

New Mexico's Energy, Economics and Environment

**Background Report for the
29th New Mexico First Town Hall
Carlsbad, New Mexico
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A division of
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Executive Summary

This Background Report focuses on energy in New Mexico in its relationship to two vital elements: economic development and the environment. None of these elements can be separated from the other two completely; thus each has to be considered in the context of the others.

Part I of the Background Report focuses on the primary and secondary energy industries of New Mexico: coal, oil, natural gas, and electricity. Statistics of production and usage are presented, as are quick sketches of each industry, its current state, and regulatory problems. Next, the current status of renewable energy in New Mexico is reviewed. The report also looks at electricity industry restructuring in New Mexico, though currently on hold until 2007, and implications of rulemaking at the national level. Finally, Part I reviews the current status of domestic energy security and how changes might be effected to enhance it.

Part II deals with the economic aspects of energy in New Mexico, beginning with a discussion of sustainable development including energy issues in long-range planning for communities and planned communities, including the State Land Office's Mesa del Sol, southwest of Albuquerque. Next, Part II considers how it is not only cheap power but reliable utilities that currently are attractive to industry, as well as other qualities that New Mexico has to offer industries looking to relocate. The issue of restructuring and economic development is examined, including the need for more transmission and the concerns of rural electric cooperatives and municipal utilities in a restructured environment. Then, Part II considers the impact of regulation and its economic impact on energy industries, including the problem of rights-of-way and the cost of environmental protection. Two different scenarios for oil and natural gas development are offered, with widely varied outcomes. The impact of technology-based energy development is also assessed. Next, Part II discusses possible ways in which renewable energy might become cost-effective; economies of scale, technological breakthroughs, incentives, and the use of distributed generation. Finally, quality of life issues with regard to economic growth are considered. Ways of measuring the quality of life and three brief examples of land use conflict, or, examples of how "quality of life" can conflict with energy development are presented. Finally, views on land use compromise from the recent *Decisionmakers* conference are offered.

Part III is concerned with the environment as energy development affects it, beginning with the acknowledgement that energy/economic development has a cost for the environment and that energy activities frequently conflict with environmental protection. Next, current issues in air, water, and surface protection are reviewed and examples of environmental problems, with solutions, for each industry are presented in connection with these regulations.

Part IV of the Background Report deals with maximizing economic gain and minimizing environmental risk. Several tools that industry uses to this purpose are reviewed: waste minimization programs, integrated resource planning and environmental management systems.

Next, the Background Report lists a number of different incentives that are used, both to help protect the environment and stimulated energy production: federal and state renewable energy tax credits; the coalbed methane production incentive; cap-and-trade incentives and emissions-trading credits; and performance-based regulation incentives for utilities. Model legislation is briefly discussed and finally, the Report reviews a number of measures other states have taken: state renewable energy programs; a “green” building program in Austin, Texas; a low-emission coal gasification power plant in Indiana; the Texas Railroad Commission’s waste prevention program, the Oklahoma Energy Resource Board (a voluntary oil and natural gas producers’ organization), and North Dakota’s wind energy development efforts.

Introduction to the Background Report

This Background Report was prepared for the 29th New Mexico First Town Hall, which is the second Town Hall on New Mexico's energy. The 24th Town Hall, and the first to deal with energy, entitled, "New Mexico's Energy Future," was held just a little more than two years ago, on June 1–4, 2000. It dealt with a broad range of energy topics that affect the state. We saw then that the energy scene in New Mexico was entering a time of change, and that there were things to be done: the challenge identified in that Town Hall was how best to use New Mexico's abundant energy resources to best advantage, economically, efficiently, and in an environmentally-friendly manner.

The 24th Town Hall had a number of recommendations for the Implementation Team to carry out. The Team was successful in effecting the following:

- Energy Efficiency and Conservation, as well as other clean energy initiatives, have been formally added to the New Mexico Green Zia Environmental Excellence Program. First Green Zia applicants with focus on energy management have applied.
- House Bill 405 (Public Facility Energy Efficiency Act) Signed into Law – related to performance contracting for energy efficiency in public buildings.
- House Bill 293 (Navajo Coal Sales Gross Receipts Tax Credit) Signed into Law
- Energy Summit Proposal supported by New Mexico Congressional Delegation and Public Regulation Commission
- Senate Appropriations Subcommittee on Energy and Water Development increased fiscal year 2001 budget for renewable energy resources by \$53.6 million over fiscal year 2000 expenditures.
- New Mexico Alternative Energy Symposium was conducted in December 2000 relating to renewable energy development. The New Mexico Sustainable Energy Collaborative, consisting of both public and private sector entities, has been established with the intent to pursue incentives to develop renewable energy projects.
- The New Mexico Energy, Minerals and Natural Resources Department (EMNRD) and Sandia National Laboratories (SNL) have jointly established Wind and Geothermal Working Groups in New Mexico to facilitate "... the aggressive pursuit of research, development, and demonstration projects..." in these areas.
- ENMRD is working with the President-elect of NMOGA, Cliff Brunson, requesting an industry task force to identify aging infrastructure and develop solutions. If rule making is involved, then a work group will be formed consisting of industry, public interest groups and the Oil Conservation Division (OCD). Task force should be created by the end of August.

- NM Tech has received a DOE grant and matching funds from the state to research treatment of water produced from oil and gas wells.
- OCD is conducting an in-depth review of its regulatory requirements and business processes for oil and gas wells. The OCD review team will complete the first phase of its work in September. At that point, the team will submit a report that will include draft rule changes, lists of recommended data elements for various applications and reports, and diagrams of proposed internal business processes. The team will then seek the participation of BLM and other agencies, as well as industry, in the development of a proposal for submission to the Oil Conservation Commission.
- OCD's portion of the EMNRD budget requests for FY02 was approved essentially in full. On the federal level, the energy legislation working its way through Congress contains increased funding for resource management planning and other BLM functions.

In view of these impressive accomplishments, it would seem that little more needed to be achieved. However, many events have taken place over the past two years. There are significant changes at the national level either imminent or already occurring, that will affect New Mexico, as they will all the states. Legislation for a National Energy Policy is now before Congress, which, if passed, could affect every energy industry in all producing states. The Clear Skies Initiative, the Administration's plan to introduce flexible, multipollutant cap-and-trade programs for the electricity generation industry, is also before Congress. The restructuring of the wholesale electricity power market is moving ahead, even in the face of serious problems such as those that occurred in California, one of the first states to deregulate. The Federal Energy Regulatory Commission (FERC) is moving towards the assumption of federal control of all electricity transmission in the face of state uncertainty. Changes in regulation could mean a breakthrough for renewable energy resources, and for distributed generation, two energy alternatives that haven't been able to significantly penetrate the market as yet. And finally, there were the terrorist attacks of September 11, 2001, which forever changed the way we see ourselves as a nation. One of the things we are seeing more clearly now is our energy vulnerability.

This Background Report focuses on energy to look at its interplay with two vital elements: economic development and the environment. None of these elements can be separated from the other two completely; readers will see how all three twine together so that each has to be considered in the context of the others.

Part I. Energy Production, Consumption, Transmission, Regulation

Introduction

New Mexico, rich in energy resources, is an important supplier of energy to the US. In 2001, we ranked fourth in natural gas production, fifth in crude oil production, and thirteenth in coal production. We also supply our own energy needs from this production. Coal-fired power provides by far the most of our electrical generation.

Environmental concerns have grown over the years, and the extractive industries have developed progressively less intrusive means of extraction to meet these concerns. New technologies that reduce both production costs and environmental impacts have lightened the footprints of oil, natural gas, and coal industries.

The revenues from extractive energy production in New Mexico provide from 20–25% of the General Fund revenue, as it has for many years. Investments generated in part from production on our state endowment lands help support New Mexico's schools. Oil, natural gas, and coal extraction also support the local economies of the producing counties.

Gas pipeline rights-of-way, safety, and security issues, access control, and congestion of our electricity transmission infrastructure are now major state, regional, and nationwide regulatory concerns. Obtaining access to public lands and expediting the permitting process are the top regulatory concerns of the extractive industries.

New Mexico is also supplied with abundant wind, solar, and geothermal resources. Our state's geothermal greenhousing leads the nation, and many people off-grid benefit from solar PV electrical generation. Wind power in the state is commercial, and poised to grow.

Both fossil energy and renewables are important to the state. Though our extractive industries are strong, reserves are finite. As the U.S. imports nearly 60% of its crude oil, energy self-sufficiency has become a concern to the nation. Finally, environmental concerns are becoming more pressing. With its great store of renewable energy, New Mexico has the potential to be an energy leader as the nation diversifies its fuel supply.

Renewable energy portfolio standards (RPS) that prescribe a certain amount of renewable energy to be used in electrical generation are now under consideration for the state, although incentives for renewable energy use are preferred by other entities in New Mexico. Green pricing programs, like those in other states, are also under consideration. Distributed generation (DG) is another way of diversifying energy sources that is advocated. Use of this technology would change the distribution of electricity from large, centralized plants to small sources of power near the point of use, and encourage the use of renewable energy resources as well.

Regional Transmission Organizations (RTO) are another emerging issue for the electrical generation industry. The federal government favors the formation of these organizations in the face of wholesale power marketing across the nation, in order to ensure reliability of the transmission grid. The formation of federally-regulated RTOs is thought by the federal government to be necessary for the successful transition to a restructured electricity industry, but states have concerns about maintaining regional control.

Restructuring in New Mexico, another concern for the electricity industry and its customers, has been postponed until 2007, but the Public Regulation Commission (PRC) is continuing the rulemaking and review process. Asset separation, where investor-owned utilities are separated from their generation facilities, has not yet taken place in New Mexico. The PRC is addressing the RTO issue by remaining active in discussion with the Federal Energy Regulatory Commission (FERC) to protect New Mexico consumers and to advise the state Legislature on the effect of pending changes.

Domestic energy security is now of paramount importance to the nation and for the individual states. Energy independence and protection for our fuel supplies and transmission facilities are crucial to our energy security. There are a variety of strategies proposed for this purpose, including increased access to public lands for energy production, more support and research into renewable energy sources and distributed generation, and changes in federal policies to protect transmission infrastructure.

Energy Statistics for New Mexico

New Mexico is an exporter of energy, producing much more than it consumes.

Table 1. New Mexico Energy Consumption (primary energy), 1999 (EIA State Profile)

Energy Source	Amount	Btu Equivalent (in trillions)
Coal	16,303 thousand short tons	298.0
Natural Gas	229 billion cubic feet (Bcf)	224.7
Petroleum (all products)	48,035 thousand barrels (bbl)	257.4
(Gasoline)	(22,189 thousand bbl)	(115.6)
Nuclear Power*	0	0
Hydroelectric Power	243 million kWh	2.5
TOTAL		635.0 †

† This total reflects a net interstate electricity flow with electricity loss of 153.1 trillion Btu; it also does not equal the sum of the columns (EIA includes renewable energy in the total but not the columns)

* This does not include power generated at the Palo Verde plant in Arizona, which serves PNM customers in New Mexico with about 30% of the electricity generation they consume annually.

Table 2. New Mexico Energy Production 1999 (compare to consumption figs, Table 1)

Energy Source	Amount	Btu Equivalent (in trillions)
Coal	38,845,336 short tons	729.5
Natural Gas	1.668 trillion cubic feet (Tcf)	1,558,376
Crude Oil	65,743,004 bbl	381.3
Uranium	232,000 lb	---
Hydroelectric Power	243 million kWh	2.5
TOTAL		1,559,489.3

Quick Sketches of Extractive Energy Industry

Oil and Natural Gas

The oil and natural gas industry is an important contributor to our state's economy. In 2001, New Mexico ranked fourth in production of natural gas and fifth in crude oil production of the lower 48 states.

New Mexico's crude oil and natural gas annual production for 2001, according to data collected by the New Mexico Oil Conservation Division was: natural gas: 1,681,338,276 cubic feet (1.681 Tcf) and crude oil: 68,729,524 barrels (bbl). These figures are slightly higher than those for production for 2000, which, in turn recovered dramatically from 1999.

Marketed oil and natural gas production for New Mexico was projected by the New Mexico Department of Finance and Administration (NMDFA) to reach \$10 billion in 2001. This means that the industry contributed almost \$1.3 billion to state government revenues in 2001, with the industry contributing \$747 million to the state's general fund (NMDFA, 2002). More than 23,000 New Mexicans are directly or indirectly employed by the oil and natural gas industry.

New Mexico's oil and natural gas wells number around 45,000. The typical (though not average) well is a stripper, or marginal well, producing fewer than 10 bbl/day for crude oil and >60 mcf for natural gas. These marginal wells are important to our economy however, contributing significant production to the state's total. The typical oilman in New Mexico is the independent producer, representing most of New Mexico's 700-plus oil and gas producers. An independent company is a non-integrated company that receives all its revenues at the wellhead. The independent producer works exclusively within the exploration and production segments of the industry. Although some of New Mexico's independent companies are quite large, most of these companies are small, with fewer than 10 employees. It should be noted, however, that the top five producing companies operating in New Mexico are major energy companies, whose presence adds significantly to state revenues.

Eight counties in New Mexico produce virtually all of the oil and natural gas found in the state: San Juan, Rio Arriba, McKinley, and Sandoval counties in the northwest (San Juan Basin) and Roosevelt, Chaves, Lea, and Eddy counties in the southeast (Permian Basin). The southern counties produce most of New Mexico's oil, while the northern counties yield the majority of the

state's natural gas (although Lea and Eddy counties in the southeast are strong natural gas producers also).

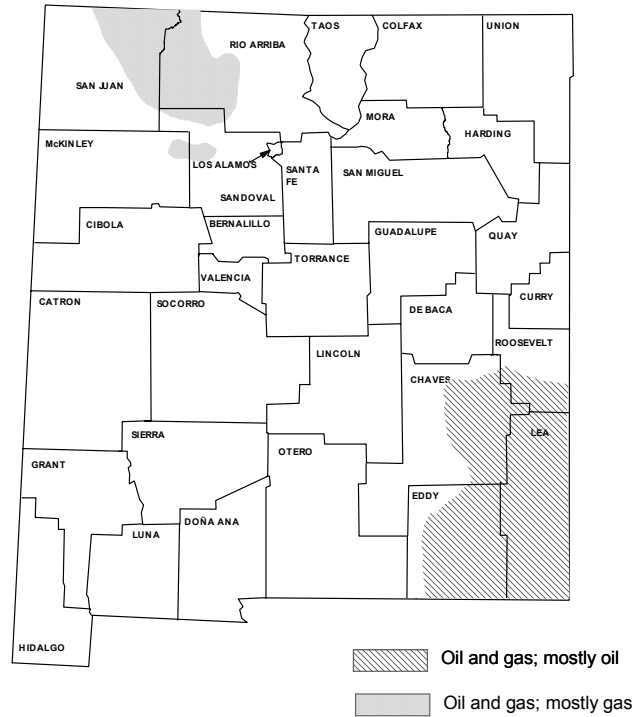


Fig. 1. Areas of oil and natural gas production in New Mexico.

Table 3. 2001 Crude Oil and Natural Gas Production in New Mexico Compared to Production in Surrounding States (EIA Energy Monthly)

State	Crude Oil (million bbl)	Natural Gas (bcf)
New Mexico	68	1673
Texas	424	6335
Oklahoma	68.5	1679
Colorado	16.5	736
Utah	15.2	284
Wyoming	57.4	1345
Arizona	60	60

Coalbed Methane

In recent years, coalbed methane (a form of natural gas extracted from coal beds) has become increasingly important to New Mexico's natural gas industry. New Mexico is one of three states that, collectively, hold 75% of the nation's coalbed methane reserves. For 2001, coalbed methane recovery in New Mexico totaled 533,134,125 mcf, more than 30% of New Mexico's total natural gas production. (New Mexico Oil Conservation Division, Production Data at <http://www.emnrd.state.nm.us/ocd/Data/Monthly%20Reports/prod.pdf>)

New Mexico also holds huge reserves of oil, natural gas, and coalbed methane. We are second for natural gas and fourth for crude oil reserves in the lower forty-eight states.

Table 4. New Mexico Reserves Compared to Reserves in Surrounding and Rocky Mountain States (DOE/EIA data as of 12/31/01)

State	Crude Oil (million bbl)	Rank	Natural Gas (bcf)	Rank	Coalbed Methane (CBM) (bcf)	Rank
New Mexico	719	4	17,322	2	4,278	2
Texas	5,273	1	42,082	1	n/a	n/a
Oklahoma	610	5	13,699	4	n/a	n/a
Colorado	217	11	10,428	7	5,617	1
Utah	283	8	4,235	10	1,592	3
Wyoming	561	7	16,158	3	1,540	4
North Dakota	270	9	433	n/a	n/a	n/a
Montana	235	10	885	n/a	n/a	n/a

Coal

New Mexico ranks 13th in coal production in the U.S., and third in coal reserves. Coal is economically important to New Mexico's energy industry, principally because of its role in providing electricity. Additionally, the State of New Mexico enjoys significant revenues from the coal-mining industry. Table 5, below, compares New Mexico's coal production to that of surrounding/RM states.

Nearly half of New Mexico's energy needs are supplied from coal-fired generating power plants located near coal mines in northern New Mexico's San Juan and Raton basins. Six mines are active in the state, although one, Pittsburg and Midway's Ancho mine, is closing down in 2002, with final reclamation activities to be completed in 2003. Coal mining in New Mexico employed about 1500 people in 2001. (Hoffman, *Decisionmakers*, 2002)

New Mexico coal, relatively low in sulfur, is expected to stay in demand as both the economy and the need for electricity generation grow. Compared to coal mined in other states, New Mexico's coal is expensive, due to regulatory and transportation costs, so most of our coal stays here, supplying the generating stations that are close to the mines.

Table 5. New Mexico's Coal Production Compared to Coal Production in the Surrounding and Rocky Mountain States

State	Production 2001 million short tons (EIA)	Reserves (1999; recoverable coal reserves at producing mines) million short tons (EIA)
New Mexico	29.6	1,385
Arizona	13.0	Withheld to avoid disclosure of individual company data
Colorado	33.4	617
Montana	39.0	1,147
North Dakota	30.5	1,188
Oklahoma	1.6	35
Texas	45.0	756
Utah	26.9	424
Wyoming	365.5	7,094

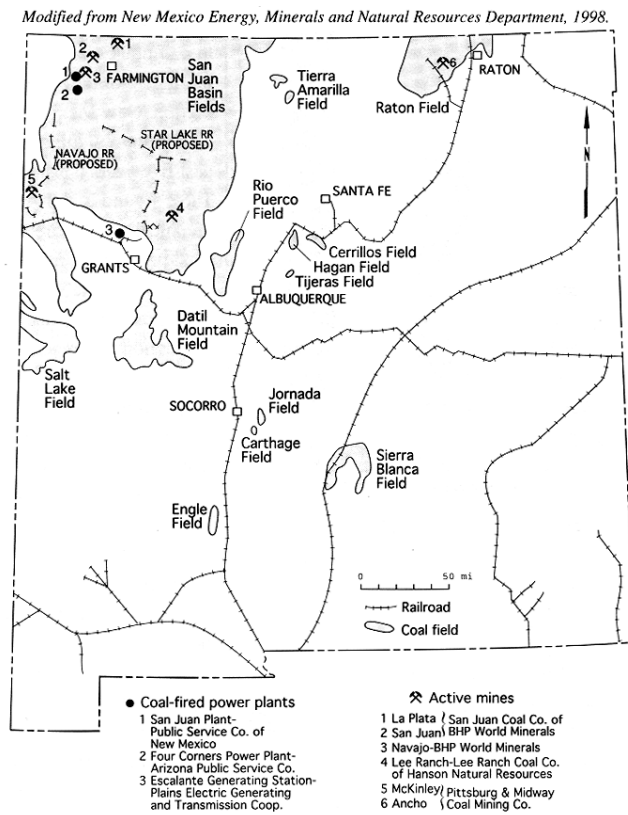


Fig. 2. New Mexico's Principal Coal Mining Areas (Courtesy of New Mexico Energy, Minerals and Natural Resources Department)

Uranium

The uranium industry in New Mexico, once booming, is lately quiescent. With 175,000 tons in reserves, New Mexico ranks second in the U.S. after Wyoming, though it lags behind other states in production (NMEMNRD 2001, EIA, *Uranium Industry Annual 2001, 2002*). Most of the state's recoverable uranium deposits are located between Grants and Gallup. Overall, the uranium industry in the Continental U.S. has been in decline since the 1990s due to increasing numbers of retired nuclear-powered plants and intense foreign competition. Most uranium mining operations in New Mexico have been placed on hold. Only Quivira Mining Company's Ambrosia Lake mining operation, near Grants, recovered uranium in 2000 from inactive underground operation waters, and that plant became inactive at the end of 2001 (EIA, *Uranium Industry Annual, 2002*). However, if uranium prices should increase, it is likely uranium mining in New Mexico will see more activity.

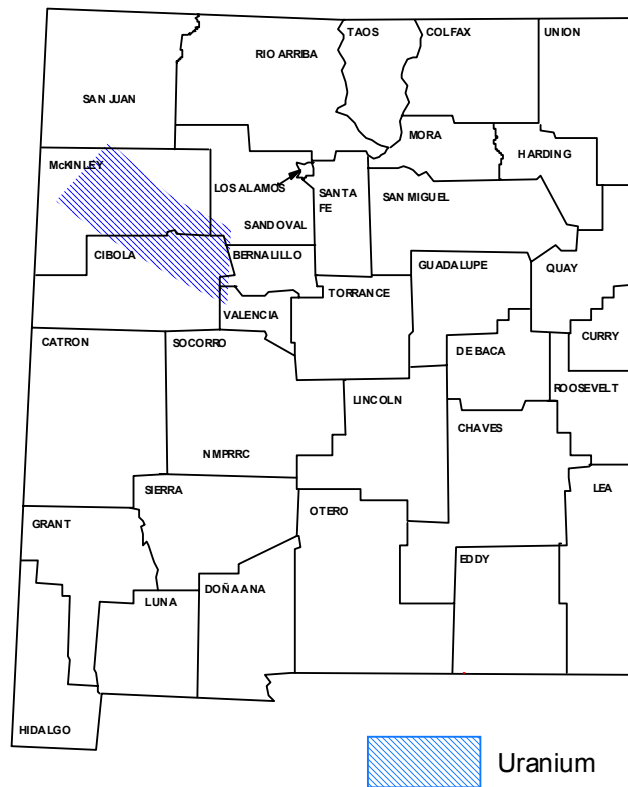


Fig. 3. Principal areas of uranium mining in New Mexico

It is always possible that nuclear reactors may see a revival in the United States, as concerns about global warming and greenhouse gas increase. Another concern is for domestic energy security. The National Energy Policy currently before Congress recommends the expansion of nuclear power generation and new nuclear plant construction. The U.S. Department of Energy states that with emerging technology, advanced safety features have been incorporated into reactor design, with the latest models (some 25 years away) significantly improved in performance economics, safety, and waste minimization. (American Institute of Physics webpage, <http://www.aip.org/isns/reports/2002/041.html>).

An increase in nuclear power generation in the United States is now far from certain, but its occurrence would have implications for New Mexico.

New Technologies Lighten Footprints of Industry

Environmental concerns over extractive industry methods have led to the development of progressively better means for extracting energy resources. “Better” in this case means not just more efficient methods, but the use of improved technologies that are less disruptive to the surrounding land, air, and water.

Water contamination is of paramount concern to the extractive industries. Coal mining, coalbed methane extraction, and oil production are all historic contaminators of ground and surface water. Surface disturbance and air pollutants are other problems of extraction.

Oil and Natural Gas Extraction

New technologies that reduce both production costs and environmental impacts are crucial to New Mexico’s oil and gas industry. Enhanced oil recovery (EOR) methods are required for economically viable oil recovery that also produces minimal environmental impact. Because deeper knowledge of the underlying processes will result in both these outcomes, petroleum research in the State’s scientific institutions focuses on production technologies and applied geological research. Current research includes projects on factors influencing the rate and efficiency of oil recovery at the rock pore level, the use of gel treatments to minimize waste water production, expert systems applied to petroleum exploration, and a better understanding of carbon dioxide flooding, an enhanced oil recovery technique that is widely used but far from fully understood scientifically. Geological efforts center on using more advanced reservoir characterization techniques to tap into under-produced portions of older existing fields and looking at frontier basins using techniques to analyze their productive capabilities.

Horizontal/Directional Drilling

A horizontal well, briefly, is a well that is not vertical. Horizontal drilling technology has been used for a number of years, and is rapidly becoming a more accurate technique in oil and natural gas recovery. It is used to produce reserves that are not economic to produce, or that are not accessible to vertical wells. The objective is to expose more reservoir rock to the wellbore

surface than is possible with a vertical well. The horizontal well curve is related to the physical characteristics of the reservoir. This technology also creates less surface disturbance in environmentally sensitive areas, making it more feasible for production under multiple-use regulations. Although this technology can extend the producing life of a reservoir, it is not now cost-effective. As operators become more practiced and as further research efforts yield results, directional drilling is expected to become more prevalent. (“Drilling Sideways,” U.S. DOE, 1993).

Produced Water Treatment

A major area of concern for oil and gas production is the treatment of produced water. Nationally, according to the U.S. Environmental Protection Agency (EPA), about 10 barrels of brine are produced for every barrel of oil. The volume of produced water from gas wells may be even higher. The disposal of this water is not only expensive, but poses an environmental risk. The New Mexico Oil Conservation Division (NMOCD) disallows surface disposal of produced water because of its high content of dissolved solids. Produced water must be treated, therefore, before it can be stored, reused, or released. Reverse osmosis desalination has been shown to be effective on a large scale, but so far this method has not proved feasible for oilfield application. Several projects are examining/researching better methods for desalination of produced waters.

Corrosion

Corrosion, as it affects pipeline systems, is also an important topic for research and development in the oil and natural gas industry. Leaks and spills occasioned by corroded pipes are a burden to the industry and a threat to public safety and the environment. The majority of corrosion failures can be prevented with improved corrosion and scale management techniques to minimize spill risks and downtime. Although there is no cohesive body of management resources available for New Mexico, applicable projects are under development in our research institutes.

Coal Mining

Coal mining technology has advanced as global positioning equipment and computerized exploration technology are put to use in the industry. Global positioning systems combine space-age technology with coal mining:

When linked to blast-hole drillers for access to seams and deposits, such systems allow the placement of minimum explosives for maximum precision and blast-control according to plan. Aboard dozers and shovels, they give the equipment operators pictures of where they are, where the seams and deposits are, and what should be done to conform to plans and regulations. In depicting precise location, they allow more complete recovery of the resource. On haul trucks, they ensure that the right loads of coal, ore or other minerals are delivered to the right places at the right time. Human error, confusion and accidents are reduced, including mistakes such as delivering ore to disposal sites or material for disposal to processors. Productive use of equipment is

increased. (Purvis, B: "Using Heaven to Move Earth: An Industry Enters a New Era," National Mining Association, 2002)

Most of New Mexico's coal mines are surface mines but the San Juan Mine is in transition from surface to underground mining. This will minimize surface disturbance and some of the need for reclamation, although environmental issues still exist for underground mining, as well as increased safety concerns for the miners.

