NEW MEXICO FIRST
People. Ideas. Progress.

GROWING NEW MEXICO'S ENERGY ECONOMY

A NEW MEXICO FIRST TOWN HALL

BACKGROUND REPORT

- **May 14-16, 2009**
- **Albuquerque Convention Center**

Town Hall Signature Sponsor

Intel

New Mexico First Sustaining Sponsors

Hatton W. Sumners Foundation
PNM
New Mexico Mutual
Sandia National Laboratories
Hunt Development Group

Lead Sponsors

BHP Billiton
Chevron
Lockheed Martin/Sandia National Laboratories/
Technology Ventures Corporation
Los Alamos National Laboratory
National Commission on Energy Policy
New Mexico State University

Major Town Hall Sponsors

New Mexico Economic Development Department
New Mexico Energy Minerals and Natural Resources Department

Scholarship Sponsors

Arizona Public Service
Armstrong Energy Corporation
First American Bank
LES
Los Alamos Department of Public Utilities
New Mexico Gas Company
REDW-The Rogoff Firm

Research Partner

Kettering Foundation

New Mexico First
320 Gold Avenue SW Suite 300
Albuquerque, New Mexico 87102
Phone: 505-241-4813 (Albuquerque)
Fax: 505-241-4819
Email: info@nmfirst.org
Website: www.nmfirst.org

Table of Contents

Foreward

About this Report

This background report is designed to help participants prepare for the New Mexico First statewide town hall, *Growing New Mexico's Energy Economy,* May 14-16, 2009.

Note: There are few right or wrong answers to any public policy question, and the problems and opportunities around our state's energy economy are complex. As a result, no brief explanation of the situation – including this report – can hope to cover all the information and opinions available. The contributors have provided their knowledge and expertise, but ultimately the people and policymakers of New Mexico must decide what course our energy future will take.

About New Mexico First

New Mexico First is a nonpartisan, nonprofit organization that engages citizens in public policy in order to improve the state. Co-founded in 1986 by U.S. Senator Jeff Bingaman (D-NM) and retired Senator Pete Domenici (R-NM), the organization brings people together for multi-day town hall meetings. These town halls use a unique consensus-building process that enables participants to learn about a topic in depth, develop concrete policy recommendations addressing that topic, and then work with fellow New Mexicans to help implement those recommendations with policymakers.

New Mexico First was created to answer the question: "What would it take to make New Mexico ***first*** in national rankings, instead of near the bottom?" (Historically, the state often has ranked poorly in factors like poverty, education, or health.) So, regardless of the topic, we continue to focus on how to strengthen the state and improve the lives of its people.

The Town Hall Process

New Mexico First town halls are not typical conferences with day after day of presentations. There will be a series of guest speakers to help set the context, but the bulk of the event will be comprised of small group discussions among citizens who care about the topic. This particular three-day town hall will ask participants to share their best ideas for growing the state's energy economy. Because citizen discussion is at the heart of this process, we ask participants to take an active part in all three days of the event.

On day one of the town hall, participants are divided into small groups to discuss the issues and answer a common set of questions. On day two, participants begin refining and combining those answers. On day three, participants come together as a full group and finalize their recommendations.

This Report

New Mexico First's Board of Directors chose the topic of this town hall in August 2008, based on input from citizens throughout the state. Researching this report began right away, and a number of New Mexicans contributed to it. The reviewers were not paid; instead they donated their time as a demonstration of their support of the town hall process. New Mexico First thanks all the people who lent their expertise.

Authors

Lynne Canning, consultant, New Mexico First
Heather Balas, President, New Mexico First

Research & Review Committee

Brian Sanderoff, Research and Polling, Inc., *Committee Chair*
Sandra Begay-Campbell, Sandia National Laboratories
Charles Bensinger, Renewable Energy Partners
Thomas Bowles, Office of the Governor
Thomas Clifford, PhD, New Mexico Tax Research Institute
Jennifer de Garmo, Natural Resources Defense Council
Joan Drake, Modrall Sperling
Gerald Geernaert, Los Alamos National Laboratory
Joel Goldblatt, Bluenergy Solarwind, Inc.
David Griscom, Regional Development Corporation
Keven Groenewold, NM Rural Electric Cooperative Association
Mike Hayter, Raser Geothermal
Michelle Henrie, MHenrie
Mushtaq Khan, New Mexico Tech
Marte Lightstone, Modrall Sperling/NMOGA Legal Committee
Kevin Malloy, UNM School of Engineering
Jim Manatt, Providence Technologies, Inc.
Tom Mancini, Sandia National Laboratories
Susie Marbury, Energy Minerals and Natural Resources Dept.
Joe Menapace, Menapace Government Relations
Brendan Miller, NM Economic Development Department
Tom Mills, Thomas C.H. Mills, PA.
Katherine Mortimer, City of Santa Fe
Marita Noon, Citizens' Alliance for Responsible Energy
Claudia Pavel, Positive Energy, Inc.
Professor Jim Peach, Department of Economics, NMSU
Bob Perls, New Energy New Mexico
Carol Radosevich, PNM
Tracy Rascoe, North Am. Wind Research & Training Center
Van Romero, New Mexico Tech
Gail Ryba, Coalition for Clean Affordable Energy
Mark Sardella, Local Energy
Rusty Schmit, CleanSwitch, Inc.
Fredrick Yarger, NM Tech, NM Center for Energy Policy
George Yates, Heyco Energy Group

Introduction

As Americans, energy impacts almost all aspects of our daily lives – from heating our homes to fueling our cars to powering our computers. As New Mexicans, energy production affects our state's economy in significant ways, with the oil, gas and coal industries funding large portions of New Mexico's tax base. Our state is also poised to become a national leader in renewable energies including wind, solar, biomass, and geothermal. New Mexico's growing uranium industry is yet another piece of the picture.

People used to think of energy policy choices as "either/or" propositions: conventional sources versus renewable sources; the political left versus the right; big business versus small. Those old arguments may not hold up anymore. Retired U.S. Senator Pete Domenici wrote, "America ought to find more oil, and use less of it…When I'm asked if I favor more drilling, more conservation, or more renewable energy, I answer 'all of the above'."[1] Energy experts across the board tend to agree. At March 2009's Global New Energy Summit, experts pointed out that either/or choices between conventional and renewable energy sources are simply not relevant in our world today.

Daniel Fine, in a lecture to the Heritage Foundation in March of 2007, touted New Mexico as a model for an emerging new energy paradigm. "The New Mexico model is based on a diversity of fuels. It is not exclusive; in fact, the language of alternative, conventional, bio, geo is almost disappearing. The concern statewide is: What is fuel? Where is the supply of energy going to come from? And the model is diversification..."[2]

President Obama's 2010 budget recommends removal of oil and gas tax incentives and allocates $43 billion in spending for renewables. A recent Gallup poll seems to imply that Americans in general might prefer a broader approach.[3] A majority said they supported both increased government financial support and incentives for alternative sources (77%) as well as continued government support for traditional sources (67%).[4] *(See Appendix for more information on subsidies.)*

The nation's need for energy is not a stand-alone issue, however. At the same time our state and country are seeking a comprehensive and integrated energy policy, New Mexico continues to need a stronger, more diverse economy. Our state ranks 48th in the nation for people in poverty, and our unemployment rate has climbed to almost 5% (from 3% only a year ago).[5] These indicators warn us to diversify our economy and find ways to create new jobs now.

New Mexico state government's heavy financial reliance on the extractive fossil fuel industries tells us we need these industries to continue to help fund our schools and government services. However, this reliance also places us at risk, as evidenced by the global drop in oil prices that fed this year's $575 million state deficit.[6]

These basic assumptions – that New Mexico needs a comprehensive and integrated energy policy that includes all of our abundant conventional and renewable energy resources, *and* we need it integrated into an overall economic development strategy – create the fundamental question of New Mexico First's 2009 statewide town hall: ***How should our state grow its energy economy?***

Why Now?

The primary factors that contribute to this being an appropriate time to address energy policy include national security, the need for job creation in the state, and environmental concerns.

> *America ought to find more oil, and use less of it… When I'm asked if I favor more drilling, more conservation, or more renewable energy, I answer "all of the above."*
>
> -- Retired U.S. Senator Pete Domenici

National Security

Americans of all political viewpoints agree that we must expand domestic energy production and reduce dependence on foreign oil. As a result, we see an increasing commitment by policymakers, the national labs, universities, business leaders, nonprofits and community groups to elevate America's standing as an international leader in research, development, and deployment of energy technology.

Jobs

Policymakers in our state and nation are focused on job retention and creation. New Mexico has the potential to take advantage of the fact that much of the nation's new job creation surrounds energy issues. The February 2009 federal stimulus package contains $43 billion for energy investments including energy efficiency, renewable energy projects and construction of a "Smart Grid" to ship wind and solar produced electricity from one end of the country to another.[7] Also within the stimulus package is funding for 22,000 New Mexico jobs, some of which will target energy. *(See Appendix E for federal stimulus package information on the 2010 federal budget.)*

Since 2004, Governor Richardson's administration has promoted New Mexico as the nation's "Clean Energy State." Many actions have been taken by the administration, the legislature and the Public Regulation Commission to advance

that goal. Those efforts produced results in terms of job creation and business growth. New Mexico's current energy policy initiatives promoted development of renewable energy, sought to build industry clusters, and have advanced energy efficiency and conservation efforts. These initiatives also create a competitive advantage for the state in seeking federal grants. [a]

In addition to job creation, national and state leaders remain focused on job *retention* (keeping the jobs that already exist). In New Mexico regarding energy, that priority primarily points to existing jobs in oil, natural gas, and coal. *(See page 11 for a table on the conventional energy jobs.)*

> *We all recognize that we must make significant changes in how we produce, transmit, and use energy… This shift can create tens of thousands of jobs in clean technology industries.*
>
> -- U.S. Senator Jeff Bingaman

Environment

Concerns about pollution and climate change are also clear drivers of many federal and state energy policy initiatives. These priorities include reducing carbon emissions and increasing the use of renewable energy.

While some Americans debate the causes of climate change,[b] that issue is not the subject of this report. This document focuses on the federal and state energy policy context, and how those policies influence our economy.[8]

In that regard, lawmakers have approved a range of energy policies to reduce greenhouse gases and are considering more. The Western Climate Initiative, the Governor's Climate Change Executive Order, and federal carbon reduction proposals are among many regional, federal, and state policies addressing the linkages between energy and climate issues.

"The energy challenge we see today is global rather than national," said U.S. Senator Jeff Bingaman at a 2008 speech at MIT. "It is to change the way the world produces, stores, distributes, and uses energy so as to reduce greenhouse gas emissions."[9]

Climate change is not the only environmental issue intersecting with energy policy. Electricity production is a water-intensive

New Mexico's Energy Resources

New Mexico has world class energy resources, both below our feet (coal, oil and gas, geothermal) and above our heads (solar and wind).

Conventional Energy Production

- NM produces almost one-tenth of America's natural gas.
- The San Juan Basin contains the nation's largest field of proved natural gas reserves.
- The Permian Basin (located in NM and TX) holds three of the 100 largest oil fields in the U.S., and NM ranks fourth in the nation in crude oil reserves.
- Coal resources underlie 12% of the state, mostly in the San Juan and Raton basins.

The state's depleted oil and gas basins are also promising sites for large-scale carbon sequestration (described later in this report), and may provide opportunities for "enhanced oil recovery" as well as access to geothermal resources.

Renewable Resources

- NM has the third largest percentage of wind generation among all states, and its utilities currently provide wind power to customers.
- NM is second in the nation in solar resources; utility-scale solar projects are being planned.
- NM has potential for large scale geothermal power production due to existing natural resources.

Research and Development Capacity

- NM is home to Sandia National Laboratories and Los Alamos National Laboratory, both of which do research in conventional and renewable energy and are working to bridge the gap between research and commercialization.
- Several of NM's universities (UNM, NMSU, NM Tech and Northern New Mexico College) are undertaking a range of energy research efforts.

[a] *New Mexico has been named one of the Top 20 Greenest States, Business Facilities, 2008; 1st in Manufacturing Momentum, Business Facilities, 2008, 8th for Jobs in High-Tech Fields, State New Economy Index 2007, 8th in Reducing Oil Dependency, Natural Resources Defense Council, 2008.*

[b] *Survey published by Rasmussen Reports, January 19, 2009, shows 44% of Americans attribute global warming to natural planetary changes rather than human activities, while 41% attribute it to human activities.*

process, and although most of the water used for the cooling of natural gas, coal and nuclear power plants is recycled, 2% to 3% of that water evaporates. Even this small fraction adds up to approximately 1.6 to 1.7 trillion gallons of water each year.[10] Water is also used extensively in the production of oil and gas, requiring management of groundwater aquifers.[11] Coal mines can be water intensive, although studies have been done on sustainable use of water in coal mining.[12] Uranium mining, not currently taking place in New Mexico but under consideration, also uses a great deal of water.[13] The issue of water is further addressed throughout this report.

NM's Energy Production

Much of this report deals with how New Mexico produces and uses energy. It addresses both *transportation* energy (fuel for cars, trucks, trains, etc.) and *power generation* (electricity, heating, cooling, etc.). Readers will recall from high school science that most electricity is produced by spinning some sort of turbine in a power plant. The question that drives many public policy matters is, simply put, what spins the turbine? Currently most power plants are fueled by coal, natural gas, or nuclear power. Renewable sources, such as geothermal steam, wood, and even garbage (a form of biomass) can be used as fuel for power plants.

Wind and solar contribute energy to the electrical grid as well as generating energy right at homes and businesses. Developing and integrating each of these energy sources to achieve energy diversification will not only address New Mexico's energy needs and enable export of our energy, but it will also drive economic growth and jobs.

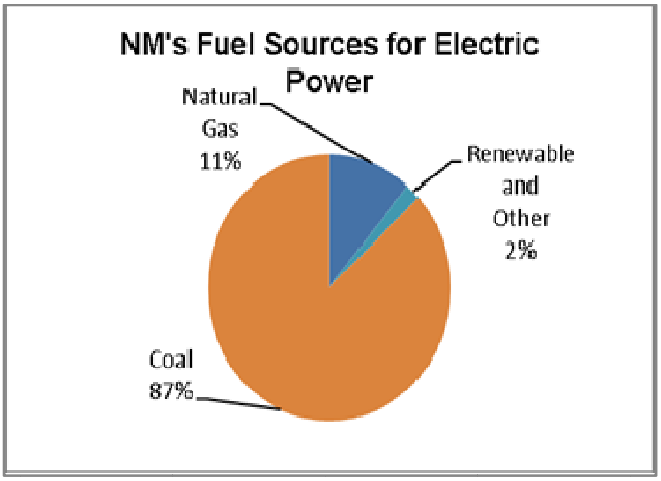


Figure 1: Energy Information Administration, 2006

Figure 1 illustrates the electric power produced in New Mexico, with coal making up the lion's share. Our utilities import additional power from outside the state, so the mix of electricity we actually use includes nuclear power and higher percentages of renewable energy.[14]

How Economies Grow

Given that the fundamental question of the town hall is how to grow New Mexico's energy economy, we need a quick word on economic development. Most economists agree that "economic base" jobs are essential to any growth strategy. An economic base (or primary) industry is any industry that produces a product or service that is sold outside the area and thus brings in outside money. It does not matter if the company is large or small; what matters in terms of our economic growth is whether it is bringing in money from outside New Mexico.

Secondary industries produce goods or services that remain *in* the area. They are good too, because they create jobs and keep money here, but they do not necessarily bring in new money. Energy companies can be both primary *and* secondary industries because they may sell power in the state or may export it to others.

Although rich in energy resources, New Mexico has comparatively low energy demand, enabling us to export energy outside of the state. Further development of our diverse energy resources will enable us to export even more, creating local jobs and bringing in outside dollars.

Examples of large and small economic base jobs related to energy might include:

- oil and gas drilling
- manufacturing of solar systems to be sold nationally
- research projects for which the funding comes from outside New Mexico
- small businesses that sell a product across state lines
- wind farms or solar plants whose energy is exported outside of New Mexico

The unifying characteristic of all these examples, small and large, is that they bring revenue into New Mexico from somewhere else. Creating and retaining a mix of large and small businesses is important, because small businesses have consistently driven employment growth in recent years, and they continue to create jobs, even during the economic slowdown.[15]

Workforce Development

A growing economy requires a growing pool of people to work in it. For each of the energy sectors described in the remainder of this report, there is a corresponding workforce need. Whether that need is geologists to manage oil fields, technicians to maintain wind turbines, or engineers to plan a solar installation, we need qualified, motivated people to work in energy.

Energy and environmental degrees are offered at 20 different institutions throughout New Mexico. A few include:

- Petroleum, Natural Gas, or Mining Engineering at NM Tech
- Chemical and Nuclear Engineering at UNM
- Institute for Energy and the Environment at NMSU
- North American Wind Training Center at Mesalands Community College
- School of Energy at San Juan College
- Sustainable Technology Center at Santa Fe Community College
- Solar Energy Research Park and Academy at Northern New Mexico College
- Energy Technology Program at New Mexico Junior College

There are also a number of groups collaborating on initiatives to help develop the energy workforce. The state Higher Education Department emphasizes that our pioneering energy programs need to grow and be complemented by others if New Mexico is to become a national leader in diversified energy production.[16]

To address the growing need for the jobs that are being created in the emerging renewable and energy efficiency industries, a statewide Green Collar Jobs collaborative is being formed that includes schools, organizations, and businesses.[17]

Report Structure

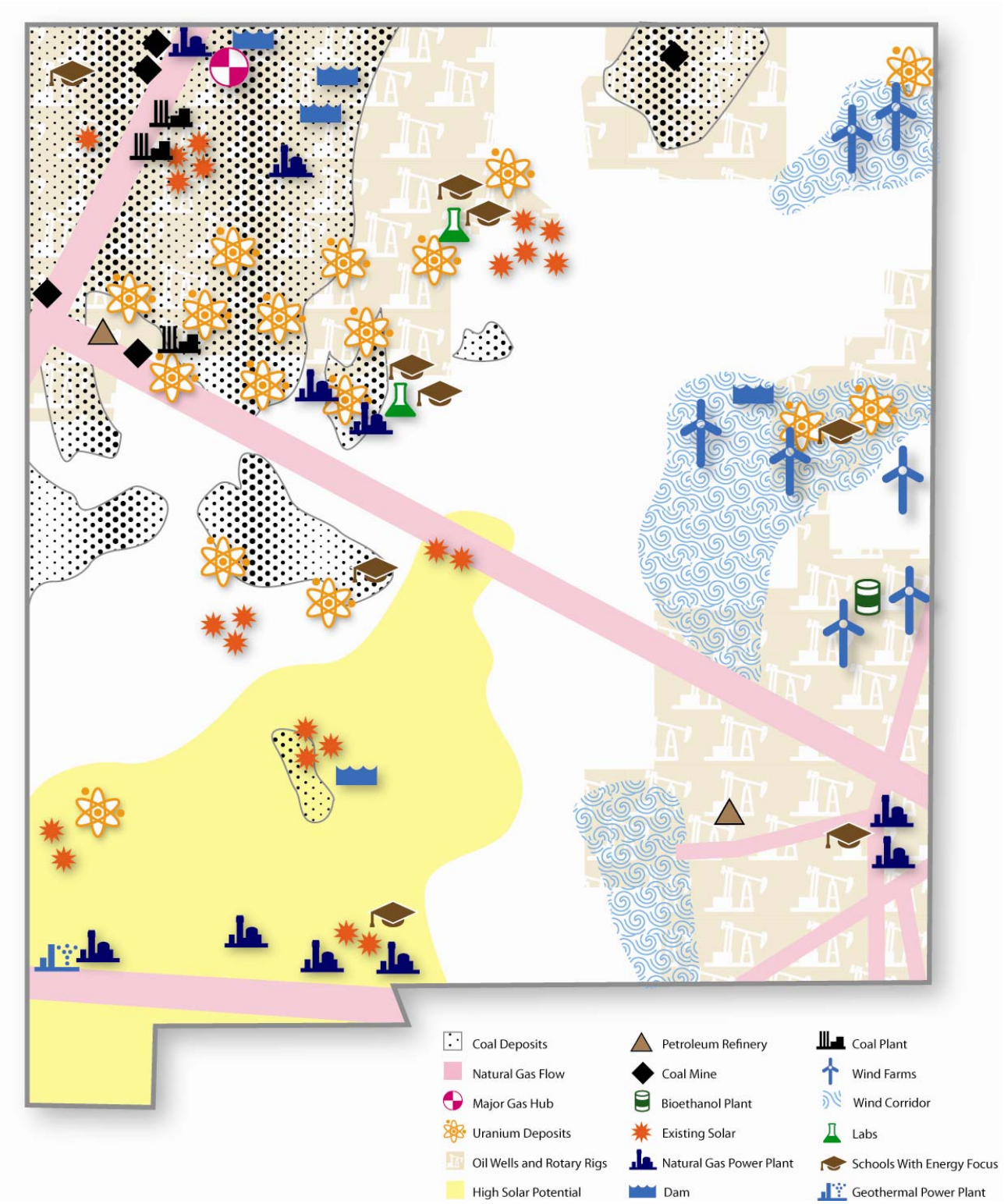
The remainder of this report focuses on specific energy resources, profiling each in terms of assets and challenges. The resources are grouped by:

- Conventional energy sources (oil, natural gas, coal, and nuclear)
- Renewable energy sources (wind, solar, biomass and biofuels, and geothermal)
- Energy efficiency and more efficient use of power

In preparation for the town hall, readers are encouraged to look for overlaps and linkages between the different energy sectors.

New Mexico's Energy Picture

The map below provides a snapshot of the range of energy resources and activities currently underway in New Mexico. It does not necessarily reflect *all* major energy-related activities in the state.



Conventional Energy Sources

Annual Economic Impact of NM Conventional Energy Sources

(mmbl- million barrels; Tcf – trillion cubic feet; mt –million short tons; mmBtu – million BTU)

	Current Production[18]	Direct employment[19]	Direct spending[20]	Gross Production Value[21] (in millions)	Current State & Local Revenue[a] (in millions)	Average Price (dollars per mmBtu)[22]
Oil	60 mmbbl	13,946 [b]	$2,580	$4,300	$690	$19.45
Natural Gas	1.48 Tcf			$10,900	$1,460	$8.89
Coal	26.3 mt	1,379		$744	$65	$1.56
Uranium [c]	--	400	$36	--	--	--

Data compiled by Professor Jim Peach, Department of Economics, NMSU, and Tom Clifford, PhD, New Mexico Tax Research Institute

[a] Oil and gas revenues include royalty payments on state and federal lands. Figures shown are average collections for FY 2006 – 2008. During this period, average wellhead prices for New Mexico producers were $71 for oil and $7 for natural gas. Coal: Production taxes from May 2008 Official Statement for Sale of Severance Tax Bonds, N.M. State Board of Finance. Coal gross receipts taxes from N.M. TRD's Report 80, Gross receipts taxes by industry, total of monthly value from FY 2008. Renewables: Estimated GRT from sale of electric power at retail.

[b] 2005 to 2007 average including oil and natural gas extraction, drilling and support activities for oil and gas, NAICS codes 211111, 213111 and 213112. Does not include retail gasoline station employment. Source Bureau of Economic Analysis, U.S. Department of Commerce. http://www.bea.gov/regional/spi/action.cfm

[c] New Mexico does not have a nuclear generating plant. The NM Energy, Minerals and Natural Resources Department Annual Report, 2008 (http://www.bea.gov/regional/spi/action.cfm) lists 102 jobs in uranium permitting, exploration and reclamation activities with an estimated payroll of $3.1 million in 2007. The 400 jobs listed include estimated employment at the uranium enrichment plant near Eunice, NM. No gross production value or state and local tax revenue estimates are available.

