the grid. New, inter-state transmission would also have to be built if New Mexico were to capitalize on and export its wind and solar resources.

Transmission is notoriously difficult to develop, and projects run into roadblocks with both permitting and cost recovery. Transmission lines often cross multiple land jurisdictions (federal, tribal, state, and private), which makes permitting onerous. There are increasingly fewer right-of-way corridors suitable for large-scale transmission development.

In addition to large-scale transmission, the modern electricity grid is moving toward a more distributed model. In this new model, many different small generation sources and intelligent devices create a transactive grid with complex management of distribution systems. Intelligent devices and smart meters enable greater demand response, when end-use customers tailor their electricity use in response to power grid needs, resource availability, or economic signals. While it is important to maintain and improve upon New Mexico's larger transmission infrastructure, it is also important that the state prepare for a modern grid.

Improving state-controlled aspects of transmission siting and permitting can help support utilities to make transmission infrastructure investments. Transmission policy should prioritize transmission projects and upgrades that benefit New Mexico's economy and citizens through enhanced reliability, energy security, or access to additional economic opportunities.

Electricity Delivery Recommendations

Engage in regional transmission planning and siting initiatives, including WestConnect and its subsidiary the Southwest Area Transmission Regional Planning Group and the Western Governors' Association transmission siting task force.

Consider the installation of smart meters by utilities to accommodate the needs of a basic smart grid.

Promote expansion of existing demand response programs where electricity users voluntarily curtail consumption during peak times and receive compensation from a utility.

PUBLIC BUILDING EFFICIENCY

Maximize cost-effective deployment of energy efficiency in public buildings

Increasing energy efficiency without reducing productivity reduces waste and optimizes the use of New Mexico's energy resources. Energy efficiency programs also support job creation (such as construction, supply chain, and induced jobs from utility savings).

The existing inventory of New Mexico's state public buildings, including state office buildings, K-12 schools, universities, and prisons, represents a vast amount of square footage and energy efficiency potential. Public buildings that are more energy efficient have lower utility bills, helping to control operating costs that are paid for with taxpayer dollars.

When capital funding is not identified in the General Services Department to support energy efficiency projects in state government buildings, energy savings performance contracting (ESPC) can be used. An ESPC is an agreement between a governmental entity and an energy service company (ESCO) to conduct a comprehensive energy audit of designated facilities and identify improvements to save energy. If a state agency wants to pursue the upgrades, the ESCO designs, constructs, and pays for the project. The ESCO provides the up-front costs and guarantees energy savings from the improvements, and these cost savings pay for the project over the term of the contract (up to 25 years). After the contract terminates, all additional cost savings accrue to the state.

Energy Efficiency in Public Buildings Recommendations

Institutionalize a program for energy performance in public buildings with phased implementation that:

1. Requires annual benchmarking of energy and water use for state buildings;
2. Requires disclosure of energy use in benchmarked buildings;
3. Establishes energy performance targets for buildings that include cost-effectiveness criteria requirements for energy upgrades; and
4. Monitors energy usage and maintenance to preserve energy savings.

Perform an evaluation of ESPC policies and seek to address any barriers to expanding this type of financing in New Mexico. Evaluate existing funding mechanisms to address repayment of ESPC energy upgrades for state government facilities.

PUBLIC HEALTH, SAFETY & THE ENVIRONMENT

Address public concerns regarding energy development and public health, safety, and the environment

All forms of energy development have impacts. In New Mexico, there are a number of energy sectors where issues surrounding the environment, public health, or safety have been of concern to the public. The boom in unconventional oil and gas production across the United States has raised public awareness

about impacts from development. In particular, there have been concerns about groundwater contamination from oil and gas operations, including hydraulic fracturing. In the power generation sector, there are also concerns about emissions from coal-fired power plants. The legacy of uranium mining and risks associated with nuclear power development are also of concern for some members of the public. Even renewable energy development can have unintended consequences of disturbing habitat impacting wildlife and land use. It is important that the state continues to implement a balanced approach and enforce regulations to prevent environmental degradation and protect public health while allowing for development to occur.

Groundwater Protection

New Mexico's water resources are precious, and concurrent with energy production is the critical need to protect groundwater resources, both fresh and brackish. Most forms of mining require protections for groundwater. Within the oil and gas industry, hydraulic fracturing has received a considerable amount of media attention, but there are no confirmed cases where hydraulic fracturing has impacted groundwater resources. However, there are other activities within the energy sector that could pose a potential threat to groundwater and surface water. In the oil and gas industry, there have been instances where rogue produced water haulers have intentionally dumped produced water in unauthorized places contrary to state and industry rules and policies.