Longwall underground mining is also being transformed by technology. Longwall mining means the extraction of any mineral from underground by means of a long (more than 80-meter) "wall," or working face. Longwall mining has been known in some form since the 1600s in England, and was known in the United States at least by 1899, when it was used in Alabama. New Mexico's first longwall mine will be the San Juan Mine, now in transition from open-pit to underground.

Longwall mining methods are now mechanized, using hydraulic jacks to support the mine roof and automated shearing machines. Computerized control systems have been developed that obtain input data by sensor. These are able to analyze situations and respond faster than a human operator, although there is currently no automated substitute for human experience and judgment. Future technology anticipates more sensitive remote control, in order to minimize the number of miners that work directly at the wall. (Berryan, R.J.: "Evolution of Longwall Mining and Control Systems in the United States," U.S. Mine Safety and Health Administration, n.d.)

The Importance of Extractive Industry to New Mexico Revenues

Oil, natural gas, and coal production are highly important to New Mexico's economy, generating substantial income to the state in the form of taxes, royalties, rents and leases, as well as investment fund payments. For Calendar Year 2000 (most recent figures available), marketed oil production for New Mexico exceeded \$2 billion and natural gas sales topped \$6 billion, according to figures from the New Mexico Department of Finance and Administration. In FY 2001, the industry contributed almost \$765.2 million to the state's revenues (NMDFA). In addition, the oil and natural gas industry provides employment either directly or indirectly for almost 23,000 New Mexicans within the state's eight producing counties.

Nearly half of the State's General Fund's budget provides direct funding to New Mexico schools. In recent years the General Fund received between 20 and 25 percent of its funds from revenues generated by the oil and gas industry. Thus, New Mexico schools and education programs benefit directly from oil and gas activity in the state. The state's school funding formula ensures that all school districts in New Mexico receive oil and gas revenues through several sources.

New Mexico schools also benefit from distributions of interest from invested Land Grant and Severance Tax Permanent Funds. Land Grant trust funds are derived by way of the State Investment Office's management of royalties and income from mineral extraction on 13.4 million acres of state trust land. Revenues from these lands are held in trust for public schools and other state institutions. Severance taxes from mineral extraction in New Mexico go first to pay debt service on severance tax bonds issued by the state. The remaining revenues are transferred to the Severance Tax Permanent Fund for investment. These trusts comprise some of the best-invested funds in the U.S. In FY01, New Mexico public schools received more than \$264 million from these distributions. (New Mexico State Land Office *Annual Report*, 2001)

Finally, the Oil and Gas Ad Valorem Production Tax and the Oil and Gas Ad Valorem Equipment Taxes contribute to the counties and school districts from which oil and natural gas are extracted. These are taxes based on the assessed value of production and of the equipment used at each production unit.

Coal mining also contributes a significant amount to New Mexico's income. Coal extraction is subject to severance tax and the Resource Excise Tax. In 2000, coal production generated more than \$33 million in federal and state royalties, and rentals as well as state severance, resources excise and energy conservation tax revenues (NMEMNRD, 2002).

Timely Regulatory Issues for the Coal, Oil and Natural Gas Industries

Access to Public Lands—Oil and Natural Gas

New Mexico is one of several western states that possess significant fossil fuel resources on state and federal lands. Measures taken to protect surface resources by federal and state agencies that manage public lands are mandated by law. Thus, coordination of oil and gas activities with wildlife preservation and other resources on public land can, and do, lead to conflict with oil and gas exploration and development. Some circumstances prevent oil and gas recovery in certain areas; still, much may be left to the discretion of local field offices of federal agencies to regulate. In these areas, questions of what activities are permissible have become problematic for New Mexico's oil and gas producers.

Problems of energy development versus other public lands usage have beset the oil and gas industry since 1987, when Congress passed the Federal Onshore Oil and Gas Leasing Reform Act, which established new leasing rules.

Oil and gas are subsurface resources whose value and extent is difficult to determine prior to exploration, even though exploration technology has become more sophisticated and accurate. Developing resources may require a longer period of time than a land use management plan may allow. If there is no history of production in a given area, it is hard to predict the impact of oil and gas activities. Oil and gas producers disagree frequently and vigorously with regulatory agencies on these issues. A recent example in New Mexico entails the discovery of a significant natural gas show in southern New Mexico, in Otero County, that is being held back from leasing

and development until the BLM completes an Environmental Impact Statement and a revised Resource Management Plan for that area. This issue will be explored further in a later chapter, as an illustration of some of the conflicts of multiple land use and habitat preservation that New Mexico faces.

Access for Coal Mining

Access issues for the coal mining industry are very similar to those of oil and natural gas. Coal is also found predominantly on public or tribal land in New Mexico, so the attendant difficulties are similar. One case in point is that of the Fence Lake Mine, near Quemado, which took almost 25 years, from initial scoping to final permitting, to realize. There are still objections to the mine by tribes and environmental groups, so this mine may never see operation. The Background Report will discuss the Fence Lake Mine more fully in Part II.

Permitting Process

Streamlining and coordinating the permitting process across several regulatory agencies is a serious concern for New Mexico's coal, oil and natural gas producers, as it is across the country. Although recent efforts by both federal and state agencies are duly acknowledged by the industry, miners and producers are looking at national policy changes, such as the proposed National Energy Policy, to expedite exploration, production, and transmission or transportation of resources on public lands.

The electrical industry is also required to undergo a lengthy permitting process in every state, whenever a company wants to build a plant. Air quality, water appropriation, wastewater discharge, and site suitability all require permits to be applied for and approved before construction can be started. In some areas, the lengthy permitting period is obstructing the construction of needed generation, and plans are under development to fast-track the process.

Pipeline Safety

A tragic incident in New Mexico has created more urgency on the part of industry and the public for increased pipeline safety measures. The explosion of a natural gas pipeline near Carlsbad that killed 12 people in August 2001 gave momentum to the introduction of safety legislation by the U.S. Congress. The U.S. House of Representatives recently (July 25, 2002) passed a pipeline bill that would pave the way for faster environmental reviews of proposed pipelines and more thorough review of older structures that are being replaced or retrofitted for new purposes. A similar bill was approved in the Senate last year. Pipeline safety legislation is now expected to clear Congress as early as this year.

New Mexico's extractive fuel industries continue to be strong into the twenty-first century, but have declined noticeably from former years. We continue to rely heavily on fossil fuels for power and transportation, but the energy scene is inexorably changing. New Mexico's oil fields are aging, and even the newest technologies cannot restore their production levels of a few decades ago. Environmental concerns have never been stronger, and concerns for domestic energy security (to be examined in more depth in a later chapter) have intensified. As we will see,

these changes, and the changes wrought by the prospect of the nation's electricity industry restructuring is bringing about new concerns and more changes in the way our energy needs are met.

Renewable Energy Resources in New Mexico

Wind, sunshine, abundant geothermal sources, and technical research institutes—New Mexico is generously endowed with renewable energy resources and the high-end knowledge to make them work. However, renewable generation in New Mexico for 1999 (latest figures available) was still far less than 1%. New Mexico's current electrical generating capacity now stands at 5,700 megawatts (MW). Of this, the DOE's National Renewable Energy Laboratory (NREL) has calculated that renewable sources of power generation currently represent 81 MW (.025%) of all electricity generated in the state. About 99% of that generation is hydroelectric power, with wind and solar making up the rest (Wentz, C. in: *Decisionmakers*, 2002). The wind farm currently operating in southeastern New Mexico generates 0.66 MW of electricity.

Clearly, New Mexico has a long way to go towards market viability for renewable energy sources. In recent years, however, public interest, federal and state support, and ongoing studies are all contributing to a favorable climate for renewable energy. Pending decisions by the Public Regulation Commission may create an even more encouraging environment for renewable energy sources. (NMEMNRD, "Comments," Utility Case 3619)

A considerable amount of small-scale renewable energy projects like geothermal, solar, and wind technologies have well-established niches in New Mexico. Geothermal and wind resources already have commercial applications, and there are photovoltaic projects in the works that have *net metering* capabilities (selling power back to the grid).

Geothermal Projects in Southern New Mexico

Geothermal greenhousing in New Mexico is a growth industry. There are currently four commercial geothermal greenhouses in New Mexico, all in Doña Ana and Hidalgo Counties, with an annual payroll of >\$6 million, and annual sales of >\$22.6 million. Their energy generation is 655,200 MMBtu/yr. Geothermal greenhouse sales are among the top ten agricultural sectors of the state. In fact, New Mexico leads the nation in geothermal greenhouse acreage. ("Developing New Mexico" newsletter, online at http://www.edd.state.nm.us/NEWS/vol2_no1/grnhouse.htm)

The development of geothermal greenhousing illustrates how renewable energy technology can find a satisfactory niche. Though current state and federal geothermal policies focus on generation of electricity, the availability of such desirable conditions as exist in New Mexico can make geothermal heating both attractive and economical compared to fossil fuels, and more environmentally friendly.

Photovoltaic Cells Used on Native American Lands

The success of solar energy in New Mexico is illustrated by the current use of photovoltaic generation by several tribes. At the Indian Pueblo Cultural Center in Albuquerque (IPCC), a PV array that consists of 92 120-watt photovoltaic cells occupies the top of the Center's carport, providing car shading and 9kWh at peak generation times. The carport is also tied into the commercial grid through net metering. The solar carport provides 10 percent of the IPCC's power, saving the center an estimated \$3,500 to \$4,000 annually in electricity (*ABQ Tribune*, 12/27/99). In another kind of savings, an estimated 44 tons of coal and 1 million gallons of water are spared, and air emissions are eliminated as well, compared to conventional sources of power generation. (D. Melton, *Decisionmakers*, 2002)

A renewable energy project at Laguna includes a photovoltaic solar array, photovoltaic-powered water pumps, and solar hot water heaters. The project site is at the Laguna Majors ranch, ten miles from the existing power grid. The project objective is to establish the Majors Ranch, currently a Youth Center and Retreat, as a self-contained community with its own source of electrical power that utilizes both solar and wind resources. In addition to a 10 kW wind turbine, the facilities include two photovoltaic arrays (2.8 kW total) with battery storage, two 1.2 kW photovoltaic-powered water pumps, and two 100-gallon active solar hot-water heating systems. (Council, C. et al. "Using Renewable Energy on Native American Lands," paper presented at the 2000 Annual Conference of the American Solar Energy Society, June 16–21, 200; EREN (U.S. DOE, Office of Technology Access, Tribal Energy Program, Projects on Tribal Lands; Pueblo of Laguna; Project Summary).) Another project is a 2.4 kW photovoltaic unit in Dulce, NM for the Jicarilla Tribal Utility Authority, installed on the roof of Dulce High School. The objectives of this project, in addition to producing electricity, are to demonstrate the benefits of PV power in a highly visible way. (EREN (U.S. DOE, Office of Technology Access, Tribal Energy Program, Projects on Tribal Lands; Jicarilla Apache Nation: Project Summary).) The U.S. Department of Energy awarded \$430,000 to the Southwest Indian Polytechnic Institute in Albuquerque to develop a major renewable energy project on the campus that includes the use of photovoltaic cells. When completed (scheduled for late 2002) the system will be on-grid. This project is also aimed at providing educational application for SIPI students.

Significant, though less visible, PV installations also exist throughout housing areas on Indian tribal lands in New Mexico where the remoteness and distance of many of these homes from the existing grid have fostered the installation of numerous modular, off-grid PV power systems. Just recently the Navajo Nation, in addition to adding about 110 homes to the existing grid, further invested in more photovoltaic units for the more remote households. (*ABQ Journal*, March 12, 2002)

Twenty-nine solar PV lighting systems like these are in use at 15 New Mexico State Parks. A solar PV aeration system was installed at the Rio Grande Nature Center, and a few smaller PV systems are in operation around the state.

Wind Energy, Now Commercial, Is Poised to Expand

At present, there is only one wind-generated electrical power plant in New Mexico, near Clovis, operated by SPS/Xcel, that generates less than 1 MW. In recent developments, however, a Florida-based company (Florida Power and Light Energy Co.) is considering a large wind farm in Quay and DeBaca counties. Reportedly, this plant would consist of 180 wind turbines and could generate up to 200 MWh in electricity. Power would be purchased by PNM. This much wind-generated power would easily cover a 10% renewable energy generation requirement under consideration for New Mexico by the Public Regulation Commission and supported by many renewable energy advocacy groups in the state. One barrier to wind development is that remotely located wind projects may require a large investment in transmission infrastructure that should be included in cost calculations, rather than just the per-kW cost at the wind tower.

A Current Sketch of New Mexico's Electric Utility Industry

New Mexico has 21 power plants, generating capacity 5,723 MW, which produced a total of 32,175 million kW of net generation in 2001. This generation was mostly coal-fired (28,403 million kW, or 88.3%), consuming about 16 thousand short-tons of coal. This amount of generated electricity comprises >1% of the nation's electricity production with 59.7% coal-fired electrical generation that consumed 818,353 thousand short-tons of coal. (NMEMNRD, 2001)

Table 6. Electricity Consumed and Generated in New Mexico, 1999 (EIA)

Electricity consumed	18.6 million MW	191.3 trillion Btu
Electricity produced	32.6 million MW	335.4 trillion Btu

New Mexico is an exporter of electricity. Many of its power plants supply power to other states as well as New Mexico. New Mexico's combined residential, commercial, and industrial consumption accounts for less than 60% of our total electricity production. Thus, almost half the electricity we produce leaves the state. The reason for this is our proximity to major consuming markets like California and Arizona. This proximity also accounts for the recent proliferation of fossil-fueled merchant power plants in the state (NMEMNRD, "Comments on Utility Case 3619").

Four investor-owned utilities operate in New Mexico:

- El Paso Electric Company
- Public Service Company of New Mexico
- Southwestern Public Service Company
- Texas-New Mexico Power Company

Together, these companies serve approximately 70% of New Mexico's customers. The largest of these investor-owned utilities in New Mexico is the Public Service Company of New Mexico (PNM), serving 369,000 electricity customers in New Mexico. Nineteen rural electric distribution cooperatives serve 21% of the state's population who live in 85% of the state's area. The remaining 9% of New Mexico's electricity customers are served by seven municipal electric utilities. (NMEMNRD, 2001)

Table 7. Generated Electricity for 2001 (EIA *Electric Power Annual*, March 2002)

	New Mexico	New Mexico as a percentage of US	US Total Generation
Electric utility net generation (MWH)	32,175	1.3%	2,551,027
Electric utility net generation from coal (MWH)	28,403	1.8%	1,589,796
Estimated electric utility retail sales to ultimate customers (MWH)	19,214	.6%	3,385,293
Estimated revenue from U.S. electric utility retail sales to ultimate consumers (million \$)	1,349	.6%	242,444

Table 8. Cost of Electricity (Cents per kWh) in New Mexico. (Data for 2001, EIA *Electric Power Monthly*, March 2002)

Area	Residential	Commercial	Industrial	Other	Average of All Sectors
US	8.22	7.76	5.02	6.07	7.16
New Mexico	8.8	7.5	5.4	5.4	7.0
<i>Other Mountain States</i>					
Arizona	8.3	7.4	5.2	4.0	7.2
Colorado	7.4	5.7	4.5	7.5	6.0
Idaho	6.0	5.2	3.6	4.7	4.9
Montana	7.0	6.4	5.8	8.5	6.5
Nevada	9.0	8.5	6.4	5.0	7.7
Utah	6.7	5.5	3.6	4.2	5.2
Wyoming	6.7	5.5	3.5	5.1	4.5

The cost of electricity in New Mexico is very close to the national average; Kentucky has one of the lowest costs at 4.2 cents per kWh for the average of all sectors (5.5 cents per kWh for residential), while Hawaii's homeowners paid as much as 16 cents per kWh with an average of 13.7 for all sectors. (EIA *Electricity Power Monthly* May 2002)

New Mexico's Power Plants

Twenty-one power plants are currently on-line in New Mexico. Ground was broken in October 2001 for Duke Energy's 600 MW combined-cycle, gas-fired merchant generating plant near Deming, although construction of this facility has been indefinitely deferred as of August 2002, due to a weak wholesale power market. A location permit for another merchant plant of 1200 MW, a combined-cycle, gas-fired plant in Curry County, was applied for November 13, 2001. There are reportedly five more of these plants in the planning stages. Though many of these are investor-owned, The City of Farmington, served by the Farmington Electric Utility, has begun construction on a combined-cycle power plant to serve its growing population.

The Four Corners and San Juan power plants are by far the largest in the state, accounting for about 70% of the state's generated electricity. The Four Corners power plant (2040 MW generating capacity) supplies electricity to Arizona and is owned by Public Service Company of New Mexico, Arizona Public Service, Southern California Edison, Salt River Project, Tucson Electric Power, and El Paso Electric. The 1800 MW San Juan Generating Station (SJGS) operated by PNM serves customers in New Mexico and other states and is owned by PNM and eight other entities. These two major power plants are key facilities in the southwestern United States (Goodman, *Decisionmakers*, 2002) and are among the largest coal-fired plants in the U.S. that are supplied by nearby coal mines. Over their years of operation, both plants have generated environmental concerns and controversy along with electricity. New Mexico has several smaller gas- and coal-fired power plants and although the number of gas-fired power plants exceeds those that are coal-fired, coal-generated electricity still predominates the market (>88%, as stated previously).

Who uses New Mexico's electricity? More data on customers

Table 9. Estimated New Mexico Electric Utility Retail Sales to Ultimate Customers 2001 (MW)

Sector	Residential	Commercial	Industrial	Other *	All Sectors
NM	5,128	6,807	5,359	1,920	19,214
US	1,201,935	1,086,464	981,906	114,988	3,385,293

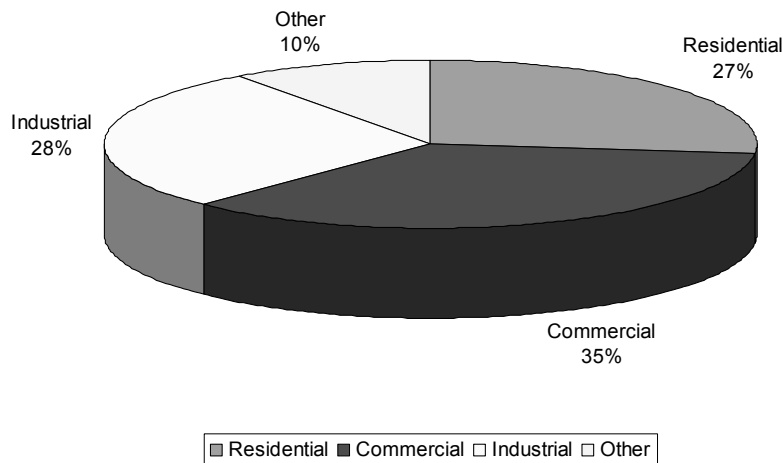
*Includes public and highway lighting, other sales to public authorities, sales to railroads and railways, sales for irrigation, and interdepartmental

Table 10. Revenue from New Mexico Electric Utility Retail Sales of Electricity
To Ultimate Customers 2001 (Million \$)

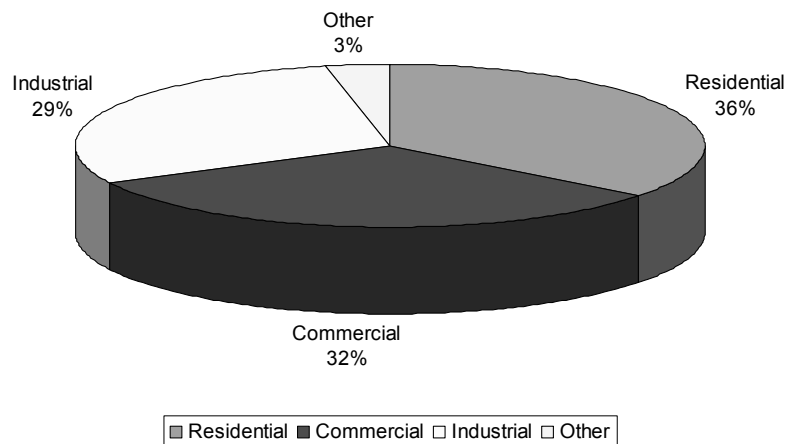
Sector	Residential	Commercial	Industrial	Other *	All Sectors
NM	449	508	288	104	1,349
US	101,882	84,330	49,260	6,976	242,444

*Includes public and highway lighting, other sales to public authorities, sales to railroads and railways, sales for irrigation, and interdepartmental

Estimated NM Electric Utility Retail Sales of Electricity to Ultimate Customers
2001 (MKW)

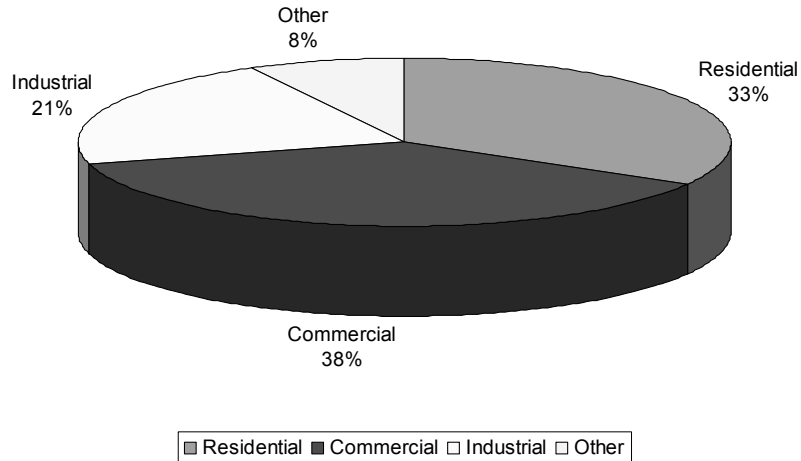


Estimated US Electric Utility Retail Sales of Electricity to Ultimate Customers
2001 (KWH)

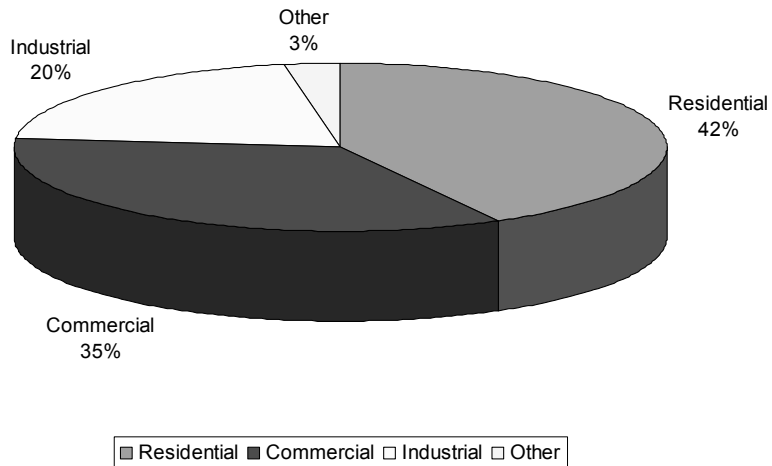


Figs 4a-4b. New Mexico utility retail sales compared to U.S. retail sales, 2001

Revenue from NM Electric Utility Retail Sales of Electricity to Ultimate Customers 2001 (million \$)



Revenue from US Electric Utility Retail Sales of Electricity to Ultimate Customers 2001 (million \$)



Figs. 5a–5b. Revenues from New Mexico electric retail sales compared to U.S. sales, 2001.

The percentages of all sectors shown in the charts above indicate that New Mexico’s electric power usage profile differs in character from the U.S. in general (e.g., residential power sales are much lower (27% vs. 36%) than in U.S. residential sales overall).

Taxes Paid by the Electricity Industry

The NMEMNRD Annual states:

Electric utilities that have service areas in New Mexico pay property tax, State and local franchise taxes, and a gross receipts tax that is directly passed on to their customers. The four investor-owned utilities and Tri-State [Generation and Transmission Association, a wholesale supplier of 13 member cooperatives] also are assessed a corporate income tax. In addition, all utilities that are regulated by the New Mexico Public Regulation Commission (PRC) pay an inspection and supervision fee.

For example, the San Juan Generating Station's owners pay about \$6.6 million annually in property taxes, and \$49.5 million annually in royalties and taxes for coal deliveries.

Fuel usage of the electricity providers in New Mexico indirectly produces income for the state through oil and gas royalties and taxes, and through coal severance and conservation taxes. The extractive industry section of this report provides further details. (NMEMNRD, 2001)

Extractive and Renewable in Dialogue

Though oil, gas, and coal abound in New Mexico, reserves are finite. The U.S. currently imports nearly 60% of its crude oil and the demand for more each year is likely to continue. For this, and other reasons, concerns about national energy security are stronger than ever.

Environmental concerns are growing stronger too. As a nation we remain heavily dependent on coal-fired power plants, especially in New Mexico. Although much time, effort, and money have been spent to implement environmental safeguards through regulation and to raise public awareness about the long-term effects of careless daily consumption, the amount of fossil fuel energy consumed globally continues to steadily rise.

While there are signs that the energy climate is changing, it is difficult to know whether this shift toward energy awareness and regulatory efforts to safeguard our natural resources will remain permanent; thus renewable energy is becoming a serious concern. Even oil giants like Shell and BP are making heavy long-term investments in renewable energy development which, for the short term, is smart public relations; however, given their 50-year development plans it is clear that these companies mean business.

As more states deregulate, more states are becoming committed to using renewable energy sources for generating power. Incentive programs have been created in many states to encourage the development and use of renewable power sources.

Even with New Mexico's great renewable resource potential, we have not yet developed a statewide system for the cultivation and use of natural energy. The PRC is working on a rulemaking that would prescribe renewable energy mixes for all electricity sold in New Mexico, but many are not convinced that mandates are the best way to implement the use of renewable energy.

Mineral production taxes, rents, and royalties contributed about 20–25% to the General Fund in Calendar Year 2001, about the same as every year. Electric power industries also paid numerous taxes to the state. With renewable energy, tax credits and incentives are likely to be flowing into renewable development from the government for a time until renewable energy sources become cost-effective. There are differing opinions as to how this can be achieved.

Renewable Energy Portfolios

A Renewable Energy Portfolio Standard requires that all companies selling electricity within a competitive market include some amount of renewable energy as part of their portfolio. The portfolio standard imposes an equal obligation on any company selling electricity in-state. Some entities favor imposing the Renewable Energy Portfolio Standard such as the NM PRC's proposed new rule 572 supports. Others are very much opposed to mandates, preferring to offer incentives for the use of renewable energy.