Oil and Natural Gas

Oil

Oil is mostly used for:
☐ Electricity generation
☐ Heating
☐ Cooling
☑ Transportation

Global and National Context

Oil will be the world's main source of energy for many years to come, even under the most optimistic assumptions about the development of renewable energy.[23] The world uses 86 million barrels of oil a day – 40,000 gallons every second.[24] At the same time that world oil drilling activity peaked in 1981, world consumption began to outstrip replacement, driven primarily by economic growth in developing countries.[25] The U.S. consumes almost 21 million barrels a day of petroleum products, making us the world's largest petroleum consumer. And although we are third in crude oil production, we still need to import more to meet the demand.[26] At current patterns of consumption, by 2030, Americans will consume 22% more oil than we did in 2005.[27] In 1980, during President Carter's administration, the United States imported 36% of its oil; today we import 60%.[28]

The potential development of oil shale deposits in northwest Colorado, Wyoming and Utah's Green River Basin may also provide a long-term new source of oil. These shale deposits are thought to hold three times the proven oil reserves of Saudi Arabia, and rising energy costs combined with developing technology are making them increasingly economically viable. In September 2008, the Bureau of Land Management set aside almost two million acres of public lands for commercial oil shale development, saying that the area "holds the equivalent of 800 billion barrels of oil – enough to meet U.S. demand for imported oil at current levels for 110 years."[29]

Colorado's governor and national environmental groups have urged federal officials to delay a final plan and rules for commercial oil shale development, saying there are too many unanswered questions about the effects on water, wildlife, air and local economies.[30]

New Mexico Context: Oil

As of 2006, New Mexico ranked fourth in the nation in crude oil reserves,[31] with 56,000 wells producing oil in 2007. While the number of wells operating in the state has steadily increased over the last decade, the amount of oil actually produced has declined. (Oilfield decline is a challenge nationally and internationally, as well.)[32] New Mexico produces about 60 million barrels a year of oil per year and New Mexicans consume about 50 million barrels of that, leaving the remainder for export.[33]

New Mexico has about 700 oil and gas operators (petroleum and gas producers, drillers, and service companies).[34] In addition to the oil and gas drilling and extraction infrastructure in the state, New Mexico has three oil refineries:

- Navajo Refinery in Artesia
- Western Refining Southwest Inc. in Bloomfield
- Western Refining Southwest Inc. in Gallup

Processing over 100,000 barrels of crude oil per day, these refineries supply much of New Mexico's gasoline demand.[35] The fuel is also exported out-of-state via petroleum pipelines that connect the refineries to state and regional markets.

Much of the state's oil and natural gas is produced on state trust lands. The State Land Office has approximately three million acres leased under 9,700 leases.

Natural Gas

Natural Gas is mostly used for:
☑ Electricity generation
☑ Heating and cooking
☐ Cooling
☑ Transportation

Global and National Context

Natural gas is our country's second largest energy source, and almost all of the natural gas Americans use is produced in North America. However, because of increasing demand for this fuel in power plants, experts predict that by 2025, more than 15% of our natural gas supplies will be imported from countries other than Canada and Mexico.[36] More than half of the world's uncommitted natural gas reserves are in Iran, Qatar, and Russia, and the U.S. could face competition for these resources from China, India, and other developing nations.[37] Over the past two years, however, the U.S. natural gas industry saw an increase in reserves, which could significantly reduce our need for imported natural gas.[38]

Natural gas burns more cleanly than other fossil fuels. It has fewer emissions of sulfur, carbon, and nitrogen than coal or oil, and when it is burned, it leaves almost no ash particles. Being a clean fuel is one reason that the use of natural gas, especially for electricity generation, has grown so much and is expected to grow even more in the future.[39] Another factor that could impact the production of natural gas is its proposed use as automobile fuel. That issue is addressed later in this section.

New Mexico Context: Natural Gas

New Mexico is the nation's second largest natural gas producer, and its output accounts for close to a tenth of U.S. production. Although natural gas production declined through much of the 1980's, output increased sharply since the early 1990's due in large part to the rapid development of coalbed methane production (the extraction of unconventional natural gas from coal seams). Today, coalbed methane accounts for about one-third of New Mexico's natural gas production, and the San Juan Basin is the nation's leading coalbed methane-producing region. Additional production is under development in the Raton Basin.[40]

Most of New Mexico's households (68%) use natural gas as their primary energy source for home heating, but we do not use nearly as much of the product as we produce. The vast majority of our natural gas is exported out-of-state, strengthening our economic base. The natural gas is delivered via pipeline to the west coast and Texas, and is further distributed to locations in the Midwest.[41]

Oil and Gas State Economic Impact

Other than sales tax, the oil and gas industry is the largest single source of state revenue, and the largest private sector contributor. For every $1 drop in oil prices, New Mexico loses about $8 million in annual revenue. For every 10 cent drop per thousand cubic feet of natural gas, the state loses about $12 million annually.[c]

Oil and gas contributed 21% to New Mexico's General Fund in 2006, from a combination of the mineral production tax, rents and royalties, and severance taxes. In FY 2008-2009, the state will generate about 30% of its total revenue from oil and gas.[42]

The production of oil and gas requires a specialized workforce to install, maintain, and operate. The southeastern New Mexico city of Hobbs, which is the hub for the production of oil and gas in the Permian Basin, is an example of how the oil and gas industry creates economic activity. Hobbs is largely defined by the oil and gas industry, supplying piping, fittings, drilling rigs and other specialized equipment and services; without the industry, Hobbs would not be a viable population center.[43]

---

[c] *New Mexico Oil and Gas Association website, http://nmoga.org/industry/. These calculations assume the taxable production volumes for FY 2009 used in the Consensus General Fund Revenue Forecast of February 2009. They also assume that 20% of natural gas value and 10% of crude oil value is deducted for processing costs and royalty payments. These values are derived from "Volume and Value" reports on the Taxation and Revenue Department's ONGARD Web site.*

In 2007, the oil and gas industry ranked 40th in employment in New Mexico, but third in earnings. Statewide, only about 2% of all employment is oil and gas, but in Lea County, for example, 27% of employment stems from the industry. In 2006, the industry employed close to 14,000 New Mexicans.[44]

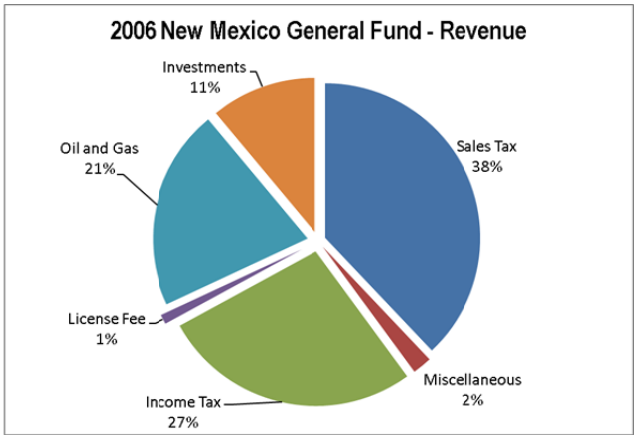


Figure 2: *NM Department of Finance and Administration, 2006*

Environmental and Regulatory Issues

Oil and Gas Regulation

Oil and gas representatives argue that their industry is over-regulated in New Mexico, which they say potentially affects industry profits and thus the state's general fund revenues. On the other hand, the Oil Conservation Division (OCD), New Mexico's main oil and gas regulatory agency, has argued that it does not have the tools to effectively regulate the industry. Still others point out that the issue is not one of "over" or "under" regulation, but ensuring that regulation is tailored to effectively address the intended issues. Oil and gas production is regulated by at least 12 different state and federal agencies.[d]

The oil and gas industry, in arguing that it is *over*-regulated compared to other states, points to the following examples:

- Stronger "pit rule" regulations adopted in 2008, were designed to protect groundwater and control the disposal of brine water, oil remnants, and debris produced during oil and gas extraction. (The brine and debris goes into large in-ground pits.) These new pit rules, according to the industry, created significant new expenses, even for drilling not located near groundwater. (Per well cost estimates range from $3,000-$90,000, according to OCD, or up to $300,000, according to the NM Oil and Gas Association.[45]) In February 2009 Governor Richardson proposed changes to the regulations which would allow oil and gas companies to better absorb the costs associated with the new rules. The proposed changes included granting exceptions to the rule and extending the time frames for compliance.[46]
- Local moratoriums and drilling laws, established recently in Mora, Rio Arriba, and Santa Fe counties, block or regulate oil drilling within specific areas. Industry representatives argue that these piece-meal policies are being made on a county-by-county basis when the issues should be regulated by state policy. Local communities, by contrast, argue for their own authority to regulate oil and gas drilling in their areas.[47]

By contrast, two examples supporting the notion that oil and gas is *under*-regulated include:[48]

- Attempts failed to update a 1935 provision legally protecting oil and gas operators unless the state could prove they "knowingly and willingly" violated the state's Oil and Gas Act. The provision means that an operator can violate the act without penalty unless the state can prove the violation was on purpose.

[d] *The New Mexico Oil Conservation Division Oil and Gas Rule Book contains 177 pages comprising 1,300 rules, definitions and procedures for the industry.*

Natural Gas as Vehicle Fuel

Natural gas is primarily used in this country to power electricity, home heating, and industrial processes. However, it can also be used as transportation fuel. It can power cars, trucks, trains, and other vehicles. Oilman T. Boone Pickens, in his much publicized awareness campaign, calls for a national shift to natural gas for transportation fuel. (He argues that we switch to wind and solar energy to produce the electricity currently generated by natural gas.)

Carbon emissions from natural gas are 23% lower than diesel and 30% lower than gasoline. There are close to nine million natural gas vehicles in use worldwide, but only 120,000 are in the U.S.

Depending on the level of government support, use of natural gas to power the nation's trucks and buses could displace between three to 10 billion gallons of gasoline per year by 2017.

Opponents of increased use of natural gas for transportation argue that it would be expensive and take many years to convert the nation's automobile infrastructure.

New Mexico currently has natural gas filling stations in six locations. Some of our cities, including Albuquerque, and Santa Fe, are already running buses with natural gas. Such groups operating fleets of vehicles are the most logical place to start.

- Attempts failed to change a $1,000 Oil and Gas Act fine for groundwater contamination, also established in 1935, when the amount represented a significant financial penalty, the equivalent of 2,500 barrels of oil. Today the fine is worth only about 10 to 20 barrels and thus is not perceived as being a deterrent. Over 700 instances of groundwater contamination were logged by the OCD through 2005, although the accuracy of these figures is challenged by the industry. It argues that these instances were only soil contamination with *potential* groundwater impacts.[49]

In March 2009, the state Supreme Court ruled that the Oil Conservation Division may not directly impose penalties on operators, but must instead go through the attorney general, (who would have to sue to try to collect penalties for alleged violations of regulations or the law).

Mark Fesmire, director of the division, said in a newspaper article that this ruling will make it more difficult, time consuming and costly to regulate oil and gas activity. "We'll go back to where the oil and gas industry is basically unregulated in New Mexico…And if we do that, more and more counties are going to do what Santa Fe County did."[50]

Surface vs. Mineral Rights

Millions of acres in New Mexico have separate surface and mineral rights, each owned by different parties. Homeowners may discover they do not own the mineral rights to their properties only after they receive notice that drilling is planned near their homes, after which they actively oppose the drilling.

Owners of mineral rights, on the other hand, point out that their asset has little or no value if it cannot be accessed. They argue that the nation needs the fuel and that it should be drilled for whenever possible. State legislation introduced in 2009 would have required that surface owners receive notice from oil and gas operators prior to their entering into an oil or gas lease. It would also have provided mineral estate owners with alternative, competitive options for benefiting from mineral ownership. The legislation did not succeed, but the issue is likely to remain alive. [51]

Access to Public Lands

Access to public lands is critical to oil and gas development as well as to development of other sources of energy. Energy development on public lands is controversial, often requiring land managers from state and federal agencies to work with diverse interest groups to balance public resources and stakeholder needs. In addition to oil and gas development, the Bureau of Land Management and the state land office are also working on numerous applications for solar, wind, and biomass projects.[52]

OIL AND GAS: Policy Implications

For each energy source, this report provides a range of questions to help the reader consider multiple perspectives. We do not attempt to explicitly answer these questions in the report; instead we hope they inspire interesting and thoughtful dialogue during the statewide town hall.

Revenues: New Mexico currently exports the vast majority of its natural gas and about much of its oil. The industry would like to produce more. What could increased production provide in terms of jobs and revenues? What must the state do to finance its public services if it does *not* support increased oil and gas production?

Where to drill: Many Americans call for increased domestic oil and gas drilling, yet the question remains, where? Local advocates and land owners often oppose drilling near their communities or in environmentally, historically, or culturally sensitive areas. Should local governments be able to block or regulate drilling in their areas? How can New Mexicans reconcile these issues? Are there places where new drilling can occur without conflict, and if so, under what conditions?

Environmental protections: Clearly groundwater and other aspects of our natural environment need to be protected. How should policymakers balance protection of natural resources against industry concerns that current protections go overboard?

Compressed natural gas (CNG): Given our state's large natural gas reserves, this issue is relevant to us. What opportunities exist for increasing the use of natural gas as transportation fuel? To what degree should we incentivize cities or other government entities to convert their fleets? What about personal vehicles? If CNG for cars was widely adopted, its prices could increase. How might changes in cost affect its use as a fuel?

Coal

Coal is mostly used for:
☑ Electricity generation
☐ Heating
☐ Cooling
☐ Transportation

Global and National Context

Coal provides the second largest share of world energy today, after oil. Global demand for coal is projected to grow another 65% by 2030, mostly because of rising electricity use in developing countries. By that time, experts believe coal will provide half of the world's electric power.[53] In our own country, coal powers about half of U.S. electricity generation, with each American using an average of 7,500 pounds of coal annually.[54] The U.S. has over a fourth of the world's minable coal. At current consumption rates, the U.S. has enough economically recoverable coal resources for over 200 years. Projections could change, however, if carbon reduction laws are enacted.[55]

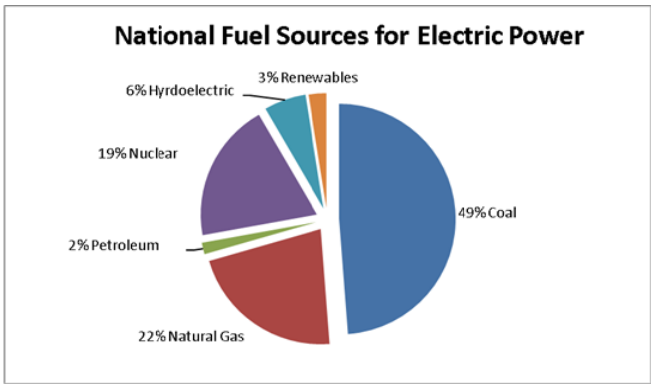


Figure 3: Where America Gets its Electricity
(Source: Energy Information Association, 2007

Why should we in New Mexico care about the rest of the nation's and world's need for coal? This knowledge gives us a glimpse into the industry's long-term future. Today, our state is an exporter, with New Mexico's coal powering homes in Arizona, California, Colorado, Utah, and Texas. Every dollar earned from outside our boundaries strengthens New Mexico's economic base.

New Mexico Context

Coal resources underlie about 12% of New Mexico (14.6 million acres). Most of the coal is in the northwestern part of the state, in the San Juan Basin and in the Raton Basins in the northeast. Major mines include:

- Navajo Mine/BHP Navajo Coal Company
- San Juan South/San Juan Coal Company
- McKinley/Pittsburg & Midway Coal Mining
- Lee Ranch/Lee Ranch Coal Company

Some of New Mexico's coal is mined on state trust lands leased by the State Land Office. Royalty from coal production on state trust land in 2008 was over $400 million.

New Mexico's three coal-fired power plants dominate the state's electricity market and supply most of the state's electric power.[56] Those plants employ about 800 people, with another 1,300 employed in the coal mines.[57] By 2015, coal generation is projected to increase New Mexico's economic output by $14.4 billion, while creating $5.5 billion in personal income.[58]

Coal mining jobs and revenues have significant impacts on New Mexico's rural and tribal communities. For example, 65% of coal company BHP Billiton's New Mexico employees are Native Americans. A significant portion of the Navajo Nations' non-federal revenues are directly derived from tribal coal royalties and taxes.

Electricity produced by coal is about one-third the cost of other energy sources, and roughly 80% of New Mexico's electricity comes from it.[59] This factor contributes to the fact that New Mexico's retail electricity rates are nearly 17% below the national average.[60]

Environmental and Regulatory Issues

Water

Large quantities of water are often needed to remove impurities from coal at the mine. In addition, coal-fired power plants use high volumes of water for producing steam and for cooling.[61]

Emissions and "Clean Coal"

Coal is abundant, relatively inexpensive and is an essential element of our nation's current energy mix. Coal-fired power plants also produce coal combustion by-products (CCBs), more commonly known as coal ash. While most of the ash is captured, some escapes from the boiler into the atmosphere. Regulations focus on reducing the amount of ash that escapes and on storing, burying or recycling it. (The most common way to recycle coal ash is in the creation of cement.)

A single power plant can produce over a million tons of coal ash a year, which can pollute groundwater or create other environmental hazards if it is not properly disposed of. Ash

disposal in New Mexico is well regulated by the state, with few if any evidences of groundwater or environmental hazards, according to the industry.[62] Increased federal regulation of coal ash disposal is possible, in part prompted by the 2008 spill of over a billion gallons of muddy ash in Tennessee.[63]

Another challenge facing the coal industry is carbon. Coal-fired power plants produce nearly 80% of the greenhouse gases released through U.S. energy production.[64] The coal industry, the government, and others are committed to the development and commercialization of advanced "clean coal" technologies.[e]

Over the last 35 years, America's coal-based electricity providers have invested more than $50 billion in technologies to reduce emissions. These efforts, according to the industry, have resulted in power plants that are 77% percent cleaner than in 1970.[65] The focus by the industry has now moved to developing carbon capture technologies to reduce greenhouse gas emissions.

Critics argue that there is no such thing as "clean coal."[66] It is certainly not yet a reality, and federal and state government funding and incentives will be required to take small-scale demonstration projects to a scale that can be used at coal-fired power plants. At this point in their development, clean coal technologies have higher capital and operating costs compared with conventional coal generation.[67]

New Coal-Fired Power Plants

The question of whether to open new coal-fired power plants is controversial. The Desert Rock Energy Project is a proposed development by Sithe Global Power and the Diné Power Authority, and enterprise of the Navajo Nation. The project would consist of a 1,500 megawatt power plant using Navajo coal to deliver power to Arizona, New Mexico, and Nevada. Desert Rock was endorsed by the Navajo tribal council, with leaders saying it would create jobs and generate $50 million in annual revenues for the tribe.

In July 2008, the Environmental Protection Agency the proposed facility, saying "The emission limits required by the permit for the Desert Rock power plant… are some of the most stringent in the country and will set a new level of performance for coal-fired plants in the United States."

Not all Navajos support the project, however. Some argue that the plant would violate Diné laws and traditions. While the plant's emissions would be low compared with other coal-fired power plants in New Mexico, opponents voice concerns about mercury and carbon emissions, water use, groundwater contamination, and impacts on threatened species.[68] The EPA's permit was appealed by the state of New Mexico and a number of national and local environmental groups.[69] The issue remains unresolved.

Carbon Capture and Sequestration

Carbon Capture and Sequestration takes CO_2 from power plants, oil refineries, and other industrial facilities and stores it underground in deep saline formations, depleted oil and natural gas reservoirs, or unmineable coal seams.

According to the Southwest Regional Partnership on Carbon Sequestration, headed by New Mexico Tech, the region's natural geology makes it ideal for carbon sequestration, a factor that could drive economic development opportunities for New Mexico. The San Juan Basin is one of the top ranked basins in the world for CO_2 storage in coalbeds. Interestingly, injecting CO_2 into coalbeds enhances the recovery of coalbed methane, an important source for natural gas.

In 2008, a bipartisan bill was introduced by Democratic Senator Jeff Bingaman and Republican Senator Arlen Specter that put a price on emitting carbon and included funding and incentives for large-scale carbon sequestration projects at coal-fired power plants, refineries and cement manufacturers. The bill did not pass, but if similar legislation becomes law in the future, economic opportunities will exist for New Mexico companies. At the same time, our existing coal-fired power plants, refineries and other industries will have to retrofit to reduce carbon emissions.

[e] *The WGA is a nonpartisan organization serving 19 states and three U.S. Flag Pacific Islands. In 2006, the Western Governors' Clean and Diversified Energy Advisory Committee identified incentive-based, non-mandatory recommendations that would facilitate 30,000 megawatts of new clean and diverse energy by 2015, a 20% increase in energy efficiency by 2020, and adequate transmission for the region. Task Force reports produced included: Advanced Coal, Biomass, Energy Efficiency, Geothermal, Solar, Transmission and Wind. Given the relevance of this research to New Mexico's energy's question, this document makes frequent references to this series of reports.*

COAL: Policy Implications

Clean coal: Technology to affordably capture and store carbon emissions from coal-fired power plants remains a long way off. How will new "clean coal" technologies get tested and implemented? Who pays? Are consumers able or willing to pay more for zero-emissions power?

New mines or power plants: One of New Mexico's coal mines is likely to close soon because of depleted ore. Some of our coal-fired power plants are aging. Any new facilities face significant environmental, social, and cultural hurdles. Should new coal mines or plants open? How might New Mexico overcome the challenges of bringing together disparate land owners (federal, state, tribal, and private)? How should New Mexico balance calls to protect sensitive lands with the desire for electric power?

Coal ash regulation: New federal regulations may be on the horizon for managing this power plant byproduct. Are additional environmental protections needed? What impact might new regulations have on the coal industry?

Jobs and tax revenues: Coal is a primary industry in New Mexico's economic picture. What are the potential financial impacts of the industry either growing or shrinking? In what ways would our tribal and rural communities be affected by changes to the coal industry?

Inexpensive energy: Many New Mexicans live at or near the poverty level. Increased environmental protections will likely contribute to increased energy prices. Are New Mexicans willing to pay more for clean energy?