New Mexico has many effective regulations in place to protect against water contamination from oil and gas activities. OCD is responsible for creating and enforcing regulations for surface impoundments and for enforcing appropriate well construction methods. OCD regulations require layers of cement and surface casing to protect groundwater and also require monitoring for well integrity. Also in the mining sector, uranium mining and processing has historically contaminated groundwater in New Mexico. Maintaining the quality of New Mexico's groundwater resources is a high priority for the state.

Groundwater Protection Recommendations

Continue to protect public health and the environment while developing the state's oil and gas resources.

Encourage voluntary baseline groundwater testing by the oil and gas industry at private water wells near drilling sites before new well drilling commences.

Provide the oil and gas industry with information about produced water disposal requirements, including the use of OCD-approved water haulers.

Communicate with and educate local authorities, the general public, and industry to reaffirm that the OCD will investigate and enforce state laws that prohibit produced water dumping, and elicit their support in reporting dumping incidents.

Air Emissions

Leading New Mexico emissions concerns in the energy sector are: 1) increased awareness of the amount of methane flared and released from oil and gas development and processing, and 2) impending federal carbon dioxide regulations for new and existing power plants, which primarily have implications for coal-fired power plants.

Methane Emissions

When oil is produced, natural gas is often co-produced, and it is composed primarily of methane. Operators can vent the methane, flare it, or capture it and sell the gas. To capture and sell the gas the gas must be of pipeline quality and there must be sufficient pipeline and processing infrastructure to transport captured gas to market. In southeast New Mexico, as in many other parts of the country, there is insufficient natural gas gathering infrastructure; operators therefore flare some of the natural gas co-produced with oil. The Energy Information Administration reports that the estimated amount of gas vented and flared in New Mexico has increased 25 fold from 2009 to 2012 (481 million cubic feet in 2009 to 12,259 million cubic feet in 2012). This is a consequence of increased well drilling and completion.

Flared gas is a valuable resource that could bring additional revenues to both operators and the state. If the proper infrastructure is in place, gas that is typically vented or flared can be captured via “green completions,” or “reduced emissions completions,” which are systems that reduce methane losses by recovering gas during well completion. The U.S. Environmental Protection Agency is considering methane regulations for the oil and gas industry and BLM is evaluating the impacts of methane emissions. The OCD will keep apprised of these federal actions and will be collaborating with several other state agencies to assess the economics and benefits to both the state and industry of better capturing methane emissions.

Carbon Dioxide Emissions

Air quality concerns are also exerting pressure on New Mexico’s coal-fired power plants, which are some of the oldest power plants in the country. In the last year, two of the four units at San Juan Generating Station (340 MW) and the three oldest of the five units at the Four Corners Power Plant (560 MW) have been scheduled to be or have been shut down to meet air quality requirements.

Most recently, EPA has released carbon pollution standards for new, modified, and existing electricity generation sources under Sections 111(b) and 111(d) of the Clean Air Act. The final rules have major implications for coal-fired generating units, which are the largest carbon dioxide emitters in the power sector. With this and other regulatory actions, EPA is indicating that greenhouse gas emissions from power generation will be regulated and restricted in the future. There are a number of pathways for New Mexico to address the Section 111 rulings and meet emissions reduction targets, all of which will require collaboration among state agencies and the public and private sectors.



Air Emissions Recommendations

Encourage natural gas gathering pipelines in New Mexico to reduce the flaring of methane.

Explore the process of issuing presumptive, temporary approvals when paperwork is submitted for green completion approvals and then end that approval if the paperwork proves to be unsatisfactory to the OCD.

NMED, EMNRD, and PRC should work in partnership to develop a compliance plan for Section 111(d) of the Clean Air Act. Adequate resources should be provided to NMED for development of the plan.

Support efforts to capture and sequester CO₂ from energy production and industrial sources, especially for subsequent use in enhanced oil recovery.

Other Energy Issues

The growth of oil development between 2010 and 2014 in the state has brought other questions to the fore: what are the risks of induced seismicity from oil and gas operations? Are there any public health effects from oil and gas development on surrounding communities? How is oil transportation regulated and what are safety implications from increased oil transport on roads and railways? There are also concerns related to possible nuclear development, radiation releases, nuclear material transport, and waste disposal.

Induced Seismicity

Produced water injection wells, in which large quantities of oil and gas produced water are injected at high pressures, have been linked to seismic events in a few other states, particularly in areas with certain geological structure. While this has not caused problems in New Mexico, state authorities and research universities are monitoring for induced seismic events in New Mexico.