Renewable Energy Portfolio Standards (RPS) for New Mexico

A pending rulemaking by the New Mexico PRC would establish a Renewable Energy Portfolio (RPS) for New Mexico, requiring utilities to provide “a progressively greater percentage of service from renewable sources on a least-cost basis and, preferably, from generators in New Mexico.” A utility could satisfy some or all of these requirements through acquisition of certificates from any other New Mexico generator. The RPS phase-in would start with a 2% RPS by September 1, 2003, and culminate in a 10% RPS by September 1, 2007. The rulemaking also proposes to require utilities to offer “green pricing” programs, wherein customers can voluntarily purchase renewable energy. Prices charged for these voluntary programs are to be established in renewable energy tariffs. (NM PRC, Notice of Proposed Rulemaking, Utility Case No. 3619).

Responses to this rulemaking differ; here is one example:

...after witnessing what a properly structured, well-executed RPS has done to add substantial renewable electric generation capacity in states such as Texas, we are convinced that adoption of a RPS in New Mexico is appropriate and warranted at this time. Indeed, despite our world-class renewable energy resources, New Mexico's installed commercial generating capacity from all non-hydro renewables currently amounts to less than one-tenth of one percent of total electric generation capacity. (Energy Conservation and Management Division of the NMEMNRD, “Comments”),

Justifications for a Renewable Portfolio Standard in New Mexico

- Renewable resources would be unlikely to realize their full potential without the RPS.
- Diversity of the electricity supply would be enhanced

- The RPS would foster the growth of renewable energy and, ultimately, economic development associated with more jobs and revenues in New Mexico (“Comments”).

Are Incentives Better?

Other entities in New Mexico do not agree with a RPS for the state. Some arguments against the RPS are:

- Costs to consumers are inevitably increased.
- Customers and the market should be able to select what types of electricity are produced.
- The RPS provides an unfair market advantage to renewable energy technologies.
- These organizations favor the establishment of rewards and incentives to promote and encourage renewable energy development instead of mandates.

Certain incentives are already in place in New Mexico. For example, SB 187, signed in March 2002, offers a one-cent per kilowatt-hour tax credit for companies that generate electricity from wind power or solar energy (Database of State Incentives for Renewable Energy website; <http://www.dsireusa.org/dsire>). Net metering (where the meter runs backwards, so to speak; if the customer is using distributed generation a net metering calculation credits net energy generation to the customer month by month) is also in effect in New Mexico. The Solar Rights Act has been in effect since 1978, wherein property owners are allowed to create solar easements for proper access to sunlight. Finally, the wind energy production tax credit is a federal incentive that provides a 1.5 cents per kilowatt-hour credit, adjusted annually for inflation (for 2002, the tax is 1.8 cents/kWh). This production tax credit could mean a boost to New Mexico’s commercial wind energy projects, although it is set to expire December 31, 2003.

Green Pricing

Voluntary renewable energy tariffs (“green pricing”) for utilities give customers the option to purchase a portion of the electric demand from renewable energy sources; typically the customer will pay for the additional costs associated with those purchases. About 85 companies in 29 states offer the option, enabling the companies to build loyalty in those customers who support renewable energy, as well as to expand their services.

The New Mexico Solar Energy Association says, “Green pricing programs are one of the great successes of the 1990s for renewable energy, and many now exist in the United States. Roughly one in five Americans can now choose to have some or all of their electricity supplied by renewable energy sources.” (NMSEA, <http://www.nmsea.org/>)

As in other states, New Mexicans have said that they want green power, though there are differing opinions as to how many customers would actually buy it if it were available . Renewable advocates contend that consumer education and proper and effective marketing is key to consumers' selection of green power. A focus group study performed in Albuquerque by Public Service Company of New Mexico (PNM) stated that New Mexicans would be interested in purchasing renewable energy if the opportunity were available.*

Two green pricing programs are in effect in New Mexico:

- Southwestern Public Service (SPS) offers wind power from the Clovis wind farm turbine in blocks of 100 kWh. Each block costs \$3 more than power purchased at SPS' standard rates.
- The Kit Carson Rural Electric Cooperative in the Taos area offers wind energy from the Taranoya Wind Station near Medicine Bow, WY. This is the only co-op in New Mexico that offers a choice of renewable energy, due to interest in renewable energy among its membership. Members may purchase 100 kWh blocks, at \$2.50 per month under a year's contract.

The proposed new Rule 572 ("Renewable Energy as a Source of Electricity") states, "Each public utility shall offer a voluntary renewable energy tariff, for those customers who want the option to purchase renewable energy, regardless of cost, based on availability." (NM PRC, "Notice of Proposed Rulemaking, Renewable Energy as a Source of Electricity, Item 10: Renewable Energy Offer of Service," Utility Case No. 3619). In other words, all utilities serving New Mexico would be required to offer green pricing; of course, that means they would also be required to offer electricity generated by renewable energy sources to those customers who are willing to pay more.

This rule is strongly supported by many renewable energy advocates, who generally call for strong marketing and education initiatives to accompany the offer of green pricing.

Table 11 lists successful green pricing programs in New Mexico's neighboring states: Arizona, Colorado, and Texas: (the U.S. DOE's EREN website: <http://www.eren.doe.gov/greenpower>; last update 02/02)

* Other evidence indicates that customers actually don't choose renewable energy in any great numbers when it is offered to them.

Table 11. Green Pricing Programs in Surrounding States.

State	Company	Program	Power Source	Amount	Date of Initiation	Additional Cost
AZ	Arizona Public Service	Solar partners	Central PV	1MW	1996	\$2.64/150 kWh
AZ	Salt River Project	Earthwise Energy	Central PV, landfill gas, small hydro	4.4 MW	1998	\$3.00/100 kWh
AZ	Tucson Electric	GreenWatts	PV, landfill, gas	6kW	2000	7.5-10¢/kWh
CO	Colorado Springs Utilities	Green Power	Wind	1MW	1997	3¢/kWh
CO	Holy Cross Electric Coop	Wind Power Pioneers	Wind	5.9MW	1996	2.5¢/kWh
CO	Public Service Co. of CO	Renewable Energy Trust	PV	110kW	1993	Contribution
CO	Public Service Co. of CO	Renewable Resource Power Service	Wind	20 MW	1997	2.5¢/kWh
CO	Tri-State Generation & Transmission	Renewable Resource Power Service	Wind	Planned 2.66 MW	1999	2.5¢/kWh
CO	Yampa Valley Electric Association	Green Power	Wind	450 kW	1999	3.0¢/kWh
TX	Austin Energy (City of Austin)	GreenChoice	Wind, landfill gas	77 MW	2000	0.17¢/kWh
TX	City Public Service of San Antonio	Windtricity	Wind	25 MW	2000	4.0¢/kWh
TX	El Paso Electric Co.	Renewable Energy Tariff	Wind	1.32 MW	2001	1.92¢/kWh
TX	Texas-New Mexico Power Co.	Wind Power	Wind	2.6 MW	2000	1.0¢/kWh

These renewable sources are mostly wind and solar energy resources, which New Mexico has in abundance and whose development is strongly advocated.

How Will Distributed Generation Enter the New Mexico Market?

Distributed generation (DG) is another way to transmit electricity that can bring about a blending of renewable and fossil energy sources. *Distributed generation* refers to small sources of power near the point of use that can be connected to the distribution grid, or that can operate independently. These typically range from less than a kW to tens of megawatts (MW). Unlike central generating facilities, these small sources are distributed throughout the grid. They include biomass-based generators, combustion turbines, concentrating solar power and photovoltaic systems, fuel cells, wind turbines, microturbines, engines/generator sets, and storage and control technologies. (US DOE's Distributed Power website, <http://www.eren.doe.gov/distributedpower/>)

The National Association of Regulatory Utility Commissioners (NARUC) encourages the development of distributed generation for the nation. NARUC recommends that the nation adopt distributed generation technologies for the following reasons:

- New technologies enhance customer choice;
- On-site generation improves customer value through control of costs and enhanced power quality and reliability;
- Distributed generation can enhance the efficiency, reliability, and operational benefits of the distribution system;
- Access to distributed generation technologies can increase competition by reducing the market power of traditional power providers, particularly in transmission- and distribution-constrained regions;
- Generation close to load can reduce total electric generation costs, and associated fuel and operational costs, by reducing line losses through the transmission and distribution system;
- Distributed generation allows utilities to improve the asset utilization and associated financial capital and operational expenses of their transmission and distribution equipment;
- Distributed generation resources can be permitted, installed and put into use more quickly than central station generation or transmission; and
- Distributed generation technologies can provide environmental benefits. ("Resolution Encouraging State Commissions to Adopt Full and Open Access Rules for Distributed Generation Technologies and to Remove Regulatory Barriers and Promote "Best Practices" That Encourage Economic Deployment of Distributed Generation Technologies" at: http://www.naruc.org/Resolutions/2000/summer/ere/best_practices.shtml)

Many regulators are looking at distributed resources to provide low or no-cost solutions to the needs of ratepayers. In this context, distributed resources are promoted as energy systems that are connected to the distribution grid, are not paid for by the ratepayer, and provide benefits to the ratepayer; unlike central generating facilities that have large ratepayer funded transmission,

distribution, and ancillary service costs. (The Regulatory Assistance Project, website at <http://www.rapmaine.org/>)

It is not clear how DG system planning will be accomplished in the future since many regulatory issues need to be resolved: i.e., interconnection and interface, maximizing both system and customer benefits, and siting and permitting. Beyond regulation, other problems include funding and obtaining technical expertise. (NARUC, “More Distributed Generation with Pay-As-You-Save,” Nov. 2001) A number of organizations are studying the issue and trying to find ways to make interconnection a practical reality.

The Federal Energy Regulatory Commission (FERC) is working towards interconnection standards for distributed generation: “Standardization of Generator Interconnection Agreements and Procedures - Notice of Proposed Rulemaking, Docket No. RM02-1-000,” issued April 24, 2002. Through this rulemaking, FERC hopes to foster economic generation development and liability, and to resolve problems between generators and transmitters through standardized generation agreements and procedures for public utilities.

Standardized procedures applicable to all interstate transmission are expected to facilitate the development of new generation. FERC believes that well-crafted standard agreements and procedures for interconnection, a critical component of open access, are essential for providing the right incentives to both transmission providers and electricity generators. Standardized agreements and procedures are expected to:

- encourage needed investment in infrastructure;
- limit opportunities for transmission providers to favor their own generation; and
- ease entry for competitors while ensuring efficient siting decisions.

The proposed interconnection agreement and procedures are generally based on the Generator Connection Agreement and the Generator Connection Procedures of the Electric Reliability Council of Texas (ERCOT), plus “best practices” (in most cases, based on FERC’s past rulings) prescribed by FERC.

New Mexico has already initiated rules to promote distributed generation: Rule 571 was established to simplify the interconnection requirements for qualifying facilities of 10kW or less (microsystems), and to encourage use of small-scale, customer-owned renewable or alternative energy resources as a way of recognizing the benefits that development of such resources will have on the state’s environment. (These rules, however, will not support commercial deployment of distributed resources.) (NMAC, Title 17, Chapter 10, Part 571). Rule 571, which went into effect December 31, 1998, also covers net metering.

How much headway has New Mexico made with distributed generation? Since Rule 571 has been in effect, a few small photovoltaic systems have connected to the distribution grid but larger systems are still obstructed by numerous technical and regulatory barriers.*

Regional Transmission Organizations

An issue currently of great importance to the electric power industry is the formation of Regional Transmission Organizations (RTOs). Competition among electricity providers, growth in power generation, and the increasing demand for electricity has placed an increasing burden on the nation's century-old power transmission grid.

The DOE's recently completed (May 2002) *National Transmission Grid Study* has recommended the formation of RTOs that would keep the grid reliable and address transmission bottlenecks that currently are responsible for transmission failures and costs to consumers in the hundreds of millions of dollars.

The electricity transmission system in North America (called "one of the greatest engineering achievements of the 20th century" by the National Transmission Grid Study's authors) is a series of interconnected networks of high-voltage power lines that transmit power from generator to customer.

North America's power grid was built over the past 100 years, a small piece at a time, to provide utilities with a means for transporting electricity to their customers. Interconnections were created among neighboring systems to increase reliability and to share excess power when feasible. Traditionally, utilities have been the system's only users, ensuring transmission reliability through cooperation. The North American Electricity Reliability Council (NERC) is the governing body that issued planning and operating standards that utilities supported by voluntary compliance.

The Federal Energy Regulatory Commission (FERC) is an independent federal agency that has jurisdiction over the interstate transportation of natural gas, interstate oil pipelines and the interstate transmission and sale for resale of electricity. In 1996, in response to the changing electric power market situation, FERC issued its landmark rulings that fundamentally changed the nature of power transmission and electricity marketing in North America. Orders 888 and 889 required utilities to allow non-utility power producers to use their transmission grids. The *National Transmission Grid Study* says:

* The DOE has released an extensive study of barriers to distributed resources, "Making Connections: Case Studies of Barriers to Interconnection of Distributed Power," which we will return to later, in Part II of this report. Independent attempts to use distributed resources in New Mexico have encountered similar barriers to those outlined in this DOE report.

Centralized decision making by vertically integrated utilities, alone, now no longer determines electricity production. Instead, competitive market forces, involving a number of new market participants, increasingly determine who produces electricity and where it will be consumed. Since 1996, the transmission system has been slowly transformed into an interstate highway of commerce upon which emerging wholesale electricity markets depend (NTGS 2002)

Wholesale power marketers proliferated at the end of the twentieth century, increasing sales sixfold. Additionally, traditional utilities are still active in generation and sales. After a period of decline, forecasts now predict growth in generation capacity (EIA, *Restructuring of the Electric Power Industry*, 2000). Electricity flows and the resulting bottlenecks are now greater in size than was ever envisioned by the builders of today's grid.

Both DOE and FERC, working independently, identified a series of major transmission bottlenecks that seriously undermine the reliability of the U.S. power grid and raise the cost of power to the end customer. New Mexico has not yet been seriously affected by transmission congestion, although the Western Interconnection Biennial Plan of 2000, commissioned by the Western Systems Coordination Council, found that Path No. 27 of the Western power grid, connecting southeastern Arizona with southern New Mexico, was ranked the third busiest transmission line in 1999. (Story, *Desert Sun*, 2001, online at <http://www.thedesertsun.com/power/gridindex.shtml>) Inevitably, we will be involved in transmission issues and the changes in electric power marketing, which are going to include Regional Transmission Organizations.

Can RTOs Relieve the Strain?

The DOE says, "Robust and reliable regional electricity transmission systems are the key to sustaining fair and efficient competition in wholesale markets that lower costs to consumers." (NTGR, 2002) In place of federal ownership and operation or, in other words, instead of a nationalized power grid, the private sector is charged with assuming the challenge of providing reliable transmission. FERC proposes that RTOs manage the transmission of electricity through regional grids. FERC would regulate these entities as they are engaged in interstate transactions. This system, FERC says, would best facilitate the change to a deregulated wholesale power market. In fact, the National Energy Policy (now before Congress) contains a provision to give FERC authority over these RTOs. FERC's Order 2000, issued in December 1999, calls for the voluntary formation of RTOs "in order to facilitate the development of a robust national wholesale market for electric energy." (PRC, *Annual Report 2001*)

In turn, the states are concerned with their regulatory responsibilities to electricity customers. They are concerned about federal regulation of RTOs through a "one-size-fits-all" mode, which does not take into account the regional differences in grid operation across the country. The state agencies also feel that individual states may lose some of their jurisdiction if federally supervised RTOs become a reality. This occurs if RTOs are authorized to address issues such as transmission upgrades and expansions and generation additions under federal oversight, which have traditionally fallen within the purview of state agencies. Furthermore,

some states, including New Mexico, have not yet implemented retail restructuring and some (possibly including New Mexico) may never believe retail competition to be in their best interests. They feel that RTOs are not necessary in the absence of retail restructuring, even though the FERC believes RTOs are necessary for wholesale restructuring, which is a federal, not a state issue.

Where is New Mexico's place in this new landscape? New Mexico lies within the Western System of the three interconnected major power systems. WestConnect is a for-profit RTO that has just been formed by a group of southwestern transmission line owners. Agreements and operating protocols were filed with FERC on October 15, 2001 by the group, which includes El Paso Electric and Public Service Company of New Mexico—two of the investor-owned utilities that deliver power to New Mexico.

WestConnect evolved out of an earlier RTO project, DesertSTAR, which was a not-for-profit RTO model, "in response to recent FERC rulings and a desire to create a governance structure that will encourage innovation and creativity in the operation and further development of the Western transmission grid." ("WestConnect established as framework for regional transmission organization," WestConnect news release, 10/15/01) WestConnect expects to commence operation in 2004, supplying power through New Mexico, Arizona, and Colorado.

New Mexico regulators are concerned about this development. The Office of the New Mexico Attorney General submitted its Protest of the WestConnect filing on November 30, 2001. The Protest states, "...no showing has ever been made that RTOs would provide any benefit to electricity customers. Their sole purpose is to facilitate the move to electric competition—a move that many western states have not yet decided to make and which Congress has not yet approved. Moreover, there is no evidence that a national electricity market is desirable or even possible." The Protest further states that it is fundamental for states to retain the right to regulate transmission, in order to protect retail electric service.

The Protest claimed many flaws in the WestConnect filing, as well as in FERC's Order 2000. The highlights are:

- West Connect does not meet the standards of Order 2000*.
- The market structure proposed by WestConnect will make it impossible to monitor and mitigate market power.
- Relying on market-based price "signals" for transmission services to manage congestion and to dispatch the generation system will lead to higher transmission rates and economic efficiency will suffer.
- Jurisdiction for setting the retail rates for transmission services must always remain with the State Public Utilities Commission.

* Regarding the voluntary formation of RTOs

- Establishing a tight power pool instead of the proposed WestConnect RTO might be a better means for reducing ratepayer costs in the desert southwest.
- There are concerns over potential shifting of costs and jurisdiction; the collaborative process (the development of WestConnect was preceded by the development of the now-defunct Desert Star, a not-for-profit RTO); and independence and market monitoring (a for-profit organization cannot effectively or objectively monitor itself)

In conclusion, the Protest asserts that the WestConnect filing should be rejected by FERC and that FERC should change its RTO process.

The existing transmission systems were built for a regulated utility industry. Now, in a competitive market, there are fears that market-driven transmission may not benefit New Mexico. Regulators and power marketers alike concede that it is necessary that more transmission lines must be built; however, if market forces drive their construction, there are significant concerns that consumers in sparsely populated states like New Mexico will end up with higher rates. The costs incurred by the RTO would very likely be passed on to consumers. On the other hand, other reasonable scenarios for the future claim that large RTOs would eliminate such nuisances as “pancaked” transmission rates, wherein users must pay each utility owning a transmission system separate rates for using their lines, thus making power transmission cheaper.

The future of RTOs is predicated upon wholesale power marketing and electric power restructuring, which is another important issue for the energy industry in general, the electric power industry in particular, and for everybody in New Mexico who is tied into the grid.

The new FERC proposed rule of July 31, 2002 which promulgates a standard market design under FERC, following up on Rules 888, 889, and 2000, will decide what the future of RTOs, for New Mexico and all other states, will be. FERC’s white paper report (March 15, 2002), “Working Paper on Standardized Transmission Services and Wholesale Electric Market Design,” expressed the Commission’s intention to put all transmission providers on a single tariff and establish a standard market design. “Remedying Undue Discrimination through Open Access Transmission Service and Standard Electricity Market Design,” (SMD Rule) is intended to remove the remaining impediments to competitive markets in transmission and wholesale electricity sales. These have been identified as undue discrimination and lack of standardized tariffs, service provisions and rules.

The FERC will acquire jurisdiction over transmission for bundled services, as wholesale transmission activities which it already regulates. A single flexible transmission service (Network Access Service) will impose one set of rules on all transmission customers. Network Access Service will give the transmission customer the right to transmit power between any points on the transmission system. The draft rule will also provide standard market design for wholesale electric markets. Although all transmission providers may not start out as members of RTOs, they must contract with an independent transmission provider (ITP) to operate their transmission

facilities until they have joined an RTO. An ITP may no financial interest in any market participant in the region, or in neighboring regions, where it provides its services.

“The FERC recognizes that its jurisdictional expansion to reach bundled retailed transactions is opposed by many state public utility commissions and it has committed to working with the state commissions to effectuate this transition.” (memo, Leslie Lawner, August 2, 2002) FERC has also prepared an environmental assessment that will consider the environmental impact of the proposed rule.

Electricity Deregulation Is Postponed, But Not Forgotten

The previous Energy Town Hall in 2000 discussed the implications of deregulation in careful detail, when New Mexico’s deregulation had not yet been postponed.

Senate Bill 266 delayed the start of electricity deregulation until 2007. The Public Regulation Commission (PRC), in its 2001 Annual Report, states, “Progress towards restructuring continues to be determined by events in California. California’s deregulation plan is now regarded as a failure, with unforeseen disastrous results for the economy of the state as well as the financial stability of State governments. The California restructuring disaster has had an impact on New Mexico’s move towards restructuring and open access.” (PRC, 2001)

The commission continued the rulemaking process throughout 2000 to develop the rules necessary for customer choice. By September 2000, additional hearings were underway to further explore the status of restructuring and its impact on NM. As a result of California’s grim experiences, the Commission subsequently re-opened the rulemakings for additional input; all six rulemaking dockets remain open.

New Mexico Not Yet at the Point of No Return

Asset separation—the separation of utilities from their generation facilities—is perhaps the most important component of restructuring (for investor-owned utilities; municipal utilities are not subject to this part of the Restructuring Act, and cooperatives, although they have a choice whether or not to participate, are separated already). The Commission stated, “New Mexico’s restructuring act requires utilities to sell or transfer all their generation assets. Once this asset separation is completed, the state will lose jurisdiction over the generation assets. Utilities will no longer own generation. Asset separation is the most significant act of restructuring and represents a point-of-no-return for states moving towards deregulation.” (PRC, 2002)

That point has not yet been reached. On March 8, 2001, SB 266 was signed into law, delaying New Mexico’s restructuring for five years. SB 266 allows utilities to acquire or build generation plants that will not be providing retail service to New Mexico customers (merchant plants) during the delay period before generation and utility assets are separated.

The PRC legislative recommendations made in 2001 are described in the Annual Report:

- Expand Standard Offer Service (SOS) to include public schools and post-secondary educational institutions.
- Add system reliability approval to the Public Utility Act as part of the Commission's authority in approving location applications.

SOS was designed to aid small customers; larger customers must purchase power from a competitive power supplier. Expansion of SOS to public schools and other institutions, however, "will protect consumers, but may reduce the attractiveness of the New Mexico electric market for competitive power suppliers, thus thwarting efforts to create a robust electric market...[also] the pricing of SOS would be based on market rates, not the current regulated rates."(PRC, 2002)

Currently, the PRC has authority to approve the proposed location of any new power plant with more than 300 MW generation and transmission of [equal to or greater than] 230kV. The concerns of the PRC, however, are currently limited to environmental and quality-of-life concerns. The PRC says, "System reliability impacts of the location of a large generating unit are within the Commission's expertise but are not included in the standards for evaluating location applications." (PRC, 2002)

Required Examinations

The Commission further examined nine specific issues related to restructuring in 2001, as required by section 19 of the Restructuring Act:

- Standard offer;
- Consumer education and protection;
- Safety, reliability, quality, and performance standards for competitive power suppliers and distribution and transmission facilities;
- The presence of market power, its impacts on the restructuring of the electric industry and methods available to limit or eliminate its adverse impacts;
- Alternative operations and regulations, including an independent system operator;
- Regional transmission and governance efforts, both public and private, and the advisability of regional cooperation by the state;
- Emergency and back-up service;
- The advisability and desirability of requiring renewable energy portfolio standards in supply service offered to customers in the state; and
- Procurement of power from on-site generation facilities, including facilitating net metering.

Good for Green

Certain rules and proposed rules are desirable for the future of renewable energy sources in New Mexico.

Rule 571— Net-Metering for Small Renewable Energy Systems—is an incentive to facilitate net metering, a simplified means of transferring excess energy generated by a consumer’s renewable energy system to the electric power grid. The meter, in effect, runs backwards. Rule 571 also provides for interconnection and on-site self-generating.

Proposed Rule 572—Renewable Energy as a Source of Electricity—utilities would offer a voluntary renewable energy tariff (“green” pricing), for customers who want the option to purchase renewable energy. The rule also proposes a Renewable Portfolio Standard (RPS) of 10% for New Mexico electricity suppliers.

Proposed Rule 573—Disclosure of Generation Source, Fuel Mix, and Emissions—customers must be informed of the generation used by the competitive power supplier and the emission profile of the supply. This rule will aid customers in selecting a competitive supplier and ensure that “green energy” claims are valid.

Rule 591—Standard Offer Rule—utilities are required to purchase New Mexico renewable energy up to 5% of the total Standard Offer Service (SOS) purchase, provided that the overall SOS rate does not increase more than 1 cent per kWh. The rule also requires utilities to make available more renewable energy to SOS customers who desire to use more. This Rule becomes effective January 1, 2007.

The PRC and RTOs

Most concerned parties agree that there are not enough transmission lines in New Mexico, but New Mexico’s PRC is concerned about what it identifies as FERC’s “fast track” movement towards RTOs. In July 2001, the Commission opened a special docket to investigate transmission issues and their effects on New Mexico consumers. Later, the Commission voiced its concerns in Washington during “RTO Week,” a FERC event in October 2001, that the benefits of RTO participation were not sufficiently clear to warrant support and that RTO formation might, in fact, be harmful to New Mexico ratepayers (PRC, 19). After active participation by the NM PRC and other regulatory bodies during RTO Week, FERC lifted its December 15, 2001 implementation (of Order 2000) deadline, although still committed to a progressive timeline toward RTO implementation. The Commission plans to remain engaged in the upcoming FERC discussion to protect the interests of New Mexico electricity customers as the U.S. moves towards RTO formation, and to advise the Legislature about the effects RTO formation will have on the retail electric marketplace in New Mexico (PRC, 19).

New Mexico Electric Energy Policy Principles

Even though electricity restructuring has been delayed until 2007, the New Mexico PRC passed a resolution calling for electric energy policy principles for the state, which include:

- Requiring utilities to support more diverse generating sources, including renewable energy;

- Encouragement of distributed generation;
- Requiring utilities to operate an adequate distribution infrastructure;
- Calling for a thorough analysis of New Mexico’s transmission system to determine under-capacity and constraints both regionally as well as in the state;
- Redesigning retail rates;
- Rewards for energy efficiency;
- Leveling the playing field for alternatives; a thorough study on the subsidization of fuel sources at New Mexico generating plants to gain information to be used regarding renewable energy sources, combined heat and power applications, and distributed generation; and
- Constructive partnerships with neighboring states to develop regional solutions, especially with regard to interstate transmission.

The last two principles state that New Mexico “should develop a more active and prominent presence on electric energy policy issues...to assure representation and inclusion in the development of strategy and outcomes;” and, “A thorough risk benefit analysis of competition as well as a review of the lessons learned from other states should be performed prior to opening New Mexico markets.” (NM PRC, “Electric Energy Policy Summary,” 2002)

New Mexico’s regulators (PRC) and lawmakers want to keep a solid regional grip on the regulation process. Nevada has already repealed their restructuring, and a significant number of states are not yet committed to deregulation. A very large amount of discussion, decision-making, and policy-crafting remains before the “point-of-no- return” is reached and asset separation is a reality for investor-owned utilities.