Uranium Production and Nuclear Energy

Uranium (as a fuel for energy) is mostly used for:
☑ Electricity generation
☐ Heating
☐ Cooling
☐ Transportation

Global and National Context

Nuclear energy provides over 16% of the world's electricity, more than the world used from all sources in 1960. Today 31 countries use nuclear energy to generate up to three-quarters of their electricity, and there are currently 440 nuclear power reactors in the world.[70]

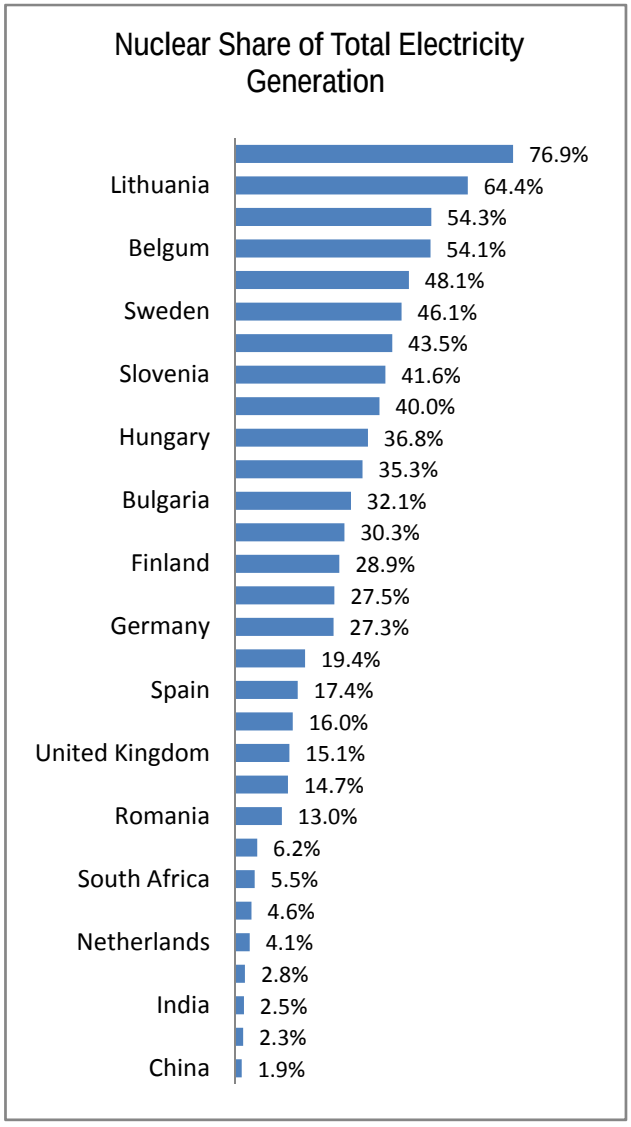


Figure 4: *International Atomic Energy Agency, 2004*

The U.S. has 104 nuclear reactors providing almost 20% of its electricity. There have been 17 license applications to build 26 new nuclear reactors since 2007, with seven more expected in 2009.[71] The rising costs of natural gas and coal, together with energy security and concerns about carbon emissions, are among the factors contributing to anticipated nuclear growth.[72]

However, throughout the nation, high construction costs, the length of permitting processes, uncertainty about disposal of radioactive waste, and concerns about nuclear proliferation remain challenges. The cost of any major construction project presents uncertainty, but with nuclear power especially, this is heightened by the lack of recent experience in this country with building new nuclear power plants. This uncertainty is not necessarily factored into estimates of the delivered costs of electricity produced by nuclear energy.[73]

Another issue that impacts the location of potential nuclear facilities is water. Nuclear power plants also use large quantities of water for steam production and for cooling.[74]

New Mexico Uranium Mining and Milling

Nuclear energy relies on uranium. New Mexico was the nation's leading uranium producer during the 1950s, 1960s, and 1970s. State production declined dramatically after the late 1970s and, except for small recovery operations, most production ended by the early 1990s, stopping entirely after 2002. During the 1990s, uranium prices fell far below the cost of production. Today, prices are up again (from a low of $6 a pound in 2000 to an average of about $90 in 2008).[75] The economic downturn has brought those prices down again, however. Uranium short term prices dropped to $42 a pound in March 2009, while the long term price was at $70 per pound.[76]

A NMSU Arrowhead Center report indicates that at higher prices, uranium mining and milling in New Mexico would again be feasible. At $100 per pound, New Mexico's uranium reserves would be worth about $34 billion dollars.[77] However, a New Mexico Environmental Law Center report argues with that number, calling it an exaggeration and noting that it does not include environmental costs such as clean up of groundwater contamination and waste disposal. The report also expressed concern about damage to the local economy if the environment is damaged.[78]

Environmental and Regulatory Issues

The U.S. Nuclear Regulatory Commission (NRC) regulates uranium recovery operations in Wyoming, New Mexico, and Nebraska. Supporters of uranium mining argue that substantial improvements have been made to the industry. They say modern uranium mining is heavily regulated, safe for workers, and safe for the environment. Uranium mining opponents point

to existing groundwater contamination and concerns about potential health risks for the next generation of miners.

Regarding health issues, the federal government paid out $577 million to uranium miners, millers, and ore transporters from 1992-2007, as compensation for radiation exposure.[79] In May 2008, the federal government issued an advisory recommending cancer screenings for workers in the uranium industry.[80]

In New Mexico, the question of whether to mine uranium also divides tribal communities since it is estimated that approximately 70 million pounds of uranium reserves are located on tribal lands. Some tribal members argue for the job opportunities and economic benefits of leasing tribal mineral rights to uranium companies. Others oppose uranium mining on the basis of preservation of sacred lands, the protection of groundwater, and health issues. In April 2005, through state legislation, the Navajo Nation imposed a ban on uranium mining and milling within Navajo Indian Country.[81]

Uranium mining is associated with an increased incidence of lung cancer among Navajo uranium miners.[82] A study of Navajo men residing in New Mexico and Arizona from 1969 to 1993 found that uranium mining contributed substantially to lung cancer.[83]

Status of Uranium Mines

There is considerable interest in a resurgence of the uranium mining in New Mexico. Available information is presented in the following table. *The table may not represent a complete listing of all the state's uranium mines.*

Uranium Operation	Where	Notes
Ambrosia Lake, operated by Rio Algom Mining, LLC	Cibola County	Rio Algom's original milling facility is being decommissioned, at a cost of $18 million.[84] Neutron Energy currently has an application for exploration in the Ambrosia Lake area with NMEMNRD, and there is a permit filed to build new facilities with the capacity to produce 8,000 tons of uranium ore per day. [85]
Grants Ridge, operated by Uranium Energy Corporation/New Heap Leach mine/	Cibola County	A letter of intent was filed with the NRC in February 2008; the application is expected July 2009.[86]
Homestake project	Cibola County	This uranium mill site is under reclamation. It processed uranium from the late 1950's until 1990. A groundwater corrective action plan is underway by the EPA through Superfund. The cost for decommissioning is estimated to be approximately $55.5 million and is expected to be completed by 2017.[87]
Mt. Taylor project, operated by Rio Grande Resources	Cibola County	In March 2008, Rio Grande Resources notified the Nuclear Regulatory Commission of its intent to apply for permits for a new uranium mill processing facility. Estimated application date is January 2010.[88]
Crownpoint Uranium Recovery facility, operated by Hydro Resources, Inc.	McKinley County	The site has a license but no active operations.[89]
Church Rock facilities, operated by United Nuclear Corporation	McKinley County	The facilities operated from 1977 to 1982, processing uranium ore from the Northeast Church Rock and the Old Church Rock mines. The area is a Superfund site, undergoing an EPA groundwater corrective action plan. The cost for decommissioning is estimated to be approximately $3.7 million.[90]
Juan Tafoya project, operated by Neutron Energy Inc. (NEI)	McKinley County	In March 2008, the company notified the NRC of its intent to apply for permits for a new uranium mill processing facility. Estimated application date is December 2009. Plans are underway to do confirmatory drilling and begin mine planning at the nearby Marquez Canyon deposit. Both the mine and mill would be on the private land of the Juan Tafoya Land Corporation[91]
Roca Honda Project, operated by Strathmore Minerals Corp.	McKinley County	A letter of intent was filed with NRC in April 2007 for a proposed uranium mill 70 miles from Church Rock. NRC estimates September 2010 as the application date.[92]

New Mexico Uranium Enrichment

In June 2006, the NRC issued a license to Louisiana Energy Services (LES) to construct and operate a gas centrifuge uranium enrichment plant. The National Enrichment Facility in Eunice, NM, started major construction work in 2007.[93]

In November of 2008, LES announced plans to pursue expansion of its facility that would double its permitted size. As currently configured, the facility will provide the equivalent of 25% of the total U.S. nuclear reactor fuel enrichment service demand. The expansion would enable the facility to provide approximately 50% of U.S. enrichment demand. LES already has orders for the next 20 years with customers in the U.S., East Asia, and Europe. [94]

LES has 276 full-time employees and 800 construction workers in Eunice. Expansion could result in the retention of approximately 400 construction jobs through the end of 2014. LES' sister company ET US, which will supply LES with centrifuges, employs an additional 60 people. LES' total New Mexico investment is projected at an annual payroll of approximately $33 million per year and a monthly construction payroll of approximately $11 million.[95]

Environmental and Regulatory Issues

Critics of LES are concerned about the amount of water used in the process and groundwater protection. [96] They also argue that the facility lacks a concrete disposal plan for long-term disposal of nuclear waste, which they say will amount to approximately 4,800 tons per year, double that if that facility is granted its expansion request.

At the time the Nuclear Regulatory Commission issued LES' combined license to construct and operate its New Mexico facility, there was no NRC policy for depleted uranium disposal. The NRC is currently conducting a review of depleted uranium disposal in order to create a policy for it. The U.S already has 450,000 tons of uranium hexafluoride (UF6) waste temporarily stored at existing or closed uranium enrichment plants at Oak Ridge, TN, Paducah, KY, and Portsmouth, OH; there is currently no permanent disposal place for this substance.[97]

LES reports that the waste streams generated by the National Enrichment Facility will include low-level radioactive waste and mixed waste, but that there will be no treatment of hazardous waste or mixed waste on site that will require a RCRA (Resource Conservation and Recovery Act) permit. The depleted uranium produced by the facility will be stored for a period of time in Uranium Byproduct Cylinders (UBC's) on site before final disposal in appropriately licensed facilities. Depleted uranium "tailing" (a waste product) may be recycled for the plant, thus minimizing the amount of depleted uranium that will need to be managed.[98]

In April, Idaho-based International Isotopes, Inc. announced that it plans to build a $93 million plant to extract fluorine gases and acids from tailings created in the process of enriching uranium. The gases would be used in manufacturing electronics and medical equipment. The plant would be located near Hobbs in Lea County and, if licensed by the Nuclear Regulatory Commission, would create 150 construction jobs and employ a full-time staff of 130-150 people. The plant would use tailings from the LES facility.[99]

URANIUM: Policy Implications

Uranium mining: Given the rising national and international demand for nuclear power, should New Mexico begin uranium recovery operations once again? How do issues with the decommissioning of existing uranium mills, including environmental and health concerns, factor into decisions to pursue uranium recovery? How do economic development and job creation goals factor into the question? To what extent is tribal unemployment a factor?

Uranium enrichment: LES is considered an economic development and job creation asset for its community of Eunice near Hobbs. It has applied for expansion of its existing permits, potentially enabling it to double in size. What are the pros and cons of such an expansion? What issues, if any, need to be addressed in terms of waste?

Renewable Energy Sources

Along with 28 other states, New Mexico has adopted renewable portfolio standards (RPS), which require its utilities to provide customers with a certain percentage of energy generated from renewable sources. By 2020, 20% of electricity from investor-owned utilities (PNM, El Paso Electric and Xcel Energy) must be provided by renewables; rural electric cooperatives must meet a 10% renewable requirement by 2020. The Renewable Portfolio Standard also sets minimums for percentages of renewables that must be fulfilled by investor-owned utilities, including 20% of RPS from solar, 20% from wind, 10% from geothermal and biomass, and 3% from distributed renewables.[100]

These requirements have played a major role in driving New Mexico's development of renewable energy. The following section provides overviews of New Mexico's most promising forms of renewable energy: wind, solar, biofuels/biomass, and geothermal.

The report does not address hydroelectric power, because our state has limited hydroelectric capacity (totaling about 80 megawatts from five dams).[101] Hydropower is not a large portion of the state's total generating capacity, and is unlikely to become an integral part of New Mexico's energy future due to New Mexico's arid climate and concerns about water.

New Mexico's State Land Office leases public land for wind, solar, biomass, and geothermal energy production.

Annual Economic Impact of NM Renewable Energy Sources

	Production[102]	State & Local Revenue[103] (in millions)
Wind	1,700,000 MWh	$10
Solar	2,800 MWh	$0.02
BioFuels/BioMass	274,000 MWh	$2
Geothermal	70,000 MWh	$0.4
Energy efficiency/ Conservation	150,000 MWh	NA

Data compiled by Professor Jim Peach, Department of Economics, NMSU, and Tom Clifford, PhD, New Mexico Tax Research Institute

Wind

Wind energy is mostly used for:
☑ Electricity generation
☐ Gas-powered heating and cooking
☐ Transportation

Global and National Context

The U.S. wind industry is growing rapidly, with enough wind energy installed in 2008 to serve over two million homes. Last year, the nation's capacity to generate wind power rose by 50% and $17 billion was invested into the economy through wind. Wind energy in the U.S. now has the capacity to power the equivalent of close to seven million households.[104]

Under the Department of Energy's *20% Wind Scenario,* U.S. wind power capacity would grow enormously (from about 11 gigawatts a year to more than 300 by 2030). Wind would supply enough energy to displace about half of electric utility natural gas consumption and 18% of coal consumption by 2030.[105]

New Mexico Context

While long-time New Mexicans might think our state has more wind than just about anywhere, we are actually 12th in the nation in wind capacity, with North Dakota and Texas topping the list. Still, our resources are significant and wind generation capacity continues to grow. New Mexico had the third largest percentage of wind generation among all states in 2007.[106]

New Mexico currently has five utility-scale wind farms, employing a total of 50-60 permanent employees.

- New Mexico Wind Energy Center near Ft. Sumner
- Caprock Wind Ranch near San Jon
- San Juan Mesa Wind Project near Elida
- Aragon Mesa Wind Project near Santa Rosa
- Llano Estacado Wind Ranch near Texico

High Lonesome Mesa, a new wind farm under construction south of Willard, is scheduled for completion in 2009. About 100 construction workers are building the facility, which will bring the state's total installed wind capacity to almost 600 megawatts, enough to power approximately 162,000 homes.[107]

The existing wind farms create power that is purchased by Xcel Energy, PNM, and Arizona Public Service Company.[108]

Economic Impacts and Job Creation

Wind projects can boost rural tax bases, helping to pay for schools, roads and hospitals, while also providing steady income to farmers, ranchers, and other landowners. Each wind turbine contributes $3,000 to $5,000 or more per year in rental income to the landowner, while farmers and ranchers can continue to grow crops or graze cattle on the same land.[109]

Construction of the New Mexico Wind Energy Center created 200 jobs, and it is projected to bring more than $40 million into rural DeBaca and Quay counties over 25 years.[110]

In addition to the job creation potential of constructing wind farms, some industry experts see New Mexico as a logical location for future wind turbine manufacturing. Attempts have been made in recent years to attract wind manufacturing businesses to the state, but thus far without success.[111]

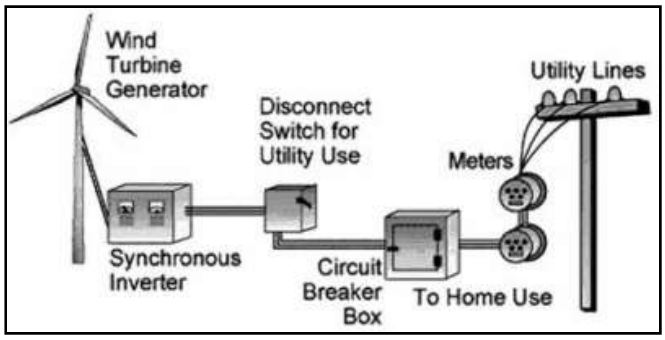


Figure 5: *How Wind Turbines Produce Power*
(Source: Mark Burger, Illinois Solar Energy Association; illustration by Canadian Wind Energy Association)

Wind Energy and the Electric Power Grid

New Mexico's potential for increased electricity generation from wind is enormous, especially on the eastern plains. Estimates place New Mexico's annual wind energy potential at 435 billion kilowatt-hours.[112] (An average household uses about 10,000 kilowatt-hours of electricity each year.) Much of this potential power can be exported to other states, strengthening our economic base. Additional development of wind for export in New Mexico, however, will in large part depend on upgrading and expanding the electric power grid to more effectively incorporate wind and other sources of renewable energy.[113] Sandia National Laboratories, New Mexico Tech, and other entities are working to address these challenges.[114]

The primary challenge to effectively integrating wind into the electric power grid is the intermittent and variable nature of wind. These "intermittency issues" – the fact that wind doesn't blow all the time and rarely blows during the time of peak power demands – are a challenge for developing the wind industry. Wind in New Mexico is typically available when we need the power the least, during the nights and in spring and fall.

Building wind farms in diverse locations will be important to help balance out the intermittent nature of the resource. Establishing a wind project in the western part of the state (to balance the east side) could enable more effective incorporations of wind into the grid.[115]

Regulatory and Environmental Issues

Supporters of the wind industry point to the fact that it produces energy without emissions. The Department of Energy projects that under its *20% Wind Scenario*, a total of 7,600 million metric tons of carbon emissions could be avoided by 2030, and cumulative water use in the electric sector could decline by 8% or four trillion gallons. The study shows that much of the projected water savings would occur in western states, where water resources are particularly scarce.[116]

However, wind energy also comes with a cost. Each wind farm must be built with infrastructure, including roads, power lines, and an electrical substation to convert the raw power and deliver it to the commercial grid. In addition, wind turbines are often installed in large groups, creating significant changes to the landscape. For example, the scenic caprock overlooking what used to be an outdoor amphitheater near San Jon in eastern New Mexico is now a large wind farm. Many also oppose installation of transmission lines.

Other people oppose wind farms because of the noise they make. Many people who choose to live in the country do so *because* it is quiet, and the nightly whir of the turbines impacts their quality of life if their homes are nearby. Low frequency noise pollution in particular is an emerging health concern with turbines, increasing the need for proper distance setbacks from homes and communities. While admitting that noise was a serious problem for the older equipment, the American Wind Energy Association says that improved technology is addressing the issue. "Today, an operating wind farm at a distance of 750 to 1,000 feet is no noisier than a kitchen refrigerator or a moderately quiet room."[117]

Another environmental concern is wildlife. Birds and bats can be injured or killed by colliding with rotors, towers, or related structures. Other animals' habitats may be impacted by the footprint of the turbines, roads, and power lines.[118]

WIND: Policy Implications and Tradeoffs

Rural revenues: Many farmers and ranchers can make dual use of their land by allowing wind farms to be built on it, increasing the revenue base for struggling rural communities. What are the "siting" (location) issues that must addressed when building new wind farms? How might communities balance the need for revenue generation and "clean energy" production against landscape, wildlife, and noise concerns?

Transmission: Wind turbines are most often located in rural areas; electricity is needed in urban areas. What might New Mexico do to export more wind energy? How can we address the challenges of determining whether the transmission lines be upgraded or built, whose property must new lines cross, and who pays for it? *(These issues are addressed in greater detail in the transmission section.)*

Wind industry manufacturing: Both New Mexico and Arizona are making strides in the regional wind market. Both states will need manufacturing parts and supplies. What would New Mexico need to do to successfully attract wind manufacturing to the state?

Solar

Solar energy is primarily used for:
☑ Electricity generation
☐ Heating
☐ Cooling
☐ Transportation

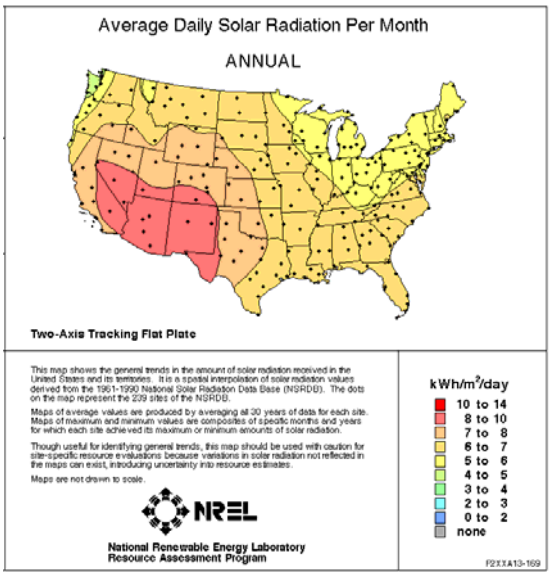
Global and National Context

Solar power is a growing industry, with a fourfold expansion of global solar installations in the past five years.[119] Currently, solar represents a small fraction of total electricity generation in the U.S., but experts predict that the industry's contribution could reach 10% by 2025.[120] Some estimates project that 8,000 megawatts of capacity, enough to power about two million homes, could be installed in the western states by 2015, using a combination of utility-scale solar power plants, distributed solar power, and other small-scale solar installations.[121]

For utilities, periods of "peak load", or high demand, are the most expensive because the utility always has to have that capacity available, even when it's not being used. This factor makes solar energy potentially appealing to utilities. Unlike wind, which does not always blow when the energy is needed, the sun shines during the heaviest periods of electricity demand, particularly on hot summer afternoons when people use air conditioning.

Solar power, like wind power, is almost always combined with electricity generated from "dispatchable" energy sources, such as coal, gas, or nuclear. (A dispatchable energy supply is guaranteed or predictable 24 hours a day.)

Because wind often blows at night and the sun shines during the day, wind and solar can balance each other out and "dampen" intermittency. The more diversity there is in the energy mix, the more resiliency and flexibility there is in the system.[122]



New Mexico Context

New Mexico ranks second in the nation in solar energy production potential.[123] Our state receives more than 3,200 hours of sunshine per year, twice that of most other regions in the U.S. New Mexico's average daily energy consumption is about the same as the average daily amount of solar energy received within an 18 square mile area, or as much as 161,000 barrels of crude oil. In other words, New Mexico could theoretically power a large percentage of the state with solar energy.

Distributed Solar Power

Distributed solar power is generated at homes or businesses, often via solar panels installed on rooftops, carports or yards. (Energy can also be produced via *passive* solar heating, which collects the sun's warmth through architectural strategies like south-facing windows, overhangs, or increased insulation.) However, most of this section deals with *active* solar systems that either produce electricity using solar panels (called photovoltaics), or generate heat (called solar thermal energy). Solar thermal energy can be used for hot water, space heating and cooling and pool heaters.

Most homes or businesses that use distributed solar power are also connected to a utility.[124] A "grid-tied" power system allows consumers to get part or all of their electric power from renewable sources while still being connected to the electric utility grid.

"Net metering" laws enable these customers to provide energy to the grid during the day, and draw from it at night. When the solar system is generating more power than the customer is using, the excess power feeds into the grid for the closest neighbor to use. The electric meter literally spins backward, "banking electrons" as a credit for future use.[125] When the sun goes down, and the solar customer needs electricity from the grid, the meter spins forward.[126]

These types of solar systems can also produce Renewable Energy Credits, which can be sold to the local utility for their compliance with state Renewable Portfolio Standards, enhancing the economics of a project by providing a new revenue stream. REC programs are now available to PNM, El Paso Electric and Xcel Energy customers.

Costs and Incentives for Distributed Solar Power

Solar energy prices have declined an average of 4% a year over the past 15 years, driven by advances in technology and manufacturing economies of scale. A recent study examined 37,000 grid-connected systems installed between 1998 and 2007 in 12 states. It found that average installed costs declined from $10.50 per watt in 1998 to $7.60 per watt in 2007.[127] Experts predict that the industry will approach break-even costs

with other grid connected energy sources by the end of the decade.[128]

Upfront installation costs continue to be the biggest barrier to more widespread use of distributed solar power in New Mexico, although existing public and private sector incentives have made a difference. A residential solar energy system typically costs between $20,000-30,000. Where government incentive programs exist, installed costs can be lowered significantly.[129]

Over 400 small-scale solar systems were installed in New Mexico since 2006, thanks in part to almost $2 million in state solar tax credits.[130] As of January 2009, the state added a 10% income tax credit onto the existing 30% federal income tax credit for solar purchases.[131]

Utility Scale Solar Power

In addition to distributed solar power, there are utility-scale solar power plants, which, like fossil-fueled power plants, can provide non-intermittent electricity generation when coupled with storage.[132] New Mexico has three examples of utility-scale solar power currently in development:

- In June 2008, New Mexico's four largest utilities providers – El Paso Electric, Xcel Energy, PNM, and Tri-State Generation and Transmission Association – jointly issued a request for proposals from solar developers for the construction of a "solar parabolic trough" to provide solar electricity by 2012.[133] This commercially proven technology uses a field of linear mirrors to collect, redirect and concentrate sunlight. There are similar plants up to 80 megawatts currently operating in the U.S.[134]

- In March of 2009, Tri-State Generation and Transmission Association signed an agreement with First Solar, Inc. to construct and operate a 30-megawatt power plant in northeastern New Mexico. The plant will be located in Colfax County near Springer and will include 500,000 solar panels and produce enough electricity to power 9,000 homes. This will be one of the largest plants of its type in the world. Tri-State, which supplies wholesale power to 44 electric cooperatives, including 12 in New Mexico, is taking on the project to diversify its generation mix, reduce carbon emissions, and help meet its members' renewable energy requirements. (New Mexico Coops are required to derive at least 10% of their energy from renewable sources by 2020.) Construction will begin in April 2010, employing between 120-140 people.[135]

- El Paso Electric is planning a solar tower power plant that will provide enough electricity for 29,000 homes.