Public Health

Concerns about public health in oil and gas producing areas have emerged in the United States. Claims of health impairment are often cited to oppose oil and gas operations. Accordingly, additional scientific research is needed to study potential health impacts that may arise from air emissions or other environmental effects from oil and gas development. In addition, should nuclear power development or uranium mining occur in New Mexico, worker health and safety is of utmost importance and needs to be monitored.

Transportation

Pipeline infrastructure has not been able to keep up with the boom in oil development in southeast New Mexico, and the new oil play in northwest New Mexico has also led to identification of oil transportation bottlenecks. In northwest New Mexico in particular, the absence of rail and limited oil pipelines have led to trucking oil along Highway US-550 and a new and largely unregulated industry of trans-loading oil to rail along the I-25 corridor. This presents risks to small communities unprepared for oil and rail activities. Transporting nuclear fuels and waste is also an activity that requires oversight and coordination, as New Mexico has experienced with transporting defense-related low-level nuclear waste to the WIPP facility.

Other Public Health & Safety Recommendations

Support state-specific research on induced seismicity from oil and gas operations.

Encourage scientific studies of health and environmental effects of oil and gas activity, uranium mining, and nuclear energy development to address public concerns.

Establish public safety regulations of the oil trans-loading industry and assist affected towns and counties with technical information for guidance and planning purposes; coordinate with the U.S. Department of Transportation in trans-loading industry response.

ENERGY & WATER

Reduce fresh water consumption for energy production

Energy and water are interconnected. Most energy sources require water as part of the development process. Likewise, water can rarely be obtained, treated, or delivered for industrial and other use without using energy.

This policy marks the first time that water and energy planning and sectors have been combined in New Mexico. In the future, as water supplies become increasingly stretched, it will become even more important to consider energy while planning for water as well as consider water supplies while planning for energy development and generation. In general, state policy should encourage water conservation and reuse as much as possible. In the energy sector, companies should be rewarded for using the best achievable water-saving or reuse technologies, through tax credits or other financial incentives.

There are a number of important areas the state can focus on to reduce water consumption in the energy sector. Reducing fresh water use and recycling produced water in oil and gas operations could have major regional impacts. Dry cooling and more efficient water use in the power generation sector also could relieve pressure on fresh water supplies in the state. New Mexico also has extensive brackish water resources that could be used for energy development, but also take large amounts of energy to treat. Lastly, it may be beneficial to expand state water planning to include water that does not have water rights associated with it (e.g., produced or some brackish waters) and explicitly address water needs for the energy sector.

Reducing Fresh Water Use in Oil & Gas Operations

Modern horizontal drilling and multi-stage hydraulic fracturing—and the resultant surge in U.S. unconventional hydrocarbon development—have led to increased water use by the oil and gas industry. In New Mexico, oil and gas sector water use is currently most pronounced in the southeast. At the present time, much of the water used for drilling and fracturing is fresh water, though non-potable water

Reduction of Fresh Water Use in Oil & Gas Operations Recommendations

Aggregate data on current water usage in the oil and gas industry to determine facts on the effects of industry activity on groundwater and surface water sources.

Encourage reporting of water treatment and reuse figures from oil and gas companies.

Develop a “best practice” approach that allows for the surface handling of all water utilized or produced in conjunction with oil and gas operations. Ground the practices in science and address all aspects of surface storage, transportation, recycling, and disposal. Factors to be considered include economics, logistics or practical applicability, and the environment. This approach will specifically address the needs required for different areas based on factors such as the distance to groundwater. The closer groundwater is to a recycled water facility, the greater the prescribed protections.

is also used for hydraulic fracturing. Based on data that operators have supplied to the New Mexico OCD on frac disclosure forms submitted in 2013, more than 5,325 acre feet (41 million bbls, or 1.7 billion gallons) of fluid (composed mostly of water) was used for hydraulic fracturing. Considering the 1,583 fracture stimulation jobs reported in 2013, the average volume of fluid used in these treatments was approximately 4 acre feet (30,000 bbls, or 1.3 million gallons) per well.

According to the most recent report from the New Mexico Office of the State Engineer (OSE) on fresh water usage (2010 data), the oil and gas industry uses less than 0.5% of the appropriated water in New Mexico. Although this amount is minimal when compared with the more than 78% used for irrigated agriculture, there has been a significant increase in oil development since 2010 and there may be localized impacts from oil and gas industry water demand in active producing regions. Unfortunately, there is no more recent data on water use in the oil and gas industry in New Mexico, and the existing data may be incomplete because of the water use reporting structure and cycle of the OSE. Reducing water use for all oil and gas operations, including hydraulic fracturing, greater recycling of water, and using brackish or produced water in operations will reduce producers’ dependence on fresh water resources and conserve valuable fresh water sources for other purposes.