Domestic Energy Security

The energy sector is not alone in its concern over domestic energy security. The events of September 11, 2001 have awakened our country to a harsher reality than most of us have ever known. Ensuring the safety of the nation’s fuel and power supply is now a security issue of the highest order.

Two elements crucial to our domestic energy security are energy independence, and the protection of our supplies and transmission facilities, both of which were continuously debated and evaluated long before the September 11 attacks. Now they are even more crucial.

Crude Oil Supply

One of our primary vulnerabilities is our dependence on foreign oil. The U.S. already imports close to 60% of its crude oil, and that figure is predicted to increase to 64% in 2020 (EIA). The characteristic volatility of the world oil market, with its dramatic price drops and spikes (for example, from September 1998 to September 1999, crude oil prices increased by 61%) has always been a problem for consumers and producers. Price recoveries might mean a long-term trend, or just a market fluctuation. Although the producing nations recognize the danger to

the world economy of prolonged high prices and volatility, there is a certain reluctance to interfere with natural market fluctuation and demands with specific policy interventions (Congressional Research Service Report RL30290: “Domestic Oil and Gas Producers: Public Policy When Oil Prices Are Volatile”). As the demand for crude oil has increased, on-shore lower-48 domestic production has fallen by 40% since the 1980s. American oil and natural gas producers, especially the independents who depend on exploration and production, feel the acute effects of low oil prices.

The extremely low oil prices that prevailed during 1998 and early 1999 have been cited as the chief cause of adverse impacts on domestic crude output and on producers (CRS RL30290, 1999). Conversely, high prices for heating oil and gasoline are seen as stimulation for domestic policies to encourage domestic production. (“Coping With High Oil Prices: A Summary of Options,” CRS Report RL 30459)

Congress enacted a guaranteed loan program in 1999 to aid oil and gas producers (Emergency Oil and Gas Guaranteed Loan Program, PL106-51). Other policies that have been suggested include a range of tax incentives, and acquisition of domestic oil for the Strategic Petroleum Reserve, either in direct purchase or as royalty-in-kind.

Another approach that has received strong support from the industry is the facilitation of access to public lands for exploration and production. Besides Alaska’s Arctic National Wildlife Refuge—the most high-profile of these off-limits lands—many millions of acres of public lands in the lower 48 are currently unavailable to oil and gas activities. It has been estimated that acreage available for oil and gas exploration in eight western states, including New Mexico, decreased by more than 60% between 1983 and 1997 (Cooperating Associations Forum survey, as reported by the American Petroleum Institute). Producers argue that easing restriction on these lands would add substantially to domestic oil production and thereby to national energy security.

The question of access is of special concern to New Mexico’s producers, as more than 50% of the oil and natural gas produced from public lands in the United States comes from New Mexico (New Mexico State Department of Taxation and Revenue, 2001). The state’s production statistics show that in 2000, 43% of New Mexico’s oil production and 65% of its natural gas production came from federal lands. The figures for revenues generated from federal leases in New Mexico show that the state’s share of federal mineral leasing rentals and royalties for 2000 was \$221.1 million. That share is estimated at \$386.7 million for FY 2001, increasing by 74.9% (NMDAF, 2001).

Protecting Our Infrastructure

Another major area of vulnerability is our overall energy infrastructure. The physical security of power plants and transmission lines, offshore platforms, pipelines, refineries, and other supply systems can be threatened in a national emergency—or worse, be the target of attack.

Electricity Infrastructure Security

The energy community has responded strongly to the September 11 attacks. The United States Energy Association, an association of public and private energy-related organizations, corporations, and government agencies, released a report (*National Energy Security Post 9/11*, July 2002) addressing national energy security in the wake of the September 11 attacks. Their policy recommendations include:

- Encourage conservation and energy efficiency;
- Maintain diversity of energy supplies while enhancing domestic production and efficiency
- Strengthen contingency planning and emergency preparedness;
- Balance energy security, economic, and environmental concerns;
- Accelerate research and development to create and deploy advanced energy technologies.

The Edison Electric Institute, a trade association for shareholder-owned electric companies in the US, states that while the industry historically has coped with *natural* disasters, “the recent attacks [on the World Trade Center, September 11, 2001] vividly demonstrate that even when not directly targeted, however, energy infrastructure can be vulnerable to *horrendous* man-made disasters.” They call for federal policy changes to address many high-priority infrastructure security issues including information sharing and security measures for sensitive information, removal of barriers to maintaining existing generation capacity, expediting new generation capacity and expansion of the transmission system, and changes in tax laws that hinder the development of critical new electric infrastructures. (EEI, “Electric Infrastructure Security: Urgent Issues for Congress” November 2001)

Reliability, already a subject of intense discussion as electricity deregulation proceeds towards a nationwide wholesale power market, is even more important in the wake of the September 11 attacks. The National Energy Reliability Council (NERC) is calling for a new electric reliability oversight system, and legislation mandating transmission system reliability rules, rather than relying on voluntary cooperation, as is the case now.

Sandia National Laboratories (SNL) is currently engaged in a study of the vulnerabilities of the nation’s power grid, a predominate focus of communications studies since the events of September 11, 2001.

Oil and Natural Gas Transmission Security

Like the electric power industry, the oil and natural gas industry is scrutinizing its equally vast transmission infrastructure for previously unforeseen vulnerabilities. New risk assessments based on the possibility of terrorist attack are now underway. Domestic terrorism has never before been a target of the industry’s regular security practices. The industry is looking at the experiences of international corporations that have long had to cope with terrorist threats and civil unrest in other parts of the world.

Communication is also paramount for the oil and gas industry in the realization that information sharing must become the norm. As with the electricity industry, coordinated state, federal, and industry activity in communication will be required for heightened security.

Pipeline companies are working with law enforcement authorities nationwide to ensure pipeline security, according to the Interstate Natural Gas Association of America (INGAA). Refineries and petrochemical plants are tightening access and updating security procedures. Oil and gas companies are also hiring outside security consultants to perform risk assessments and evaluate the security of their facilities. (“Security Challenges in Oil and Gas,” Special Report, *OGJ*, April 22, 2002)

A New Answer: Diversified Power Sources

Renewable energy advocates claim that domestic energy security will increase as a result of a diversified power source base. We are especially vulnerable because our power supply is centralized. Distributed generation (addressed extensively in the Renewable Energy chapter, as well as in Part II), where there are many smaller generating sources plus a diversified energy base that does not depend solely on petroleum and coal, is promoted as a means to create a more secure energy transmission network.

By moving away from dependency on foreign imports, we could strengthen our energy security with renewables as a fuel source. Energy security is an important reason cited by the New Mexico Department of Energy, Minerals and Natural Resources in its support for renewable development and a Renewable Portfolio Standard for New Mexico. (NMENMRD, “Comments” 2002)

It is reasonable to assert that every sector of the energy industry is now in a state of heightened awareness as a result of the September 11, 2001 attacks; although focuses may differ, everyone seems to be in agreement that changes in policy must be made.

Summary

- New Mexico is energy-rich, producing more oil, natural gas, and electricity than it consumes. Coal is mined for electricity generation. The uranium industry is currently inactive, though this could change if the renewed national interest in nuclear energy prevails.
- Environmental concerns have led the extractive industries to the development and use of new technologies that are less disruptive to the environment
- Oil, natural gas, coal, and the electricity industry are strong contributors to the state’s economy, for which there currently is no substitute.

- An energy mix of fossil and renewable fuels is favored, but opinions differ in how to achieve that balance. Renewable Energy Portfolio Standards (RPS) are prescribed for New Mexico, but incentives are also promoted as an alternative way for renewable energy to penetrate the market. Green pricing programs (voluntary renewable energy tariffs) for utilities offering renewable energy to customers exist in many states, but only two are in New Mexico.
- Distributed generation's entrance into the New Mexico market is slowed by technical and regulatory concerns.
- Regional Transmission Organizations, regulated by the federal government, are proposed for the nation, but the states want to have more control over transmission in their jurisdictions.
- Electricity deregulation in New Mexico is postponed until 2007, but the New Mexico Public Regulation Commission (PRC) continues rulemaking and review. The PRC has concerns about the formation of RTOs and their effect on transmission issues in New Mexico. New Mexico Electric Energy Policy Principles have been established by the PRC.
- Crucial elements for domestic energy security are energy independence and the protection of supplies and transmission facilities. Several methods for ensuring security are prescribed.

Part II. Energy and Economy

Introduction

“Growth is getting bigger; development is getting better.” The New Mexico Department of Finance and Administration defined the difference in its 1996 report, *Growth in New Mexico: Impacts and Options*. In New Mexico, as anywhere else, energy industries and energy consumption have unquestionably impacted both growth and development. Historically, the energy industry has contributed significantly to New Mexico’s economy, and as our population grows, our energy consumption increases.

New Mexico’s population has grown considerably and is expected to grow considerably more. The 2000 census record shows a population at 1.8 million, a 20.1% increase over 1990, and projections are that this number will surpass 2.5 million by 2025. Growth has not been as explosive as it has been for some western neighbors (Nevada at 66.7% for example) but our population is steadily increasing. Growth has slowed for Albuquerque, our largest city, but the metro population is still projected to reach more than 800,000 by 2010 (U.S. Census Bureau).

Energy use is a marker for economic development and long-range forecasting. The consumption of energy is the benchmark for a state’s or a nation’s industrial capability, strongly linked to gross national and state production. Figure 6 shows that New Mexico’s trajectory is no different; as its gross state product (GSP) increases, so do BTUs consumed.

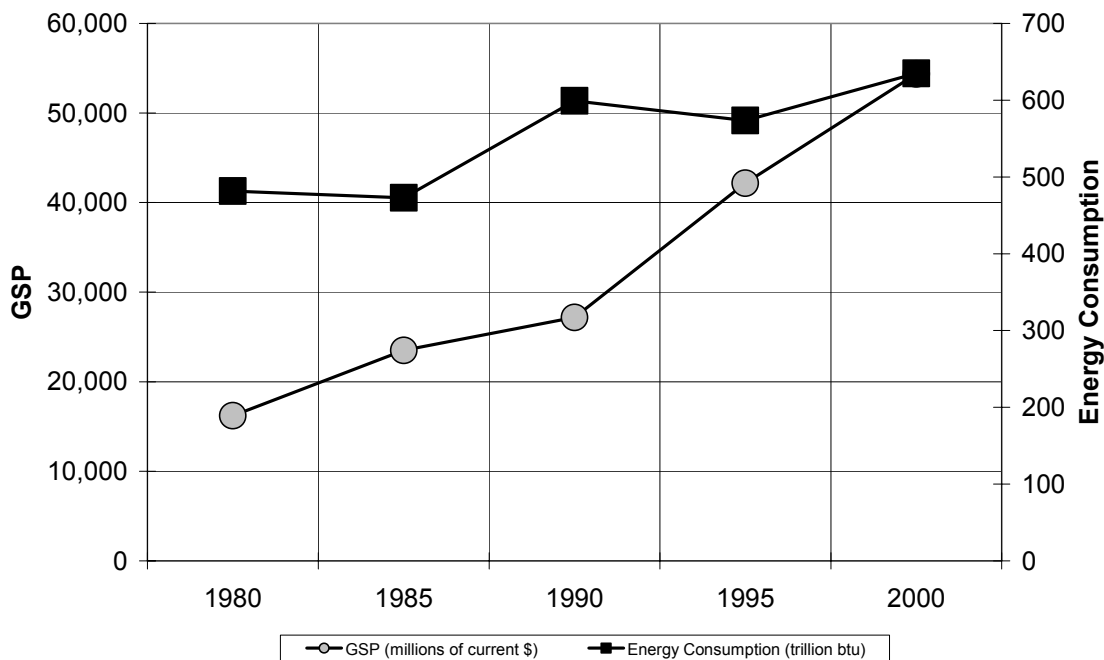


Fig. 6. Gross state product vs. energy consumption.

It is also true that energy consumption historically increases with population growth. Figure 7 displays this data for New Mexico.

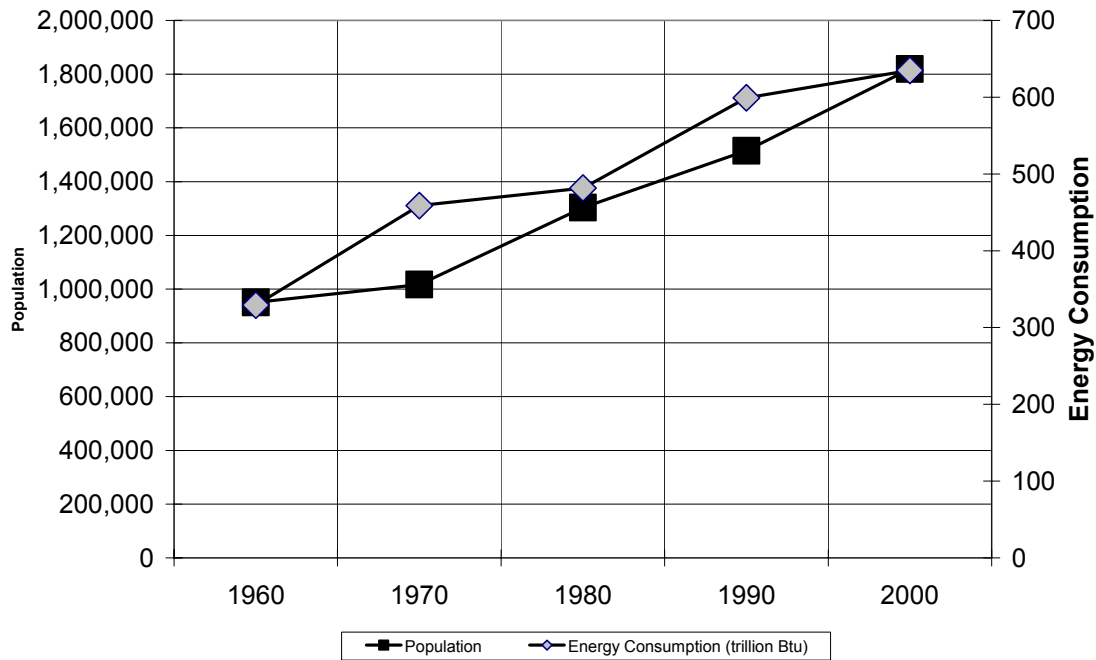


Fig. 7. Population vs. energy consumption.

These two charts show that population, GSP, and energy use all rose together, although GSP more rapidly from 1980–2000 than did all of the other elements, possibly due to the high growth of private industry in the area, as well as some recovery in mining and oil and natural gas production. (Data from US Census Bureau)

New Mexico’s economic growth, according to Moody’s Investors Service, is diversified and stable: “The state economy has displayed a steady trend of diversification over the last decade, with the wholesale and retail trade and services sectors growing and mining and government declining, although still accounting for a higher percentage of jobs as compared to the US.” Moody’s expects that our economic expansion will continue, and our healthy reserves and income stream from the permanent fund will offer some stabilization against economic downturns. (Report by Moody’s Investors Service Global Credit Research, October 29, 2001, Rating Assignment for NM General Obligation Bonds)

Oposing points of view exist: some view this kind of development as the antithesis of “getting better.” A report by the New Mexico DFA cautions: “Growth by itself as a strategy for community development does not work when demands on government to service growth

outweighs increase in revenues....Newcomers do not guarantee economic development.”
(NMDFA, *Growth*, 1996)

In this view, getting bigger can mean getting worse. Though larger cities usually offer more amenities, they can also mean crime, congestion, pollution, and rising housing costs that all dampen the pleasure of savoring the variety of urban living. Growth can also mean urban sprawl. Even in New Mexico, we feel the pressure of unplanned growth and the need to rein it in, creating sustainable communities that do not waste the next generation’s resources.

New Mexico’s economy is steadily diversifying. We have tried to attract industry, and we have succeeded. Furthermore, California’s current energy problems could be a turning point for New Mexico in the business realm, as we will see later on in Part II.

A growing population uses more energy. New Mexico has plenty of coal and natural gas for heat and electricity and we also have plenty of crude oil to sell to refineries. Our power plants generate more than enough electricity for most of the state*, though more than half leaves the state (more than half our generating stations are owned outside the state). Our extractive energy industries and our electric power industry are significant—and at this time, irreplaceable—contributors to our economy. Our renewable energy resources are in position to enter the market significantly. What could be better? A one-word answer to that is *more*. The United States needs ever-increasing amounts of energy and energy security as well. New Mexico is one state with the potential to supply that. The way, however, is not simple or clear.

Some of the factors adversely affecting the potential for increase in domestic energy production in response to the growing demand for energy are limitations on access to public lands and conflicts with extractive energy industries, environmental concerns, and other public needs. (*NEP*, 2001). Loss of revenue to oil, natural gas, and coal producers eventually comes around to fewer revenues for the state through taxes, rents, and royalties. The extractive energy industries are seeking a way around this barrier, and changes in national policies, as well as changes and improvements in energy technologies may offer answers in the future.

New Mexico, in addition to fossil energy resources, is also rich in wind, solar, and geothermal potential. None of these renewable energy resources have entered the market in a significant way. In order to render these resources cost-effective, a variety of solutions have been proposed, ranging from more technology to a change in regulation.

Finally, there is quality of life to consider—an issue that might be as elusive as a feeling of rightness about one’s life, or an entity that can be defined by various indicators and measured. New Mexico’s much-celebrated quality of life now faces the possibility of profound change as

*Most, but not all: it has been noted that, for some time, the Clayton area of New Mexico has been at the limits of electric power delivery, which is a potential inhibitor of economic growth for that area. The *2002 Annual Report* to the Members of Southwestern Electric Cooperative states: "The Tri-State line, which will be constructed from Walsenburg, Colorado, to Gladstone, New Mexico, is on hold while a dispute over easements can be settled... we need more electricity here in Northeastern New Mexico and are running at the very limit of the capabilities of the line from Springer. The increase of flickering and blinks we experience during the summer months is directly related to the

the recent course of events in our country's energy industry, regulation, sales, and transmission continue to unfold. The solutions offered are numerous and will require balance and compromise in certain areas.

Sustainable Development

Highly dispersed development patterns have been characteristic of American cities for at least the last 50 years. *Sprawl*, the changeling child of highly dispersed development, is uncontrolled growth that disperses from urban areas outward and is characterized by the consumption of open spaces, increased reliance on cars for transportation, poor land use, and unappetizing appearances. Sprawl has been with us in name, at least, since 1937, when the term was first publicly used by the Director of the Tennessee Valley Authority to describe the sort of growth pattern we've all come to hate, "...bursting its bounds, the city actually sprawled and made the countryside ugly ..., uneconomic [in terms] of services and doubtful social value." (<http://www.plannersweb.com/>)

Cities bursting their bounds are not yet that common in New Mexico, although unregulated homebuilding just outside nominal city boundaries is a cause for concern. Unregulated growth, with its accompanying pollution, traffic congestion, and water management problems, is widespread throughout the state. (Though water is perhaps the most critical of all our resources now, in the Background Report we are concerned with population growth and energy use, in energy development linked to economic development, and in all of these things as they affect New Mexico's environment. Water, though vital to economic growth and to industry, will not be a focus of our discussion, though it will enter from time to time.)

We now perceive that the typical approaches to planning and development in practice over the last several decades are creating, rather than solving, societal and environmental problems: congestion, sprawl, pollution, and resource overconsumption.

Sustainable development is the response to sprawl. Also called "smart growth," this approach offers economic development strategies for communities that enhance quality of life and benefit (or at least, do minimal harm to) the local environment. In addition to planning, sustainable growth principles include civic engagement on the part of affected parties, and development of indicators to measure a community's economic benefit, environmental protection, and quality of life. The claims for sustainable development are optimistic:

Sustainable development provides a framework under which communities can use resources efficiently, create efficient infrastructures, protect and enhance quality of life, and create new businesses to strengthen their economies. It can help us create healthy communities that can sustain our generation, as well as those that follow ours. (Energy Efficiency and Renewable Energy Network, US DOE, <http://www.sustainable.doe.gov/>)

lack of power." (2002 *Annual Report*; personal communication).

One commentator has observed that sustainable growth is now acquiring the same resonance as *wilderness* did in the 1970s. (Rocky Mountain Institute). And, like wilderness, sustainable development is attracting a certain amount of dissonance too. Other commentators, like John Carlisle, claim that contrary to current beliefs, America is not in danger of being covered up by strip malls any time soon, nor is the new development that we see really threatening rural lands, as 75% of the population lives on 3.5% of the land. Additionally, more land is being set aside for national parks and monuments than is being developed. Carlisle says:

The ratio of land being set aside for rural parks and wilderness areas is much higher than the ratio of land undergoing development. Between 1949 and 1992, the amount of urbanized land increased from 18.2 million acres to 57.9 million acres, an increase of 39.7 million acres. But the amount of land set aside for parks and wilderness areas was even greater, increasing from 27.7 million acres to 86.9 million acres, an increase of 59.2 million acres. In other words, the nation has protected one-third more land than it has developed since World War II. (John Carlisle, “The Campaign Against Urban Sprawl: Declaring War on the American Dream,” National Center for Public Policy Research (April 1999)

Carlisle finds that the “New Urbanists” want to recreate nineteenth-century American life, doing away with the suburbs entirely. He criticizes communities like Portland, Oregon, whose municipal planning initiatives for sustainable development resulted in more congestion and soaring housing costs.

Energy Issues in Long-Range Planning for Communities

For sustainable development, energy use must be efficient and it must also add to the economic benefit of the community. Community planning, under sustainable development principles, seeks to decrease the reliance on vehicles that results in pollution, congestion, and often danger to the community. Sustainable development planning attempts to lower vehicle miles traveled, and cut down travel time within the community.

One element of sustainable development is “building green” through use of increased building density and energy-efficient technologies in order to lower fuel consumption for heating and power. Other ways to lower energy consumption, such as a “dark skies” community policy—low impact lighting—have also been prescribed. Journal Pavilion, in fact, part of the Mesa del Sol development planned for Albuquerque, makes use of dark skies technology in the amphitheatre, using special lighting to reduce light pollution while saving energy.

Another important facet of sustainable development is renewable energy use, which involves maximizing renewable energy sources and minimizing power use from conventional power generating sources for street lights, traffic controls, and other civic infrastructure.

One such project in Albuquerque uses biogas energy—municipal waste-generated methane— for Albuquerque’s Southside Water Reclamation Plant. Co-generation with biogas energy produces enough electricity to fulfill about half the plant’s power needs (2,200 kW), saving an estimated \$70,000 per month (2002 prices) (<http://www.eren.dov.gov>; <http://www.cabq.gov/wastewater>).

PNM’s microturbine generating unit at St. Vincent Hospital in Santa Fe is a project that combines energy-efficient technology with on-site generation. This system generates about 56 kW and includes a heat exchanger that captures exhaust heat to preheat water for the hospital’s boilers (cogeneration). This is expected to lower heating costs and prolong the lives of the boilers. The performance of the low-emission natural-gas powered microturbine will be evaluated by researchers from Sandia National Laboratories (SNL) and New Mexico State University (NMSU). Cost per kilowatt hour, efficiency, reliability, and environmental impact are the indicators to be studied. A similar microturbine was installed at the Santa Fe Hilton. These microturbine projects evolved out of the Project Power group meetings, whose participants evaluate options for ensuring an adequate power supply for the Santa Fe and Las Vegas areas. (PNM news release, March 12, 2002)

Finally, sustainable development involves not only “green” buildings, but the attraction to and encouragement of “green” industry for the community. These would be sustainable businesses that practice lowered resource use, resource conservation, and use of alternate energy sources. The creation of jobs, goods, and services that are all produced with energy-efficient and renewable technologies would thus enhance the economic life of the community.

A question exists whether “green” development is really profitable. Proponents like the Rocky Mountain Institute claim that well-executed green development projects are cost-effective. Other critics say that utility fees are set at a scale that favors larger development projects, creating more sprawl; infill development, a sustainable development approach that the City of Albuquerque is attempting to implement downtown, is at a disadvantage. Other critics suggest that sustainable development planning will result in yet more regulation, and more constraints.

Planned Communities

A planned community is a large-scale, mixed-land-use development that conforms to a single master plan. Planned communities can incorporate sustainable development principals in their creation.

Planned communities are expected to escape the perils of sprawl by definition. The City of Albuquerque, in its *Planned Communities Criteria* (1991), for example, calls upon “Planned Communities” to improve upon “Established and Developing Urban Areas” in many different areas.

Mesa del Sol: “the Renewable Energy Mesa”?

Mesa del Sol is a planned community west of Albuquerque that will be developed on lands held in trust for the State of New Mexico's schools by the New Mexico State Land Office. This is the largest (>12,000 acre) parcel of undeveloped land under single ownership within a city limits in North America. The State Land Office says it will take 70 years to develop fully, providing homes and employment for up to 97,000 people and offering a solution for sustainably accommodating Albuquerque's expanding population.

Mesa del Sol planners are very interested in efficient energy technologies and renewable energy. The Renewable Energy Policy Project (REPP), in an extensive working paper, has envisioned a "renewable energy industry cluster" for Mesa del Sol that would provide jobs, generate revenue, and offer minimal harm to the environment.

Another idea for Mesa del Sol is eco-industrial development. "Eco-industrial businesses use shared, renewable, and alternative sources of energy, and they exchange by-products among themselves...The primary focus is on the development, production, and distribution of renewable energy technologies." (Zoretich, F. "Mesa del Sol: Can it be green and make green?" *Albuquerque Tribune*, February 18, 1999) Several possibilities for such businesses at Mesa del Sol include retail, transport, tourism, and manufacturing. Eco-industrialism is actually being tried out in Chattanooga, at the city's Smart Park development.

The City of Austin's green builder program serves as a model for Mesa del Sol. Austin's program emphasizes a market-driven strategy for resource-efficient construction and development. In a similar manner, the advantages of green building for Mesa del Sol will be advertised to the public. Seventy years from fruition, the Mesa del Sol project still has a long way to run; a developer was just recently hired, in June 2002.

Available, Affordable Utilities Attract Industry

It has become a truism that businesses need power that is both inexpensive and reliable. Our economy is based on the expectation that reliable, low-cost electricity will always be available.

For example:

Affordable electricity is critical to the success of most businesses. Energy costs rank very high in determining whether a business will be competitive and profitable. Profitable businesses expand, creating new jobs in their communities. If electricity prices are too high, businesses will relocate to areas with lower rates, taking with them the jobs that support working families. (Center for Energy and Economic Development)

And: "Poor infrastructure drives business away from a community; ...but adequate power and natural gas facilities available at a reasonable price to the ratepayer should be insured by adequate public planning and a goal of infrastructure investment." (NMDFA, *Growth*, 1996)

This view of progress requires low-cost, reliable electricity and natural gas facilities to be available to businesses and industries. This availability results in more jobs, better jobs, and better quality of life (by way of more goods and services) for more citizens.