Economic Impact

New Mexico already has a growing solar industry cluster with a wide range of businesses around the state. These businesses include manufacturers, systems installers, and start-up technology-based companies. These companies all benefit from the state's low cost of operations, economic incentives, qualified labor force, and synergy with the labs, whose research and development capabilities continue to advance solar technology.[136] In addition, New Mexico has a strong venture capital community that can help commercialize that technology. Since 2003, New Mexico has actively recruited large solar manufacturing companies, in part through tax incentives. The Solar Energy Industry Association anticipates 19,000 new jobs created in New Mexico by 2016, the highest per capita gain in the country.[137]

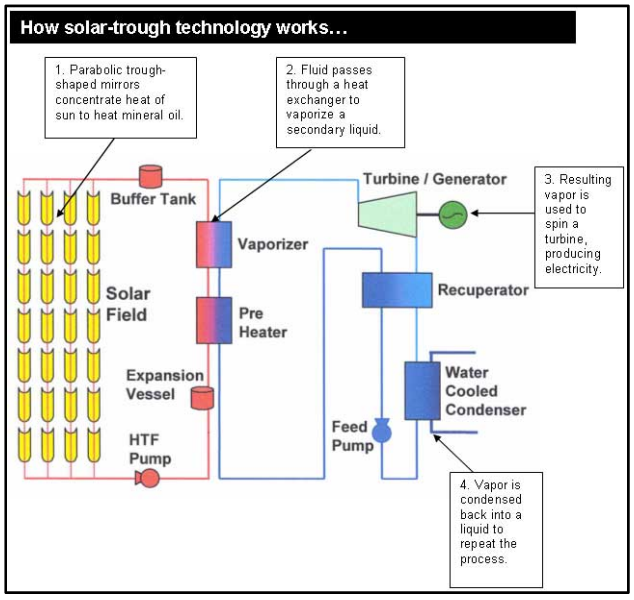


Figure 6: *How Solar-trough Technology Works*
(Source: Hydrogen Now, http://www.hydrogennow.org)

UNM's Bureau of Business and Economic Research studied the economic and fiscal impacts of building solar power plants in the state. Building five 100 megawatt plants over ten years would create the largest concentration of solar power in the *world*. It would also contribute to further developing the cluster of solar power technology suppliers that could make New Mexico a world supplier of solar technology. The study estimated that *constructing* one concentrating solar power plant would create between 1,500 and 2,000 jobs, producing over $56 million in income. The economic impact of *operating* the same plant would be $7 million, producing 72 jobs and an annual income of $2.7 million.[138]

Tribal Energy Program

Several of New Mexico's Native American tribes have participated in the Department of Energy's (DOE's) Tribal Energy Program.[139]The purpose of the program is to promote tribal energy sufficiency, economic growth, and employment on tribal lands through the development of renewable energy and energy efficiency technologies. Participating tribes include the Nambe, Jemez, Zuni, and Laguna Pueblos as well as the Jicarilla Apache Tribe.

The Pueblo of Laguna was able to make the 20,000 acre Majors Ranch, a Laguna-owned operation, into a self-contained community with its own source of electrical power utilizing its solar and wind resources, installing solar systems, a wind turbine and tower, and battery bank.[140] The Jicarilla Apache Reservation installed a solar array to provide electricity for Dulce High School.[141]

Environmental and Regulatory Issues

From an environmental perspective, solar panels require area and can be visible on rooftops and in yards. They change the appearance of buildings, which can cause concerns. For example, Santa Fe is currently debating whether solar panels are appropriate in its historic districts. New Mexico has a very strong Solar Rights Act which gives citizens a property right to access the sun. Under current law, this cannot be taken away except in historical districts and where covenants excluding solar were established before 1978.

Similar challenges may exist with solar power plants, which may be located on public lands. And unlike wind farms, which can co-exist with other agricultural activities, a solar-electricity farm precludes dual usage of the land. Widespread production of solar power in urban areas and on public lands will inevitably raise conflicts over landscape and wildlife conservation issues.

There is not yet a public process for leasing land for solar power plants, although a number of public agencies have experience with oil and gas leases. One concept being pursued by a joint federal-state effort is to reuse contaminated land (brownfields) for solar power production.

SOLAR: Policy Implications

Financing: The upfront costs of installing solar equipment continue to be significant, and these costs are the biggest obstacle to more widespread use of solar energy. Currently, federal and state tax credits and incentives have done much to spur solar installation, but the upfront costs continue to deter many people. Subsidies are continuing in New Mexico and at the federal level. To what degree and for how long should solar continue to be subsidized?

Locations: How will "siting" issues for small scale and larger scale solar installations be resolved? How will New Mexicans balance the environmental benefits of using solar energy with potential conflicts in urban areas, historical districts, and on public lands? Another location hurdle is where to put transmission and distribution facilities and lines. How will those be resolved?

Biomass and Biofuels

Biomass

Biomass is primarily used for:
☑ Electricity generation
☑ Heating
☐ Gas-powered heating and cooking
☐ Transportation

Global and National Context for Biomass

Biomass energy or "bioenergy" – the energy from plants and plant-derived material – has been in use since people began burning wood to cook food and keep warm. Wood is still the largest biomass energy resource today, but other sources of biomass can also be used, including food crops, stalks or thinning from agriculture or forestry, and the organic component of municipal and industrial wastes (garbage). Even the methane fumes from landfills can be used as a biomass energy source.[142]

Biomass power plants currently produce 11,000 megawatts per year, which is the second largest source of renewable energy in the nation. At present, most biomass power plants burn lumber, agricultural, or construction wood wastes.[143] Critics of these types of power plants may oppose the use of trees as fuel, or oppose any type of power plant that produces emissions. Some argue that anything that pollutes, even if it pollutes less than conventional sources, cannot be considered renewable.[144]

Regional Context for Biomass

There are several biomass projects currently underway in New Mexico including: [145]

- Two woodchip-fueled power systems, one at Jemez Mountain schools and the other at Fort Bayard Veterans Hospital. Both use lumber mill waste and forest thinnings for fuel. (This is a collaboration between U.S. Forest Service and State Forestry Division.)
- Proposed biomass plant
- The Pecos Valley Biomass Cooperative received $2.3 million in 2009 to use the manure from 20 to 25 dairies to produce natural gas. Gas emissions from the manure would be compressed, cleaned and turned into natural gas that would be shipped via pipeline to energy companies.[146]

CASE STUDIES

Biomass Power Plant

Using forest and rangeland thinning as a biomass fuel source can be controversial. In July 2006, Western Water and Power Production and PNM proposed a 35 megawatt biomass power plant, large enough to power 25,000 homes, to be located near Estancia.[1]

The company planned to employ 150-200 people during the construction phase and 20 to 30 employees over the lifetime of the facility. The renewable energy project was supported by the state because it would use forest and rangeland thinnings harvested using existing forest restoration principles.

Opponents of the project argued that the total biomass available within a 50-mile radius of the plant would fuel the biomass plant for no more than five years without doing irreparable harm to the forest ecosystems. Proponents of the project argued that the project would be *good* for forests by thinning areas apt for wildfires.

The project stalled when PNM opted out, but it may be moving forward again, pending a contract with a California utility to purchase the electricity produced.

Sources: PNM website, Albuquerque Journal (2-25-08), New Mexico Biomass Blog, Mountain View Telegraph (2-26-09)

SFCC BioMass Boiler

Santa Fe Community College began using a biomass boiler in 2008. The boiler can provide up to 85% of the peak demand needed to heat the entire campus. SFCC believes its project provides a wise use of forest thinning and other waste wood products, and the school expects to save $100,000 in annual energy costs.

In the biomass boiler, flue gases go through a multi-cyclone to extract any "fly ash" particulates, and the flue gas is monitored to burn away the carbon and eliminate a smoky plume.

Source: Santa Fe Community College Wood Biomass Chip-Fed Boiler Fact Sheet, 2008

Recognizing the challenges faced in developing biomass projects, the Western Governors' Association created biomass recommendations for state governments, including the following:[147]

- Extend the same state and federal tax credits and incentives to biomass that are currently available to other renewable energy sources.
- Directly purchase power from biomass projects and support biomass research.
- Work to ensure that biomass is consistently defined as a renewable resource.

Biofuels

Biofuels are mostly used for:
☐ Electricity generation
☐ Gas-powered heating and cooking
☑ Transportation

Global and National Context for Biofuels

Unlike other renewable energy sources, biomass can be converted directly into liquid fuels, called "biofuels," to help meet transportation fuel needs. The two most common types of biofuels are ethanol and biodiesel.

- Bioethanol is an alcohol that is made by distilling the carbohydrates from crops such as corn, wheat, barley, rye, sugar beet, or sugar cane. Technology is being developed to allow ethanol to be made from the bulk of most plant matter.[148]
- Biodiesel is made by combining alcohol with any type of vegetable oil, animal fat, or recycled cooking grease. It can be used as an additive to diesel to reduce vehicle emissions or in its pure form as a renewable alternative fuel for diesel engines.[149]

The federal Renewable Fuel Standard (RFS) requires U.S. biofuel production to reach 36 billion gallons by 2022, with most of that provided by "advanced biofuels" (also called "second generation biofuels") that are not based on food crops. The nation has a way to go; in 2006, biofuels production totaled just under five billion gallons.[150]

Recent research by Sandia National Laboratories and General Motors, the *90-Billion Gallon Biofuel Deployment Study,* found that plant and forestry waste and dedicated energy crops could sustainably replace nearly a third of gasoline use by 2030. The study pointed out that meeting these levels would require continued research and development as well as ongoing funding for production and initial commercialization (sale in the marketplace).[151]

New Mexico Context

Our state is already producing biofuels. Abengoa Bioenergy is currently one of the largest producers of bioethanol in the U.S. The national company has four plants in operation, one of which is located in Portales, New Mexico. The Portales plant was constructed in 1985 and has the capacity to produce 30 million gallons of ethanol a year. As of March 2009, the Portales plant was temporarily idled, but the company says it plans to reopen when economic conditions allow.[152]

Algae

Algae is considered by many entrepreneurs and investors to hold great promise as an alternative to petroleum-based transportation and aviation fuels. Over $200 million in venture capital and government grants has been invested nationally in various algae company start-ups since 2007.

The use of algae as a feedstock for biofuel is particularly promising for New Mexico's climate and geography. Algae is estimated to have 30 times the amount of oil per acre of any agricultural crop, and it grows quickly, doubling itself every 3-4 hours. While one acre of soybeans can produce 60 gallons of ethanol, the same acre of algae can produce 6,000 – 10,000 gallons of biodiesel.[153] Algal material is also ideal for making specialty chemicals, food, medicinal products and cosmetics. Algae grown on 12% of New Mexico's land mass could theoretically produce all U.S. transportation fuel.[154]

The Center of Excellence for Hazardous Material Management and NMSU's Agricultural Science Center's algae to biodiesel fuel project is experimenting with saltwater algae growth in open ponds, using inexpensive desert land and extensive below-ground brackish and brine water supplies. This "commercial-sized" harvesting experiment does not compete with traditional agriculture for land and water, thus avoiding of the pitfalls of food-based ethanol production.[155]

Southern New Mexico and the El Paso area have drawn interest from companies hoping to create biofuel from algae. In 2008, Sapphire Energy of San Diego, purchased land in the Las Cruces industrial park to grow algae to make gasoline and jet fuel. The Las Cruces facility will have large ponds for growing algae, and the resultant oil, called green crude, will be refined just like crude taken from the ground.[156] As part of its agreement with the city of Las Cruces, Sapphire Energy committed to creating 30 jobs at 120 percent of the average salary for the area.[157]

Environmental and Regulatory Issues

Biomass

Although the combustion of biomass does release carbon dioxide, it is generally considered to be carbon neutral.

Biomass power plants require the use of water, because the boilers burning the biomass need water for steam production and for cooling. If this water is used over and over again, the amount of water needed is reduced.[158]

Biofuels

Since algae excels at converting CO2 into oxygen and energy feedstocks, algae farms could be co-located alongside major CO2 sources such as coal-fired power plants, refineries or cement plants. For example, 3.2 tons of CO2 could produce 1.75 tons of algae, which would in turn be used to produce over 160 gallons of biodiesel, over 200 gallons of ethanol and 2.25 tons of pure oxygen.[159]

Large scale algae farms are still experimental, so there is not yet experience with any potential public health or environmental problems associated with the practice. Where algae grows, mosquitoes tend to grow. Planners will need to address these and any other public concerns.[160]

BIOMASS/BIOFUELS: Policy Implications

Biomass power plants: Like coal-fired power plants, biomass facilities burn something to make energy. How do we ensure the new fuels do not create environmental issues of their own (such as deforestation)? State-of-the-art technology reduces the emissions from biomass plants, but is more expensive and, in some cases, may not even exist yet. How do top notch technologies get paid for? And, how much of that cost should be passed along to consumers?

Biofuels: The majority of biofuels (ethanol) currently comes from corn, a water-intensive food crop. How do we balance potentially conflicting environmental priorities (such as carbon reduction versus water conservation)? What about the displacement of agricultural land previously used for food? "Advanced" biofuels (such as those made from algae) do not displace food crops but they lack the existing infrastructure of the ethanol industry. How to overcome these challenges?

Taxes and subsidies: The Western Governors' Association and Sandia National Laboratories have both reported that policy incentives such as carbon taxes, excise tax credits and loan guarantees are important to driving the market for biofuels. The same argument can be made for biomass. To what degree should these types of incentives be advanced in New Mexico? With the growing interest in a wide range of renewables, how might lawmakers balance competing requests?

Where: Energy production can be messy business, literally. What policies should influence the locations of new businesses like algae farms or biomass power plants so that consumers are not affected by smells, insects, or other nuisances?

Geothermal Energy

Geothermal energy is mostly used for:
☑ Electricity generation
☑ Heating
☑Cooling
☐ Transportation

Global and National Context

Geothermal power is a reliable, consistently available (24 hours a day), energy source that creates electricity without emitting significant pollutants other than steam. Unlike power plants that use fossil fuels to boil water for steam, geothermal power plants use steam produced from reservoirs of hot water found below the Earth's surface.[161]

The U.S. is a world leader in geothermal energy, with 30% of the world total.[162] The largest group of geothermal power plants in the world is located north of San Francisco, creating enough electricity for 725,000 homes. Significant amounts of geothermal power are also produced in the Philippines and Iceland. However, geothermal power generates less than 1% of the world's total energy.[163]

The western region of the U.S. has the capacity to develop almost 5,600 megawatts of geothermal energy by about 2015, which could add nearly 10,000 full-time jobs plus construction employment. These geothermal power plants, ranging from 10 to over 200 megawatts depending upon the resource, could supply enough electricity to meet the needs of 10,000 to 200,000 homes. [164]

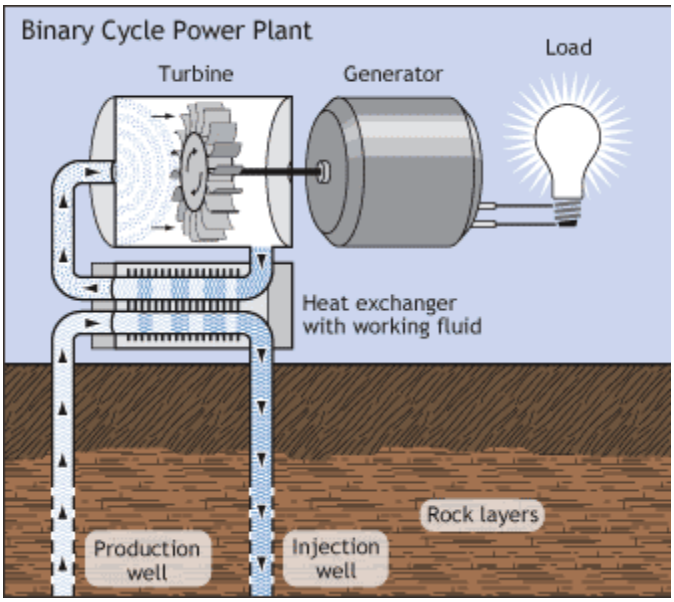


Figure 7: Binary Cycle Power Plant *(Source: U.S. Department of Energy)*

CASE STUDY: Animas, New Mexico

The very small community of Animas, located near Lordsburg, has natural geothermal resources. Two businesses utilizing those resources follow:

- Raser Geothermal broke ground in September 2008 for the state's first commercial power plant. The plant is projected to produce enough zero-emission electricity to power 6,000-8,000 homes. It has already secured contracts to sell at least part of the power to Phoenix.
- AmeriCulture, Inc. is a fish farm that produces Tilapia fish. It has 10-12 full-time employees and ships out seven million fish a year. The low cost of geothermal energy makes it possible for AmeriCulture to compete with Latin American growers, and their annual energy cost-savings compared to natural gas is about $240,000.

Sources: U.S. Department of Energy; Geothermal Energy Association; November 2008 interview with staff, Raser Technologies

New Mexico Description

New Mexico is one of seven states with geothermal electric power generation.[165] In the north-central region of the state, volcanic activity of the Valles Caldera in the Jemez Mountains has led to the occurrence of New Mexico's only known high-temperature geothermal system. Additional resources are concentrated in the western part of the state; there are six specific locations in New Mexico where the geological conditions make them suitable for geothermal power production.[166] Small-scale geothermal power plants (under five megawatts) have the potential for widespread application in rural areas.[167]

Geothermal energy can also be used to heat and cool buildings. "Ground source heat pumps" allow homes and businesses to tap into geothermal resources just 200-300 ft below the surface to provide constant indoor temperatures in summer and winter. For example, the 32 acre Burgett Geothermal Greenhouse complex in southwestern New Mexico is the largest geothermally heated greenhouse complex in the nation, producing 25 million roses a year and employing 90 people. The energy saved using geothermal is estimated at about $736,000 annually, as compared to using propane. Geothermal energy also provides heating for various commercial and public facilities, including homes and businesses in Gila Hot Springs.[168]

New Mexico State University conducted geothermal research that resulted in the development of a geothermal space-heating system that at one point heated up to 30 campus buildings, such

as dorms and athletic facilities. Sandia National Labs is also one of the three national laboratories working on geothermal research and development.[169]

Other possibilities for New Mexico include:

- A new proposal to generate up to 10 MW of geothermal electricity is being considered for the Fenton Hill area of the Jemez Mountains, and would use existing well heads that were drilled in the 1970's.
- Deep oil and gas wells can be also converted for geothermal power production.

Environmental and Regulatory Issues

Geothermal energy is one of the cleanest resources for generating electricity. But like all energy sources, it faces "siting" issues. The best geothermal resources are sometimes located at remote sites that may have significant wilderness, scenic or recreation value. While requiring relatively little land itself, the location of a geothermal plant may cause land impacts when new transmission lines are connected to power plants in these rural regions.[170]

The Western Governors' Association Geothermal Task Force made a series of recommendations to spur development of geothermal resources:

- Federal and state tax credits to reduce the risk and high capital cost of new projects, including making permanent (or extending by a decade) the federal production tax credit
- Promotion of power purchase agreements between developers and utilities, including incentives for utilities to enter into long-term contracts for geothermal power
- Ensuring that permitting, leasing, and environmental reviews are completed in a timely and efficient manner
- Continued support for state and local governments, tribes, and others seeking to utilize geothermal resources

GEOTHERMAL: Policy Implications

Tax credits and incentives: What would be the benefits and disadvantages of extending additional state tax credits and incentives, beyond Renewable Portfolio Standards, to spur development of geothermal electric power in New Mexico?

Water use: Even though geothermal consumes and discharges less water than fossil-fueled power plants, what impact would large scale geothermal electric power plants have on New Mexico's water supply? Should New Mexico only allow binary cycle plants that re-inject all the water back into the ground, or should water issues be addressed on a case-by-case basis?

Siting and permitting issues: What unintended consequences might emerge from streamlining the permitting processes for geothermal energy? What benefits? Since geothermal plants would most likely be sited in areas with sensitive wilderness, scenic, or recreational value, and would require transmission lines, what type of public hearings or other strategies might be called for?

Energy Efficiency and Delivery of Power

Energy Efficient Buildings

People think of energy efficiency and conservation as tools for saving energy, which is true, but few Americans see these strategies as actual "energy sources." That view is changing, with increasing numbers of utilities, businesses, policymakers, and individuals recognizing efficiency as a resource of its own. Experience across the country demonstrates that energy efficiency can be delivered to customers at less than half the cost of building and operating new power plants.

Energy efficiency means reducing the amount of energy needed to perform a particular task. When businesses or families practice energy efficiency, they increase or maintain their level of service while decreasing the energy used to provide that service. Examples include using Energy Star appliances, fluorescent light bulbs, better insulation for buildings, efficient windows, improved air conditioning equipment, or vehicles with better gas mileage.

Another distinct strategy is energy conservation, which means changing a behavior to reduce energy usage. Examples include car pooling, using mass transit, turning down the thermostat in the winter, or turning it up in the summer. Some conservation measures may require "sacrifices," but others may just be good habits, like turning off the lights or the computer. Public education efforts are critical to increasing energy conservation.

All of these types of strategies are "win-win" because they:[171]

- save money for consumers and businesses
- reduce the need for new power plants
- increase the reliability of the energy supply
- cut pollution
- lower energy imports

Wyoming Governor Dave Freudenthal said, "Energy efficiency and conservation represent a vast and still underutilized domestic energy resource. It is often said that the cheapest and cleanest watt is the one that we never have to produce."

The Western Governors' Association determined that if every western state adopted energy efficiency best practices, the need for new power plants in the region could be reduced by as much as 75% over the next 15 years, the equivalent of 100 new power plants. Estimates project a regional net economic gain of $53 billion from these energy efficiency practices.[172]

There are already concrete examples of money saved and jobs created through energy efficiency. For example, from 1972-2006, energy efficiency measures enabled California households to redirect money toward other goods and services, creating about 1.5 million jobs, driven by household energy savings of $56 billion.[173]

Buildings are responsible for about half of all U.S. energy consumption and carbon emissions annually.[174] Building operations alone (heating, cooling, lighting etc.) account for 43% of U.S. carbon emissions and over three-quarters of electricity consumption. The *Architecture 2030 Challenge*, a plan to cut greenhouse gas emissions in half by 2030, has been adopted by the U.S. Conference of Mayors, the National Association of Counties, the American Institute of Architects, the U.S. Green Building Council, the state of New Mexico, the cities of Santa Fe and Albuquerque, and many others.[175]

> *It is often said that the cheapest and cleanest watt is the one that we never have to produce.*
>
> --- Wyoming Governor Dave Freudenthal

The current federal administration also prioritizes energy efficiency in buildings. In a February 2009 speech, President Obama committed to modernizing most federal buildings and improving the efficiency of more than two million American homes. The President said that in addition to creating jobs, this plan would cut the federal energy bill by a third, save taxpayers $2 billion each year, and save Americans billions of dollars more on their utility bills.[176]

Compared with other states, New Mexico ranks 25th in energy efficiency.[177] Through a 2006 Executive Order by Governor Bill Richardson, as well as through 2007 state legislation, New Mexico has committed to achieving a 20% reduction in per capita energy use by 2020.[178]

In 2008, the Southwest Energy Efficiency Project analyzed 25 proposed policies for saving energy in New Mexico. Their study estimated that implementing all 25 would, by 2020, reduce energy use considerably (including a 24% reduction in electricity and a $7.2 billion net savings for citizens and businesses). Several priority strategies for the state are:[179]

- Low-income energy efficiency assistance
- Expanded energy efficiency for state agencies, local governments and schools
- Greener building codes
- Expanded electric utility and natural gas efficiency programs
- Public education campaigns
- Combined heat and power systems that generate electricity and also heat buildings
- Industry challenge and recognition programs

Other suggested energy efficiency options proposed by the state may pursue include: [180]

- adoption of innovative electricity rates to stimulate greater energy conservation
- adoption of a residential energy conservation ordinance to spur energy efficiency at the time a home is sold
- increased energy efficiency in the oil and gas sector
- incentives to stimulate purchase of more efficient cars
- acceleration of retirement of inefficient cars

New Mexico has already made a major investment in energy efficient buildings, with close to 200 projects either certified or seeking certification under the U.S. Green Building Council's LEED certification program.[181] There are state energy efficiency requirements for new construction or major renovation, and the cities of Albuquerque and Santa Fe have both developed green building codes. The state, cities and counties throughout New Mexico were recently awarded a total of almost $20 million in funding from the federal Energy Efficiency and Conservation Block Grant Program to improve energy efficiency within their communities.[182] The green building effort has also begun to create new green jobs in New Mexico. New Mexico's community colleges are implementing green building curricula to address the need for these new skill sets.