Produced Water Reuse

Billions of gallons of water are produced with oil and gas resources each year in New Mexico’s Permian and San Juan Basins. In some cases, fresh water

or produced water is injected into oil reservoirs to improve oil recovery, and some of this injected water is subsequently produced along with the increased oil production. Over the past five years in New Mexico, an average of 100,400 acre feet (779 million barrels, 33 billion gallons) of water has been produced annually as a byproduct of oil and gas production, and the volume in 2014 was 113,570 acre feet (880 million bbls, 37 billion gallons). Currently, much of that water is handled and regulated as a waste product and is most often trucked offsite and injected into deep salt water disposal wells. Oil and gas producers and their contractors may be able to reuse produced water to replace fresh water in drilling and completion operations, and many companies are already moving in this direction. Some operators have reached over 90% reuse.

Opportunities also may exist to treat and reuse produced water for other uses outside the oil and gas industry, such as agriculture or municipal use. Currently, treatment and recycling of produced water is allowed within the oil and gas sector in drilling, completion, or plugging and abandonment operations without a permit. However, pathways for reuse outside the oil and gas sector are unclear. The Office State Engineer (OSE) regulates water quantities (consumption), the New Mexico Environment Department (NMED) regulates water quality (for ground and surface waters), and Oil Conservation Division (OCD) regulates produced water storage and disposal. There is no regulatory framework for an entity to treat produced water and sell it or put treated produced water that is not of drinking water quality back into the water cycle.

Produced Water Reuse Recommendations

Explore and evaluate opportunities to reuse produced water both within and outside of the oilfield.

Provide clear regulatory guidance for produced water reuse or disposal outside of deep well reinjection or evaporation, and convey to BLM the importance for them to revise their rules to encourage produced water recycling and reuse.

Encourage recycling of water used in drilling and completions as well as reuse of produced water and water used in hydrostatic testing of pipelines. Developing user-friendly recycling rules is a first step. Such a rule was adopted by the Oil Conservation Commission in early 2015 and needs to be implemented swiftly.

OCD and OSE should host meetings with producers and provide handouts that outline the steps for recycling produced water and for using brackish water.

Promote technology development for both brackish and produced water treatment. The state should encourage pilot projects for research on or demonstration of uses for produced water. The state's universities and national laboratories should continue research efforts for treatment of produced water for other uses, including those beyond the oilfield.

Clarify in writing the ownership of, and liability for, recycled produced water.

Look at possible incentives related to water recycling and pipelines for recycling water in the oilfield and in other locations where water can be reused.

Conduct a feasibility study of centralized water recycling facilities.

Reducing Fresh Water Use in Power Generation

Thermoelectric power generation uses steam to drive turbines that in turn generate electricity. Water is then used to cool and condense the steam. The amount of water needed to produce electricity varies with the fuel source, design of the power plant, and cooling technology utilized. Most power plants utilize "wet cooling" systems; "dry cooling" systems can reduce water use at thermoelectric power plants by 90%, but have higher capital costs and efficiency penalties. In hot temperatures, dry cooling systems are less efficient, which leads to lower power output in times when electricity demand can be highest. There are also hybrid cooling systems that use a mixture of the two cooling systems. Renewable energy, such as solar photovoltaics and wind energy, require no water.

Although power plants utilize less than 2% of water withdrawals in New Mexico, the scarcity of fresh water in New Mexico and recent years of drought put pressure on planning for water use in the power generation sector. The PRC requires investor-owned utilities to report fresh water consumption at existing power generation facilities, though—like in other energy industries—utilities do not typically report any brackish or recycled water consumption. Some utilities also include analysis of water needs in future planning through the Integrated Resource Planning (IRP) process.

Brackish Groundwater

New Mexico has substantial brackish groundwater aquifers that could be utilized for oil and gas development (drilling, fracking, dust suppression,



etc.), thermoelectric cooling, and other areas of industrial (e.g., potash mining) or municipal water use. Brackish groundwater can be defined as water containing greater than a potable level of salinity, in many cases greater than 1,000 milligrams per liter (mg/L) of salts up to about 10,000 mg/L. The U.S. Bureau of Reclamation's Brackish Groundwater National Desalination Research Facility is located in Alamogordo and is an asset for the state to further distinguish itself as a hub of expertise for brackish water treatment and reuse. Acquiring, treating, and transporting brackish water for drinking, municipal, industrial, and other water uses will require additional energy beyond what is currently used for fresh water acquisition and use. It is important to understand the effects of this additional demand on New Mexico energy supplies and costs.