Low-Cost or Reliable?

In light of California's problems with wholesale power marketing, low-cost power and fuel is becoming less important and reliability is now urgent. An article in *smartbusiness*, an on-line magazine, quotes comments by Intel CEO, Craig Barrett, that appeared in the January 9, 2001 *San Francisco Chronicle*:

Would I OK the expansion of anything in Silicon Valley right now? Not a chance. Will I build my new facilities in Oregon and Arizona and New Mexico and Ireland, and even Massachusetts and Israel, where I can get an assured supply of power? Absolutely, yes, and that's where my expansion is going.

(<http://www.smartbusinessmag.com/article2/0,3959,42321,00.asp>(August 2001)

If the comments of CEOs are anything to go by, the issue now is not so much about lower-cost electricity (which is still a good thing—California's power rates went up drastically) but reliability. Rolling blackouts in California cost industry hundreds of millions of dollars—a widely quoted figure is \$1million/minute for the semiconductor industries. The California Manufacturers & Technology Association is now not so much concerned with high energy costs as with issues of reliability. (<http://www.thedesertsun.com/power/neweconomy.shtml> (2001, latest; at the CMTA website)

How might this affect New Mexico? In a *New Mexico Business Journal* interview, PNM CEO Jeff Sterba says:

...it is clearly an opportunity for the state. But the state has to realize that we're in competition every day. Because Texas has that view, Arizona has that view... We can create greater value by building generation in this state with our natural resources. We are engaged in helping to carry that message to the kind of industry that would benefit. The ability to say we have got the energy capacity to serve your needs is powerful. We know how to serve a customer like Intel. We are committed to provide that. (*NMBJ*, August 2001)

New Mexico, as Mr. Sterba points out, does indeed have the wherewithal to create more generation. However, as he also pointed out in his comments on transmission, we also have federal and state lands as well as sovereign nations to cross with power lines—an issue we will look at in more detail.

The federal government is also very concerned about reliability. The US DOE sees this issue as crucial in the transition to a competitive power market. As we have seen, the *National Transmission Grid Study* found the U.S. power grid to be inadequate for a market-based power

structure, congested, and in need of a general overhaul. The *Study* was also concerned about the construction of new transmission lines and the improvement of existing lines under wholesale power marketing, where transmission might no longer be taken care of under an integrated vertical utility structure.

How does New Mexico fit into this picture? Regional transmission needs vary, of course, and New Mexico is not like the highly industrialized states of the Midwest; nor are we like California, although New Mexico is watching California closely. We do not have enough high-voltage transmission lines, and utilities seeking to build transmission lines are faced with regulatory obstacles when those lines cross federal, state, and tribal lands. In an interview published last year in the *New Mexico Business Journal* (August 2001) PNM's chief executive, Jeff Sterba, commented that it took PNM \$12 million and 10 years to build a 30-mile transmission line through the Jemez Mountains. Access is problematic for the electricity industry, as it is for oil, natural gas, and coal extraction, and pipeline companies as well.

Our state is trying to attract more high-tech, nonpolluting industry, through a variety of strategies. High-technology industry clusters are already in place in the state, in information technology and software, biomedicine and biotechnology, optics and photonics, and electronics. Another, emerging cluster is aerospace technology (MetroNew Mexico Development Alliance, (<http://www.nmsitesearch.com>)).

Compared to other states, New Mexico ranks high in the following high-tech categories:

- Exporter of high-tech products (no. 1);
- Initial public offerings (no. 1);
- Percentage of scientists and engineers (no. 2); and
- Presence among top 50 cities for business expansion and relocation (no. 3).

(Metro New Mexico, from US Bureau of Labor Statistics, US Census Bureau, NSF, State New Economy Index, Miliken Institute Report, Expansion Management)

The Twenty-fifth Town Hall (Nov 2000) dealt with economic growth for New Mexico. The Background Report for that Town Hall highlighted the importance of the electronic and electric equipment sector in New Mexico's economy. "In 1997," the report states, "SIC 36 [that is, electronic and electric equipment manufacturing] accounted for 19.1 percent of the value added in manufacturing in the nation, while the comparable figure for New Mexico was 94.9 percent." (*New Mexico's Options*, New Mexico First, 25th Town Hall, November 9–12, 2000) Computer chips are the symbol of the new, high-tech manufacturing in New Mexico. A silicon mesa is actually an element in the structure of semiconductor chips, and "Silicon Mesa" is what many people hope for Albuquerque's future.

Favorably priced electricity has not been the only crucial element in attracting these industries, well-known for their high electricity usage. Intel's decision to expand a factory in Rio Rancho in 1993 was controlled by factors other than low-cost utilities and incentives. The

company, commenting favorably upon incentives offered by New Mexico, mentioned only that PNM offered them a “competitive” power rate. Technology resources (like the Rio Grande Research Corridor), the labor force, and the relatively uncongested lifestyle available in New Mexico were all listed as the decisive factors. (“Intel’s Spectacular Southwest,” August 1995, *Geofax*)

Quality of life and elbow room actually seem to be strong selling points for New Mexico as a location for high-tech industries. *Inc. Magazine* called the state a “semi-rural Valhalla.” We could also be in position to offer a competitively favorable energy environment for a variety of industries.

High-tech industries are not the only ones in our semi-rural paradise. Dairy farming is growing rapidly in New Mexico. Ideal climate and low-cost feed have helped the dairy industry increase by 186% from 1990 to 1998, and it is still growing. In 1999, the average NM dairy produced almost 25 million pounds of milk, averaging approximately \$3.2 million in income from milk sales per dairy. Dairy production contributed over \$1.4 billion to the New Mexico economy (Dairy Producers of New Mexico).

All of New Mexico’s dairies are in rural areas, mostly in southeastern New Mexico, where their impact on local economy is great. While many are served by rural electric co-operatives, El Paso Electric and Southwestern Public Service Co. also serve New Mexico’s dairy industry. Electrification is undoubtedly one of the strongest influences on the modern dairy industry. Milking machinery and refrigerated transport are two of the greatest advances of the dairy industry under electrification. As do the semiconductor industries in Rio Rancho, so do the state’s dairymen depend on perpetually available electricity: if the lights go out, nothing is going to prevent tons of milk spoilage on a hot day, and un milked cows can be very unhappy.

How favorable is New Mexico’s electricity situation for new industry? In 1999, industrial electricity prices in New Mexico equaled the national average. In 2000, however, New Mexico’s industrial electricity prices increased over the national average by 8.9%, probably due to high natural gas prices. However, all utility prices rose in the four-year period from 1996–2000. (From EIA statistics, *New Mexico Natural Resources Yearbooks* for 2000 and 2001) Data for 2001 (EIA, *Electric Power Monthly*) shows that industrial cost in New Mexico is close again to the national average, 5.4 cents per kWh compared to 5.02. By all accounts, there is plenty of electricity (in most places) to supply the state’s needs.

Power reliability in New Mexico is not currently problematic, but there are issues that must be addressed as the nation moves towards wholesale power marketing. The reliability of the transmission grid, the expansion of the current transmission system, and the financing of these improvements will affect New Mexico as surely as they affect the rest of the nation. Another aspect of these changes is the possible transfer of regulatory authority, from state to federal government. It is highly possible that all these changes will have an economic impact, urban and rural, although the future is by no means certain.

Restructuring and Economic Development

The restructuring of the electricity industry is, in some opinions, primarily an economic move. Wholesale power marketing, with generation separated from other elements, is the objective of deregulation. The objective of wholesale power marketing is to permit electricity competition that is predicted to ultimately lower electricity prices to wholesale customers. These changes, already underway, are expected to have significant impact on the structure of energy marketing and consumption in the United States. This passage from the CRS Report “Electricity: the Road to Restructuring”, is worth quoting in full:

The electric utility industry has been in the process of transformation. During the past two decades, there has been a major change in direction concerning generation. First, improved technologies have reduced the cost of generating electricity as well as the size of generating facilities. Prior preference for large-scale—often nuclear or coal-fired—power plants has been supplanted by a preference for small-scale production facilities that can be brought online more quickly and cheaply, with fewer regulatory impediments. Second, this has lowered the entry barrier to electricity generation and permitted non-utility entities to build profitable facilities. Recent changes in electric utility regulation and improved technologies have allowed additional generating capacity to be provided by independent firms rather than utilities. (CRS Report IB10006, Library of Congress, Sep. 7, 2001)

The generation of electricity, thus, becomes a business in its own right, and one that may offer favorable implications for New Mexico, as we mentioned in the preceding section on attracting industry.

There are a number (seven as per *Electricity Restructuring Weekly Update*) of power plants either under construction or proposed for New Mexico*. Most of these are to be built for the wholesale market, although the new Farmington power plant is being built for the utility’s customers. Currently, there is plenty of electricity available to meet New Mexico’s needs. The construction of power plants that will provide electricity to the wholesale market should not affect the regulated business of New Mexico’s energy companies. The increased number of generating plants in New Mexico can be expected to contribute to the energy industry in our state, with more jobs and more revenues to state and federal government. The presence of more generating stations in New Mexico will also require the consumption of more fuel: coal and natural gas, already in abundant supply in the state. Production and sale of these fuels will be an added contribution to the state economy.

* It appears that new power plant construction is being put on hold currently, due to a lagging wholesale power market.

Pipelines and Power Lines Wanted

Transmitting generation is an issue that includes both obtaining rights-of-way for power lines and financing new line construction. Additionally, transporting fuels to locations where they are needed may require more infrastructure— railroad tracks and natural gas pipelines. As noted in Part I, the problems of building, maintaining and paying for transmission infrastructure are important economic concerns to the nation as it moves towards the deregulation of the electricity industry and wholesale power marketing. It is not yet clear who will have the responsibility for financing all of this.

The *National Transmission Grid Study* points out that while new generation facilities are rapidly being built all over the US, new transmission systems are not. This is because there is a lot of uncertainty about recovery of investments from such construction, which the DOE identifies as a barrier to new infrastructure. Currently, for investor-owned utilities, the costs of transmission are recovered under the authority of federal and state regulators. In a restructured power market, it is not clear how investments in transmission infrastructure would be recovered.

Co-op Concerns in a Restructured Environment

The rural electric cooperatives of New Mexico are also faced with the economics of restructuring and transmission structure overhaul. New Mexico's co-operatives have close to 42,000 miles of power lines crossing tribal, state, federal, and private lands, and \$525 million invested in infrastructure (New Mexico Rural Electric Cooperative Association, website at <http://www.nmco-ops.org>). Affordable electricity is as vital to rural economic development as it is to urban areas. Rural electrification is more expensive to operate than is urban; per-customer capital costs are more expensive for rural systems and all rural systems are characterized by "low population density, lack of economies of scale, less affluent customers, and fewer industrial and commercial customers per residential customer." (Wally Beyer, "Testimony before the House Agriculture Subcommittee for General Farm Commodities, Resource Conservation and Credit," May 26, 1999) Cooperatives also pay taxes, as do all businesses. New Mexico's cooperatives pay property taxes, gross receipts taxes, unemployment taxes, and payroll taxes—about \$30 million a year. (NMRECA)

Restructuring has been of interest to rural areas because electricity distribution costs are higher there than in urban areas. With fewer customers and higher per-capita costs, rural electric cooperatives (RECs), which serve the majority of rural residents, have concerns about issues such as: 1) how new Federal rules may affect their access to low-cost Federal power sources; 2) their continued ability to attract industrial and commercial customers; and 3) their ability to keep functioning as cooperatives. Their ability to compete in the future is still largely unknown and will depend greatly on the new rules decided. (National Rural Electric Cooperative Association)

Rural electric co-ops are also concerned that their own transmission facilities will suffer if and when federally regulated Regional Transmission Organizations (RTOs) become a reality.* Although NRECA (National Rural Electric Cooperative Association) supports RTO formation, there are concerns that co-ops may suffer under new rules that do not take local situations into account, resulting in higher prices and less reliability.

Municipal Utilities in a Restructured Environment

In accordance with SB 428 – The Electric Utility Industry Restructuring Act of 1999, municipal electric utilities will also have options. The municipal governing body is authorized to elect whether and when its municipal utility participates in customer choice and open access. The decision by the governing body is not to be made until after January 1, 2007 and will be made by the adoption of an appropriate ordinance or resolution.

The law is also clear in that “nothing in the Electric Utility Industry Restructuring Act of 1999 impairs the tax-exempt status of municipalities and municipal utilities.” That is the existing concern with federal legislation and FERC’s push for regional transmission organizations (RTO’s). The transmission and distribution systems built by municipal utilities are financed mainly through tax-exempt bonds to deliver electricity to the residents of the communities they serve. Should those systems be used for other purposes, such as a generator wheeling power across a municipal system to access another wholesale market, the tax-exempt financing would be jeopardized.

Due to municipal electric utilities’ goal in providing cost-efficient, stable rates, they are also concerned about the perceived benefits of RTOs. The following RTO principles have been agreed upon by many municipal and cooperative electric utilities in the West:

- Focus on reliability, simplicity and minimizing costs;
- Provide non-discriminatory transmission service to all loads;
- Do not impose increased costs from RTO development or operation unless there are demonstrable, significant benefits that offset such costs;
- Ensure that all costs are paid for by all users of the transmission system on an equitable basis;
- Be flexible and adaptable over time in market design and governance to accommodate regional differences;
- Accommodate vertically integrated utilities as well as disaggregated utilities on a non-discriminatory basis;

* This is getting closer to being realized, with FERC’s new proposed rulemaking of July 31, 2002, discussed in Part I.

- Honor existing contractual and legal obligations and rights according to contract terms and bond covenants;
- Accommodate public power's unique statutory and regulatory restrictions and ensure that the statutory rights of customers of federal power marketing administrations are protected; and
- Be based on a completed, independent, credible regional cost-benefit study that shows sustainable net benefits to end-use consumers in each affected state.

And, customers must benefit from RTOs:

- Congestion management should place priority on serving loads;
- Loads must receive transmission rights;
- System must ensure long-term price stability for transmission service; and
- Load serving entities must ensure adequacy of supply through a requirement to maintain appropriate reserves and to ensure the ability to transfer these reserves (Courtesy of Maude Grantham-Richards, Farmington Electric Utility).

Natural Gas Pipelines

Power lines are not the only means of transmission that are of concern. More natural gas production, supported by increasing demands for fuel as wholesale power production grows, requires the construction of new pipelines and the overhaul of existing infrastructure. New Mexico has enjoyed the fruits of expansion in the natural gas industry for the past decade. While there is adequate pipeline capacity at the present, since the state is likely to continue to be a major producer of natural gas for the foreseeable future, more pipeline capacity is likely to be required. Numerous projects are now either under construction, permitted, or planned to increase the capacity of interstate pipelines into California. The Reasonable Foreseeable Development Plan for the U.S. Bureau of Land Management's new Resource Management Plan/Environmental Impact Statement, projects an additional 3,600 miles of pipeline to be built in the San Juan Basin.

Regulation and Its Economic Impact on Energy Industries

In Part I we saw the magnitude of the energy industry's contribution to New Mexico's economy. Fees, taxes, rents, royalties, and jobs are all supplied by the production and sale of coal, oil, natural gas and electricity. New Mexico's economy depends heavily on these industries. While our state economy is steadily diversifying, there is currently no replacement for energy industry contributions: they are critical for our state's economy.

Most of the oil, natural gas, and coal that is produced in New Mexico comes from public lands. Statistics from the New Mexico Energy, Minerals, and Natural Resources Division for 2000 (latest) show that more than 80% of the state's oil production and 87% of natural gas production was on federal, state, and Indian lands.

Access to federal, state, and private lands must be sought and permitted before any exploration, production, or construction takes place. A number of agencies also govern this process, and requirements may even conflict. Right-of-way is also governed by the need for permission. Roads, railroad tracks, oil, refinery product, and natural gas pipelines, and electricity transmission lines must all have permission to cross state, public, and private lands. Finally, there are still rules that must be obeyed related to recovery and use on any sort of land. Environmental protection is also regulated by a number of entities for the public good.

In New Mexico, about 13.4 million acres, or 31% of the state's total acreage, are managed by the United States Bureau of Land Management (BLM). BLM New Mexico (comprising New Mexico, Kansas, Texas, and Oklahoma) has one of the BLM's largest oil and gas programs. Most of the land managed by the BLM in this district is in New Mexico, with more than 6,500 producing oil and gas releases.

It is hard to determine the amount of land available for oil and gas leasing, as the withdrawal of some lands and the release of others for leasing is an ongoing process. The state keeps tabs on production, however—in 2000, 41% of NM oil production came from federal lands, as did 66% of the natural gas production. The latest figures on revenues generated from federal leases in NM report that \$151.4 million is the state's share of federal mineral leasing rents and royalties. (*NM Natural Resources* 2001)

Industry finds the permitting process to be a frequent source of problems, and agencies even conflict with each other in their requirements. Sometimes rules are interpreted and enforced differently in different regional offices of the same agency. Frequently, there are delays in the permitting process that can be translated into lost opportunity and lost dollars. Especially in the oil and natural gas industry, producers feel the need to move immediately on a promising show, so lost production can be costly and problematic. Sometimes, in multiple usage areas, different industries are in conflict over the same resource.

In addition to regulatory issues, there is the ultimate problem of denial of access. Millions of acres of public lands are now off-limits to any kind of energy production or right-of-way.* Because most of the oil, natural gas, and coal deposits in New Mexico are on public lands, loss of access to these areas means loss of production, loss of revenue to the producer, and ultimately, loss of revenue to the states. This issue has become problematic for the entire US energy industry,

* The industry has had a concern for several years about the ability of the BLM's local field offices to be able to arbitrarily remove acreage from lease sales. As of July, 2002, the state office must now review and approve all requests for removal of such acreage and the requests must include an energy impact statement. ("Oil and Gas Lease Parcel Review Procedures," Instruction Memorandum No. 2002-064, New Mexico State Office, BLM, July 17, 2002)

not just in New Mexico. Companies have been known to give up on trying to get permitted for their New Mexico leases and move their oil or natural gas operations to places like Canada and Texas

The New Mexico Oil Conservation Division has stated that each well in New Mexico is valued at over a million dollars to the state. What if these wells don't get drilled? Producers are reluctant to put a specific price tag on the oil and natural gas that they were unable to produce because of denied or delayed access to public lands; something that did not occur is very hard to measure. Estimates also vary depending on who is performing the estimation.

Company and federal estimates of production vary considerably. In the draft *RMPA/EIS for Federal Fluid Minerals Leasing and Development in Sierra and Otero Counties* (2000), the BLM used an estimated total of 105 producing wells with oil and gas prices for 1997 to obtain a value of \$83,897 per oil well and \$145,421 per gas well per year for producing wells anticipated in the study area. Those figures were based on "average production" figures of 75,500 Mcf for gas wells and 3,000 bbl for oil wells per year for southeastern New Mexico. The BLM's overall RFD (Reasonable Foreseeable Development) therefore was \$5,872,787 for oil wells and \$5,089,728 for gas wells, with a grand total of \$10,962,514 per year. (*Draft Plan*, Oct 2000).

Figures amassed by the producer making the natural gas discovery are very different and much higher than the federal government's assessments. The company claims that the problem with the RFD model is that 1997 pricing (\$21 oil \$1.76 gas) is used, which is substantially lower than current prices (which are expected to climb higher) and that averages of current well producing rates are very low, weighted from mature stripper production. They contend that less than 1% of the area has actually been tested for hydrocarbon potential, and that the source rocks indicated in their geological survey suggest a higher yield than reported in the Draft Plan. They say that a more reasonable expectation would be 150 Mm bbl of oil and 1 Tcf natural gas as a resource base, currently valued at approximately \$8 billion with a royalty income generated of \$1–2 billion. They claim that extrapolation of the BLM's 20-year modeling of the resources would only amount to 3.75 Mmbbl of oil and 25 Bcf of natural gas, currently valued at \$197 million.

Lost royalties also have an economic impact for both state and federal governments. The BLM (draft *RMPA/EIS for Federal Fluid Minerals Leasing and Development in Sierra and Otero Counties*) states that royalties generated by production on federal lands average \$1.534/bbl of crude oil and \$0.25/Mcf of natural gas. Using the BLM's figures, for every month this average gas well is not flowing, \$7,500 in royalties are not being generated. The "average" oil well with 3230.25 bbl/yr, on federal lands, would generate \$4,955.20 in royalties. The "average" natural gas well, at 81,765 Mcf/yr, would be worth \$20,441.25 in royalties. (*Access to Public Lands*, PRRC, 2001)

The regulation of coal mining deals with public health, safety, property, cultural rights, and the environment. Federal and state agencies also implement various laws governing coal mining. Interplay of these issues can result in some coal resources becoming uneconomical to

produce. Statutory, regulatory, and administrative difficulties also may limit or prevent the production of some coal resources.

Removal of large areas of land from surface mining usage coupled with initiatives such as the recent US Forest Service Roadless regulations have removed many millions of tons of coal reserves in the United States. Slow processing of lease applications has also been pointed out as a detriment to coal mining economics.

Rights of Way on Federal Lands

The BLM estimates that 90% of the oil and natural gas pipeline and electric transmission rights-of-way in the Western United States cross federal lands. Roads and railroads, used for development of minerals and transport of coal, can cross public lands also. These lands are lands principally managed by either the BLM or the USFS. Rights-of-way are authorized through an approval process that allows the public to comment on proposals to locate infrastructure items, like utility poles, on these rights-of-way. As part of this process, proposals are examined for resource and other use conflicts and a national interest test is applied prior to approval. The right-of-way application process can also be time-consuming and expensive.

The National Energy Policy states that limited access to federal lands can block needed transmission expansion. PNM's experience with this issue led their CEO to state that a line from San Juan Generating Plant to California would be "...almost impossible. It cost us \$12 million and 10 years for the Ojo project that was going through the Jemez Mountains before we got an answer. A 30-mile line." (*NMBJ*, August 2001). The Ojo Line Extension was never built. Neither the mountainous route that was first selected nor an alternative route in the valley was ever approved.

The *National Transmission Grid Study* recommends that federal agencies that manage public land "should work together to re-evaluate the development of transmission corridors across federal lands and identify the current and potential future use of existing transmission corridors on federal lands." (*NTGS*, 2002) The movement toward federal eminent domain authority in the siting of power plants and transmission lines, however, is not universally supported. The National Governors Association (NGA) opposes a legislative proposal which would establish federal eminent domain authority over electricity transmission facilities. The National Conference of State Legislatures (NCSL) also opposes federal preemption of state authority over electric facility siting. (National Governors' Association, <http://www.nga.org/nga/legislativeUpdate/>)

Coal Development on Federal Land

In addition to its vast natural gas stores, the San Juan Basin holds most of the recoverable coal reserves in New Mexico. Most of the coal mined here is used for electricity generation in New Mexico plants, since lack of railroad transport prevents its being widely shipped out of the Basin.

Land ownership in the SJB is a pastiche of private, state, federal, Native American, and Spanish land grant properties held in common, each with different ownership issues and regulatory processes. In addition to multiple land ownership, several types of mineral ownership are usually involved in developing coal reserves. Negotiating the permitting process can be a stumbling block to coal development. One estimate of capital outlay to develop a small surface mine is over \$1 million. (Hiles, In *Decisionmakers*, 2002)

The San Juan Basin is not the only area in New Mexico where coal reserves are problematic to mine. The Fence Lake Mine in Catron County 14 miles north of Quemado in west-central New Mexico was recently granted permission to start operation, 15 years after the Arizona-based Salt River Project filed its coal lease application with the Bureau of Land Management in 1988. It is possible that the process of cultural identification was very time-consuming, as the Socorro District Office remarked that this was the first major case in New Mexico to attempt to identify traditional cultural properties in compliance with Section 106. The company plans to dig 80 million tons of coal over the next 50 years, which will be shipped to Arizona for electricity generation. New Mexico is projected to receive some \$60 million in taxes and another \$60 million in royalties from the mine, and 75–150 permanent jobs are expected to be created by the mining operation, even after construction of the mine and a 43-mile railroad line is finished. Capitalization for the mine has been estimated at \$120,000, far short of the \$1 million quoted earlier. (Fence Lake Mine figures from *Magdalena Mountain Mail*, June 10, June 17, 2002)

Two Different Scenarios for Oil and Natural Gas Development

Last year, scientists from the New Mexico Institute of Mining and Technology prepared a Reasonable Foreseeable Development Scenario (RFD) for the San Juan Basin's oil and natural gas development potential. This plan was prepared for the Bureau of Land Management, in preparation for its revised Regional Management Plan/Environmental Impact Statement that would prescribe the management of the Farmington Area for the next 20 years. The report was prepared to determine the subsurface development potential measured geologically and through engineering evidence, as well as to estimate the associated surface impact. Researchers found that production out of the San Juan Basin could be expected to be strong, consistent with current production levels for the RFD period, assuming that the regulatory climate is favorable. The report anticipates the implementation of the National Energy Policy, and increased pipeline capacity and distribution systems out of the basin, incited by the strong and anticipated increase in energy needs both in the west and nationwide. It also anticipates the use of advanced technologies that minimize the impact of oil and natural gas recovery upon the environment.

The San Juan Basin is “one of the most strategic gas producing basins to the US economy, due to its annual volume of production and the market it supplies...[it] is California's largest single supplier.” (*RFD*, 2001). The authors emphasize:

it is of critical importance that the BLM and the public realize the economic impact that regulator decisions will have regarding development and sustainability of production from the basin. The cost of alternative management strategies to the economy of New Mexico and the downstream market must be carefully weighed against competing philosophies of land management, alternative resource development, or preservation. (RFD, 2001)

In the analysis of the scientists who prepared this report, ongoing development of the San Juan Basin oil and natural gas resources is feasible, sustainable, and above all, economically significant to the state. The BLM has based its RMP/draft EIS planning on these projections.

The proposed Farmington area RMP/EIS has four different scenarios: current management, resource production maximized, resource conservation, and preferred alternative, in which management is balanced between conservation and production.

On comparing the scenarios, it is interesting to see that there is not much difference anticipated by BLM between the production and conservation scenarios as far as mineral development and social impact is concerned. No habitats or Wilderness Areas were expected to be adversely impacted in any of these alternative plans; the prime consideration for rewriting the RMP/EIS came about because of the increase in leasing activity in the San Juan Basin, although off-road vehicle activity was also of concern in the new plan. In all cases, we can see that the BLM emphasizes that *market value* of production will dictate the value of production from the SJB. The greatest predictable economic value comes from the steady provision of jobs, and from taxes and royalties that are extracted from oil, natural gas and coal production.