ENERGY EFFICIENCY: Policy Implications

Efficiency: Although energy efficiency saves money for customers and utilities, it may also cost more up front. Who will pay for energy efficiency? Should efficiency programs be optional or mandatory? What types of public awareness campaigns could be used? What will be the long-term energy costs to consumers of not retrofitting existing buildings and building new homes and businesses to be more energy efficient?

Jobs: Energy efficiency creates job opportunities, from manufacturing caulk, insulation and windows to installing those materials in people's homes. How can New Mexicans benefit from federal, state, and local governments' increasing investment in energy efficiency? How can we ensure that people are trained to do these jobs?

Building codes: Building codes dictate minimum requirements for designing and constructing buildings. As green building practices become more widely used, building codes must be changed, adding staffing and costs to already stretched local government budgets. Who will pay?

Utilities

Efficiency is just one of several issues facing New Mexico's large and small utilities. Most businesses and homes purchase their electricity from one of the following:

- PNM
- El Paso Electric
- Xcel Energy
- One of 19 rural electric cooperatives
- One of seven municipal utilities

Utilities are complex entities in that most are for-profit enterprises, but they are heavily regulated by the government. The big challenges facing utilities are affordability, reliability, environmental sustainability, and infrastructure investments.[183]

The following table illustrates some of the ways we use electricity; it does not include the entire state, but it provides a snapshot of typical energy usage.

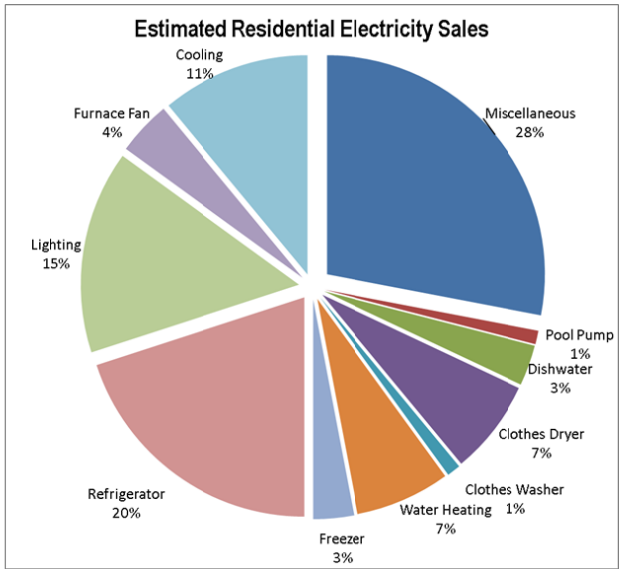


Figure 8: Source, PNM Electric Energy Efficiency Potential Study", Itron Consulting and Analysis, September 2006

Rate Cases[184]

Most utilities are natural monopolies, because it would be inefficient to have more than one set of power lines or natural gas pipelines in a given area. Because they are monopolies, their rates are set in New Mexico by the Public Regulatory Commission (PRC).[f] Utilities continually invest in infrastructure

[f] *Investor-owned utilities are regulated by the Public Regulatory Commission, as are rural electric cooperatives, while municipal utilities are not. Both investor owned utilities and rural electric cooperatives must comply with Renewable Portfolio Standards requirements.*

(power plants, transmission lines, distribution lines, etc.), with those investments prompted by aging technology, rising consumer needs, and legislation (such as New Mexico's Renewable Portfolio Standard requiring utilities to provide 20% renewable power by 2020.)[185] All these expenses are ultimately paid by the customer, through the rates they pay. Different rates are paid by commercial users and residential users. When a utility wants to change their rates in order to pay for the expenses above, it files a "rate case" with the PRC. The PRC must balance a utility's request for a "fair rate of return" on their infrastructure investments with the needs of consumers to have affordable power. Determining that "fair rate" is a contentious process. For example, advocates for low-income families worry about their constituents being able to afford higher rates. The Low Income Home Energy Assistance Program (LIHEAP) and the PNM Good Neighbor Fund are examples of programs to help low-income users pay their utility bills.[186]

Demand Response

Energy use patterns are based upon consumer behavior. Demand-side management (DSM) can reduce strains on the electricity grid during peak demand (high energy use) periods and help avoid the need to build more power plants to serve that peak demand. Currently, most electricity consumers are on flat, average rates that do not vary by time of day or season. "Demand response" technologies provide electricity consumers with information and incentives to reduce or shift their energy usage so that when energy demand is at its peak, they can, for example, adjust their thermostats, reduce lighting, or avoid doing laundry, thus saving energy and money on their utility bills.[187]

Transmission

Transmission is essentially how electricity moves from its source to the consumer. It may come as a surprise to many that transmission and distribution of electricity plays such a key role in the overall energy picture and to New Mexico's economic potential. We can build wind farms or large solar arrays, but without the right transmission lines to carry the power to urban areas, the energy does not get where it is needed.

Currently, the U.S. electric power grid consists of 164,000 miles of high-voltage transmission lines and more than 5,000 local distribution networks. This national transmission grid was originally designed to deliver cheap power to a broad population, and its basic structure is unchanged since the time of Thomas Edison. As regional monopolies and government agencies built mostly fossil-fueled power plants close to population centers, transmission and distribution networks were developed to deliver electricity to regional customers. By contrast, New Mexico's coal-fired power plants are located close to energy sources but far from population centers, requiring an extensive long-distance transmission network to deliver power within the state and for export.[188] There is widespread agreement that even without attempting to integrate renewable energy, the existing electrical transmission grid is already overburdened.[189]

Transmission versus Distribution

Power travels along *transmission* lines, carrying the power long distances from its source to a community. Then it gets picked up by *distribution* lines, which carry power locally to individual homes and businesses. Transmission lines might transport electricity from a southern New Mexico power plant to Phoenix, where the distribution lines would take over.

The distinction is important because each represents different policy problems. Transmission challenges might include how to build new power lines and where to put them, while distribution challenges might include technologies to make a particular community or home more energy efficient, and thus make local power go farther.

Renewable Energy's Impact on Transmission

We have already addressed a number of renewable energy sources in this report. However, none of those sources can meaningfully affect energy supply without major investments in the transmission infrastructure. In addition, 29 states, including New Mexico, have established goals to increase the use of renewable energy, and Congress is expected to adopt renewable energy goals. The President's 2009 economic stimulus package allocates $32 billion for transforming the nation's energy grid.[190]

National Smart Grid

Experts say the new grid must be "smart" and two-way rather than a one-way system, incorporating "demand response" technologies that allow customers to reduce their usage during peak times. Advantages of a Smart Grid include:[191]

- Reducing or holding down overall electricity costs
- Providing electricity customers with new information, technologies and tools to increase their energy efficiency practices and control their electricity bills
- Improving the reliability of the nation's power grid
- Increasing energy independence, enabling the U.S. to use more domestic renewable resources
- Reducing emissions during the peak period when older and less efficient power plants are used to meet high demand
- Nurturing American innovation in the energy sector
- Creating new skilled "green" jobs

NM's Green Grid

Creating the Smart Grid will require distinct efforts in every state. New Mexico's Green Grid Project dovetails with the national drive to create a Smart Grid while focusing specifically on bringing research and development, manufacturing, and venture capital investment to our state.[192]

The Green Grid Task Force, which includes over 50 diverse partners,[g] wants to make New Mexico a national leader in developing and demonstrating the next generation of transmission technologies that will effectively incorporate intermittent and variable renewable resources into the grid. The project is designed to be the first effort in the U.S. to fully integrate the electric grid infrastructure at all levels (distribution, commercial and residential).[193]

The cost for upgrading the nation's power grid will be paid by a mix of sources, including federal funds, state governments, and utilities – or in other words, taxpayers and rate payers. For example, experts estimate that generating 20% of U.S. electricity from wind will require a $60 billion investment in 12,650 miles of new "smart" transmission lines.[194]

Where to Put New Lines

Just as with most other energy issues, one of the biggest challenges facing the expansion and further development of the electric grid is *location, location, location.* As a state and a nation, we must decide where to put new power lines, and whose land must be crossed to do it. For states like New Mexico, where we have federal, state, and tribal lands – plus city, county, and private property – the issue is no small matter.

Federal law in 2005 required government agencies to begin identifying right-of-way corridors on federal land and researching land use management plans.[195] The Federal Energy Regulatory Commission (FERC) regulates transmission across state lines, but individual states retain control over whether and where major transmission lines actually get built. There is an increasingly lengthening queue to gain access to the electricity grid, for both large and small producers.[196] In 2007, FERC adopted changes to its decade old "open access transmission policy," to create more transparency and coordination in transmission planning, increase efficient use of transmission, and enable better access to the grid.[197] The Western Governors' association has encouraged public utility commissions to coordinate regionally and adopt policies to incentivize transmission expansion.[198]

RETA

Some of this work has already begun. New Mexico was among the first states to establish a Renewable Energy Transmission Authority (RETA) to work with the private sector and issue bonds to construct new transmission lines. RETA is essentially creating a funding structure so that our needed transmission lines can be built. Established in 2007, RETA is developing proposals for new transmission lines.[199]

The High Plains Express Transmission Project (HPX) is an initiative of seven electric utilities, three state agencies, and an independent transmission development company to expand and reinforce the transmission grid in the desert southwest and the Rocky Mountain states. The project will be integrated with existing generation and power delivery systems and coordinated with other regionally planned projects like the "Sun-Zia" transmission proposal for southern New Mexico and Arizona. The partners' goals for additional North-South and East-West transmission capability include: broadening markets for renewable energy, enhancing system reliability and connecting the states of Wyoming, Colorado, New Mexico, and Arizona to provide cost-savings opportunities for consumers.[200]

Decoupling

One proposal for helping to cover some of the costs for improving the nation's electrical grid is called *decoupling*. The concept affects large utilities, most of which earn much of their annual revenues from *selling* energy. The theory goes that utilities have a disincentive to promote energy efficiency because it reduces sales and thus their profits. Because many of the costs associated with Smart Grid upgrades will be paid for over decades by the utilities, some analysts argue that the industry needs a new rate structure that "decouples" energy sales from utility profits.

The structure would allow periodic consumer rate adjustments (up and down) to meet specific pre-determined revenue targets. Supporters argue that such a structure would stabilize utility revenues, enable them to make needed investments in the grid, and encourage greater energy efficiency. They believe this rate structure change would "unleash utilities to do greater amounts of demand side management."[201]

Utilities' reactions to decoupling are mixed. In response to New Mexico state legislation, utilities are already encouraging energy efficiency through various programs, recognizing that it is half as expensive to help consumers become more energy efficient than to build new power plants.[202] Decoupling would represent a very significant change to current rate-making principles.

[g] There are currently over fifty "Green Grid Partners", including Research and Development institutions such as Sandia Labs, LANL, UNM, NMT, NMSU, and SFCC; utilities such as PNM, Kit Carson, El Paso and Springer Electric; state agencies such as the governor's office, EDD, EMNRD, and RETA; regulatory and public agencies such as PRC and CCAE; and business, industry and venture capitalists such as Arch Venture, Emcore, Energy Control Inc., Intel, Mesa del Sol, and Schott Solar.

Storage

Energy storage is often described as key to effectively integrating intermittent renewable energy sources like solar and wind into the electric power grid. While it is natural to think that batteries or other storage systems are always needed in order to supply steady power, the power system essentially already has storage in the form of hydroelectric reservoirs, gas pipelines, and gas storage facilities that can provide energy when needed. Storing electricity is currently significantly more expensive than combining the use of solar and wind power with "dispatchable" power like hydroelectric and natural gas.[203] In addition, a Smart Grid combined with demand response strategies can help manage high demand.

New Mexico institutions working on energy storage issues include Sandia National Laboratories (with over 50 projects on this issue), Los Alamos National Laboratory, and the Navajos' Diné Power Authority.[204]

POWER DELIVERY: Policy Implications

- Higher utility costs: New Mexico and America cannot achieve renewable energy or efficiency goals without massive investments in infrastructure and the federal stimulus package will not be enough. A large portion of the expense will be paid by the utilities, which will affect their rates to consumers. To what degree are average consumers willing to pay higher utility rates? Up to 40% of New Mexicans live at or near the poverty level; to what degree can they pay more?
- Jobs: All of these new lines and equipment would need to be manufactured and installed, creating jobs and revenues. To what degree are these new jobs a motivator for investments in the electrical grid? What workforce training investments may be needed?
- Where to put new lines: Running new transmission lines, getting right of ways, and finalizing permits takes time and money. In some areas, needed new lines may be opposed because they affect people's views or the natural environment. How can the state juggle our various types of land ownership (federal, state, tribal, private, municipal), and the different regulations that come with each? At what environmental and social costs might New Mexico build the new lines? Are there actions that can help speed the process? Are there effective public process solutions for addressing these challenges?

Conclusion

By now it is clear that the issues affecting New Mexico's energy policies are complex and value-laden. The choices we make today as a state have the potential to bring enormous impacts to our future economy, environment, and way of life. As you read through the report, you probably found your own opinions reflected in some places and not others. That is expected and will stimulate interesting discussions during the town hall.

In New Mexico First town halls, the goal is to bring together a wide spectrum of people, with different opinions and points of view, and to help the group find the invisible consensus. We choose to unify New Mexicans by finding and focusing on the common ground.

During the town hall, *Growing New Mexico's Energy Economy,* you will take part in three days worth of discussions. By the end of the process, the entire group will have come to agreement on a smart set of recommendations for business people, communities, and policymakers. These recommendations should point to strategies the participants feel can make the biggest impacts.

What happens after the town hall?

Once the town hall is complete, some of the participants will spend 12-18 months trying to implement them, working with state and local officials, economic development professionals, the energy business community, and other New Mexicans. A list of policy outcomes from previous town halls is available at www.nmfirst.org.

Appendices

Appendix A: Energy Subsidies

The purpose of energy subsidies is to support activities that affect energy production, consumption, or conservation in ways deemed to be in the public interest. One example is supporting producers in bringing new technologies to market.[205] Federal energy-specific subsidies and support totaled $16.6 billion in 2007. Total energy subsidies have more than doubled since 1999, and that increase is distributed widely across all energy groups, including coal, oil, natural gas, nuclear, renewables, electricity and conservation.[206] Examples include:

- In FY 2007, wind power received subsidies and support valued at $23.37 per megawatthour (MWh), and refined coal and solar had even higher subsidies per MWh produced. Of traditional energy sources used for electricity production, coal received $854 million, nuclear received $1.267 million, and natural gas and petroleum liquids received $227 million. Since these traditional sources produce the most electricity, these subsidies and supports per unit of production range from between $0.25 and $1.69 per megawatthour.[207]

- Renewable energy subsidies have grown the most since 1999, and renewable energy received $4.9 billion in subsidies in 2007. In 2007 ethanol production received $3.0 billion, refined coal (chemically enhanced to reduce certain emissions) received about $2.4 billion, and there were $3.8 billion of conservation and end-use efficiency subsidies.[208]

- The oil and gas industries received 60% of the roughly $725 billion of federal energy subsidies between 1950 and 2006, with 46% going to the oil sector.[209] Federal tax concessions for oil and gas are the largest of all incentives, amounting to about 80% of all tax-related allowances for energy. Regulation of prices on oil from stripper wells or new wells comprises the second largest amount of incentives aimed at a particular energy type.[210]

- The majority (85%) of nuclear energy incentives are Research and Development funding. Since 1988, federal spending on nuclear energy R&D has been less than spending on coal research and, since 1994, has been less than spending on renewable energy research.[211]

- Federally funded regulation and Research and Development funding, at about 20% each, are the second- and third-largest incentives.

Federal and state government funding for clean-up of environmental damage from energy extraction or electricity production, as well as health problems related to working in these industries are forms of subsidies. Examples include:

- Two of New Mexico's previously operating uranium recovery facilities are Superfund sites under the Environmental Protection Agency's Superfund Program; decommissioning costs are approximately $60 million dollars.[212]

- The federal government paid out $577 million to uranium miners, millers, and ore transporters from April 1992 through June 30, 2007, as compensation for radiation exposure, under the Radiation Exposure Compensation Act of 1990.[213]

- The Black Lung Benefit Program provides compensation to coal miners who are totally disabled due to black lung disease and to eligible survivors.[214] As of the early 1990's half a million black lung victims had received the benefits and in 2008, benefits of $270,763 were paid out.[215] In 1980, the regional Miners' Colfax Medical Center Black Lung Program was founded by the federal government in Raton, New Mexico, and continues to provide outreach to miners with occupational black lung disease. In 2007, the Health Resources and Services Administration awarded the Miners' Colfax Medical Center Black Lung Clinic $255,193.[216]

Appendix B: State "Clean Energy" Incentives & Regulations[217]

Solar Market Development Tax Credit: works with the federal solar tax credit to pay up to 30% of recipients' solar photovoltaic (panels) or solar thermal system. Recipients can receive up to $2,000 in a federal tax credit and up to $9,000 in a state tax credit for your solar system.

Sustainable Building Tax Credit: encourages private sector design and construction of energy efficient, sustainable buildings for commercial and residential use. The tax credit is based on third-party validation of the building's level of sustainability.

LEED Certifications: provide tax credits for new homes that are built to be more energy efficient than standard building codes. Different levels of credit apply, depending on the level of built-in energy efficiency.

Biodiesel Blending Facilities Tax Credit: applies to the blending of biodiesel and is designed to assist the industry's preparation for the new requirement that, beginning in 2012, *all* diesel sold in-state will be "B5," meaning 5% biodiesel blended with 95% diesel fuel.

Solar Gross Receipts Tax Exemption: The Solar GRT exemption is available for the sale and installation of a solar energy system.

Hybrid Tax Exemption: provides one-time exemption from Motor Vehicle Excise Tax to buyers of hybrids. ($600-$1,000).

Energy Innovation Fund: designed to accelerate innovation development to enable faster commercial adaptation of clean energy technologies in New Mexico.

Clean Energy Projects: The Clean Energy Projects (CEP) program was established pursuant to legislation passed in 2004. The CEP provides grants on a competitive basis for clean energy projects to public entities including municipalities, counties, agencies, colleges, tribal governments, and public schools. Eligible clean energy projects include those related to renewable energy, energy efficiency in transportation or governmental buildings, and clean-burning transportation fuels such as compressed natural gas, ethanol and biodiesel.

Alternative Fuel Vehicle (AFV) Research and Development Tax Credit: provides a credit against combined reporting taxes (gross receipts, compensating, and withholding) for manufacturing alternative energy products, which include hydrogen and fuel cell vehicle systems, and electric and hybrid electric vehicles. The credit is limited to 5% of qualifying expenditures, and manufacturers must fulfill job creation requirements to be eligible.

Biofuels Tax Exemption: Under the Gross Receipts and Compensating Tax Act, the value of biomass materials used for processing into biofuels, biopower, or bio-based products may be deducted in computing the compensating tax due. Biofuels include biomass converted to liquid or gaseous fuels such as ethanol, methanol, methane, and hydrogen.

Biodiesel Fuel Production Tax Credit: provides tax incentives for production and sale of biodiesel in New Mexico provides a tax credit to a taxpayer who paid (or would have paid) the special fuel excise tax and files a New Mexico income tax or corporate income tax return. Participants are eligible to claim an income tax credit against tax liability for each gallon of blended biodiesel fuel. Blended biodiesel means at least two percent biodiesel used along with diesel fuel.

Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Grants: provides state grants for projects utilizing clean energy technologies and providing clean energy education, technical assistance, and training programs; qualifying entities are municipalities and county governments, state agencies, state universities, public schools, post-secondary educational institutions, and Indian nations, tribes and pueblos; no single entity is eligible to receive more than $100,000.

Energy Efficiency & Renewable Energy Bond Program: authorizes up to $20 million in bonds to finance energy efficiency and renewable energy improvements in state government and school district buildings.

Additional information is available in the Database of State Incentives for Renewables and Efficiency (DSIRE): www.dsireusa.org

Rules, Regulations and Policies

Renewable Portfolio Standards

- Investor-owned utilities: 20% of energy from renewable sources by 2020
- Rural electric cooperatives: 10%of energy from renewable sources by 2020

Mandatory Utility Green Power Option

New Mexico investor-owned utilities (IOUs) are required to offer a voluntary program for purchasing renewable energy to customers. IOUs are also required to develop an educational program communicating the benefits and availability of the green power option.

Appendix C: 2009 Energy Legislation (Passed)

Note: The following bills were signed by Governor Richardson in April. They may not represent a complete list of all newly passed energy-related laws.

HB 375: Certain Geothermal Heat Pump Tax Credits: (Rep. Gonzalez) Establishes a 30% income tax credit for ground-coupled heat pump systems up to a maximum credit of $9000/system. EMNRD certifies the systems and is limited to certifying no more than $2 million/year in tax credits.

HB 572: Solar Energy Improvement Special Assessment Act: (Rep. Egolf) Allows for counties to adopt "solar energy improvement special assessments" that can be used to finance solar energy improvements (photovoltaic and solar thermal) to a home or business. The special assessment is used to pay the loan on the improvement and stays with the property at time of sale of the home or commercial property.

HB 622: Green Jobs Act: (Speaker Ben Lujan) Authorizes the establishment of a "Green Jobs Fund" and directs the Higher Education Department to "develop a plan for the development of green jobs training programs…" The Green Jobs Fund will consist of funds received pursuant to the federal Green Jobs Act of 2007 and other sources.

SB 237: Renewable Energy Tax Credit: (Sen. Cisneros) Amends the existing Advanced Energy Tax Credit statute to make the 6% (of project development costs) credit more "accessible" to renewable energy developers – personal and corporate income taxes are added as types of taxes that can be used toward the credit and the carry forward period is extended from 5 to 10 years. Geothermal and solar photovoltaic systems are added to the types of advanced energy technologies that qualify for the credit.

SB 257: Solar Market Development Tax Credit: (Sen. Keller) The existing NM solar tax credit is a combined federal and state tax credit of 30%. The federal government recently amended the federal tax credit to a full 30% without the previous $2000 tax credit per system cap. SB 257 establishes a simple 10% state solar tax credit that is in addition to the now unrestricted federal 30% credit.

SB 288: Higher Education Alternative Energy Program Awards: (Sen. Garcia) Creates the Higher Education New Energy Development Fund for universities and colleges to develop programs in alternative energy and energy efficiency. The appropriation was removed from the bill.

SB 318: Green Jobs Development Training Funds: (Sen. Eric Griego) Allows the Industrial Training Board to spend up to $1 million of development training funds for the development of training in green industries.

SB 647: Renewable Energy Financing District Act: (Sen. Wirth). Permits cities and counties to form "Renewable Energy Financing Districts" in order to facilitate the funding of renewable energy improvements (including solar, wind, and geothermal heat pump systems). This would allow local governments (and homeowners who need to finance their renewable energy improvement) to take advantage of zero interest, tax free federal "Qualified Energy Conservation Bonds". The bonds are paid off via a special tax assessment for the renewable energy improvement.