Currently the process for regulating brackish groundwater, including water rights and concentrate management, has no clear policy pathway. For utilization of brackish water resources to occur on a larger scale, there will need to be a clear and stable regulatory environment. In particular, guidelines for concentrate management are critical.

Brackish Water Recommendations

Collect, review, centralize, and make public information and data on brackish water aquifers. Identify brackish groundwater aquifers that may be appropriate in place of fresh water for many uses, collect and centralize data on the interconnections between fresh water and brackish water aquifers, and inventory deep saline aquifers that can be used for concentrate disposal.

Implement recommendations from the 2004 New Mexico Brackish Groundwater Assessment Workshop.

Create concentrate management regulations and policy.

Promote interagency coordination and communication among OSE, NMED, and EMNRD on brackish water policy development and implementation.

State Water Planning

The State Water Plan is being updated. OSE via the Interstate Stream Commission leads this process, while some aspects of water use and quality are regulated by other departments, such as NMED or EMNRD. For example, EMNRD regulates the oil and gas industry and produced water disposal, while NMED would be involved with concentrate disposal from brackish water treatment. Water planning in New Mexico, including the regional and state planning led by OSE and the Interstate Stream Commission, is oriented toward management of the administrative water supply tied to water rights that meet designated beneficial uses.

With the update of the State Water Plan there is an opportunity for agencies to collaborate while setting future state water policies, drawing on multiple areas of expertise. In addition, there may be new water sources associated with energy development that are not fully utilized because they are not included in the traditional water use profile of New Mexico.

State Water Planning Recommendations

Include energy/water nexus discussions as part of the OSE regional water planning.

Participate in the U.S. Department of Energy's water/energy nexus discussions and projects in conjunction with Los Alamos and Sandia National Laboratories.

The OSE should formally engage EMNRD, NMED, and any other relevant agencies in State Water Plan development.

OSE should consider efforts to incorporate all water in state planning, including water within and outside the administrative supply. State agencies and research units should consolidate all water assessments into a single common platform with participation by EMNRD, OSE, NMED, the Water Resources Research Institute (WRRI), and NM universities.

ENERGY EDUCATION

Provide science and technology-based information and data about the energy sector to the public and elected officials

To make informed energy decisions, the New Mexico public and decision makers must have accurate information about the pros and cons of energy systems and advances in technologies. The state has a role to play in this area to provide high-quality, unbiased information, make information readily accessible, and facilitate information sharing among groups.

Public Oil & Gas Education

Many New Mexicans do not understand the importance of either the oil and gas industry or the overall energy industry to the state. Some depend on non-factual and negative information on oil and gas operations. As development is proposed in areas that have not had oil and gas production, citizens will need science and technical information.

Public Oil & Gas Education Recommendations

Implement an education campaign to increase citizen knowledge of oil and gas operations and investment potential. Encourage county listening sessions to allow local citizens to have a platform for expressing their concerns about oil and gas development. Demonstrate how state revenues from oil and gas are used.

Create a repository of facts available on oil and gas resources in New Mexico for the public and media to reference.

Public Renewable Energy & Energy Efficiency Education

It is also important that New Mexicans receive unbiased, fact-based information about renewable energy, particularly wind and solar development, and energy efficiency. Education and outreach is needed to help the public understand the full spectrum of the costs and benefits of all energy sources.

Public Renewable Energy & Energy Efficiency Education Recommendations

Implement an education campaign to increase citizen knowledge of renewable energy and energy efficiency operations and investment potential. Explain the nature of renewable versus non-renewable energy resources.

Create a repository of up-to-date facts available on wind and solar development in New Mexico for the public and media to reference, including economic statistics, where available. Explain how the evolving electric system incorporates these technologies.

County & Local Government Issues & Concerns

Recently, there have been concerns at the and local levels about oil and gas and uranium development, particularly effects it may have on water resources and infrastructure. In New Mexico, San Miguel, Santa Fe, Rio Arriba, and Mora Counties have placed or attempted to place restrictions on oil and gas development. County prohibitions and requirements for the oil and gas industry have established the need for the state to supply or facilitate assistance to local jurisdictions.