Table 12. Comparison of Four Development Scenarios (After BLM's RMP/draft EIS)

A no change in management	B resource production	C resource conservation	D preferred alternative
Effects on Mineral Production			
4,910 Bscf (44% potential reserves) natural gas to be produced in 20 yr management scenario; 138,000 acres of federal minerals available for consideration of coal leasing	11,158 BSCF (100% potential reserves) to be produced in 20 yr management scenario; 378,875 acres available for consideration of coal leasing	11,002 BSCF (98.6%) to be produced in 20-yr management scenario; 378,275 coal acres available for consideration of coal leasing	11,125 BSCF (99.7% to be produced in 20-yr management scenario; 378,275 coal acres available for consideration of coal leasing
Effects on Social and Economic Conditions : changes in oil and gas production have greatest potential to cause economic impacts			
Moderate loss of jobs with a moderate impact on the local economy and minimal on the regional. Coal jobs expected to remain steady but could increase. Tax revenues	Moderate increases in oil and gas industry jobs (1,460 additional jobs; 20% increase over 20 years), minor benefit for local economy, minimal for	Minor changes in oil and gas industry jobs (500 additional jobs; 6% increase over 20 years), minimal effect for local economy, minimal for the region.	, moderate increases in oil and gas industry jobs (1,460 additional jobs; 20% increase over 20 years), minor benefit for local economy,

<p>could benefit under current management up to 43% over current levels, but market value continues to influence tax revenues primarily. Little changes in coal royalties and some change in oil and natural gas with moderate benefit possible for state and local revenues.</p>	<p>the region. Tax revenues could benefit substantially (doubled production in 20 years), but market value primarily continues to influence tax revenues. Coal industry jobs expected to remain steady but could increase if coal leasing increased. Increases in royalties from expanding production of federal energy resources would benefit state and local revenues.</p>	<p>Tax revenues could benefit substantially (doubled production in 20 years), but market value primarily continues to influence tax revenues. Up to 450 coal industry jobs could be lost if San Juan and La Plata mines are not expanded. * Decreases in royalties from less federal coal reserves development would reduce mineral dispersements to New Mexico somewhat (expected to be offset from increased oil and gas employment and production</p>	<p>minimal for the region. Tax revenues could benefit substantially (doubled production in 20 years), but market value continues to primarily influence tax revenues. Coal industry jobs expected to remain steady but could increase if coal leasing increased. Increases in royalties from expanding production of federal energy resources would benefit state and local revenues.</p>
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This regulatory outcome (or, predicted regulatory outcome as it is not final yet) strongly supports continued mineral extraction on federal lands in the San Juan Basin. Even the Conservation Alternative still allows for 98.6% potential recovery of identified reserves of natural gas, as well as continued coal mining. However, there are other land use planning scenarios dealing with mineral recovery with different outcomes in the state. One strongly contrasting plan is now in its final stages in the Las Cruces District of the BLM.

The impact area is south-central New Mexico, in Otero/Sierra counties. A currently-published Environmental Impact Statement/Resource Management Draft Plan (EIS/RMP) reports low-to-moderate potential for oil and gas recovery. This revised plan was undertaken when a rise in leasing activity prompted the regional BLM office to take another look at their Management Plan.

The company that recently made a very fruitful natural gas discovery disagrees with the revised EIS. The company in question began leasing in the area in 1986. In May 1996, an Application for Permit to Drill (APD) for a well was approved. Their discovery well, completed in 1997, has raised the possibility for high oil and gas potential in parts of the area. In February 1997, the company requested an extension for the original well. BLM postponed the request because of a potential threatened and endangered (T&E) species habitat conflict in the area, that of the Aplomado Falcon. A well was drilled prior to the first APD's expiration and the company

* These mines are getting too deep for economical coal extraction and the company may not renew the leases (Papich, In: *Decisionmakers*, 2002)

subsequently filed more APDs. In August 1997, BLM halted further leasing until the RMPA/EIS was completed.

In November 1997 their discovery well was completed. Reported production testing showed a flow of 4.4 million cubic feet (Mmcf) per day. A draft EA, also prepared in August 1998, led the BLM to conclude that the Las Cruces Resource Management Plan did not adequately address oil and gas production and transport, so an amendment to the RMP was required. Furthermore, due to the need for compliance with the Migratory Bird Treaty Act, the BLM could not grant additional APDs. In September 1998, the BLM stopped production and other activities until the EIS was finished. A moratorium was placed on oil and gas leasing activities pending completion of the revised EIS.

In November 2000 the draft EIS was released. Records of public hearings conducted in Roswell, Alamogordo, and Truth or Consequences show that there was vigorous disagreement with the EIS. Some of the points were:

- BLM underestimated the economic potential indicated by the gas discovery, as well as the size of the potential resource.
- Stipulations and constraints proposed by two of the Management Alternatives would effectively prohibit oil and natural gas recovery in that area
- Grassland fragmentation and other potential harm is not as certain as it is described to be in the EIS
- A threatened species, the Aplomado falcon, that was described in the EIS as having habitat threatened by oil and gas activity actually does not live in the area; this is as yet a potential habitat.

In general, energy production supporters contended that the “preferred alternative” would effect such drastic stipulations that the area would be rendered essentially unproducibile. The final EIS/RMP is pending; the response to the draft EIS may well have altered the course of management of this area, as well as recognition of the heretofore unknown natural gas potential of the area revealed by the discovery well. As of this time, all production has been suspended. The company has permission to drill, but not to produce; nor has right-of-way been granted to a pipeline company.

Coal vs. Coalbed Methane

Conflict can also occur between companies that each have leases and rights to the same resources, but for different purposes. In the San Juan Basin, coal mining and gas drilling have come into an unexpected controversy. The San Juan and La Plata open-pit coal mines have been in operation since 1972 and currently supply coal to the San Juan Generating Station. These mines are now too deep for economical coal extraction, so plans have changed in order to meet the ongoing needs of the generating station. The company, after examining a variety of

alternatives, decided to go underground with the San Juan mine. The San Juan Basin's first underground, or "longwall" mine started production in 2001.

In the 1970s and 1980s, however, the BLM had leased the San Juan Mine coal seam for both coal mining and natural gas production. The mining company had not developed underground mining plans for this period, nor had natural gas companies much interest in drilling at that time. Then federal tax credit for coal seam gas production began in 1988–1992, intending to encourage the development of unconventional gas resources. Coalbed methane gas now represents 50% of natural gas production in the basin.

The conflict arises from two different methods of production that are now scheduled for the same area. Two natural gas production companies have either drilled, or are going to drill, into the coal seam that is going to be mined. The natural gas that they seek lies underneath the coal seam. The mining company is worried about the risk of cave-ins and spontaneous combustion. The longwall mine has to go ahead if the San Juan Generating Station is to be supplied with coal, thus involving electricity that is in danger of not being produced. Mine safety is the leading issue, followed by the question of whose lease takes precedence, and maximizing two resources out of the same coal seam. The BLM has the task of negotiating a settlement with all parties coming to some sort of agreement and resolution of the conflict. (Papich, *Decisionmakers*, 2002)

The Cost of Environmental Protection

Although New Mexico industries currently have a good record of compliance, the regulatory process itself is frequently arduous. Costs of environmental compliance must be reckoned with, as well as the cost of various fees and permits. These costs have been estimated at various rates, some very high. In the 2000 Town Hall on Energy, the Background Report cited a study performed by the EPA and the American Petroleum Institute in 1990 that estimated the cost of industrial compliance with EPA requirements from \$15 to \$79 billion initially, and \$2-7 billion annually thereafter. The study concluded that most hydrocarbon resources would become uneconomical as a result of environmental compliance.

Has that happened? The Fossil Energy Office of the U.S. DOE says "In 1996, the petroleum industry, including refining, spent as much on environmental protection as it spent searching for new domestic supplies: \$8.2 billion, or 9 cents for each gallon of gasoline Americans used." The DOE states:

The higher cost of meeting environmental regulations places a substantial economic burden on industry. The burden is magnified by the economically marginal conditions of a large percentage of domestic oil wells, and a growing share of domestic natural gas wells. Over two-thirds of domestic oil wells are classified as marginal, producing, on average, less than three barrels of oil per day (or the equivalent in natural gas), making them highly sensitive to increasing costs. Yet, these wells produce more than 26 percent

of onshore Lower-48 oil and 8 percent of onshore Lower-48 gas, contributing more than \$9 billion to the U.S. economy (in 1998). Every dollar of stripper well production creates 59 cents in additional economic activity.

Modest increases in environmental compliance costs can cause marginal wells to be plugged and abandoned, permanently cutting off access to oil and gas resources left in the ground. Premature abandonment of wells and forgone exploration and production threaten to increase our Nation's reliance on oil imports, and reduce the supply of natural gas, at a time when its use is projected to increase dramatically, especially as a fuel for electric power generation.

The government has responded with a new program to find more cost-effective ways for producers, especially those with marginal wells, to meet environmental requirements. The industry has responded with a call for “more common-sense” regulation that “would give oil and gas producers more flexibility in determining how they can best meet standards, yielding the same environmental benefits at lower costs.”

(http://www.fe.doe.gov/oil_gas/environment/index.shtml)

The DOE claims that the program by 2010, could:

By furthering risk-based, streamlined regulations based on credible scientific information, and by developing lower cost compliance technologies:

- Decrease cumulative industry environmental compliance costs by over \$29 billion;
- Increase oil production by 160,000 barrels per day;
- Increase gas production by 430 Bcf per year;
- Contribute \$17 billion in cumulative revenues to federal and state treasuries;
- Add as many as 20,000 jobs to the U.S. economy; and
- Increase Federal royalty revenues by almost \$2 billion.

Thus, protecting the environment, making money for the government, and saving money for producers are all implemented. (http://www.fe.doe.gov/oil_gas/environment/index.shtml)

The coal industry also bears the cost of environmental regulation. Compliance with reclamation and safety regulations enacted by the Coal Mine Health and Safety Act (1969) and the Surface Mine Control and Reclamation Act (1974) caused many small mining companies to go out of business. In 1974, New Mexico coal cost \$5/short ton; by 1981 the price had jumped to more than \$17/short ton.

Environmental compliance rules for the electricity industry where coal-fired power is the norm also have an effect on coal mining. The Clean Air Act is now a focus of attention for coal-

fired generating plants. For example, the United Mine Workers of America recently charged that stricter emission rules for coal-fired power plants would ensure the retirement of many older coal-fired generating stations as too costly to operate, thus throwing coal miners out of work by the thousands. There are not thousands of coal miners in New Mexico; more like hundreds, but their jobs are still crucial. The UMW states further:

Dozens of states could be forced to adopt emission controls for rural coal-fired power plants exceeding the requirements of the 1990 Clean Air Act, with little impact on urban smog. EPA estimates that compliance costs for such a program would range from \$2 to \$4 billion annually, some two to four times larger than the cost of the 1990 acid rain control program.

In this section, industry has looked at economy in terms of the costs of doing business on government lands, and obeying government rules. This has been a one-sided look; in a later section, we will take a look back at industry from an environmental viewpoint. We continue with the industrial point of view in looking at ways in which new technology can result in more efficient energy production, with less disruption to air, land, and water.

The Impact of Technology-Based Energy Development

In one sense, all energy development is technology-based, as technological advances were necessary in all the extractive industries as they developed. Today's technology improvements are aimed at extracting more, faster, cleaner, safer, and cheaper—a tall order. The fossil energy industries are determined to survive in an era of diminishing reserves, of aging fields, and increasing public awareness of environmental problems that the last two centuries of industrial progress, especially, have created. To this end, oil, natural gas, and coal technology will continue to be advanced in the foreseeable future through intense research and development by industry, government, and academia.

The oil and natural gas production industry is optimistic about its advanced technology, and points to an ever-improving environmental record as proof of its effectiveness. (*DOE Report on Environment, 2000*). These technologies are at work today in New Mexico, and if the NEP is implemented, will continue to be developed and utilized in domestic energy recovery. The NEP says:

New technology and management techniques allow for better energy production and better environmental protection. Computing, 3D seismic and other technologies have transformed the oil and natural gas exploration and production industries, and reduced costs. (*NEP 5-5*)

The authors of the RFD report on the San Juan Basin performed for the Farmington Field office of the BLM are emphatic about the need for advanced technologies in the San Juan Basin, where the energy production activity continually increases:

The potential role of evolving technology cannot be over-emphasized. New drilling and completion strategies are expected to improve for directional and horizontal wells... A second example is advances in stimulation design. ..The evolution of stimulation has played a key role in development scenarios and well efficiency..” (vii)

Hydraulic fracturing is a stimulation technique first used in 1948 (and in the SJB since the 1950s) that is continually evolving, where fluids are pumped down casing or a temporary workstring under high pressure to artificially fracture a reservoir rock in order to increase production. Advances in fracture technology are found by the authors to have the greatest potential impact on future development of the SJB. Another important new technology that is important for San Juan Basin development is directional and horizontal drilling. These drilling techniques are used either to avoid surface occupation or to increase production efficiency:

Avoidance of surface occupancy is typically due to topographic or environmental concerns...a drilling location will be selected as near as possible to the subsurface target and a well bore will be constructed in such a manner as to minimize cost while achieving the subsurface target. The goal is to capture the same reserves that would have been achieved from a vertical well, had one been drilled. (Engler, 2002)

Is this more cost-effective? Actually, no. “In terms of economic efficiency, such wells are less efficient due to increased cost (approximately 20%) and higher operating expenses with no change in producible reserves.” (Engler, 2002) The authors, while promoting directional and horizontal drilling, acknowledge the need for further improvements of the technique, to be more cost-effective while improving production efficiency. Not all reservoirs in the United States are suited to horizontal well technology, though its use is on the rise. There are barriers to its use in the San Juan Basin, due to underlying structures of the reservoirs. A survey of reservoir operators has shown that costs rapidly decline as proficiency in horizontal drilling rises.

Finally, the authors recommend multiple zone completion and commingling in the San Juan Basin, which reduces the number of well bores. Again, further advances in fracture technology are anticipated to overcome the limitations of this technology.

The coal industry is also looking at new technology to ensure its survival. Coal mining is highly dependent upon electricity generation to buy its products. Increasingly higher standards for emission control pose a threat to coal-fired generation, especially the older plants that may be prohibitively expensive to retrofit with newer, cleaner technology.

Frequently characterized as the “dirtiest” of fuels, coal is literally getting scrubbed up in “clean” coal technologies. Research is being performed that promises “A power plant that emits no pollution...super-efficient energy facilities that transform coal, biomass, and other fuels into multiple commercial products....combustion-less fuel cells that quietly generate clean energy...”(Office of Fossil Energy)

The western United States is highly dependent on coal mining and coal-fired power generation. This is especially true in New Mexico, where 88% of our power is coal fired. This

situation is not likely to change rapidly; PNM official Pat Goodman says that “Today, and for the foreseeable future, PNM and other utilities will continue to rely on coal for meeting our energy needs.” (Goodman, *Decisionmakers*, 2002)

PNM, mindful of the need to lower coal-burning emissions has installed an advanced coal technology product at the San Juan Generating Plant. This is a limestone-forced oxidation system that takes flue gases after combustion is completed and forces them through limestone slurry in absorber cells. The slurry becomes gypsum when moisture is removed, which can be safely returned to the mine to be buried as part of the reclamation process. This new system reduces SO_x emissions by 50%, the company says, and costs much less to operate than older SO_x removal equipment.

Great claims are made for advanced technology, and great expectations are placed upon it. While the fossil fuel industries are advancing in this manner, public interest and government encouragement are steadily increasing for renewable energy resources as well. These resources also require more research and development to make them cost-effective, available, and reliable. In New Mexico, with our wealth of wind, sun, and geothermal energy, renewable generation is far less than 1% of the total. In order for renewable energy to penetrate the market in a meaningful way, certain conditions need to occur, or must be created.

How Can Renewable Energy Become Cost-Effective?

In previous sections, we saw that small-scale renewable projects have been successful, and that sustainable development ideals promote green energy. What more is needed to propel renewable energy technologies into the mainstream, besides the concepts of free fuel and a cleaner environment? The answer to that question is frequently “government intervention,” with taxpayer and ratepayer subsidies for renewable energy development.

This Background Report has already described how the state of New Mexico is considering a renewable energy portfolio standard to be included in its regulations. Other recommendations (on a national level) are briefly presented in this section.

Economies of Scale: Build More

A study conducted by the Public Interest Research Group (PIRG) on renewables in New Mexico (*Clean Energy Solutions*, March 2002) found that the biggest breakthrough for photovoltaic use would be in the construction of more panels. “The current cost of PV modules... is \$6–7 per watt for an installed system. This is a dramatic reduction from \$20 per watt ten years ago, and a hundredfold drop in cost since 1972.” (p. 31) PIRG states that since all the costs for PV generation is in the equipment, the more equipment, the cheaper the electricity becomes. The experience curve (relationship between increased volume and decreased price) is estimated at 82% for PV. (Ingersoll, Renewable Energy Policy Project, *Industry Development*

Strategy for the PV Sector, cited in *Clean Energy Solutions*). For every doubling of cumulative production volume, the price of PV is therefore expected to decline by 18%. To compete on equal footing with conventional power sources, PV prices would need to be around \$1/watt for an installed system. That price should be reached once total PV installations surpass 500,000 MW. Recent US growth has been steadily higher—a 52% increase in 1999. If that growth rate continues, this point should be reached by 2013. If it levels off at the worldwide steady 30% per year, it should be achieved by 2022 (PIRG, *Clean Energy*, 2002).

Another example of falling costs through economies of scale is the steady drop in price of wind power generation. Wind generation, usually from large projects, is already cost-effective in some locations.

The Union of Concerned Scientists, an organization that promotes renewable energy, says in a call for more research and development on the part of government and industry, that “renewables must overcome two major barriers to commercialization: undeveloped infrastructure and lack of economies of scale.” (<http://www.ucsusa.org>)

Technological Breakthroughs—More Research

As in the fossil fuel industries, technological breakthroughs are always being sought. The U.S. Department of Energy is funding a number of renewable energy and energy-efficient technology programs (FY2001 budget included close to \$1.2 billion for renewable research) in search of the technological leaps forward that will make renewable energy secure in the market place. States also support research and development. In California, the PIER (Public Interest Energy Research) Program uses the \$65 million collected annually from investor-owned electricity utility ratepayers to fund research on public interest energy research and development in areas such as renewable energy, energy-efficient technology, and distributed generation. PIER performs numerous research projects on microturbines and fuel cells as well.

Tax Credits and Incentives

The Renewable Energy Production Tax Credit was recently renewed by Congress through 2003. This tax credit provides a 1.5 cent per kWh tax credit (adjusted for inflation) for electricity produced using wind resources or closed-loop biomass. The proposed National Energy Policy wants to expand renewable energy tax credits and renewable research as well—a portion of this recommended to be funded from royalties generated by opening ANWR. The NEP also contains a number of renewable energy and energy efficiency provisions, including removal of regulatory barriers affecting renewable energy, requirements for net metering, fair transmission rules, and easier interconnection standards. (*NEP*, 2001)

A Different Look at the Grid

In conjunction with renewable energy development, another technology is gaining increasing support from many sectors. *Distributed generation* (DG), introduced in Part I, is in a favorable position to join renewable energy resources in a move that could transform the electric power industry. Wind and photovoltaic-powered electricity development are among the renewable energy technologies that are advancing the use of DG.

In the Domestic Energy Security section, we noted technologies that the U.S. DOE's National Renewable Energy Laboratory (NREL) researchers have identified as valuable to national security. Some of these technologies would also advance the use of renewable energy in conjunction with distributed generation, such as:

- Wind power and solar-electric systems that provide emergency back-up power in the event of a disruption of central power supplies.
- Small modular biopower systems that use locally abundant resources and can easily be deployed on a trailer.
- Wind and solar photovoltaic systems that operate independently of the utility grid to deliver dependable power to critical monitoring and security functions, such as chemical and radiation detection devices and surveillance cameras.

Removal of technical and regulatory barriers were identified in the National Renewable Energy Laboratory (NREL) study, *Making Connections* (U.S. NREL, 2000) as the greatest assistance to the widespread use of DG. Technical barriers arise when a DG system is to be connected to the power grid; regulatory barriers such as rate-related or backup charges, environmental permitting (lengthy and expensive air quality testing, for example), and other business practices. The NREL says:

Much more must be done in order to create a regulatory, policy, and business environment which does not create artificial market barriers to distributed generation...national collaborative efforts among all stakeholders are necessary to accelerate this process [i.e. resolutions of DG problems] so that near-term emerging markets for the new distributed generation technologies are not stymied. (*Making Connections*, iv)

About half the cases profiled in the report were renewable energy projects, mostly wind or PV with one biomass. Projects ranged in size from below 25 kW to more than 1 MW. It was interesting to note that excessive costs incurred in getting connected to the grid were no more likely to be incurred by the renewable project than by the fossil-fueled projects (mostly natural gas turbines). The report suggests that generation choice is not a barrier to DG as much as other elements cited. The NREL suggests several solutions to remove or mitigate the barriers, including standardization of interconnection standards, interconnection agreements, testing of interconnection of equipment, and review of connection; proceed with the rapid development of DG control technology and systems; development of new regulatory principles compatible with

DG; and regulatory tariffs and utility incentives to enable DG; expedite dispute processes, and finally, define the right to interconnect (there is now no established right to interconnect with the electrical grid).

There are many predictions about the effect that a restructured wholesale electricity market might have on renewable energy. For example, The National Wind Coordinating Committee (NWCC) predicts that “increased competition will enhance the importance of renewable energy technologies in many ways:

- Energy supply risks are likely to increase, making resource diversity more important.
- Power generators will have to meet increasing customer expectations.
- Changes in regulations may undermine the reliability of some power sources.
- Changes in environmental regulation could affect the cost and reliability of fuel-based generation technologies.
- Increased demand for clean fuels could cause price spikes and temporary fuel shortages.” (<http://www.nationalwind.org/pubs/wes/ibrief08.htm>)

The NWCC also warned that electricity restructuring might also have an undesirable effect on the success of renewable energy: “a newly created competitive environment will encourage generators to choose the cheapest available short-term resource, which favors traditional generation methods.”

The Union of Concerned Scientists (an independent, nonprofit advocacy alliance) is also wary of wholesale power competition. They recommend seven ways to ensure renewable competition in a restructured environment: renewable portfolio standards, public benefits funds, net metering, fair transmission and distribution rules, fair pollution rules, consumer information, and putting green customer demand to work

Currently, there exists plenty of prediction, but not much data. Surveys of “green choice” programs in deregulated states have shown varying results, from extremely promising to completely discouraging. The restructuring of the electric power industry is still proceeding; as we have seen, there are so many issues to be resolved that forecasts are likely to be undependable for some time to come.

Quality of Life Issues and Economic Growth

“Quality of life” can be linked to economic growth, but it also describes non-economic conditions, so the meaning is elusive. City and regional planners all over the world are establishing metrics to define this elusive goal, in a plan that will define quality of life objectively and show ways to achieve it.

Measuring the Quality of Life

Indicators beyond the traditional numbers of economic measurement are used in an attempt to measure quality of life. Communities typically apply a number of metrics (in number from 30 to 80, in our quick survey) to themselves. Income and output, in this view, are not the only measures of success. Some of the other energy-related indicators used are air quality, vehicle miles traveled, and traffic congestion.

For many years, most economists and political leaders believed that if we could ‘increase the size of the pie,’ i.e., the total output of goods and service (Gross Domestic Product) this would improve the standard of living for everyone...increased national productivity and incomes would create the additional resources necessary to protect the environment and broaden access to quality education and health care for citizens without giving up other elements of our standard of living. This appears less true today and raises questions about relying too heavily on income and output as measures of success. (Greenwood, Daphne, “Local Indicators of Quality of Life-A Preliminary Look at the Pikes Peak Region”, Center for Colorado Policy Studies, 2001)

Some of these indicators fit in more with a sustainability model, while others are more connected with commerce and industrial growth as an indicator of well-being. Not many of these projects have advanced to the point of data collection and analysis, but Albuquerque is one city that is implementing these indicators in its planning.

Albuquerque’s *2000 Progress Report* employs a number of quality of life indicators (called “goal statements” and “goal progress indicators”) to measure the city’s progress. Energy-related indicators include vehicle miles traveled (VMT) per capita, walkable mixed-use neighborhoods, air quality, and the familiar standbys of “diverse, broad-based economy with balanced job opportunities,” and “rising wealth and prosperity for all residents.” (These two last categories, as we saw earlier on, are traditionally connected to increased energy consumption). However, the *Progress Report* does not provide measures of energy consumption beyond VMT nor relate these to other indicators. A review of the measurements for each of these indicators (as well as many others not directly related to energy use or economic progress) includes data and analysis for each category, relationship of current measurements to the city’s goals, and explanations of how this indicator is linked to other indicators.

For example, under the category of vehicle miles traveled and per capita vehicle miles traveled each day, the report shows an increase in VMT from 6.8 million miles in 1978 to 12.6 million miles in 1998, and in per capita VMT, from 17.0 to 21.6 miles per day.

Analysis in the report shows that “assessing population growth alongside increases in vehicle miles traveled show the extent to which VMT grows from more people driving or from people driving more miles. As both residential and business development extend the boundaries of the City, the commuting distance is being extended as well.” When compared to population

growth in Albuquerque, the average daily VMT increased more rapidly than did the population, up until the last three years of measurement; VMT then remained steady. What does this data reveal?

...it is linked to the air quality indicator, since automobiles are the largest contributor to air pollution in the area. A decline in VMT would likely mean improvement in air quality. And, all of these are linked to community development indicators, since patterns of development are a major determinant of travel patterns and the efficiency of various modes. (*Albuquerque Progress Report 2000*)

For the “air quality” indicator, data collected is reported from 10 sites around the Metropolitan area. Although there were no exceedances of the CO levels since 1992, vehicles were found to be responsible for roughly 70 percent of carbon monoxide measured. A 10-year comparison for 8-hour ozone statistics showed a steady increase, twice exceeding federal standards in 1999.

Despite new emission control technology, ozone increases are attributable to vehicular and industrial sources as well as such sources as “gasoline pumping [that] contributes to high levels of volatile organic compounds, which are hazardous air pollutants and precursors to ozone production.” The report states, “Over the years, this region's aesthetic, environmental, and social values have consistently attracted population and economic growth. Poor air quality can disrupt this region's ability to sustain growth if it requires limits on new businesses and/or lowers the quality of life.” (*Albuquerque Progress Report 2000*)

These examples show how quality of life can be defined and measured according to certain parameters, which are then related to one another. For the City of Albuquerque, growth and economic prosperity—two positives—have also brought a steady rise in air pollution and vehicle miles traveled—two negative quality-of-life factors.

“Quality of life” can also define conditions not necessarily precisely measurable—sometimes, quality-of-life issues can starkly present themselves in response to a challenge. Energy-related challenges that have occurred in New Mexico are described in the following vignettes; when a coal mine, a power plant, or a gas-drilling rig offers to show up in the neighborhood, responses have been unwelcoming. Figure 8 shows the locations of each of these places.

Religious Values Conflict with Economic/Energy Development

The Fence Lake Coal Mine project was used earlier in this report as an example of a lengthy permitting process with a federal agency. This not the only issue that Fence Lake illustrates; there is a group composed both of Zuni and other tribes concerned about the fate of Zuni Salt Lake, and environmentalists, also concerned but for different reasons.