SB 291: Sustainable Building Tax Credit Provisions: (Sen. Feldman) Amends the existing tax credit to: 1) clarify that manufactured and modular homes installed on a permanent pad qualify for the credit (even if manufactured out-of-state). 2) adds new Build Green New Mexico residential levels 3) allows EMNRD to categorize multi-family dwellings as "commercial" if the annual aggregate residential cap has been reached in a given year 4) allows non-profit organizations (such as affordable housing builders) to take the credit via transferability.

Appendix D:
Recommendations from Previous New Mexico First Town Halls

For each of the following town halls, a handful of relevant recommendations are summarized. Complete lists are available at www.nmfirst.org.

2006 Town Hall, Albuquerque, NM
Sustainability: A Town Hall on Albuquerque's Energy Future

1. Pursue and promote use of emergent technologies to generate energy from renewable resources, emphasizing waste to energy, landfill gas, geothermal and solar;

2. Promote the use of clean local energy in ways that match the generation of that energy;

3. Create opportunities for education and business development related to alternative energies including, but not limited to: work with state, TVI, workforce training, installers, manufacturers, small businesses and clustering based on scope and scale;

4. Educate existing and recruit skilled workforces necessary to staff related industries and business;

5. Overhaul zoning and land use codes to promote sustainability and develop building codes that incorporate the use of new technologies and green materials;

6. Adopt and achieve the goal of reducing greenhouse gas emissions citywide to 2000 levels by 2012, 10% below 2000 by 2020 and 75% below 2000 by 2050 by working with financial institutions to make energy efficiency and alternative energy technologies and green building techniques affordable and available for residences and commercial structures;

7. Expand the mission of the office of Economic Development to aggressively capture, support and nurture companies that implement the sustainable energy ideas coming out of both Labs; nurture entrepreneurs that are implementing sustainable energy ideas; help the city identify industries/employers to support sustainability goals – clean energy manufacturing, R & D, and companies specializing in renewable technologies, recyclables, energy efficiencies and new energy technologies – and pursue and recruit them with incentives;

8. Develop infrastructure for hydrogen, electric and emerging technologies to further reduce dependence on hydrocarbon fuels. Move toward zero net emissions by developing clean fuel sources for transportation, including transit;

2002 Statewide Town Hall, Carlsbad, NM
New Mexico's Energy, Economics and Environment

1. Appropriate interim legislative committees and institutes to ensure that the tax structures will foster growth of the energy industry and related manufacturing.
2. Prudently develop NM's renewable energy resources.
3. Prudently develop and provide incentives for production of alternative transportation fuels.
4. Foster existing energy industries, nurturing new energy industries, and developing energy-related industries.
5. Support development of a state energy plan, and undertake a comprehensive raw energy asset inventory.
6. Encourage the Governor to broaden and commit to an energy agenda that includes all energy sources and incorporates mitigation of adverse environmental impacts.
7. Encourage legislature to identify and appropriate funds to develop and implement the energy plan.
8. New Mexico should improve its citizens' understanding of the energy industry, related environmental concerns, and their interplay with the economy.

2000 Statewide Town Hall, Farmington, NM
New Mexico's Energy Future

1. New Mexico should aggressively pursue research in energy efficiency and alternative and renewable sources and their potential applications through grants and other incentives.
2. New Mexico should assess the appropriateness of current taxation on coal production to ensure that New Mexico's involvement in this area does not hinder the competitiveness of its companies in these energy markets.
3. New Mexico should investigate, without compromising or challenging tribal sovereignty, the negative effect of dual or multiple taxation against energy resource developers, producers, and distributors in situations involving energy on tribal or federal land.
4. New Mexico should ensure that its process for determining a company's access to its lands is both standardized and orderly.
5. New Mexico should develop policies to expand the use of its vast renewable resources to realize their economic and environmental benefits.
6. The New Mexico Economic Development Department should take steps to attract new enterprises that would use New Mexico energy resources or leverage energy resources in new ways to benefit the State's economy.
7. The legislature should appropriate, in the 2001 session, if not already provided in the year 2000, funds that will immediately be available to the NMPRC for consumer education.
8. The legislature should appropriate, in the 2001 session, if not already provided in the year 2000, funds that will immediately be available to the NMPRC to hire experts to study technical problems and other restructuring issues.
9. The executive and legislative branches of New Mexico State government should adopt appropriate tax incentives to foster responsible energy production and consumption.
10. State and federal procedures must ensure access to, development of, and distribution of energy and natural resources. Processes and rules should be streamlined and standardized and prevent anti-competitive practices.
11. The New Mexico First Town Hall recommends legislation supporting the Petroleum Technology Transfer Council and the Petroleum Recovery Research Center in their efforts to develop treatment of water from oil and gas wells.
12. The Town Hall recommends that the New Mexico Congressional Delegation convene a summit with representatives from the energy industries, the public, state, federal, and tribal governments and their respective regulatory bodies, to discuss issues such as rights-of-way (ROWs), procedures and regulations, and to promote the development and growth of the energy industry and other associated industries.
13. New Mexico should pursue cost-effective strategies to improve mass transit, especially in the central Rio Grande region, to minimize vehicular energy consumption and to reduce pollution from vehicular sources.

Appendix E: NM Energy Degree Programs/Courses

CNM (Albuquerque)
Electronics Technology
Engineering Design
Environmental Health and Safety
Environmental/Environmental Health Engineering
Solar Energy Technology/Technician
Biotechnology

Eastern New Mexico University (Portales)
Wildlife and Wildlands Science and Management

ENMU-Roswell

ENMU-Ruidoso
Natural Resources/Conservation, General

New Mexico Highlands University (Las Vegas)
Environmental Studies
Natural Resources Management and Policy
Forestry

New Mexico Institute of Mining and Technology (Socorro)
Environmental Science
Environmental/Environmental Health Engineering
Hydrology and Water Resources Science
Mining

New Mexico Junior College (Hobbs)
Water Quality and Wastewater Treatment Management and Recycling Technology
Environmental Engineering Technology/Environmental Technology
Environmental Control Technologies/Technicians
Radiological Control and Waste/Handling

New Mexico State University
Environmental Studies
Wildlife and Wildlands Science and Management
City/Urban, Community and Regional Planning
Environmental/Environmental Health Engineering
Environmental Health

NMSU Alamogordo
Engineering Technology
Environmental Science

NMSU-Doña Ana (Las Cruces)
Water Quality and Wastewater Treatment Management and Recycling Technology

NMSU Grants
Engineering Technology
Environmental Science

Northern New Mexico College (Española)
Greenhouse Operations and Management
Natural Resources/Conservation
Engineering
Environmental Science
Natural Resources Management and Policy
Solar Energy Technology/Technician
Biotechnology
Radiation Protection

San Juan College (Farmington)
Energy and Environmental Technology
Natural Resources/Conservation, General
Solar Energy Technology/Technician
Water Quality and Wastewater Treatment Management and Recycling Technology
Industrial Process Operator Program
Instrumentation and Controls Technology
Natural Gas Compression
Renewable Energy
Safety
Technology
Well Control

Santa Fe Community College
Natural Resources/Conservation, General
Water Quality and Wastewater Treatment Management and Recycling Technology
Environmental Technologies
General Engineering

Southwestern Indian Polytechnic Institute
Natural Resources

University of New Mexico (Albuquerque)
Environmental Studies and Sciences
Architecture
City/Urban, Community and Regional Planning
Environmental Design/Architecture
Water Resources Engineering
Environmental/Environmental Health Engineering

UNM-Gallup
Natural Resources/Conservation, General

UNM-Los Alamos
Engineering
Environmental Science

Western New Mexico University (Silver City)
Wildlife and Wildlands Science and Management

Appendix F: Energy Funding in 2009 Recovery and Investment Act (Federal Stimulus Package)

State Energy Program
- Description: States use grants to address energy priorities and program funding to adopt emerging renewable energy and energy efficiency technologies.
- $3.1 billion total federal funds, New Mexico will receive $31.6 million in formula funding
- Administrator: NM State Energy Office

Weatherization Assistance Program
- Description: Provides energy efficiency measures in the homes of qualifying homeowners free of charge. Purpose: To assist low-income families reduce their energy bills by making their homes more energy efficient.
- $5 billion total federal funds, with provisions for increase. New Mexico will receive $30.4 million in formula funding
- Administrator: New Mexico Finance Authority

Energy Efficiency and Conservation Block Grant (EECBG)
- Purpose: To reduce fossil fuel emissions, decrease overall energy consumption, Improve energy efficiency in the transportation, building, and other energy consuming sectors of the economies of eligible entities. Assists states and local governments in implementing strategies to reduce fossil fuel emissions created as a result of activities within the jurisdictions of the eligible entities and reduce the total energy use. Projects eligible to receive funding include: conducting residential and commercial building energy audits; establishing financial incentives programs for energy efficiency improvements; grants to non-profits organizations to perform energy efficiency retrofits; developing/implementing programs to conserve energy used in transportation; developing and implementing building codes and inspections services to promote building energy efficiency; installing light emitting diodes (LEDs); and developing, implementing, and installing on or in any government building onsite renewable energy technology that generates electricity from renewable sources.
- $3.2 billion total federal funds
- Agency: U.S. Department of Energy

Energy Efficiency and Renewable Energy (EERE)
- Programs: 10 energy programs, including the Biomass Program; Building Technologies Program; Federal Energy Management Program; Geothermal Technologies Program; Hydrogen, Fuel Cells & Infrastructure Program; Industrial Technologies Program; Solar Energy Technologies Program; Vehicle Technologies; Wind & Hydropower Technologies Program; and Weatherization & Intergovernmental Program. EERE's programs conduct activities in partnership with the private sector, state and local government, DOE national laboratories, and universities
- $16.8 billion federal funds
- Agency: U.S. Department of Energy

Biomass Program
- Activities: For research, development and demonstration for converting biomass resources to biofuels.
- $800 million total federal funds
- Agency: U.S. Department of Energy, Office: Energy Efficiency and Renewable Energy (EERE)

Geothermal Technologies Program
- Activities: Research, development and demonstration efforts that emphasize the advancement of enhanced geothermal systems.
- $400 million total federal funds
- Agency: U.S. Department of Energy, Office: Energy Efficiency and Renewable Energy (EERE)

Advanced Battery Manufacturing
- Purpose: For the manufacturing of advanced batteries and components; and to provide facility funding to manufacturers of advanced battery systems and vehicle batteries that are produced in the United States, including advanced lithium ion batteries, hybrid electrical systems, component manufacturers, and software designers. Competitive grants.
- $2 billion total federal funds
- Agency: U.S. Department of Energy, Office: Energy Efficiency and Renewable Energy (EERE)

Alternative Fueled Vehicle Pilot Grant Program
- Purpose: To establish a grant program through the DOE Clean Cities Program to encourage the use of plug-in electric drive vehicles or other emerging electric vehicle technologies. May be used for the acquisition of alternative fueled vehicles, fuel cell vehicles or hybrid vehicles, including buses for public transportation and ground support vehicles at public airports. The installation or acquisition of infrastructure necessary to directly support an alternative fueled vehicle, fuel cell vehicle, or hybrid vehicle project funded by the grant is also eligible. A competitive grant.
- Recipients: State governments, local governments, metropolitan transportation authorities, air pollution control districts, and private or nonprofit entities.
- $300 million total federal funds

- Agency: U.S. Department of Energy, Office: Energy Efficiency and Renewable Energy (EERE), Clean Cities Program

Transportation Electrification
- Description: To implement a grant program for qualified electric transportation projects that reduce emissions, including shipside electrification of vehicles, truck stop electrification, airport ground support equipment and cargo handling equipment.
- Recipients: States, local governments, and metropolitan transportation authorities.
- $400 million total federal funds
- Agency: U.S. Department of Energy, Office: Energy Efficiency and Renewable Energy (EERE)

Energy Efficient Appliance Rebate Program and Energy Star Program
- Approximately 15 states have appliance rebate programs currently operating to incentivize the purchase of energy efficient appliances. This program would add federal funds to increase the effectiveness of these programs and to encourage the remaining states to adopt similar programs. This will speed the rollout of appliances that will be able to take advantage of smart meters and spur consumer purchases of smart and energy-efficient appliances.
- $300 million total federal funds
- Administrator: New Mexico Energy, Minerals, and Natural Resources Department (NMEMNRD)

Smart Grid Investment Program
- Purposes: To modernize the electric grid, enhance security and reliability of the energy infrastructure, energy storage research, development, demonstration and deployment, and facilitate recovery from disruptions to the energy supply, and authorized purposes.
- Activities: For research and development, pilot projects, and federal matching funds for the Smart Grid Investment Program to meet the goal of a modern electric grid, enhance security and reliability of energy infrastructure, and facilitate recovery from disruptions to the energy supply. The Office of Electricity Delivery and Energy Reliability projects are planned and implemented in concert with partners from other Federal programs; electric utilities; equipment manufacturers; regional, state, and local agencies; national laboratories; and universities.
- $4.5 billion total federal funds
- Agency: U.S. Department of Energy

Fossil Energy Research and Development Program
- Description: Research and Development programs include pollution control innovations for traditional power plants, including mercury reduction; improved gasification technologies; advanced combustion systems; development of stationary power fuel cells; improved turbines for future coal-based combined cycle plants; and creation of a portfolio of technologies that can capture and permanently store greenhouse gases.
- Activities: Research and development (R&D) partnerships, cooperative R&D agreements, financial assistance, and contractual arrangements with universities and the private sector.
- $3.4 billion total federal funds
- Agency: U.S. Department of Energy, Office of Electricity Delivery and Energy Reliability

Science Program
- Description: The Office of Science manages fundamental research programs in basic energy sciences, biological and environmental sciences, and computational science.
- $1.6 billion total federal funds
- Agency: U.S. Department of Energy, Office of Science

Advanced Research Projects Agency (ARPA-E)
- Purposes: To support high-risk, high-payoff research to accelerate the innovation cycle for both traditional and alternative energy sources and energy.
- Eligibility as Authorized: Awards to institutions of higher education, companies, research foundations, trade and industry research collaborations, or consortia of such entities, which may include federally funded research and development centers.
- $400 million total federal funds
- Agency: U.S. Department of Energy

Glossary

Active Heating System: A solar water or space-heating system that moves heated air or water using pumps or fans.

Alternative-Fuel Vehicle (AFV): A vehicle designed to operate on an alternative fuel (e.g., compressed natural gas, methane blend, electricity). The vehicle could be either a vehicle designed to operate exclusively on alternative fuel or a vehicle designed to operate on alternative fuel and/or a traditional fuel.

Anthropogenic: Made or generated by a human or caused by human activity. The term is used in the context of global climate change to refer to gaseous emissions that are the result of human activities, as well as other potentially climate-altering activities, such as deforestation.

Barrel: A unit of volume equal to 42 U.S. gallons. One barrel weights 306 pounds or 5.80 million Btu of crude oil. Barrel is abbreviated as bbl.

Battery: An energy storage device made up of one or more electrolyte cells.

Biodiesel: An alternative fuel made by combining alcohol with any type of vegetable oil, animal fat, or recycled cooking grease. It can be used as an additive to diesel to reduce vehicle emissions or in its pure form as a renewable alternative fuel for diesel engines.

Bioethanol: An alcohol that is made by distilling the carbohydrates from crops such as corn, wheat, barley, rye, sugar beet, or sugar cane. Technology is being developed to allow ethanol to be made from the bulk of most plant matter.

Biofuels: Liquid fuels and blending components produced from biomass (plant) feedstocks, used primarily for transportation.

Biomass: Any organic (plant or animal) material which is available on a renewable basis, including agricultural crops and agricultural wastes and residues, wood and wood wastes and residues, animal wastes, municipal wastes, and aquatic plants.

Boiler: A tank in which water is heated to produce either hot water or steam that is circulated for the purpose of heating and power.

British thermal unit (Btu): The amount of heat required to raise the temperature of one pound of water one degree Fahrenheit; equal to 252 calories. British thermal unit is abbreviated as Btu.

Carbon Dioxide: A colorless, odorless noncombustible gas with the formula CO_2 that is present in the atmosphere. It is formed by the combustion of carbon and carbon compounds (such as fossil fuels and biomass) and by respiration, which is a slow combustion in animals and plants, and by the gradual oxidation of organic matter in the soil.

Carbon capture and sequestration: A process which takes CO_2 from power plants, oil refineries, and other industrial facilities and stores it underground in deep saline formations, depleted oil and natural gas reservoirs, or unmineable coal seams.

Climate Change: A term used to refer to all forms of climatic inconsistency, but especially to significant change from one prevailing climatic condition to another. In some cases, "climate change" has been used synonymously with the term "global warming"; scientists, however, tend to use the term in a wider sense inclusive of natural changes in climate, including climatic cooling.

Coal: A fossil fuel formed by the breakdown of vegetable material trapped underground without access to air.

Coal-Fired Power Plant: A power plant that uses coal as the fuel to generate electricity.

Compressed Natural Gas: A fossil fuel substitute for gasoline, diesel or propane fuel made by compressing natural gas.

Concentrating Solar Power: Concentrating solar power (CSP) technologies use mirrors to reflect and concentrate sunlight onto receivers that collect the solar energy and convert it to heat. This thermal energy can then be used to produce electricity via a steam turbine or heat engine driving a generator.

Conventional (or Traditional) Energy Sources: Oil, natural gas, coal and nuclear power.

Decoupling: A form of rate structure that decouples energy sales from utility profits. Decoupling breaks the link between the utility's ability to recover its agreed-upon fixed costs, including the profit margin, from the actual volume of sales that occur through a rate adjustment mechanism. If a utility promotes less energy use, they are rewarded rather than punished.

Demand-response technologies: Technologies that provide electricity consumers with information and incentives to reduce or shift their energy usage so that when energy demand is at its peak, they can, for example, adjust their thermostats, reduce

lighting, or avoid doing laundry, thus saving energy and money on their utility bills.

Demand-side management: Demand-side management can reduce strains on the electricity grid during peak demand (high energy use) periods and help avoid the need to build more power plants to serve that peak demand.

Depleted uranium: The byproduct of uranium enrichment is called depleted uranium (DU). Due to its high density, about twice that of lead, the main civilian uses of DU include counterweights in aircraft, radiation shields in medical radiation therapy machines and containers for the transport of radioactive materials. The military uses DU for defensive armor plate.

Dispatchable energy supply: A dispatchable energy supply is guaranteed or predictable 24 hours a day.

Distributed generation: Distributed energy refers to a variety of small, modular power generating technologies that can be combined with load management and energy storage systems to improve the quality and/or reliability of the electricity supply. They are "distributed" because they are placed at or near the point of energy consumption, unlike traditional "centralized" systems, where electricity is generated at a remotely located, large-scale power plant and then transmitted down power lines to the consumer.

Distribution Grid: For power to be useful in a home or business, it comes off the transmission grid and is 'stepped-down ' to the distribution grid. The place where the conversion from "transmission" to "distribution" occurs is in a power substation. A power substation has transformers that step transmission voltages (in the tens or hundreds of thousands of volts range) down to distribution voltages (typically less than 10,000 volts). It has a "bus" that can split the distribution power off in multiple directions, and often has circuit breakers and switches so that the substation can be disconnected from the transmission grid or separate distribution lines can be disconnected from the substation when necessary.

DOE: U.S. Department of Energy.

Drilling: The act of boring a hole (1) to determine whether minerals are present in commercially recoverable quantities and (2) to accomplish production of the minerals (including drilling to inject fluids). There are three types of drilling: exploratory - drilling to locate probable mineral deposits or to establish the nature of geological structures; such wells may not be capable of production if minerals are discovered; developmental - drilling to delineate the boundaries of a known mineral deposit to enhance the productive capacity of the producing mineral property; and directional - drilling that is deliberately made to depart significantly from the vertical.

Electricity Generation: The process of producing electric energy or the amount of electric energy produced by transforming other forms of energy, commonly expressed in kilowatthours (kWh) or megawatthours (MWh).

Electric Grid: The electric grid delivers electricity from points of generation to consumers, and the electricity delivery network functions via two primary systems: the transmission system and the distribution system. The transmission system delivers electricity from power plants to distribution substations, while the distribution system delivers electricity from distribution substations to consumers. The grid also encompasses local area networks that use distributed energy resources to serve local loads and/or to meet specific application requirements for remote power, village or district power, premium power, and critical loads protection.

Electric Power: The amount of energy produced per second. The power produced by an electric current.

Emission: A discharge or something that is given off; generally used in regard to discharges into the air. Or, releases of gases to the atmosphere from some type of human activity (cooking, driving a car, etc). In the context of global climate change, they consist of greenhouse gases (e.g., the release of carbon dioxide during fuel combustion).

Energy: The ability to do work or the ability to move an object. Electrical energy is usually measured in kilowatthours (kWh), while heat energy is usually measured in British thermal units (Btu).

Energy Consumption: The use of energy as a source of heat or power or as a raw material input to a manufacturing process.

Energy Conservation: Changing a behavior to reduce energy usage. Examples include car pooling, using mass transit, turning down the thermostat in the winter, or turning it up in the summer. Some conservation measures may require "sacrifices" but others may just be cultivating good habits, like turning off the lights or turning off the computer. Public education efforts are critical to increasing energy conservation.

Energy Efficiency: Reducing the amount of energy needed to perform a particular task. When businesses or families practice energy efficiency, they increase or maintain their level of service while decreasing the energy used to provide that service. Examples include using Energy Star appliances, fluorescent light bulbs, better insulation for buildings, efficient windows, improved air conditioning equipment, or vehicles with better gas mileage.

Federal Energy Regulatory Agency (FERC): The Federal government agency that regulates and oversees energy industries in the economic, environmental, and safety interests of the American public.

Federal Stimulus Package: The American Recovery and Reinvestment Act, a $787 billion plan proposed by President Obama and adopted by Congress in February of 2009, to "jump start" the economy and create jobs.

Fossil Fuels: Fuels (coal, oil, natural gas, uranium, etc.) that result from the compression of ancient plant and animal life formed over millions of years.

Fuel Cycle: The entire set of stages involved in the utilization of fuel, including extraction, transformation, transportation, and combustion.

Gallon: A measure of volume equal to 4 quarts (231 cubic inches). One barrel equals 42 gallons.

Gas: A non-solid, non-liquid (as hydrogen or air) substance that has no fixed shape and tends to expand without limit. Includes natural gas, coke-oven gas, blast furnace gas, and refinery gas.

Gasoline: A complex mixture of relatively volatile hydrocarbons with or without small quantities of additives, blended to form a fuel suitable for use in spark-ignition engines.

Generator: A device that turns mechanical energy into electrical energy. The mechanical energy is sometimes provided by an engine or turbine.

Generating Capacity: The amount of electrical power a power plant can produce.

Geothermal Energy: The heat energy that is produced by natural processes inside the earth. It can be taken from hot springs, reservoirs of hot water deep below the ground, or by breaking open the rock itself.

Global Warming: An increase in the near surface temperature of the Earth. Global warming has occurred in the distant past as the result of natural influences, but the term is today most often used to refer to the warming some scientists predict will occur as a result of increased anthropogenic emissions of greenhouse gases.

Greenhouse Gases: Gases that trap the heat of the sun in the Earth's atmosphere, producing the greenhouse effect. The two major greenhouse gases are water vapor and carbon dioxide. Lesser greenhouse gases include methane, ozone, chlorofluorocarbons, and nitrogen oxides

Grid-tied: Most homes or businesses that use distributed solar power are also connected to a utility. A "grid-tied" power system allows consumers to get part or all of their electric power from renewable sources while still being connected to the electric utility grid.

Groundwater Contamination: Groundwater contamination can occur during fossil fuels extraction or when man-made products such as gasoline, oil, road salts and chemicals get into the groundwater and cause it to become unsafe and unfit for human use. Some of the major sources of these products, called contaminants, are storage tanks, septic systems, hazardous waste sites, landfills, and the widespread use of road salts, fertilizers, pesticides and other chemicals.

Heating Equipment: Any equipment designed and/or specifically used for heating ambient air in an enclosed space. Common types of heating equipment include: central warm air furnace, heat pump, plug-in or built-in room heater, boiler for steam or hot water heating system, heating stove, and fireplace.