Renewed interest in uranium mining in Grants County also has raised many local concerns based on historic uranium mining practices: open mines not being closed properly, groundwater contamination from poorly placed milling operations, poor environmental control of runoff water, dust and tailings control, and exposure of workers. For New Mexicans to take an informed position on nuclear energy issues and opportunities, they will require up-to-date information on current in situ uranium mining techniques and how SMRs differ from large nuclear power generating stations. Most importantly, New Mexico residents should receive accurate information related to the safety and risks of the modern mining and nuclear industries.

County & Local Government Education Recommendations

Create a strategic alliance of experts from independent bodies (e.g., universities, state government) to assist New Mexico's counties and municipalities with issues on energy development and provide science-based education and technical information regarding oil and gas development. Also provide education about the economic impact of the industry and the rules and regulations that the state has in place to protect groundwater and ensure public safety.

Provide speakers to the New Mexico Association of Counties annual convention and other gatherings of local decision makers to address oil and gas and renewable energy issues and provide education.

Have a "clearinghouse" of information or phone number that county commissioners can call to get information about oil and gas regulation.

Provide science and technical fact-based education for New Mexicans, including those in former uranium development areas, on the current capabilities and risks of modern nuclear energy technologies and in situ uranium mining.

WORKFORCE TRAINING

Develop initiatives with state and local colleges and universities to improve workforce training for the energy sector

Between 2007 and 2012 the oil and gas workforce in the United States grew 40%, while the rest of private sector employment grew only 1%. Demand for a skilled workforce in the oil and gas industry is perhaps as high as it has ever been. With growing workforce needs and high rates of retirement among skilled industry labor, the oil and gas industry and state and federal regulatory bodies alike require graduates trained in engineering, geology, and hydrology to fill entry-level to management positions.

Other energy sectors also offer a variety of job opportunities, and the renewable energy, energy efficient building, and nuclear industries have a variety of needs for skilled labor. Many jobs in the energy industry require science and technology training from the "STEM" (science, technology, engineering, and math) disciplines. There are many existing STEM education programs targeting all levels of the education system in New Mexico, including through the Experimental Program to Stimulate Competitive Research (EPSCoR), which serves as a hub for energy STEM education at the college and K-12 levels.

New Mexico has a number of existing successful workforce training programs from which the state

can build. San Juan College School of Energy in Farmington has been nationally recognized for its oil and gas training curriculum, which was developed in partnership with industry. New Mexico Junior College in Hobbs has developed a successful workforce training program to support the needs of the URENCO uranium enrichment facility in Eunice. Santa Fe Community College Center for Excellence is also nationally known for its green energy training programs and certifications, which have attracted students from across the world.

Four-year institutions are also poised to keep the workforce pipeline filled with bachelors and advanced degree students. The New Mexico Institute of Mining and Technology has faculty expertise in conventional and renewable energy technologies, and its petroleum engineering program is ranked as one of the top ten in the nation. The University of New Mexico (UNM) has one of the few nuclear engineering departments in the country, which uniquely qualifies the state to train workers for next generation nuclear technologies. New Mexico State University offers specialized training in renewable energy technologies through a minor in its Engineering Technology program and has research in the area of the energy/water nexus.

For New Mexico to keep up with the oil and gas sector and capture a share of emerging job markets in the renewable energy and small modular nuclear sectors, its educational institutions will have to align with workforce needs and actively seek to keep pace with industry.

Workforce Training Recommendations

Encourage colleges and universities to align their curricula with core energy workforce needs. New Mexico's university system should develop world-class degrees that will promote the development and growth of the energy industry in New Mexico. Offering degrees and recruiting students (Bachelors, Masters, and PhDs) in engineering, geology, hydrology, and other key technical areas should be a primary mission of the university system.

Support two-year energy training programs in applied energy technologies, such as those offered at San Juan College School of Energy, New Mexico Junior College, Santa Fe Community College, and Central New Mexico Community College.

Pursue specialized degree programs or certifications to meet industry needs, including:

- An oil and gas law certification program at the School of Law at UNM. This should be developed in consultation with industry representatives to ensure that legal training adequately meets the needs of the industry and remains abreast of developments in the law.
- A regulatory engineering degree at New Mexico Tech that prepares students for careers in energy regulation in federal or state government and industry.

Create a state certification program at the San Juan College School of Energy for the training of employees in the oil and gas industry using curriculum designed by the industry, including safety training.

Prepare students to choose careers in energy by making information about jobs, education, and training opportunities in the energy industry more accessible, and expose high school and college students to opportunities in oil and gas and other energy industries.