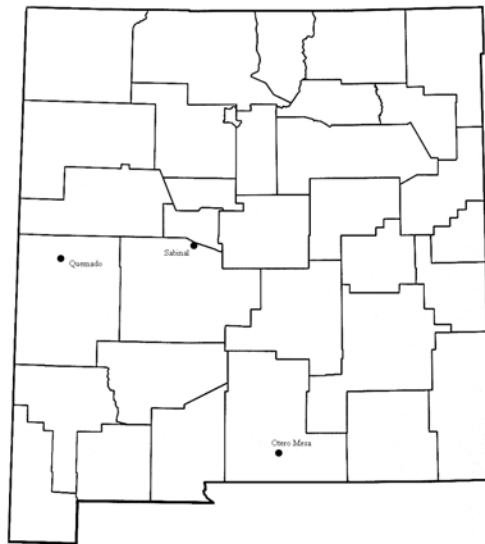


Fig. 8. Quemado, Sabinal, and Otero Mesa.

Zuni Salt Lake is located in the bowl of a 700,000-year-old volcanic crater, twelve miles from the proposed Fence Lake site. It is also one of Zuni Pueblo's most sacred sites. Tribes of the area are concerned about disturbance of burial sites and the disruption of culturally sensitive areas, but their main fear is that the mining operations will drain the lake. Zuni filed an appeal against the State's permitting decision in 1996, which was decided against in 1997, and again with the New Mexico Coal Surface Mining Commission, which was also decided against in 1997.

The Fence Lake Mine is located partly on federal lands managed by the Bureau of Land Management. The Socorro Office worked for years on the cultural impact of the Mine for the Environmental Impact Statement that was recently completed. Hydrologists reported that the mine probably would not affect the lake.

However, another report commissioned by the Bureau of Indian Affairs, released in March 2001, found that pumping at the mine site would reduce the inflow of water and salt into Zuni Salt Lake. By that time the Office of Surface Mining and the Bureau of Land Management had already approved the mine, as environmental surveys had concluded that the mining operation would not drain the lake

In addition to Zuni, the Center for Biological Diversity, while respecting Zuni's religious objective, also objects to the mine on other grounds. "It's an area that has a very wild character... an important area between the Gila ecosystem and the southern end of the Colorado Plateau," says the Center's attorney. Zuni and the Center are looking into litigation on the federal level to halt construction of the mine.

Quemado residents have exhibited mixed feelings (as reported in newspaper articles). For one thing, they're not sure they believe all the stories about the prosperity the mine will bring to them. Catron County has been in economic decline for a long time, since the logging industry there declined. They're hoping that there will be jobs for them, and not just for the construction workers and miners that will live in St. Johns, Arizona, where the power plant that the mine is providing coal for will be located. They say they understand the feelings of Zuni, to whom the area is sacred, but no comments about biodiversity were recorded.

Representatives of the Salt River Project are sure that the mine will not harm the lake. "We're committed to protecting the lake," says project manager Bob Bernard. (*Magdalena Mountain Mail*, June 10, June 17, 2002; *ABQ Journal*, July 23, 2001; *Gallup Independent*, March 13, 2001)

A NIMBY in Socorro County—Cobisa's Power Plant

Sabinal, in northern Socorro County, is a rural community that is mostly residential mixed with agriculture. Houston-based Cobisa-Rio Puerco Power Company planned to build a 145 MW, gas-fired power plant on a 50-acre lease in the county, but the company's plans were rejected this year by a strong and angry community outcry that ended in a new temporary zoning law for Socorro County.

Sabinal residents learned of Cobisa's plans when the company contacted them late in 2001 with a notification about their emission level and their plans to apply for an air quality permit.

The community had, not long before, lost a battle against the builders of a 360-ft communications tower. Community activist Les Crowder responded, "that had taught us where we could start to stop this thing." Two hundred Sabinal-area residents turned out to protest the power plant at a subsequent Socorro County Commission meeting. They obtained a 120-day moratorium on the plant. The Abeytas-Sabinal Special Zoning District was subsequently created by Socorro County Commissioners, which passed a temporary ordinance in June 2002 that will keep the Cobisa-Rio Puerco Power Company out of the area. This ordinance restricts industrial development larger than 5,000 square feet, and is not meant to restrict agricultural development nor hamper dairy operations in the area.

Citizens of Sabinal were adamant against altering the agricultural nature of northern Socorro County. Other reasons they gave for rejecting the power plant were fears about the air and water quality impacts, lack of economic benefit to the community, possible interference with the flight patterns and habitats of wildfowl from nearby refuges, and general unattractiveness. Though two different analyses found that the plant's emissions would be well under any air impact thresholds, and that the project would not impact any rare, threatened or endangered species, citizens and members of the zoning board were nonetheless committed to seeing the community remain as it is—without industry.

(<http://www.lamontanita.com/docs/newsletterarticles/2002/Febr2002/PeoplePowerNotPowerPlants.html>); *Socorro Defensor-Chieftain*, May 25 and July 6, 2002)

Otero Mesa—Another Point of View

The Otero Mesa Coalition is an organization of conservationists, sportsmen, and wildlife interests that is asking for special protection: for Otero Mesa to be added to the country's wilderness preservation system. The Coalition, which includes organizations like the New Mexico Wilderness Alliance as well as individuals, finds the Mesa to be a unique environment that contains the nation's largest untouched Chihuahua grasslands. It is also the home of the pronghorn antelope, kangaroo rat, black-footed prairie dog and several rare and endangered species of bird. Finally, the Mesa offers an opportunity to re-establish the rare Aplomado Falcon, a species that declined rapidly in the U.S. after the 1930s; its last nest in the U.S. was recorded in 1952. The Coalition is calling for all energy development to be halted immediately. "Natural gas has been discovered in the heart of this grassland and to remove it will require transforming this area rich in wildlife and wilderness into an industrial complex of roads, pipelines, power lines and toxic waste ponds." (http://alibi.com/alibi/2002-05-02/oped_section.html)

This is the same Otero Mesa that the Background Report described a few dozen pages ago, when we looked at it as a good possibility for natural gas production, and a source of considerable revenue to the State. Now it is described from a completely different point of view, one which regards any economic benefit derived from energy production as fleeting and all damage as permanent. Since the Mesa is uninhabited by human beings, opinions expressed are not those of the residents. These views represent a strong conservationist, environmental protection ethos that is just as representative of New Mexico's citizens as are those of ranchers, energy producers, or urban factory workers. In this sense, the "quality of life" that environmentalists seek to protect is that of the Mesa itself. By extension, our own quality of life is to be enriched by the preservation of this desert wilderness in perpetuity.

Determining the Issue

In these examples we see rural or wild environments, strong feelings, and disregard for economic benefit. There appears to be a common thread that portrays the energy company as just showing up one day to ravage the land, but that is a simplistic way to view a more complicated issue.

For all New Mexicans, whatever their views on the quality of life, the economy/energy/environment triad is a significant issue that we deal with in many different ways. When regarding the disparity in vision that prevails in the state, collaboration on some of the more crucial points may seem unachievable. The population is growing; New Mexico is just as energy-hungry as any state of the union; and as the CEO of PNM observed, those power plants are going to end up in

somebody's back yard. (NMBJ, Jeff Sterba Interview, August 2001) The search for resolution must take place in this context.

Views on Land Use Compromise from *Decisionmakers*

A recent conference sponsored by the New Mexico Bureau of Geology and Mineral Resources, the Decisionmakers Field Conference on the San Juan Basin, May 2002, offered some useful ideas for balancing the needs of industry and quality-of-life concerns for citizens in several essays.

Determining Successful Multiple-Use Management

The San Juan Basin is a significant energy resource for the state of New Mexico, with about 80% of its mineral estate owned by the federal government and operated by the BLM.

Valuable minerals, significant cultural resources, sensitive habitats and riparian areas, recreation areas, Wilderness, ranches, and culturally and religiously important Native American sites are all sharing federal space in the Basin.

The Farmington Field Office has released their draft RMP/EIS (cited earlier) for the management of this huge resource. Under principles of multiple use and sustained yield, a level of oil and gas development that can meet public interests, be ecologically sound, and socially sustainable must be sought. Indicators suggested by the BLM to determine whether the revised RMP/draft EIS is successful are:

- Support for the proposals and public comment on implementation;
- Minimal controversy concerning the data and assumptions used for the analysis;
- A sustainable local community both socially and economically;
- Orderly development of the oil and gas resource;
- Avoidance and mitigation of impacts to other resources; and
- Completion of reclamation requirements.

(Henke, *Decisionmakers*, 2002)

Energy Production in Urban Settings: Conflict and Resolution

In the cities of Farmington, Aztec, and Bloomfield, residential areas exist in uneasy proximity to oil and natural gas operations. This area of New Mexico has historically been one of high oil and gas recovery activity; there are many old leases that are still being held by production companies in areas that these three towns have now expanded to occupy. There are now more than 200 gas wells within the city limits of these towns, and even more on the outskirts.

In the “old days,” citizens felt differently about the proximity of wells:

Although the sight of a well with its associated equipment was at one time a symbol of prosperity and human ingenuity, current populations are just as likely to view the same well as a pollution source and a hazard to life. (Chavez, *Decisionmakers*, 2002)

General knowledge of the oil and gas industry has also declined; homeowners, landowners, and realtors are not adequately informed about the implications of existing and future oil and gas development in this area.

Local governments have been pursuing solutions since the 1980s, when Aztec, Bloomfield, and Farmington wrote city ordinances seeking to govern oil and gas drilling and production. Energy companies in the area have chosen not to challenge these ordinances, says Chavez, although serious doubt exists whether cities can legally regulate the industry.

The industry is also taking some initiative in finding solutions. Several well locations in Farmington are fenced and landscaped. Some operators, in order to reduce truck traffic, are disposing of produced water through the city sewer system and paying the city for disposing of industrial wastes. After the deaths in Carlsbad caused by a pipeline explosion, local companies developed a program through the schools on safety education. Companies also make thorough educational presentations when wells require a public hearing before the city council.

Other ways of resolving conflict are identified; most important is the pursuit of “innovative and cooperative solutions to these common problems ...to the mutual benefit of the oil and gas industry, the regional economy, and the residents of the San Juan Basin.” (Chavez, *Decisionmakers*, 2002)

Citizen Groups

Frank Titus, in *Decisionmakers* makes an appeal against the use of coercion by law and regulation, and in favor of common sense, conscience, and a desire to reach consensus—all of which, he says, make citizen groups successful. He cites three examples in New Mexico of spontaneously created citizen groups that negotiated among their different interests until agreements are reached that are not necessarily what everyone wants, but that everyone can agree on to avoid more costly mistakes down the river. Speaking of the San Juan Basin, Titus asks,

Has anyone yet offered a vision of how in their common arena they might work together to achieve a set of mutually beneficent goals? Cannot the puzzle pieces of a future be assembled in win-win format? (Titus, *Decisionmakers*, 2002)

Titus also warns: “What will be truly self-defeating will be the failure to involve stakeholders, that is, the local people, in the process.” (*Decisionmakers*, 2002)

Collaboration, rather than conflict or coercion, is recommended in these three essays for reconciling the needs of populations, industrial interests, economic growth, and the objectives of

regulation. In this view, a successful outcome—one that balances energy industry, economic progress, and quality of life expectations—is posed as a challenge to New Mexico’s citizens.

Summary

- New Mexico’s population is increasing and so is its productivity, economic diversity, and energy consumption. These conditions have a number of implications for our state.
- New Mexico’s planners are trying to head off unrestrained growth and unplanned development in establishing sustainable development goals for community and state.
- New Mexico’s energy situation appears to be favorable for the further growth and diversification of industry.
- The restructuring of the electricity industry is expected to have an effect on the state’s energy industries through changes in generation, transmission, distribution, regulation, and sales.
- The regulation of the energy industries and their access to public lands can be problematic in certain ways; industry finds that the cost of regulation has an impact on its revenues, and revenues to state and national governments as well.
- Technology-based energy development is expected to have an effect both in the fossil fuel industries and the emerging renewable technologies. More research and development is being called for by advocates in both these areas.
- Renewable energy, not yet present in the market to any great extent, needs to become cost-effective and a variety of approaches are suggested.
- Economic growth, energy industry, and quality of life issues can be at odds in New Mexico. Compromise and collaboration are suggested to achieve a balanced outcome.

Part III. Environment and Energy Development

Introduction

Part III of the Background Report focuses on the relationship of environmental concerns to extractive energy industry, electricity generation, and distribution. We have considered energy and economy, including the development of renewable energy sources and distributed generation, from the point of view of industrial strength and economic growth. The environment has been present in these considerations, but it has not been in the forefront.

The first chapter in this section is a brief observation of how all energy and economic development has an impact on the environment. In the second chapter, we see how energy extraction and transmission can conflict with the needs of the environment. Oil and natural gas exploration and production, coal mining, and electricity generation each have an effect on air, water, and land. The nearness of extractive and generative energy industries to residential areas also has an effect. The third chapter gives examples showing how energy industries are a source of pollution, and how industry takes steps to remedy it.

As energy industry and economic growth impact the environment, so does the need for, and the cost of, environmental protection concern the extraction industries. Current developments and changes in regulation on the national level will affect—and are meant to effect—energy activities and economic development in the states, but here again, the outcome is far from certain.

Energy/Economic Development Has a Cost for the Environment

The introduction of human beings into a pristine area changes the land, air, and water quality. With the development of culture came the ability of all societies to make their marks—we know how our forebears lived through the inspection of 20,000-year-old garbage dumps.

The acquisition of technology by humankind has considerably speeded human impact on the environment. The introduction of modern industry in the last 200 years has accelerated the process even more. Today, in a simple formula, we can observe:

“Human impact on the environment is a function of population size, per capita consumption and the technology used to produce what is consumed.” (United Nations Population Fund website) <http://www.unfpa.org/modules/briefkit/03.htm>

In an earlier chapter, the Background Report observed that a society’s development is traditionally measured by economic growth using the size of the gross national product (GNP) as an indicator of growth and levels of consumption. However, growth entails byproducts of wastes and pollution. The more “developed” societies, always growing, producing, and consuming, encroach more and more upon the environment. Modern sensibilities no longer regard this

process as inevitable. The drive for mastery of the land and its treasures is being replaced by an appreciation for the permanent loss of wild places and open space, and the desire to assume stewardship of our remaining resources. Whether we should achieve this end by appropriate management or by making certain places off-limits, is a matter of intense public debate.

Hydrocarbons, the conventional sources of fuel in an industrialized economy, are the sources of some of the worst airborne pollutants worldwide. Their extraction from the earth is often accompanied by permanent damage. Renewable resources are ubiquitously offered as the no-pollutant solution to our energy pollution problems, but even these have certain impacts on the environment. Avian mortality is linked with large-scale wind development (wind turbines also emit a certain amount of low-level noise) and large photovoltaic units can impact habitats and fragile ecologies. For example, a recently proposed wind farm in Norway was denied a permit (April 2002) because of concerns over potential environmental harm. Additionally, the materials and energy used to construct renewable energy-run equipment have to come from somewhere—and its fabrication is often realized through the consumption of fossil fuels.

New Mexico, though sparsely populated in most of its sizeable territory, displays the ineradicable evidence of human activity and anthropogenic emissions. With 0.6% of the U.S. total population (in 2000; U.S. Census Bureau), 3.4% of the total U.S. area, 0.2% urban areas as percentage of total area (U.S. Department of Transportation) and 0.5% of the GDP (U.S. Department of Commerce), we generated 2.1% of the country's total nitrous oxide emissions in 1999, 1.1% of small particles (PM2.5), and .8% of sulfur dioxide (U.S. EPA).

Our energy industries have grown and flourished with the state, even allowing for the ups and downs of the global energy market that influence the prices of oil and natural gas. We have seen how increases in population, gross state product, and energy consumption have all been accompanied by the soiling of air and water, the loss of soil and habitat, and all too often, the permanent scarring of the land.

With an increasing awareness of conservation and environmental protection by citizens of industrialized countries, and correspondingly more regulation by government, industries have been compelled to develop more environmentally sound technologies in order to continue producing in a public climate that is increasing its vigilance towards protecting the environment. In their management programs, foresighted companies now include the element of environmental risk management, which we will look at in Part 4.

There is less air pollution now in the United States than formerly existed, as emission control has improved, and continues to improve. An EPA summary report released in September 2001 finds that, since 1970, aggregate emissions of six principal pollutants tracked nationally were cut by 29 percent. National air quality levels measured at thousands of monitoring stations across the country showed improvements over the past 20 years for all six principal pollutants. During that same time period, U.S. Gross Domestic Product increased 158 percent, energy consumption increased 45 percent, and vehicle miles traveled increased 143 percent. The report also found that EPA's voluntary programs with companies and other organizations reduced

greenhouse gas emissions (associated with global climate change) for 2000 by 57 million metric tons of carbon equivalent (equal to removing 40 million cars from the road). (EPA, *National Air Quality Report 2000*).

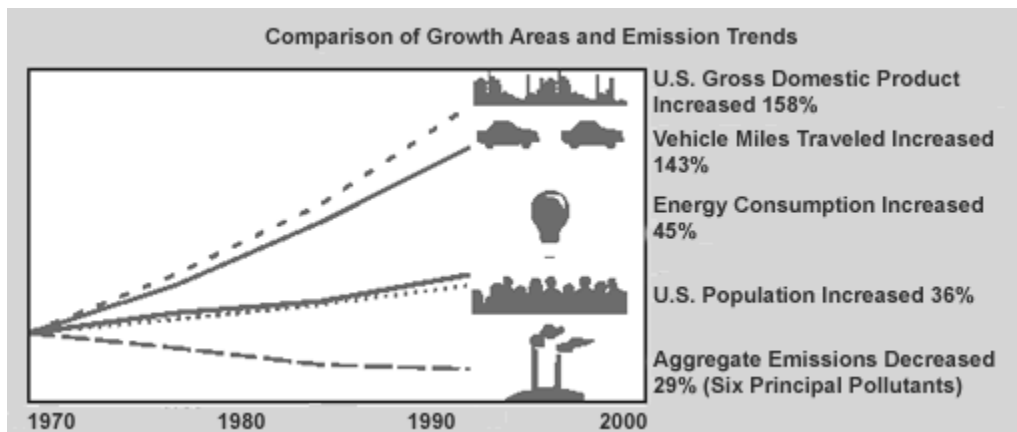


Fig. 9. Comparison of U.S. growth areas and emission trends (graph courtesy of the U.S. Environmental Protection Agency, (Sep. 2001), *National Air Quality Report 2000*; available at <http://www.epa.gov/oar/aqtrnd00/>)

Regulatory agencies are tightening emission standards and water pollution control is improving even as New Mexico’s water resources become more scarce. The restoration of abandoned mine lands is ongoing, funded by every ton of coal extracted by coal mining in the U.S.

We expect, more and more, that human hands and ingenuity will restore what human endeavor has damaged. As we continue to decry environmental damage and destruction, we call upon technology to put things right. And, ultimately, we seek to declare some places off-limits to all industrial activity (though whether recreational use will ultimately be more damaging as more and more people seek out the wild places in offroad vehicles, is not within the scope of this report to discuss).

Some of our New Mexico communities, in the heart of extraction and generation country, have already sustained damage to air, water, and land, and are paying the price even as they reap the benefits. Others, as we have seen, distrust energy industry development in the neighborhood and reject it.

Ultimately, perhaps, another measurement of progress will be developed that takes into account the degree to which a society protects the environment, while still managing to advance in traditional ways. Proponents of renewable energy, sustainable development, and distributed generation technologies foresee this outcome through basic, even radical changes in the way we produce, develop, and use energy. Fossil energy industries see the same outcome through the better deployment of technology to preserve the environment, as well as to extract more oil, natural gas, and coal more economically and use it more cleanly. Whether a balance can be achieved remains to be seen.

Energy Activities Frequently Conflict with Environmental Protection

We have seen, from the viewpoint of industry, how regulatory requirements may restrict or prevent exploration, production, generation, and transmission in the energy industries. This section of the Report looks at the industries from the viewpoint of environmental protection.

Oil and Natural Gas Production

The environmental effects associated with oil and gas activities include impacts on wildlife habitats, erosion, sedimentation, contamination of ground and surface water from product leaks and spills, groundwater contamination from communication between production or waste injection zones and aquifers, air pollution, and soil damage. Industrial noise and proximity to residential areas are also environmental problems.

Special problems in New Mexico for oil and natural gas producers include groundwater contamination (by produced wastewater brines), produced water treatment and disposal, noise pollution, and surface disturbance that interferes with fragile ecologies. While increased air pollution due to more activity in the San Juan Basin may occur under conditions of maximum production (as per draft RMP/EIS, Farmington Office, BLM), emission standards are currently not often exceeded. Pipeline safety, sharply in focus after the Carlsbad tragedy of 2000 in which 12 people died in a pipeline explosion, is an important transmission issue in New Mexico. Pipeline safety bills have now cleared both House and Senate, and legislation may be passed as early as this year by the U.S. Congress.

Coal Mining

Coal mining contributes to environmental disturbance through acid mine drainage from abandoned mines, methane emissions, erosion and habitat disruption, alkaline mine drainage, and active mine wastewater discharge. The use of blasting and heavy equipment also has an impact on the environment.

Although low-level methane emissions can be a result of surface mining operations (such as those in New Mexico), the main environmental focus for coal mining in New Mexico is reclamation, including erosion and sedimentation control, vegetation and habitat restoration.

Electricity Generation

Environmental concerns for electricity generation consist mainly of emissions introduced by the combustion of fossil fuels that accounts for most of the total electricity generated in the United States. Electricity generation from fossil fuels emits hydrocarbon combustion byproducts:

nitrogen oxides[†] (NO_x), sulfur dioxide (SO₂), carbon dioxide (CO₂), and fine particulate matter (PM_{2.5}). These compounds are major contributors to acid rain, global warming, and visibility impairment. Fossil fuel electricity generation also contributes to ground-level ozone, (also known as smog), formed when volatile organic compounds (VOCs)^{*} and oxides of nitrogen interact in the presence of sunlight. When critical levels of these emissions are present in the atmosphere, human health is endangered.

Sulfates formed primarily from SO₂ emissions from coal-fired power plants are the major source of fine particle emissions (PM_{2.5}). Although it is recognized that fine particulates are a public health issue, EPA has not yet determined whether various areas of the country meet health-based standards for PM_{2.5} (the agency needs three years of data). Though more prevalent in the eastern United States, these emissions are also troublesome in the West as *regional haze*, which restricts visibility. Regional haze has become a problem in the western US, decreasing the visual range in national parks and wilderness areas from an average of 140 miles in the late nineteenth century to 35–90 miles today. This decrease in visibility destroys the “natural conditions” sought by visitors to the nation’s last wild places. New Mexico has felt the impact of *regional haze* in its nine of its national parks and Wilderness areas, which is attributed to power generation in the San Juan Basin (Sandra Ely and Mary Uhl, New Mexico Environmental Department, “Air Quality and the Clean Air Act Amendments,” in: *Decisionmakers*, 2002).

Air, Water, Land, and More

In this section, the Background report takes a look at different facets of the environment as certain industries affect them, and how these industries remedy the potential damage, as mandated by federal and state laws. In some areas, industries achieve more than the law requires, singled out for commendation by exceeding environmental standards. The Background Report will focus on one industry in connection with each element of environmental concern.

The National Environmental Policy Act of 1969, the Clean Air Act of 1970, the Clean Water Act of 1972, and the Surface Mining Control and Reclamation Act of 1977 are the principal federal laws that protect the environment in connection with fossil energy industries. Several of New Mexico’s state agencies are involved in enforcing these and state laws protecting the environment. The New Mexico Environment Department is responsible for enforcing New Mexico’s environmental laws; those pertaining principally to energy industry are air quality (20.2 NMAC), water quality (20.6 NMAC) hazardous waste (20.4 NMAC), petroleum storage tanks (20.5 NMAC), and liquid waste (20.7 NMAC). The Office of the State Engineer is also

[†]Nitrogen dioxide is NO₂; the term NO_x is used to describe the sum of NO, NO₂ and other oxides of nitrogen, components of ozone and acid rain.

^{*} VOCs are certain compounds of carbon that participate in atmospheric photochemical reactions. They arise from the use of fuels for energy purposes, evaporative emissions during industrial processes and non-industrial use of organic solvents.

responsible for administering New Mexico's water quality laws. The New Mexico Energy, Minerals, and Resources Department administers state and federal regulations through the Oil Conservation Division (OCD) and the Mining and Minerals Division (MMD). The Mining and Minerals Division regulates coal mining under the New Mexico Surface Mining Act of 1978, NMSA 1978 (19.8, 19.10 NMAC). The Oil Conservation Division regulates oil and natural gas under the New Mexico Oil and Gas Act of 1978 and the Geothermal Resources Conservation Act of 1978 (19.14, 19.15 NMAC).

The operations of fossil energy industries have multiple effects on the environment. For example, although coal-fired power plants are known to be the largest single-point sources of emissions, oil and natural gas production and coal mining also contribute to air pollution. Additionally, vehicular emissions and dust from area sources that occur as a result of increased industrial activity also contribute to air pollution. More NO_x emission from compressors is expected to occur because there has been an increase in San Juan Basin natural gas production[†]. Methane emissions from surface coal mines are not very extensive, but as the San Juan Mine is now being turned into New Mexico's first longwall (underground) mine, methane production from coal mining could become more of a problem.

Water in this drought-ridden state is also a concern for industry. In addition to water disposal problems, water consumption issues are important. While we focus in this section on produced water as a disposal problem in the oil and natural gas industry, it is important to remember that the electric power industry is estimated to use 60–70,000 acre feet of water per year. This is not a great deal of water compared to that used by irrigated agriculture, (~2% compared to ~68%, 1995 water inventory, latest, New Mexico Office of the State Engineer), but it is still significant, and about as much water as is used by the extractive energy industries.

Air

Air quality is impacted significantly by emissions from hydrocarbon combustion. Vehicles are the principal source of air emissions in the United States, but industrial emissions are next most significant, especially from facilities that burn coal. In New Mexico, the principal coal-burning industry is electricity generation.

The Clean Air Act

The Clean Air Act is the comprehensive Federal law that regulates air emissions from area, stationary, and mobile sources. This law authorizes the U.S. Environmental Protection Agency to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment. Each state must have a state implementation plan approved by the EPA, to

[†] "It is possible that the state standard for NO₂ could be reached if all [319 larger and 12,200 over all] of the compressors identified in the RFD were installed...if the data show that the pollutant levels, especially NO₂ and particulate matter, are increasing significantly, or that compressors are concentrated in small areas, the BLM would work with the NM Air Quality Bureau to develop mitigation measures." (*Farmington Draft RMP/EIS*)

carry out these regulations. Individual states may have stronger pollution controls, but states are not allowed to have weaker pollution controls than those set for the whole country. New Mexico, is not allowed by State law to exceed federal standards in its State standards.

In 1977, the Act was amended primarily to set new deadlines for achieving attainment of National Ambient Air Quality Standards (NAAQS). The 1990 amendments to the Clean Air Act were intended, in large part, to meet unaddressed or insufficiently addressed problems such as acid rain, ground-level ozone, stratospheric ozone depletion, and air toxics.