Hydroelectric Power Plant: A power plant that uses moving water to power a turbine generator to produce electricity.

Hydropower - Energy that comes from moving water.

Industrial Sector (of the Economy): The part of the economy having to do with the production of goods. The industrial sector is made up of factories, power plants, etc.

Infrastructure: Basic physical structures and organizational components of the operation of a society or enterprise such as roads, water supply, sewers, or power grids.

Intermittent energy supply: "Intermittency" is characteristic of wind energy, in that the wind does not always blow, or doesn't always blow when it is needed. Wind energy is most often combined with "dispatchable" (available 24 hours a day) power sources.

Kilowatt: A unit of power, usually used for electric power or to energy consumption (use). A kilowatt equals 1000 watts.

Kilowatthour(kWh): A measure of electricity defined as a unit of work or energy, measured as 1 kilowatt (1,000 watts) of power expended for 1 hour. One kWh is equivalent to 3,412 Btu or 3.6 million joules.

Megawatt: A unit of electrical power equal to 1000 kilowatts or one million watts.

Miles Per Gallon (MPG): A measure of vehicle fuel efficiency. MPG is computed as the ratio of the total number of miles traveled by a vehicle to the total number of gallons consumed.

Mineral Rights: A mineral right is a right to extract a mineral from the earth or to receive payment, in the form of royalty, for the extraction of minerals. Mineral rights are distinct from "surface rights," or the right to the use of the surface of the land for residential, agricultural, recreational, commercial, or other purposes. Mineral rights may be sold or retained separately from the surface rights, in which case the mineral rights are said to be "severed." The ownership of the mineral rights in a parcel can usually be determined by examining the deed abstract for the property.

Municipal Solid Waste (MSW): Residential solid waste and some nonhazardous commercial, institutional, and industrial wastes.

Natural Gas: An odorless, colorless, tasteless, non-toxic clean-burning fossil fuel. It is usually found in fossil fuel deposits and used as a fuel.

Nuclear Energy: Energy that comes from splitting atoms of radioactive materials, such as uranium.

Nuclear Regulatory Commission: The U.S. Nuclear Regulatory Commission (NRC) was created as an independent agency by Congress in 1974 to enable the nation to safely use radioactive materials for beneficial civilian purposes while ensuring that people and the environment are protected. The NRC regulates commercial nuclear power plants and other uses of nuclear materials, such as in nuclear medicine, through licensing, inspection and enforcement of its requirements.

Offshore Reserves and Production: Unless otherwise dedicated, energy source reserves and production that are in either state or Federal domains, located seaward of the coastline.

Oil: The raw material that petroleum products are made from. A black liquid fossil fuel found deep in the Earth. Gasoline and most plastics are made from oil.

OPEC: The Organization of Petroleum Exporting Countries organized for the purpose of negotiating with oil companies on matters of oil production, prices, and future concession rights. Current members (as of the date of writing this definition) are Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela. See OPEC's site at http://www.opec.org for more information.

Parabolic Trough: A type of solar concentrator collector that has a linear parabolic shaped reflector that focuses the sun's radiation on a receiver at the focus of the reflector.

Passive Heating System: A means of capturing, storing, and using heat from the sun.

Peak Load: The period of highest demand for power due to energy requirements of users on the electric power system; for example, hot summer days when air conditioning is being used. A peak load plant usually houses old, low-efficiency steam units, gas turbines, diesels, or pumped-storage hydroelectric equipment normally used during the peak-load periods.

Petroleum: Generally refers to crude oil or the refined products obtained from the processing of crude oil (gasoline, diesel fuel, heating oil, etc.) Petroleum also includes lease condensate, unfinished oils, and natural gas plant liquids.

Pipeline, Distribution: A pipeline that conveys gas from a transmission pipeline to its ultimate consumer.

Power-Generating Efficiency: The percentage of the total energy content of a power plant's fuel which is converted into electric energy. The remaining energy is lost to the environment as heat.

Power Plant: A facility where power, especially electricity, is generated.

Production of Oil and Gas: The lifting of oil and gas to the surface and gathering, treating, field processing (as in the case of processing gas to extract liquid hydrocarbons), and field storage.

Public Regulation Commission: The New Mexico Public Regulation Commission (PRC) regulates the utilities, telecommunications, motor carriers and insurance industries to ensure fair and reasonable rates, and to assure reasonable and adequate services to the public as provided by law.

Radiation: Any high-speed transmission of energy in the form of particles or electromagnetic waves.

Radioactive Waste: Materials left over from making nuclear energy. Radioactive waste can harm people and the environment if it is not stored safely.

Radioactivity: The property possessed by some elements, such as uranium, of giving off alpha, beta, or gamma rays.

Recycling: The process of converting materials that are no longer useful as designed or intended into a new product.

Refinery: An industrial plant that heats crude oil (petroleum) so that is separates into chemical components, which are then made into more useful substances. Refined petroleum products include but are not limited to gasoline, kerosene, distillates (including No. 2 fuel oil), liquefied petroleum gas, asphalt, lubricating oils, diesel fuels, and residual fuels.

Renewable Energy Certificates: Renewable Energy Certificates (RECs), also known as Green tags, Renewable Energy Credits, or Tradable Renewable Certificates (TRCs), are tradable environmental commodities in the United States which represent proof that 1 megawatt-hour (MWh) of electricity was renewable (generated from an eligible renewable energy source).

Renewable Energy Sources: Fuels that can be easily made or "renewed." We can never use up renewable fuels. Types of renewable fuels are hydropower (water), solar, wind, geothermal, and biomass.

Renewable Fuel Standard: The federal Renewable Fuel Standard (RFS) requires U.S. biofuel production to reach 36 billion gallons by 2022, with most of that provided by "advanced biofuels" (also called "second generation biofuels") that are not based on food crops.

Renewable Portfolio Standard: Along with 28 other states, New Mexico has adopted renewable portfolio standards (RPS), which require its utilities to provide customers with a certain percentage of energy generated from renewable sources. By 2020, 20% of electricity from investor-owned utilities (PNM, El Paso Electric and Xcel Energy) must be provided by renewables; rural electric cooperatives must meet a 10% renewable requirement by 2020. The Renewable Portfolio Standard also sets minimums for percentages of renewables that must be fulfilled by investor-owned utilities, including 20% of RPS from solar, 20% from wind, 10% from geothermal and biomass, and 3% from distributed renewables.

Residential Sector (of the Economy): The part of the economy having to do with the places people stay or live. The residential sector is made up of homes, apartments, condominiums, etc.

Rural electric cooperatives: A type of cooperative that provides electricity to its members. Profits are either reinvested back into infrastructure or distributed to members. Unlike investor-owned cooperatives which are proportional to the volume of stock a person owns, each customer has an equal share of ownership.

Short ton: A unit of weight equal to 2,000 pounds, often used to measure coal.

Smart grid: A smart grid delivers electricity from suppliers to consumers using digital technology to save energy, reduce cost and increase reliability. A smart grid is a two-way rather than a one-way system, incorporating "demand response" technologies that allow customers to reduce their usage during peak times.

Solar Energy: The radiant energy of the sun, which can be converted into other forms of energy, such as heat or electricity.

Solar Photovoltaic Cells: A device, usually made from silicon, which converts some of the energy from light (radiant energy) into electrical energy. Another name for a solar cell. the technology of converting sunlight into electricity. More commonly called "solar electric" and refers to solar paneling.

Solar Power Tower: The focusing of a large number of solar rays on a single source (boiler), usually located on an elevated tower, to produce high temperatures. A fluid located in or passed through the source changes into steam and used in a turbine generator to produce electrical energy.

Solar Thermal Heating System: Systems using concentrating collectors to focus the sun's radiant energy onto or into receivers to produce heat.

Space Heating: The use of energy to generate heat for warmth in housing units using space-heating equipment. The equipment could be the main space-heating equipment or secondary space-heating equipment.

Spent Fuel: Irradiated fuel that is permanently discharged from a nuclear reactor. Except for possible reprocessing, this fuel must eventually be removed from its temporary storage location at the reactor site and placed in a permanent repository.

Transmission Line: A set of conductors, insulators, supporting structures, and associated equipment used to move large quantities of power at high voltage, usually over long distances between a generating or receiving point and major substations or delivery points.

Transmission System (Electric): An interconnected group of electric transmission lines and associated equipment for moving or transferring electric energy in bulk between points of supply and points at which it is transformed for delivery over the distribution system lines to consumers or is delivered to other electric systems.

Turbine: A device with blades, which is turned by a force e.g. that of wind, water, or high pressure steam. The mechanical energy of the spinning turbine is converted into electricity by a generator.

Transportation Sector (of the Economy): The part of the economy having to do with the how people and goods are transported (moved) from place to place. The transportation sector is made up of automobiles, airplanes, trucks, and ships, trains, etc.

Uranium: A dense, weakly radioactive element. It is found throughout the natural environment, in varying but small amounts in rocks, soils, water, air, plants, animals and in all human beings. Uranium is used primarily in nuclear power plants and to produce nuclear weapons.

Uranium Enrichment: For the types of nuclear power plants used in the United States, uranium needs to be enriched to produce power. Natural uranium primarily contains two isotopes, U-238 (99.3 percent) and U-235 (0.7 percent). The concentration of U-235, the fissionable isotope in uranium, needs to be increased to 3 to 5 percent for practical use as a nuclear fuel. In a gas centrifuge enrichment plant, like the Uranium Enrichment Facility, gas centrifuges spin UF6 gas at high speeds creating a centrifugal force that separates the isotopes by forcing the heavier U-238 further outward in the centrifuge.

Uranium Fuel Cycle: The series of steps involved in supplying fuel for nuclear power reactors. It includes mining, refining, the making of fuel elements, their use in a reactor, chemical processing to recover spent (used) fuel, re-enrichment of the fuel material, and remaking into new fuel elements.

Utility Generation: Generation by electric systems engaged in selling electric energy to the public.

Waste Energy: Municipal solid waste, landfill gas, methane, digester gas, liquid acetonitrile waste, tall oil, waste alcohol, medical waste, paper pellets, sludge waste, solid byproducts, tires, agricultural byproducts, closed loop biomass, fish oil, and straw used as fuel.

Watt: A metric unit of power, usually used in electric measurements, which gives the rate at which work is done or energy used.

Well: A hole drilled in the earth for the purpose of (1) finding or producing crude oil or natural gas; or (2) producing services related to the production of crude or natural gas.

Wind: The term given to any natural movement of air in the atmosphere. A renewable source of energy used to turn turbines to generate electricity.

Wind Tower: Devices, some as tall as 120 feet, which lift wind turbine blades high above the ground to catch stronger wind currents.

Works Cited

(n.d.). Retrieved from Energy Information Administration: http://www.eia.doe.gov/oil_gas/natural_gas/info_glance/natural_gas.html

(n.d.). *Wind Power: Capacity Factor, Intermittency, and what happens when the wind doesn't blow?* University of Mass at Amherst: Renewable Energy Research Laboratory, Fact Sheet .

(n.d.).

(n.d.). *House Bill 305* . Utility Customer Load Management.

(n.d.). Retrieved from New Mexico Solar Energy Association : www.nmsea.org/Education/General/Sunpower_Intro.php

Is Uranium DOA? Official: HRI's Churchrock uranium project on hold. (2009, March 27). Gallup Independent.

20% Wind Energy by 2030; Increasing Wind Energy's Contribution to U.S. Electric Supply. (2008). Department of Energy.

(2000). *Carbon Dioxide Emissions from the Generation of Electric Power in the United States* . EOE, Environmental Protection Agency.

(2002, August). *Renewable Energy Development on Tribal Lands* . DOE Office ofEfficiency and Renewable Energy, Weatherization and Intergovernmental Program.

(2004). *The Economic Impact of Concentrating Solar Power in New Mexico* . University of New Mexico Bureau of Business and Economic Research.

(2005). *Transmission Task Force Report* . Western Governor's Association Clean and Diversified Energy Advisory Committee.

(2006). *Importance of Coal Production in New Mexico,* . New Mexico Bureau of Geology and Mineral Resources.

(2008, December). Bureau of Labor Statistics.

(2008, September 7). (M. t. Press, Interviewer)

(2008, December 1). Retrieved from Energy, Minerals and Natural Resources Department: http://www.emnrd.state.nm.us/ocd/documents/20091-1CurrentRules.pdf;

(2008, 17 December). *Annual Energy Outlook 2009 Early Release* . Energy Information Administration.

(2008). *International Energy Outlook* . Energy Information Administration.

(2008, August). *Cruces to Be Site of Major Algae-to-Oil Project,* . Las Cruces Sun-News; www.sapphireenergy.com .

(2008, August). *U.S. Geothermal Power Production and Development Update* . Geothermal Energy Association.

(2008, October 20). *New Mexico Energy Efficiency Strategy: Policy Options* . Southwest Energy Efficiency Project (SWEEP), prepared for the New Mexico Energy, Minerals and Natural Resources Department.

(2008, June). *High Plains Express Feasibility Study Report* .

2008 Annual Rankings Report. (2008, April). Retrieved from American Wind Energy Association : http://www.awea.org/AWEA_Annual_Rankings_Report.pdf

2008 State Energy Efficiency Scorecard . (2008, October). American Council for an Energy-Efficient Economy.

(2009, March). *Short Term Energy Outlook* . Energy Information Administration.

(2009, February 27). *International Status and Prospects of Nuclear Power* . International Atomic Energy Agency; http://www.iaea.org .

(2009, February 25). *Uranium Project* . World Information Service on Energy, http://www.wise-uranium.org, online listing updated.

(2009, April 1). *Gas Plant Planned Near Hobbs* . Albuquerque Journal.

(2009, March 9). *Interview with Michael McDiarmid, New Mexico Energy* . Minerals and Natural Resources Department.

(2009, March 9). *Interview with Michael McDiarmid, New Mexico Energy* . Minerals and Natural Resources Department.

(2009, March 20). *Bingaman obtains funding for Roswell-based projects* . Roswell Daily Record.

(2009, March 30). *Feds award energy efficiency grants* . The Santa Fe New Mexican.

77 Percent Cleaner. (n.d.). (American Coalition for Clean Coal Electricity) Retrieved from America's Power: http://www.americaspower.org/The-Facts/77-Percent-Cleaner

Aerated Lagoons and Stabilization Ponds. (n.d.). Retrieved from http://water.me.vccs.edu/courses/ENV149/stabilization.htm

Algae harvesting advances in New Mexico. (2008, July 15). Retrieved from CEHMM-Carlsbad, New Mexico State University: http://www.cehmm.org/2008/07/algae-harvesting-advances-in-new-mexico/

American Coalition for Clean Coal Energy. (2009). Retrieved from www.americaspower.org/The-Facts/Factoids

American Recovery and Reinvestment Act of 2009. (2009). Retrieved from http://appropriations.house.gov/pdf/RecoveryBill01-15-09.pdf

(2005-2007). *Annual Coal Reports.* Energy Information Administration.

Annual Coal Reports. Mt = million short tons, Average Price = $28.29 per ton. (2005-2007). Energy Information Administration.

Arizona Public Service Company Resource Plan Report. (2009, January 29). p. 155.

Average annual production. (2006-2008). NM Taxation & Revenue Department's ONGARD system.

Baker, D. (2009, March 26). *Supreme Court ruling a blow to regulating oil, and gas* . Farmington Daily Times.

Battocletti, L. (2006, May). *The Economic, Environmental and Social Benefits of Geothermal Use in New Mexico* . Bob Lawrence & Associates.

Bingaman, S. J. (2008, March 27). *Biodiesel and the New Renewable Fuel Standard Statement* . for the New Mexico Biodiesel Policy Summit.

Bingaman, S. J. (2008). Energy Independence and Security Act of 2007 provisions relating to alternative fuels such as, Renewable Fuels Standard (RES), and Energy Security through increased production of Biofuels. Edison Electric Institute.

Biomass Energy Basics. (2008, July 25). Retrieved from National Renewable energy Laboratory: http://www.nrel.gov

Biomass Task Force Report. Western Governor's Association.

BLM Identifies Lands for Potential Development of Significant Oil Shale Resources, Press Release. (2008, September 4). Bureau of Land Management.

Bowles, T. (2008, November). *Green Grid Overview* .

Brancard, B. (2009, February 19). (M. a. Energy, Interviewer)

Brooks, B. (2009, March). Louisiana Energy Services.

Bryan, S. M. (2009, March 18). New Mexico Energy Secretary Testifies Before Congress. Associated Press.

(January 2008). *Building An Energy-Efficient Future.* Western Governors' Association.

Case Against Desert Rock Follows a Divided Trail. (2009, April 4). Santa Fe New Mexican.

Compton, K. T. (2008, April 25). The Energy Challenge We Face and The Strategies We Need, Senator Jeff Bingaman. *Massachusetts Institute of Technology* . published online at http://bingaman.senate.gov.

Connecting the Dots: The Oil and Gas Industry's Influence on New Mexico Politics. (2009, January). Common Cause New Mexico, .

Cost of Installed Solar Photovoltaic Systems Drops Significantly Over the Last Decade. (2009, March 3). Retrieved from ScienceDaily: http://www.sciencedaily.com

Crown Point Site . (2008, November 21). Retrieved from Nuclear Regulatory Commisioin: http://www.nrc.gov/info-finder/materials/uranium/licensed-facilities/crown-point.html

Daniel Fine, P. (2007, March 8). Oil Shale: Toward a Strategic Unconventional Fuels Supply Policy. *Heritage Foundation Lecture Series* .

Distributed Generation. (2009). Retrieved from Solar Buzz: http://www.solarbuzz.com/DistributedGeneration.htm

DOE/ESPE Current Projects 2008. (2008). *Energy Storage and Power Electronics Systems Research Program* . Sandia National Laboratories.

Egolf, S. B. (n.d.). House Bill 219. 49th New Mexico State Legislature.

EIA In Brief. (n.d.). *How dependent are we on foreign oil?*

Electricity from Biomass . (2000). Retrieved from Power Scorecard Electricity: www.powerscorecard.org/tech_detail.cfm?resource_id=1

EMNRD Annual Report. (2008). Retrieved from Energy, Minerals and Natural Resources Department: http://www.emnrd.state.nm.us/main/documents/EMNRD-Annual-Report-2008.pdf

Energy Assistance Programs. (n.d.). Retrieved from New Mexico Resources: htttp://www.newmexicoresources.org/area_assistance.cfm?pageID=14&MainPage='yes'

Energy Information Administration. (2008, June 23). Annual Energy Review.

Energy Kid's Page. (n.d.). Retrieved from Energy Information Administration: http://www.eia.doe.gov/kids/energyfacts/sources/non-renewable/naturalgas.html

Energy, Electricity and Nuclear Power Estimates for the Period to 2030. (2008). International Atomic Energy Agency, 2008.

Environment: What is biodiesel? (n.d.). Retrieved from Biodiesel Advanced Research and Development, LLC: , http://www.bardllc.com/environment.htm

(2008). *Estimated from demand management savings reported* . Energy, Minerals and Natural Resources Department .

Expected Uranium Recovery Facility Applications / Restarts / Expansions. (2009, March 11). Retrieved from http://www.nrc.gov/info-finder/materials/uranium/2008-ur-projects-list-public.pdf

Facts About Wind Energy and Noise. (n.d.). American Wind Energy Association .

Factsheet Biomass Incineration The Burning Issues. (2000, March). Retrieved from Energy Justice Network: http://www.energyjustice.net/biomass/

Fast Facts About Coal. (n.d.). Retrieved from National Mining Association: http://www.nma.org/statistics/fast_facts.asp

Fast Solar Energy Industry Facts. (2009, March). Retrieved from Solar Buzz: http://www.solarbuzz.com/FastFactsIndustry.htm

FERC Reforms Open Access Transmission Orders. (2007, February 21). Retrieved from North American Wind Energy Association: http://www.nawindpower.com/e107_plugins/content/content.php?content.473

Frequently Asked Questions. (n.d.). Retrieved from NM EMNRD: http://www.emnrd.state.nm.us/ecmd/RenewableEnergy/WindFAQs.htm

Ft. Bayard Biomass Heating Project. (n.d.). Retrieved from Energy, Minerals and Natural Resources Department: www.emnrd.state.nm.us/emnrd/biomass/projects.html#Heating

Geothermal Energy Basics. (2008, November 7). Retrieved from National Renewable Energy Laboratory : www.nrel.gov

Geothermal Electricity Production. (2008, July 25). Retrieved from National Renewable Energy Laboratory: http://www.nrel.gov/learning/re_geo_elec_production.html

Geothermal Task Force Report. Western Governor's Clean and Diversified Energy Initiative.

Gilliland, F. D., Hunt, W. C., Pardilla, M. M., & Key, C. R. (2000, March). Uranium Mining and Lung Cancer Among Navajo Men in New Mexico and Arizona, 1969 to 1993. *Journal of Occupational and Environmental Medicine: Volume 42(3)* , 278-283.

Gottlieb, L. S., & Husen, L. A. (April 1982). *Lung cancer among Navajo uranium miners* (Vol. 81). No.4 p.449-452: Chest.

Governor Bill Richardson Signs Historic Climate Change Executive Order. (2006, December 28).

Griscom, D. (2008, March 28). New Mexico Regional Development Corporation.

(2008). *Gross Receipts by Industry,monthly reports.* NM Tax and Revenue Department's Report-80.

Groups Plan Suit Over Oil Shale Development. (2009, January 7). Santa Fe New Mexican.

Growing Oil : CEHMM Algae Biodiesel Project. (2008). Retrieved from Center of Excellence for Hazardous Materials Management: http://www.cehmm.org/category/algae-biofuel/

(2008). *Hard Truths: Facing the Hard Truths About Energy, National Petroleum Council, 2007.* International Energy Agency.

Homestake. (2008, October 31). Retrieved from Nuclear Regulatory Commision: http://www.nrc.gov/info-finder/decommissioning/uranium/homestake.html

Insitute, A. P. (Ed.). (December, 2008). Energy Backgrounder.

Integration Technology Assessment and Support. (n.d.). Retrieved from Sandia National Laboratories: http://www.sandia.gov/wind/ITAS.htm

Johnson, B. (2009). Estimates for Calendar year 2009 . *Energy conservation* . NM Energy, Minerals and Natural Resources Department .

Jones, J. M. (2009, March 13). Americans on Energy: Promote Both New Sources and Old. *Gallup Poll* .

Juan Tafoya uranium mill project in McKinley County. (2008, March 25). Retrieved from Uranium Project: http://www.wise-uranium.org/upusanm.html#JUANTAFOYA

Kutscher, C. F. (2000, June 16-21). *The Status and Future of Geothermal Electric Power.* Retrieved from National Renewable Energy Laboratory: http://www.nrel.gov/docs/fy00osti/28204.pdf

Leadership in Energy and Environmental Design Green Building Rating System (LEED). (2008). Retrieved from US Green Building Council: http://www.usgbc.org

Learning About Renewable Energy: Biofuels. (2008, July 25). Retrieved from National Renewable Energy Laboratory: http://www.nrel.gov

LES's Flawed Waste Disposal Plan. (n.d.). Retrieved from Public Citizen: http://www.citizen.org/documents/FSLESWasteDisp0805.pdf

Libby, C. (n.d.). Central Solar Power for the Southwest. Electric Power Research Institute.

Lillywhite, J., & Starbuck, C. M. (2008, August 5). The Economic Impact of New Mexico's Oil and Gas Industry. p. 6.

Locations of Uranium Recovery Facilities. (2008, December 29). Retrieved from Nuclear Regulatory Commision: www.nrc.gov/info-finder/materials/uranium

Manatt, J. (2009, March 19). New Mexico's Fossil Energy Future: An Industry Perspective. (p. a. University, Interviewer)

Mariotte, M. (2002, September 9). Retrieved from Nuclear Information and Resource Service: http://www.nirs.org/factsheets/lesanduraniumenrichment.htm;

Miller, K., & Homans, R. (2009, February 13). Testimony to Department of Finance and Administration (by Cabinet Secretaries). *Mid-Session Revenue Estimate Update* . New Mexico Senate Finance Committee.