COMMITMENT TO ENERGY POLICY

Review the energy policy at regular intervals and monitor state energy policy implementation

Prior to this effort, the state has not had a formal energy policy in more than 20 years, despite changes in oil and gas production and greater penetration of intermittent renewable energy sources. The process of formulating a state energy policy involves identifying needs and issues that warrant attention from the state. If the energy policy is not updated frequently, important policy decisions cannot be informed by the most up-to-date energy information, resulting in poor policy and planning.

In addition to updating the policy at regular, discrete intervals, it is important to track and evaluate the progress of policy implementation.



Energy Policy Commitment

EMNRD should review the Energy Policy on a regularly scheduled basis: a full review with public outreach and participation opportunities is required every five years, with more frequent internal review with reference to implementation to address any needed changes. This review should score the effectiveness of all policies in place and address those that have not proven to be beneficial. This review cycle should be institutionalized via rule changes or other formal mechanisms.



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APPENDIX 1:

Oil Market Changes between 2014 & 2015

The price of New Mexican crude oil, West Texas Intermediate (WTI), at the January 2014 New Mexico Energy Policy Hobbs Listening Session was \$98.77 per barrel. This meeting had over 150 participants from the oil and gas sector, and no concerns about the future price of oil were recorded. Indeed, none of the consulting services, financial institutions, or oil price company models anticipated the collapse of oil price that occurred starting in November 2014.

The trend price for WTI of approximately \$100 per barrel that had lasted three years abruptly ended in late 2014 with a change in global oil market forces stimulated by Gulf producers in the Middle East. The Organization of Petroleum Exporting Countries (OPEC), with Saudi Arabia at its core, decided to protect its market share against non-OPEC oil producers, notably the shale oil producers in the American Southwest, North Dakota, and Texas.

Since 1994, OPEC's world market share has dropped from 40% to 30%, and its monetary return has dropped nearly \$100 billion last year. It is likely that, in response to its market manipulation, OPEC anticipates a reduction of U.S. output by late 2016 or early 2017 of some 1.75 million barrels a day. This would establish a near balance of U.S. domestic production (now at 9.4 million barrels a day) with oil imports of over 7 million barrels a day.

Costs of Drilling

The OPEC/Saudi Arabian market share strategy of maintaining or increasing production (up 600,000 barrels per day since December 2014) is based on slowing down shale oil output in the United States. Shale oil producers are high-cost relative to Middle East production. That high cost is partly the consequence of new entrants in the oil and gas industry which are non-operators. These financial entities with short-term objectives range from private equity to venture capital that were attracted by the margins in the crude shale technology breakthrough. The existence of historically low borrowing costs allowed them to bid for and make deals with higher

capital and operating costs than traditional oil and gas companies. Some of the traditional industry in New Mexico and elsewhere turned to leveraging or debt to compete. To a considerable extent, this led to an upside cycle inflationary environment of high costs or an incipient asset bubble particularly among traditional undercapitalized oil and gas companies. These companies must now maintain production to meet debt obligations or sell assets. When oil averaged \$100 per barrel with expectations of continued high prices, there was no price incentive to impose capital discipline until late 2014.

The technology play behind shale, or light tight oil, is precision horizontal drilling expanding the wellbore thousands of feet through laterals into thin-bedded formations. Coupled with hydraulic fracturing stimulation, this has created the oil extraction breakthrough in new reserves and supply. However, the decline ratio of 60% per well in the first year forces operators into a drilling machine mode. Producers must spend more to drill more wells to offset the decline of production. Operators have designed multiple well pads to drill more while sustaining or reducing costs per well.

New Mexico shale oil is not exempt from the necessity to organize capital expenditures to pay for limitless drilling, which operators refer to as a "machine" or "treadmill" sequence. Unless there are drilling rigs under contract and active, most shale oil exploration and production is not sustainable. If the rig count declines as a function of lower oil prices, the machine slows or stops and shale oil recovery is at risk. Operators get off the treadmill. This scenario is probable if the oil price remains in the range of \$50 per barrel or lower range, cost-savings per well reach maximum levels, and hedged production expires at 2015 priced contracts. Thus, New Mexico oil producers' capital expenditures are anticipated to decline in 2015 from between 25% and 35%, which approaches an estimated \$3.5 billion.