New Mexico Climate Change Advisory Group Final Report. (2006, December).

(January 2008). *New Mexico Fact Sheet: Energy Efficiency & Energy Consumption.* Southwest Energy Efficiency Project.

New Mexico Higher Education Department Update. (2009, February 3). http://hed.state.nm.us.

New Mexico Needs a Less Volatile Energy Policy. (2009, February 16). New Mexico Independent.

New Mexico Questions Desert Rock Fish Impact. (2009, April 2). Gallup Independent.

New Mexico State Energy Profile. (2009, March). Energy Information Administration. .

Obama, B. (Performer). (2009, February 5). *Presidential Remarks.* US Department of Energy Staff.

Peach, J., & Popp, A. V. (2008, August). The Economic Impact of Proposed Uranium Mining and Milling Operations in the State of New MexicoArrowhead Center. NMSU Arrowhead Center.

Policy Recommendations for the Obama Administration and the 111th Congress. (2008, November 24). Demand Response and Smart Grid Coalition.

Power, T. M. (2008). An Economic Evaluation of a Renewed Uranium Mining Boom in New Mexico. Economics Dept, University of Montana, prepared for the New Mexico Environmental Law Center, www.nmenvirolaw.org. .

Public Notice. (n.d.). Retrieved from Environmental Protection Agency: http://www.epa.gov/region09/air/permit/desert-rock/docs/Final124-19cPublicNoticeDesertRock.pdf

Radiation Exposure Compensation Act: Program Status. (2007, September 7). United States Government Accountability Office, http://www.gao.gov/new.items/d071037r.pdf.

Radiation Exposure Screening and Education. (n.d.). *Health Resources and Services Administration* . http://ruralhealth.hrsa.gov/radiationexposure/.

Renewable Energy in New Mexico. (2008, October). Retrieved from New Mexico Public Regulations Commision: http://www.nmprc.state.nm.us/renewable.htm

Renewable Energy Resources: Hydropower. (2003-2004). Retrieved from Energy Minerals Natural Resources Department: http://www.emnrd.state.nm.us/MAIN/documents/SER1_electricity.pdf

Renewables Portfolio Standard . (2008, December 12). Retrieved from DSIRE: http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NM05R&state=NM&CurrentPageID=1

Richardson, G. B. (2009, February 18). Proposes Modifications to New Mexico's Oil Field Pit Rule.

Rio Algom - Ambrosia Lake. (2008, October 31). Retrieved from Nuclear Regulatory Commision: http://www.nrc.gov/info-finder/decommissioning/uranium/rio-algom-ambrosia-lake.html

Roland-Holst, D. (October 2008). *Energy Efficiency, Innovation and Job Creation in California.* U.C. Berkeley.

Sardella, M. (2007). *Biomass-Fired District Energy: A Source of Economic Development and Energy Security* . Local Energy.

Schmit, R. (2009, March 25). *CleanSwitch* .

Solar Energy and Utilities. (2009). Retrieved from Solar Buzz: http://www.solarbuzz.com

Solar Task Force Report. (2006). Western Governors' Association Clean and Diversified Energy Initiative.

Standlee, C. (2009, March 10). *conversation with Chris Standlee, Executive Vice President of Abengoa Bioenergy Corporation.* Retrieved from http://www.abengoa-bioenergy.com

(2006). *State Energy Data System.* Energy Information Administration.

States Four Major Utilities Partner on Solar Project. (2008, June 30). Retrieved from PNM: States Four Major Utilities Partner on Solar Project, June 30, 2008, http://www.pnm.com/news/2008/0630_rfp.htm

Sterba, J. (2007, October 29). Energy: Its Future in a Global Economy, Slide 9. PNM Resources.

Strathmore Receives Permit to Drill Roca Honda Project in New Mexico. (2007, May 14). Retrieved from Strathmore minerals Corp.: http://www.strathmoreminerals.com/s/NewsReleases.asp?ReportID=186411&_Title=Strathmore-Receives-Permit-to-Drill-Roca-Honda-Project-in-New-Mexico

SUNPOWER: The Earth's largest energy resource. (n.d.). Retrieved from New Mexico Solar Energy Association: http://www.nmsea.org/Education/General/Sunpower_Intro.php

Survey:Most new jobs come from small businesses. (2008, July 30). http://www.CNNMoney.com.

Talbot, D. (2009, January-February). *Lifeline for Renewable Power* . Technology Review.

Tanaka, N. (2008, November 12). International energy Agency.

(April 2008). *The 2030 Blueprint.* Architecture 2030.

The Cheapest Clean Power You Can Buy, An Introduction to Utility-Interconnected Solar Electricity . (2002). Retrieved from Positive Energy: http://www.positiveenergysolar.com/gisys.html

The Desert Rock Energy Facility: A Cleaner Coal Power Plant. (n.d.). Retrieved from Environmental Protection Agency: http://www.epa.gov/region09/air/features/desert-rock/;

(2006). *The Economic Impacts of Coal Utilization and Displacement in the Continental United States.* Penn State University.

The National Enrichment Facility and Louisiana Energy Services. (2006, June 30). Retrieved from Concerned Citizens for Nuclear Safety: http://www.nuclearactive.org/docs/LESindex.html

The Water Information Program Newsletter. (2009, March). *Southwestern Water Conservation District* . http://www.waterinfo.org/uranium-mining.

Tribal Energy Program . (2008, May 8). Retrieved from Department of Energy: http://apps1.eere.energy.gov/tribalenergy/projects_detail.cfm/project_id=33#status

Tri-State plans 30-MW solar plant in New Mexico. (2009, March 24). New Mexico Business Weekly.

U.S. EPA Water Resource Use. (n.d.). Retrieved from Environmental Protection Agency: http://www.epa.gov/cleanrgy/energy-and-you/affect/water-resource.html.

U.S. Wind Energy Projects . (2008, December 31). Retrieved from American Wind Energy Association: http://www.awea.org/projects

using EIA Statistics. (n.d.). Retrieved from New Mexico Oil and Gas Association website.

Utility Solar Assessment Study: Reaching Ten Percent Solar by 2025. (2008). CleanEdge/Co-op America.

Water Resource Use. (2007, December 28). Retrieved from Environmental Protection Agency: http://www.epa.gov/cleanrgy/energy-and-you/affect/water-resource.html

Water Science for Schools: Mining Water Use. (n.d.). *USGS* . http://ga.water.usgs.gov/edu/wumi.html.

Water Use and Sustainable Development in Coal Mining: A Case Study from Central Queensland. (2003). http://www.bowenbasin.cqu.edu.au/pdfs/waterusesota.pdf.

Wind and Reliability Fact Sheet. (n.d.). Retrieved from American Wind Energy Association: http://awea.org/utility/pdf/Wind_and_Reliability_Factsheet.pdf

Wind Energy and Birds/Bats Workshop. (2004). American Wind Energy Association and American Bird Conservancy.

Wind Energy Grows by Record 8300 MW in 2008. (2008, January 29). American Wind Energy Association.

Witcher, J. (2002). *Geothermal Energy in New Mexico* . NMSU Southwest Technology Development Institute, .

World Energy Outlook. (2008). International Energy Agency.

Endnotes

[1]Guest column, *Albuquerque Journal*, August 2008.

[2] (Daniel Fine, 2007)

[3] Taken from the IPAA website. www.ipaa.org

[4] (Jones, 2009)

[5] (Bureau of Labor Statistics, 2008, seasonally adjusted figures)

[6] (Miller & Homans, Testimony to Department of Finance and Administration by Cabinet Secretaries, 2009)

[7] (Obama, 2009)

[8] (Meet the Press 2008)

[9] (Compton Lecture, 2008)

[10] (20% Wind Energy by 2030; Increasing Wind Energy's Contribution to U.S. Electric Supply, 2008)

[11] (Lillywhite & Starbuck, 2008)

[12] (Water Use and Sustainable Development in Coal Mining: A Case Study from Central Queensland, 2003)

[13] (The Water Information Program Newsletter, 2009); (Water Science for Schools: Mining Water Use)

[14] Taken from corporate websites of PNM, El Paso Electric; Xcel Power; Tristate GT

[15] (Most new jobs come from small businesses, 2008)

[16] (New Mexico Higher Education Department Update, 2009)*Governor Bill Richardson Releases Details of Green Jobs Cabinet,* January 22, 2009; *New Mexico Wired Implementation Plan, http://www.dws.state.nm.us/pdf/NMWIREDplan2-28-08.pdf*

[17] (Griscom, 2008)

[18] Oil & gas: (Average annual production, 2006-2008)

Coal: U.S. Energy Information Administration Annual Coal Reports. Mt = million short tons, Average Price = $28.29 per ton, 2005-2007

Renewables: (Johnson, 2009) (Estimated from demand management savings reported , 2008)

[19] Coal: U.S. Energy Information Administration Annual Coal Reports, 2005-2007

[20] Oil & Gas and Coal and Nuclear Uranium: N.M. Taxation and Revenue Department, RP-80 Gross Receipts by Industry,monthly reports, 2008

[21] Oil & Gas: N.M. TRD ONGARD system average annual value during FY 2006 – 2008.

[22] State Energy Data System, 2006 U.S. Energy Information Administration

[23] (World Energy Outlook, 2008)

[24] (Hard Truths: Facing the Hard Truths About Energy, National Petroleum Council, 2007, 2008)

[25] (Manatt, 2009)

[26] (EIA In Brief, *How dependent are we on foreign oil?* Consumption rates from 2007.)

[27] (*Annual Energy Review* (AER) Energy Information Administration, June 23, 2008)

[28] (*Energy Backgrounder*, Aperican Petroleum Insitute, December 2008; www.api.org)

[29] (BLM Identifies Lands for Potential Development of Significant Oil Shale Resources, Press Release, 2008)

[30] (Groups Plan Suit Over Oil Shale Development, 2009)

[31] (Lillywhite & Starbuck, 2008)*;* (using EIA Statistics)

[32] (Tanaka, 2008)

[33] Taken from the Energy Information Administration

[34] (Lillywhite & Starbuck, 2008); www.emnrd.state.nm.us/ocd/Statistics.htm

[35] (Lillywhite & Starbuck, 2008)

[36] (Energy Information Administration)

[37] (Tanaka, 2008)

[38] (Short Term Energy Outlook, 2009); (President/CEO Providence Technologies, 2009)

[39] (Energy Kid's Page)

[40] (New Mexico State Energy Profile, 2009)

[41] (New Mexico State Energy Profile, 2009)

[42] (Lillywhite & Starbuck, 2008)

[43] (Lillywhite & Starbuck, 2008)

[44] (Lillywhite & Starbuck, 2008)

[45] (New Mexico Needs a Less Volatile Energy Policy, 2009)

[46] *(Richardson, 2009)*

[47] http://www.co.santa-fe.nm.us/oilandgas/

[48] (Connecting the Dots: The Oil and Gas Industry's Influence on New Mexico Politics, 2009)

[49] www.emnrd.state.nm.us/ocd/Statistics.htm

[50] (Baker, Associated Press, 2009)

[51] (Senator Egolf)

[52] (Bryan, 2009)

[53] (International Energy Outlook, 2008); (Annual Energy Outlook 2009 Early Release, 2008); (Hard Truths: Facing the Hard Truths About Energy, National Petroleum Council, 2007, 2008)

[54] (Fast Facts About Coal)

[55] (International Energy Outlook, 2008); (Annual Energy Outlook 2009 Early Release, 2008); (Hard Truths: Facing the Hard Truths About Energy, National Petroleum Council, 2007, 2008)

[56] (New Mexico State Energy Profile, 2009)

[57] www.sourcewatch.org; (Importance of Coal Production in New Mexico,, 2006)

[58] (The Economic Impacts of Coal Utilization and Displacement in the Continental United States, 2006)

[59] (Energy, 2009)

[60] Energy information Administration, www.eia.doe.gov/fuelelectric.html

[61] (U.S. EPA Water Resource Use)

[62] Email communication with BHP Billiton, March 2009.

[63] (Brancard, 2009); www.epa.gov/radtown/coal-plant.htm, April 2006

[64] (Carbon Dioxide Emissions from the Generation of Electric Power in the United States, 2000)

[65] (77 Percent Cleaner)

[66] www.nrdc.org; Alliance for Climate Protection; League of Conservation Voters; National Wildlife Federation; Natural Resources Defense Council; Sierra Club

[67] Western Governors' Association Clean and Diversified Energy Initiative, *Advanced Coal Task Force Report*

[68] (New Mexico Questions Desert Rock Fish Impact, 2009); (Case Against Desert Rock Follows a Divided Trail, 2009)

[69] (The Desert Rock Energy Facility: A Cleaner Coal Power Plant); (Public Notice)

[70] (International Status and Prospects of Nuclear Power, 2009)

[71] *U.S. Nuclear Reactors,* Energy Information Administration; *Status of Potential New Nuclear Reactors in the United States,* Energy Information Administration

[72] (Energy, Electricity and Nuclear Power Estimates for the Period to 2030, 2008)

[73] (Arizona Public Service Company Resource Plan Report, 2009)

[74] (U.S. EPA Water Resource Use)

[75] (Peach & Popp, 2008)

[76](Is Uranium DOA? Official: HRI's Churchrock uranium project on hold, 2009)

[77] (Peach & Popp, 2008)

[78] (Power, 2008)

[79] (Radiation Exposure Compensation Act: Program Status, 2007)

[80] (Radiation Exposure Screening and Education)

[81] (Is Uranium DOA? Official: HRI's Churchrock uranium project on hold, 2009)

[82] (Gottlieb & Husen, April 1982)

[83] (Gilliland, Hunt, Pardilla, & Key, 200)

[84] (Rio Algom - Ambrosia Lake, 2008)

[85] (Uranium Project, 2009)

[86] (Expected Uranium Recovery Facility Applications / Restarts / Expansions, 2009)

[87] (Homestake, 2008)

[88] http://www.wise-uranium.org/upusanm.html#GRANTSRIOGR

[89] (Crown Point Site , 2008)

[90] (Locations of Uranium Recovery Facilities, 2008)

[91] (Juan Tafoya uranium mill project in McKinley County, 2008)

[92] (Strathmore Receives Permit to Drill Roca Honda Project in New Mexico, 2007); (Expected Uranium Recovery Facility Applications / Restarts / Expansions, 2009)

[93]Corporate website of URENCO Group, the owners of LES. www.urenco.com

[94] Ibid.

[95] Email communication from LES corporate office, February 2009.

[96] (LES's Flawed Waste Disposal Plan); (The National Enrichment Facility and Louisiana Energy Services, 2006)

[97] (Mariotte, 2002)

[98] (Brooks, 2009)

[99] (Gas Plant Planned Near Hobbs, 2009)

[100] (Renewables Portfolio Standard , 2008)

[101] (New Mexico's Natural Resources, 2003-2004)

[102] Renewables: Estimates for Calendar year 2009 provided by Brian Johnson, N.M. EMNRD

[103] Gross receipts tax revenue from sale of renewable power at retail, estimated by the authors.

[104] (Wind Energy Grows by Record 8300 MW in 2008, 2008); (20% Wind Energy by 2030; Increasing Wind Energy's Contribution to U.S. Electric Supply, 2008)

[105] (20% Wind Energy by 2030; Increasing Wind Energy's Contribution to U.S. Electric Supply, 2008)

[106] (2008 Annual Rankings Report, 2008)

[107] (Interview with Michael McDiarmid, New Mexico Energy, 2009)

[108] (U.S. Wind Energy Projects , 2008)

[109] (2008 Annual Rankings Report, 2008)

[110] (2008 Annual Rankings Report, 2008)

[111] (2008 Annual Rankings Report, 2008)

[112] (EMNRD Annual Report, 2008); (Frequently Asked Questions)

[113] (Interview with Michael McDiarmid, New Mexico Energy, 2009)

[114] (Integration Technology Assessment and Support)

[115] (Wind Power: Capacity Factor, Intermittency, and what happens when the wind doesn't blow?)

[116] (20% Wind Energy by 2030; Increasing Wind Energy's Contribution to U.S. Electric Supply, 2008)

[117] (Facts About Wind Energy and Noise)

[118] (Wind Energy and Birds/Bats Workshop, 2004)

[119] (Utility Solar Assessment Study: Reaching Ten Percent Solar by 2025, 2008)

[120] (Utility Solar Assessment Study: Reaching Ten Percent Solar by 2025, 2008)

[121] (Solar Task Force Report, 2006)

[122] (New Mexico Solar Energy Association)

[123] (EMNRD Annual Report, 2008)

[124] (SUNPOWER: The Earth's largest energy resource)

[125] (The Cheapest Clean Power You Can Buy, An Introduction to Utility-Interconnected Solar Electricity , 2002)

[126] Claudia Pavel, Randy Sadewic, Allan Sindelar, Positive Energy Solar, March 24, 2009 interview.

[127] (Cost of Installed Solar Photovoltaic Systems Drops Significantly Over the Last Decade, 2009)

[128] (Solar Energy and Utilities)

[129] (Fast Solar Energy Industry Facts, 2009)

[130] (EMNRD Annual Report, 2008)

[131] Taken from State of New Mexico Department of Finance website

[132] National Renewable Energy Laboratory, Resource Assessment Program, Solar Map, NREL Solar Map

[133] (States Four Major Utilities Partner on Solar Project, 2008)

[134] (Libby)

[135] (Tri-State plans 30-MW solar plant in New Mexico, 2009)

[136] (Schmit, 2009)

[137] *Expanding Use of Solar Energy Creates U.S. Jobs,* Solar Energy Industries Association, *www.seia.org/galleries/pdf/Navigant%20Consulting%20Report%209.15.08.pdf*

[138] (The Economic Impact of Concentrating Solar Power in New Mexico, 2004)

[139] (Tribal Energy Program , 2008)

[140] (Tribal Energy Program , 2008)

[141] (Renewable Energy Development on Tribal Lands, 2002)

[142] (Biomass Energy Basics)

[143] (Electricity from Biomass , 2000)

[144] (Factsheet Biomass Incineration The Burning Issues, 2000)

[145] (Ft. Bayard Biomass Heating Project)

[146] (Bingaman obtains funding for Roswell-based projects , 2009)

[147] (Biomass Task Force Report)

[148] (Learning About Renewable Energy: Biofuels, 2008)

[149] (Learning About Renewable Energy: Biofuels, 2008)

[150] (Bingaman, 2008)

[151] 90 Billion Gallon Biofuel Deployment Study, Sandia National Laboratories,www.sandia.gov/news/resources/releases/2009/biofuels_study.html

[152] (Standlee, 2009)

[153] New Mexico Ecopedia, www.nmecopedia.com, (Center of Excellence for Hazardous Materials Management)

[154] (Bingaman, Biodiesel and the New Renewable Fuel Standard Statement , 2008)

[155] (Algae harvesting advances in New Mexico, 2008)

[156] (Cruces to Be Site of Major Algae-to-Oil Project, 2008)

[157] (Cruces to Be Site of Major Algae-to-Oil Project, 2008)

[158] (Water Resource Use, 2007)

[159] (Environment: What is biodiesel?)

[160] (Aerated Lagoons and Stabilization Ponds)

[161] (Geothermal Electricity Production, 2008)

[162] (U.S. Geothermal Power Production and Development Update, 2008); (Geothermal Energy Basics, 2008)

[163] (World Energy Outlook, 2008)

[164] (Geothermal Task Force Report)

[165] (U.S. Geothermal Power Production and Development Update, 2008)

[166] (Geothermal Task Force Report)

[167] (Geothermal Electricity Production, 2008)

[168] (Witcher, 2002); (Battocletti, 2006)

[169] (Witcher, 2002); (Battocletti, 2006)

[170] (Kutscher, 2000)

[171] (New Mexico Fact Sheet: Energy Efficiency & Energy Consumption, January 2008)

[172] (Building An Energy-Efficient Future, January 2008)

[173] (Roland-Holst, October 2008)

[174] (The 2030 Blueprint, April 2008)

[175] (The 2030 Blueprint, April 2008)

[176] (Obama, 2009)

[177] (2008 State Energy Efficiency Scorecard , 2008)

[178] (Governor Bill Richardson Signs Historic Climate Change Executive Order, 2006); (New Mexico Climate Change Advisory Group Final Report, 2006)

[179] (New Mexico Energy Efficiency Strategy: Policy Options , 2008)

[180] (New Mexico Energy Efficiency Strategy: Policy Options , 2008)

[181] (Leadership in Energy and Environmental Design Green Building Rating System (LEED), 2008)

[182] (Feds award energy efficiency grants, 2009)

[183] (Sterba, 2007)

[184] *Rate Making 101 and Special Low Income Rates*, presentation by Dr. Tom McGuckin, New Mexico State University

[185] (Renewable Energy in New Mexico, 2008)

[186] (Energy Assistance Programs)

[187] (Policy Recommendations for the Obama Administration and the 111th Congress, 2008)

[188] (Talbot, 2009)

[189] (Talbot, 2009)

[190] (American Recovery and Reinvestment Act of 2009, 2009)

[191] (Policy Recommendations for the Obama Administration and the 111th Congress, 2008)

[192] (Bowles, 2008)

[193] Ibid.

[194] (20% Wind Energy by 2030; Increasing Wind Energy's Contribution to U.S. Electric Supply, 2008)

[195] (Talbot, 2009)

[196] (Talbot, 2009)

[197] (FERC Reforms Open Access Transmission Orders, 2007)

[198] (Transmission Task Force Report, 2005)

[199] Taken from NMRETA website. www.nmreta.org

[200] (High Plains Express Feasibility Study Report, June 2008, 2008)

[201] (Building An Energy-Efficient Future, January 2008)

[202] (House Bill 305)

[203] (Wind and Reliability Fact Sheet)

[204] (DOE/ESPE Current Projects 2008, 2008) (Macinnes, 2009)

[205] *Energy In Brief,* Energy Information Administration, September 8, 2008

[206] *Federal Financial Interventions and Subsidies in Energy Markets 2007;* http://www.eia.doe.gov/oiaf/servicerpt/subsidy2/pdf/execsum.pdf

[207] *Energy in Brief,* Energy Information Administration, September 8, 2008

[208] *Energy in Brief,* Energy Information Administration, September 8, 2008

[209] *Federal energy incentives have chiefly benefited oil, natural gas industries; nuclear, renewables lag,* Roger Bezdek, Management Information Services, www.energybulletin.net

[210] Ibid.

[211] *Federal energy incentives have chiefly benefited oil, natural gas industries; nuclear, renewables lag,* Roger Bezdek, Management Information Services, www.energybulletin.net

[212] http://www.epa.gov/superfund/sites/npl/nm.htm; www.nrc.gov/info-finder/materials/uranium; http://www.nrc.gov/info-finder/decommissioning/uranium/homestake.html

[213] *Radiation Exposure Compensation Act: Program Status,* United States Government Accountability Office,Sept 7, 2007, http://www.gao.gov/new.items/d071037r.pdf

[214]Black Lung Disability Trust Fund, Employment Standards Administration, http://www.dol.gov/dol/budget/2008/PDF/CBJ-2008-V2-05.pdf ExpectMore.gov, Black Lung Benefits Program, http://georgewbush-whitehouse.archives.gov/omb/expectmore/summary/10001098.2003.html; http://www.ssa.gov/policy/docs/statcomps/supplement/2008/blacklung.html;

[215] *The Nation; Coal Miners Contend Their Plight is Worsening,* New York Times, March 17, 1991

[216] Miners' Colfax Medical Center website, http://minershosp.com/Outreach/index.html

[217] *DSIRE: Incentives by State: Incentives in New Mexico,* www.dsireusa.org; http://www.emnrd.state.nm.us/ECMD/LawsRegulationsExecutiveOrders; 2009 Clean Energy Economy-Related Legislation Adopted by the New Mexico State Legislature and Signed by Governor Richardson, April 9, 2009