What this Means for New Mexico Production

OPEC's withdrawal as the price setter places the burden of production cutbacks upon American shale oil producers, which include New Mexico at 125 million barrels of oil produced in 2014, near an all-time record. While production in the state suggests

marginally less results in the first quarter of 2015 when compared to 2014, the rest of the year is estimated to contract to 2013 production levels. The rapid oil price decline has significantly impacted San Juan Basin activity. A major exploration company with capital expenditure guidance in 2014 of \$360 million has virtually shut-down, with planned deployed rigs from eight to zero for 2015. The Farmington or Four Corners area of Northwest New Mexico is now in the down-cycle of both oil and natural gas, with unemployment appearing in the oil and gas industry. Service companies are renegotiating contracts and dismissing some of their workforce.

A similar, but less dramatic, downturn is expected in the southeastern New Mexican portion of the Permian Basin—the Delaware Basin, Bone Springs, and the Shelf. This will adversely impact New Mexican oil production and the associated jobs that have maintained the Lea and Eddy County region as leading employment growth areas in the State.

There is a delay in production drop due in part to New Mexico energy producers exercising protective hedge positions in the range of \$90 per barrel. A protected hedge is a forward or future price for production through derivatives and futures markets mechanisms. A New Mexican producer can lay off price decline risk on a counter party or in an exchange at a nominal cost. Many New Mexico producers placed multiple hedge positions for 2015, which guaranteed \$85–\$95 per barrel of oil produced with different expirations throughout 2015. Some producers only partially hedged, causing significant cash flow losses and other financial complications.

Independent of the oil price collapse, nearly half on New Mexico's top oil producers have encountered cash flows less than capital expenditures. This has left some companies with vulnerabilities that constrain the industry. One of New Mexico's top producers has issued and sold debt equity or shares to offset this cash flow lag. Other producers have turned to banks and bond issuance for finance in the upside of the cycle.

With central bank interest rates at historic lows, the State's small and middle producers borrowed to acquire oil prone leased acreage at high prices. Drillers raised contract rates as demand for rigs

expanded. Oil and gas companies share prices rose as investors assumed \$100 per barrel oil and rising demand.

The Future for New Mexico Oil Production

So far, the first month of 2015 reports less than a 5% decline in oil production from December 2014, a near record production month in New Mexico history. What is the outlook for the rest of the year?

The Exploration and Production companies doing business in New Mexico must operate with rates of return and recovery of cost. Breakeven costs for oil development cost to completion range from \$52 to \$70 in the San Juan Basin and \$40 to \$55 in the Southeast. Breakeven prices are declining as a result of increased efficiencies in drilling and completion, lower costs of materials, and greatly reduced costs charged by the service companies.

Crude oil transportation bottlenecks in New Mexico result in producers receiving a lower price for the oil they sell. The WTI price of \$48 average in first quarter of 2015 plus transport bottleneck Northwest New Mexico have resulted in discounts of up to an estimated 25% per barrel. This poses a threat to producers in the area. More recently, as a result of anticipated lower volumes of crude production and lower oil prices, the discount was renegotiated in the beginning of the second quarter to less than an estimated 14%.

Because of increased competition and better infrastructure in Southeast New Mexico, the price differential between WTI price and what producers receive for oil sales is approximately \$4 per barrel, depending on factors such as distance from major collection points.

Some New Mexican oil producers are following cost-saving strategies of deferment of well completion until prices recover. At least one-third of oil well development cost is in completing the well for production. As a business plan optimization effort, deferment depends on price levels of recovery, which is integrated in the OPEC market share toolbox.

Another indicator of future production is rig count, which is down in New Mexico from a 2014 peak of

approximately 100 rigs to 50 rigs in the first quarter of 2015. The rigs deployed for drilling and completing wells represent a future supply variable. Laying down a rig is fixed in a time-lag—a decline of production six months out or more. While OPEC expects a significant shale oil production decline in the U.S., this should not happen before 2016.

The specificity of the OPEC target of high-cost American shale oil producers includes stripper or marginal well production. Nearly 15,000 oil wells in New Mexico produce less than an average of 3 barrels per day and are classified as strippers. The marginal well output in the U.S. is over 1 million barrels per day and it is high cost. OPEC recognizes they exist as domestic production against the five month embargo of OPEC oil to the United States some 40 years ago.

Yet, OPEC may have overlooked American oil producers' capacity to innovate and experiment to offset lower oil prices through cost-saving efficiencies. A New Mexican oil producer has responded with drilling bit advances and rig deployment time reductions.

In conclusion, a downside in the history of the oil business has occurred in New Mexico following global change in pricing over which the state has no control. Apart from a reduction of state taxes and royalty rate for marginal wells subject to shut-in or abandonment, there is relatively little that public energy policy can advance to mitigate the impact of lower oil prices on the general economic welfare and tax revenues of the State of New Mexico.