The 1990 Clean Air Act Amendments provided for interstate commissions that developed regional strategies for cleaning up air pollution, international pollution, and a permit program for larger pollution sources. The 1990 Act also included other provisions to reduce interstate air pollution.

The 1990 Clean Air Act Amendments also provided for flexible programs that are market-based approaches. For instance, the acid rain clean-up program offers businesses choices as to how they reach their pollution reduction goals and includes pollution allowances that can be traded, bought and sold. The 1990 Act also provides economic incentives for cleaning up pollution.

Have these goals been achieved? A recent (Nov. 1999) EPA study, “The Benefits and Costs of the Clean Air Act Amendments of 1990,” found that, in addition to ecological benefits, “the economic value of the public health and environmental benefits that Americans enjoy from the Clean Air Act Amendments of 1990 exceed their costs by a margin of four to one,” and would prevent thousands of premature, air-pollution related deaths as well as millions of asthma attacks.

Current Issues in Air Quality

In addition to New Source Review (NSR) enforcement actions* and MBTE additives for gasoline, the movement towards multi-pollutant legislation is gaining momentum in Congress, and it is this topic that the Report will focus upon.

The EPA, under the Clean Air Act, has taken steps over the past few years to reduce emissions of sulfur dioxide (SO₂), nitrogen oxides (NO_x) and mercury from coal-fired power plants. The EPA plans to promulgate controls on mercury emissions, with new regulations to be proposed in 2003.

The many regulations promulgated or suggested have created a climate of uncertainty for the electricity generation industry. Comprehensive, multipollutant legislation to regulate emissions is being seen by many in industry and government as necessary; the National Energy Policy (NEP) proposes that flexible, market-based multi-pollutant legislation be enacted to end

* The EPA believes that many older power plants are not complying with NSR standards by undergoing review or installing best available pollution controls when they add modifications, saying instead that these actions are “routine maintenance.” As a result, EPA and the Justice Department have filed suit against 14 utilities with 53 such units in 14 states. (CRS 1B10065, “Clean Air Act Issues in the 107th Congress,” June 3, 2002)

regulatory uncertainty, to increase electricity supplies, and to significantly reduce and cap emissions. To be decided will be the stringency of the controls and whether carbon dioxide (CO₂) will be included among the emissions under control.

As of April 2002, seven bills had been introduced that require strict reductions of the current levels of NO_x emissions (80% from 1998 levels) and SO₂ emissions (65–80% from 1998). Mercury is addressed in several of the bills also, from those requiring EPA to determine the allowable level, to those requiring a 90% reduction from current levels. These reductions generally would take place by 2005 or 2007, depending on the bill.

The Clear Skies Initiative, released by the Administration in February, 2002 (and with legislation now before Congress), is also meant to provide regulatory certainty to utilities. Its reductions are less stringent than those in the bills currently before Congress, and would be phased in over several more years. Carbon dioxide emissions, however, are not included, and critics of the initiative find that regulatory certainty cannot be provided to utilities without the inclusion of CO₂ standards.

Ozone and particulate standards have also come under review in recent years, and the EPA has promulgated new, stricter standards that would leave many more counties [possibly in NM, too] in nonattainment status as currently exist (329 counties under the new ozone standard, compared to 170 under the old, and 100 new counties under the new particulate standard). As a result, costs of attainment have become an issue across the country, and several groups have sued the EPA to overturn the new standards. Litigation has ended up in favor of the EPA, but the US Supreme Court found that the EPA needed to develop “a reasonable interpretation of the nonattainment implementation provisions insofar as they apply to revised ozone NAAQS (National Ambient Air Quality Standards).” This resolution has yet to be obtained by the EPA, which has not yet designated ozone nonattainment areas [as of June 2002]. (CRS, Issue Brief 1B10065, June 3, 2002)

Thus, regulatory uncertainty and potential costs have become an issue for the industry across the country, as the need for new generation grows and electricity restructuring progresses. An analysis performed by the Energy Information Administration says:

With changing standards on different timetables, comprehensive compliance planning is difficult. It can take several years to design, license, and construct new power plants and emission control equipment, which may then be in operation for 30 years or more. As a result, power plant operators must look far into the future to evaluate the economics of new investment decisions. Changing emission standards with different timetables add considerable uncertainty to investment planning decisions. An option that looks attractive to meet one set of SO₂ and NO_x standards may not be attractive if further reductions are required in a few years. Similarly, economical options for reducing SO₂ and NO_x may not be optimal if Hg and CO₂ emissions must also be reduced at a later date. Further complicating planning, some investments reduce multiple emissions simultaneously, such as SO₂ and Hg, making such investments more

attractive under some circumstances. As a result, power plant owners are wary of making investments that may prove unwise a few years hence. (*Analysis of Strategies for Reducing Multiple Emissions from Power Plants: Sulfur Dioxide, Nitrogen Oxides, and Carbon Dioxide* EIA, 2000)

Power Plants Are Targeted As One of the Sources of Regional Haze in the West

While the potential new rules have implications for the whole nation, nonattainment areas would mostly be located in the northeastern U.S. However, one area of regulation under the Clean Air Act—regional haze—has become an issue in New Mexico. Under the Clean Air Act Amendments of 1990, the EPA issued a Regional Haze Rule in 1999 aimed at reducing visual pollution and determining the health hazards of fine-particle (PM2.5) matter in the air. States must establish quantifiable goals not only to improve visibility, but to return visibility to natural conditions. New Mexico has nine Class I areas, which require special protection because of their

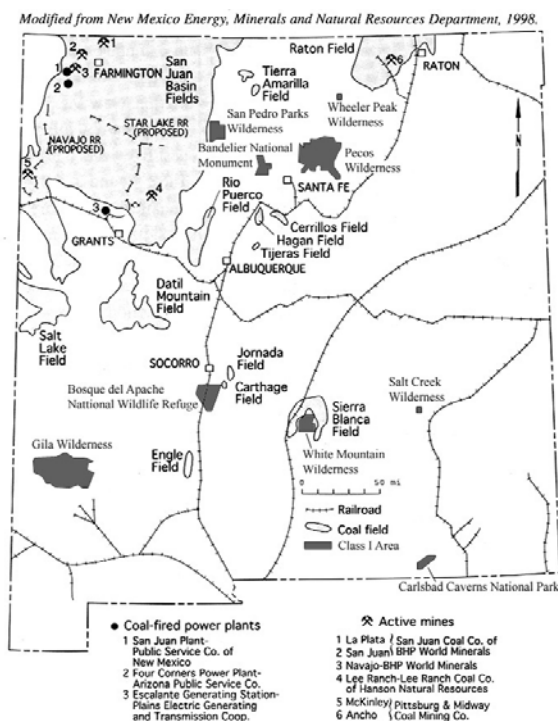


Fig. 10. Map showing locations of Class I sites and coal-fired power plants. (Graphic courtesy NMEMNRD; with enhancements after NMENVD map)

scenic qualities, wildness, or historical value. New Mexico is part of the Western Regional Air Partnership (WRAP), an organization that is developing a plan to reduce haze-forming emissions in the western US.

The three largest coal-fired power plants in New Mexico, the San Juan, Four Corners, and Escalante generating stations, located in the San Juan Basin close to the coal mines that supply them (as well as to many Class I sites, as the map shows), have been targeted. It has been found that transport of emissions from the San Juan Basin contribute to the formation of regional

haze in Class I areas of New Mexico and those of neighboring states. Although state regulators caution that the whole picture still needs careful analysis*, these three generating plants are reported to be the major contributors of haze-forming emissions in the San Juan Basin. Monitored ozone concentrations in the area of the San Juan generating station have recently been increasing and are currently close to the National Ambient Air Quality Standard limit for ozone. Currently, the NMED states that “regional haze goals for Class I areas in the West will require significant reductions in air pollution for New Mexico.” (Ely, Sandra, and Uhl, Mary, “Air quality and the Clean Air Act Amendments,” *Decisionmakers*, 2002).

How Power Plants Are Equipped for Emission Control

Coal-burning power plants invest heavily in pollution control equipment to meet federal and state standards. The three largest coal-fired plants in New Mexico report their pollution controls as follows:

Tri-State–Escalante Generating Station

Capacity: 247 MW

Operator: Tri-State Generation and Transmission, Inc.

Owner: Tri-State Generation and Transmission, Inc.

Pollution controls: “A total of 99.9 percent of the fly ash (a byproduct of burning coal) is captured by the plant's baghouse system. A wet limestone scrubber system removes 90 percent of the sulfur dioxide produced at the plant. A continuous, 24-hours-a-day, emissions monitoring system assures that flue gas levels emitting from the stack are in compliance with federal and state laws.

Costs of emission control equipment: “\$100 million in pollution controls.” (from website, <http://www.tristategt.org/>)

* It is important to note that not all fingers are pointed at coal-fired generating stations as perpetrators of regional haze. The Grand Canyon Visibility Transport Commission (GCVTC) was established in 1990 by the EPA to investigate western air quality and make recommendations. In its findings, wildfire and prescribed fire, mobile source emissions from vehicles and dust from both local road dust sources and fugitive dust emissions from wind erosion have also been targeted as major causes of regional haze. (GCVTC, *Recommendations for Improving Western Vistas: Report of the Grand Canyon Visibility Transport Commission to the United States Environmental Protection Agency*, June 1996) Area road and fugitive dust sources in particular apparently have been underestimated as contributors to regional haze. (ADEQ, Air Quality Regional Haze, Stakeholder Meeting Draft, October 3, 2001 minutes; Memo to WRAP Mobile Source Joint Forum (MSJF) from John Kowalczyk/Bob Neufeld, “Recommendations on Mobile Source “Significance” Issue for 309 SIPs/TIPs, February 7, 2002). Mobile source emissions from off-road vehicles, resulting from increased recreational activities in national parks, are also on the rise. (EPA, *National Air Pollution Emission Trends, 1990–1998*, March 2000).

When we look at the increase in emissions in the San Juan Basin in particular, we are also looking at an increase in population and in industry. The population of San Juan County is estimated to have grown more than 25% from 1990 to 2001 and a 43% increase in nonfarm employment occurred between 1990 and 1999. (U.S. Census Bureau)

Four Corners Generating Station

Capacity: 2,040 megawatts from two 170 MW units (1 & 2), two 745 MW units (4 & 5) and one 220 MW unit (3).

Operator: Arizona Public Service Company

Owners:

Units 1, 2, & 3

Arizona Public Service Company	100%
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Units 4 & 5

Southern California Edison	48%
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Arizona Public Service Company	15%
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Public Service Company of New Mexico	13%
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Salt River Project	10%
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Tucson Electric Power	7%
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El Paso Electric	7%
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Pollution controls:

- Wet venturi scrubbers on Units 1, 2 & 3 to control sulfur dioxide (SO₂) and particulate emissions.
- Fabric filter particulate removal system or "baghouse" on Units 4 & 5, and a lime-slurry scrubber system to control SO₂ emissions.

Costs of emission control equipment: Units 1, 2 & 3: \$47,950.

Units 4 & 5: \$500 million.

(from website, <http://www.srpnet.com/power/stations/fourcorners.asp>)

San Juan Generating Station

Capacity: 1,800 megawatts from four units; two are 350 MW and two are 550 MW.

Operator: Public Service Company of New Mexico

Owners:

Units 1 and 2

PNM: 50 %

Tucson Electric Power: 50 %

Unit 3

PNM: 50 %

Southern California Public Power Authority: 41.8 %

Tri-State Generation and Transmission Association: 8.2 %

Unit 4

PNM: 38.5 %

MSR Public Power Agency: 28.8 %

City of Anaheim, Calif.: 10 %

City of Farmington: 8.5 %

Los Alamos County: 7.2 %

Utah Associated Municipal Power Systems: 7 %

Pollution controls: “state of the art” fluidized combustion bed (described in part I), retrofitted in 1998, while the plant continued to meet environmental standards (Taylor, Henry, and Nischt, Walter, “San Juan Generating Station FGD Retrofit Project Update,” paper presented at Power-Gen International, Orlando, December 9–11, 1998).

Costs of emission control equipment: (figures not given) “More than 30 percent of the plant’s annual capital, operations and maintenance costs are for pollution control systems, including wastewater management and air emissions systems.” (PNM, website: <http://www.pnm.com/facilities/sj.htm>) Taylor and Nischt say that the project cost about \$80 million and is expected to save about \$20 million per year in operating and maintenance, while further reducing emissions.

San Juan Generating Station

The San Juan generating station is the seventh largest coal-fired power plant in the nation, equipped with the most modern of pollution control technology. It is operated by the Public Service Company of New Mexico and owned by PNM and the eight other entities listed above. PNM uses this plant as a model for others it operates. (Goodman, *Decisionmakers*, 2002)

In 1999, the SJGS implemented an environmental management system and obtained ISO 14001 certification in 2000.* The EPA accepted the SJGS in December 2000 as a charter member in its Performance Track System, created by EPA to motivate and reward top environmental performance by industry, and to create partnerships with these companies. (Goodman) Partnership companies are considered by the EPA to voluntarily exceed regulatory standards, benefiting the environment and the community. The SJGS was one of only two coal-fired generating plants in the US to be accepted as a charter member.

PNM's *Profile* for acceptance into the Performance Track System lists the following accomplishments:

- Reduced sulfur dioxide emissions by more than 30% by switching to a limestone-based flue gas desulfurization system
- Reduced toxic releases to the environment by almost 40% by increased scrubbing of flue gas and better emission estimations.

Proposed commitments to be achieved by 2003 include further reduction of SO₂ and toxic waste releases, solid waste reduction, and wildlife habitat restoration and preservation for the Colorado Pike Minnow through the construction of a migratory fish ladder.

This environmental track record did not prevent PNM's being sued by the Sierra Club and the Grand Canyon Trust, two environmental organizations, in a suit filed in May 2002 alleging that PNM is violating New Mexico's state air quality rules.

It is hard to target whose regional haze is drifting over the Grand Canyon since the pollution source can be miles away from the target. Other generating stations also share the distinction of being the source of San Juan Basin emissions. The *San Juan Mountain Journal* comments:

The lawsuit does not target Four Corners Power Plant, only eight miles away and across the San Juan River from the San Juan Generating Station. That is in spite of the fact that Four Corners is a bigger plant, burns approximately 43% more coal, and emits significantly larger quantities of toxins each year. According to Grand Canyon Trust/Sierra Club charts, Four Corners is the largest producer of Nitrogen Oxide and the second largest producer of Sulfuric Acid on the Colorado Plateau. This is a touchy subject for Grand Canyon Trust officials who will not speak about the issue on the record except to say it "is a complicated situation." The Four Corners Plant is on the Navajo Reservation and is regulated by the Navajo Environmental Protection Agency and EPA Region 9, based out of San Francisco. Unlike San Juan Generating Station, Four Corners is not under the jurisdiction of the New Mexico Environment Department. (*San Juan Mountain Journal*, at <http://www.mountainjournal.org/to%20read/in-depth/powerplantlawsuit3-3>)

Four Corners is also not operated by PNM, as is the San Juan Generating Station, but the Arizona Public Service Company, which also owns the bulk of the plant (PNM owns 13% of Units 4 and 5 in Four Corners). *

Water

* ISO 14001 standards are internationally-recognized environmental standards for environmental management systems, requiring continuous improvement of environmental performance by the company.

* The *SJMJ* did not go on to speculate on the motives of the plaintiffs in singling out PNM and the SJGS, and we will not pursue the matter here, either, although it may be of interest to Town Hall Participants.

Water is of supreme importance to New Mexico; three Town Hall meetings have been devoted entirely to New Mexico's water. Under these circumstances, protection of the current (shrinking) supply of both ground and surface waters—in quantity and in quality—is an imperative. New Mexico's oil and natural gas production industry, a large contributor to the state's economy, is also a large industrial producer of waste water. It is unclear whether drilling site runoff should be considered as point or nonpoint source pollution. Point sources of water pollution include domestic and industrial facilities that discharge treated wastewater to surface water or land through distinct discharge points. Nonpoint source pollution, unlike industrial pollution, comes from many different sources. Agricultural runoff is an example of nonpoint source pollution.

The Clean Water Act

Growing public awareness and concern for controlling water pollution led to enactment of the Federal Water Pollution Control Act Amendments of 1972. As amended in 1977, this law became commonly known as the Clean Water Act. The Act established the basic structure for regulating discharges of pollutants into the waters of the United States. It gave EPA the authority to implement pollution control programs such as setting wastewater standards for industry. The Clean Water Act also continued requirements to set water quality standards for all contaminants in surface waters. The Act made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions. It also funded the construction of sewage treatment plants under the construction grants program and recognized the need for planning to address the critical problems posed by nonpoint source pollution. (EPA website, <http://www.epa.gov/r5water/cwa.htm>)

The Safe Drinking Water Act of 1974 is the main federal law that ensures the quality of Americans' drinking water. Under SDWA, EPA sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards.

Produced Water from Oil and Natural Gas Operations

Oil and natural gas production typically generates large quantities of waste water. For each barrel of oil produced, an average of eight barrels of saline water are produced also, that can be nearly six times as saturated as seawater. Coalbed methane production in the San Juan Basin is also a large source of produced water.

The cost of produced water disposal is an important economic issue for producers. Estimates of water disposal costs in the San Juan Basin can range from \$1.75 to \$3.00 per barrel. (Other estimates for New Mexico range from \$0.25 to \$1.25 per barrel.)

The water (from varying sources) can be injected underground through injection wells, to help force oil and natural gas to the surface. Water thus accompanies produced oil and natural gas. In 2001, 26.9 billion gallons of produced water from oil and natural gas fields were pumped out of the ground. (Whitworth, T.M. and Lee, R.L.: "Desalting of saline waters: applications to New Mexico," unpublished, n.d) Desalination of this water for other purposes is difficult because

of the hydrocarbons dissolved in it. If this could be accomplished, “all of the water produced as a byproduct during oil and gas operations in New Mexico could be treated for human consumption and distributed, ...would provide all needed water each year for 462,866 people—almost 1/3 of New Mexico’s population.” (Whitworth, n.d.) If it could be accomplished economically, industry costs for water disposal would be reduced at the same time.

Disposal of this water, regulated by the State of New Mexico’s Oil Conservation Division (OCD), is achieved by injection into produced water disposal wells. (Water produced in this manner may also be reinjected, with more fresh water added, if it is not disposed of in a disposal well, explaining why statistics of water produced and water disposed of in injection wells differ.) These disposal wells are far below the fresh water aquifers from which most of New Mexico gets its drinking water. This process must be carried out with strict safeguards in order to keep brackish, hydrocarbon-contaminated injected water from leaking from these injection wells or migrating upward into the fresh water aquifers. With either of these consequences, fresh water wells can be contaminated, with potentially serious consequences for health. For this reason, underground injection wells are strictly monitored. If contamination of drinking water or migration of injected water is detected, the OCD and nearby well operators have to locate the source of the problem, and cause it to be repaired promptly.

The U.S. Environmental Protection Agency is also involved in produced water regulation through its nationwide Underground Injection Control (UIC) Program, under the Safe Drinking Water Act of 1974. The UIC program provides states with programs that meet federal standards with the authority to regulate injection practices within state boundaries. The State of New Mexico was the second state in the nation to achieve this authority (the State had already been regulating injection wells since they began to be used in the 1950s in New Mexico). The state receives UIC grants from the federal government, and the EPA oversees the program. (OCD Environmental handbook, <http://www.emnrd.state.nm.us/ocd/ocdrules/enviro/handbook/undergro.htm>)

Water is at a premium in New Mexico, as it is in many parts of the world where successful desalination schemes are on an immense scale to be cost-effective. The successful processes in use today throughout the world are thermal processes, which require heat to distill fresh water from saline water (usually sea water). Electrodialysis and reverse osmosis are other processes that do not involve distillation. Freeze desalination, membrane distillation, and solar humidification are other possibilities. None of the nonthermal processes are commercially successful, although the possibility and economics of converting oil field waste waters into fresh water by reverse osmosis has been studied.

The biggest problem with desalination, besides the cost, is disposal of desalination wastes. All of the processes listed here produce a concentrated brine as a waste. This must be disposed of in an environmentally acceptable manner. Chemicals used as pretreatment in the feedwater would also be present in the waste stream. These could include biocides, coagulants, sulfur dioxide, and, in New Mexico, arsenic, if it is present in the feedwater.

Desalination research is ongoing, including research projects in New Mexico specifically targeting oilfield brines. One such project investigated the use of natural clays as reverse osmosis membranes, with ambivalent results. Another project is currently underway in Lea County, an area of extensive oil and natural gas production in southeastern New Mexico. Scientists from New Mexico Tech's Petroleum Recovery Research Center (PRRC) and Sandia National Laboratories (SNL) are conducting research into ways of converting oilfield wastewaters into water that, while not drinkable by humans, is still usable for watering livestock or irrigation. The two institutes are working jointly on developing a number of water purification mechanisms, and will select two for a pilot project near Hobbs. A pilot project was conducted last year by the Eddy-Lea County Reclamation Organization (ELCRO) that produced drinkable water from oilfield wastes. (Beschizza, R.A., "Project Aims to Recycle Lea Water," *Hobbs News-Sun*, July 10, 2002). Additionally, a national, federally-funded desalination research center, unique in the nation, is being planned by SNL and the U.S. Bureau of Reclamation. The Tularosa Basin National Desalination Research and Demonstration Center will be built in Alamogordo, and is expected to become fully operational in October 2004 (Domrzalski, Dennis, "Desalination Center Planned for New Mexico," *NMBW*, August 2-8, 2002)

Though New Mexico's oil and natural gas producers have always been concerned with produced water problems, they were given new stimulus from the Produced Water Tax Incentive that was passed last year by the New Mexico legislature. The legislation provides a tax credit for water pumped from oil and gas drilling operations up to a maximum of \$400,000 per operator per year. Companies would use the tax savings to build facilities to clean the produced water and pipe it to the Pecos. The bill is expected to put 12,000 acre-feet of water back into the Pecos and save the state more than \$17 million in water rights purchases. The State hopes that initiative will help it come up with some of the annual 34,000 acre feet of water it owes to Texas, as outlined in the Pecos River Compact. (Eric Billingsley, "Oil and gas producers are looking to make water out of brine," *NMBusiness Weekly*, April 22, 2002)

As of now, however, the technology is scarce and experimental, and water transportation costs are high. Producers are not expecting to take advantage of the tax credit immediately. Research funding has been available through several sources, however, and since water purification is now a matter of domestic security, is not expected to abate. Thus, research zeal coupled with industrial needs may speed up a breakthrough in new technology, with desirable environmental and economic results.

Surface: Erosion Control and Habitat Preservation

Coal mining is a significant disrupter of surface land in the areas of New Mexico where coal is mined, because of mining methods that strip away the top layer, or overburden, to get to the coal beneath. Protection of the watershed, replacement and recontouring of the earth, and preservation of habitats are thus of principal importance in these areas.

The Surface Mining Control and Reclamation Act of 1977 (SMCRA)

SMCRA was instituted to protect public health and safety, and to restore the environment. Prior to that time there had been no federal law governing mining operations, nor any responsibility laid on mining companies to restore abandoned mines. “Dangerous highwalls, water-filled pits, open mine shafts, mine subsidence, burning refuse, and miles of polluted or dead streams from acid mine drainage (AMD)” was the result (CAC Issue Paper: “Reclamation Issues and the Abandoned Mine Land Reclamation Trust Fund,” Citizens’ Advisory Council, Commonwealth of Pennsylvania, 1998). Damage from acid mine drainage from abandoned mines is still being remedied today in many parts of the country, although it is not a concern for New Mexico. The Abandoned Mine Reclamation Fund was established to reclaim mines abandoned before passage of the Act. The Fund is supported by proceeds from every ton of coal mined in the United States, and money is funneled back to the coal-mining states to support the reclamation of abandoned mine lands. Under SMCRA, surface mine operations must restore as they mine.

The Office of Surface Mining (OSM) is the federal regulatory body that oversees the regulation of coal mining in the United States. SMCRA allows the OSM to transfer regulatory oversight to the states, if the state has an adequate state regulatory program. New Mexico’s coal program is part of the New Mexico Energy, Minerals and Natural Resources Department, under its Mining and Minerals Division (MMD), regulating state, federal, and private land. Only tribal lands are exempt from state regulation; these are overseen by OSM.

New Mexico’s coal mining regulations cover air quality, surface and ground water protection, erosion control, and waste disposal. Most importantly, the state regulates the reclamation of lands affected by mining. (O’Hara, *Decisionmakers*, 2002) Prior to the federal law that supplanted state laws, New Mexico led the nation in mining standards, with state laws that were very effective.

Surface Mining Hazards for the Environment

The OSM states that sediment carried by rainfall is one of the greatest potential environmental hazards of surface mining. Under the Surface Mining Law all surface water flowing off disturbed areas of the mine must be routed through sediment ponds, designed to slow the flow of water so that sediments can settle. Sedimentation control is an important aspect of reclamation because large amounts of sediment can clog streams, increase the risk of flooding, damage irrigation systems, and destroy fish habitats.

Toxic elements and sulfur-bearing compounds, especially pyrite, may be present in certain coal beds, overburden, and soils. These materials can pollute water and kill vegetation if not handled and disposed properly. The sulfur in pyrite can oxidize to form sulfuric acid when exposed to air and moisture, and if present in sufficient quantity, will result in acid mine drainage. Acid mine drainage kills fish and vegetation and can create high concentrations of toxic elements that make surface and groundwater generally unusable for livestock, domestic purposes, or irrigation.

The removal and replacement of all topsoil is required by the Surface Mining Law unless it is demonstrated that selected subsoil or spoil is better suited to grow plants. Topsoil is removed as a separate layer before mining and is either spread on nearby regraded areas or, if necessary, temporarily stockpiled. Under the Surface Mining Law excess spoil is permanently stored in engineered spoil fills, and highwalls must be reclaimed. Topsoil must be replaced over a graded surface to provide the medium for establishing vegetative cover.

Under the Surface Mining Law all mine sites are subject to the cultural resource protection of the National Historic Preservation Act. This provides that National Register-eligible sites may be disturbed by mining only when the disturbance will have no adverse effect on the site...there are two ways to achieve a "no adverse effect" determination. The first and most desirable means is to simply avoid disturbing the site. Where this is not practical, the law does allow exceptions. Destruction of an archaeological site may occur without an "adverse effect" where full documentation and data recovery has been carried out on the site. (Information in this "Coal Mining Hazards" section courtesy of OSM's web page at <http://www.osmre.gov/>)

Reclamation in New Mexico

Five of the techniques being used on New Mexico coal mines to enhance or preserve wildlife habitat are cliff reclamation, small area depressions, complex reclamation topography, wetland replacement, and minimization of drainage-bottom disturbance. This portion of the Report is the Abstract of a presentation, "Habitat Enhancements on New Mexico Coal Mine Reclamation"* by Dave Clark of the MMD, reproduced courtesy of the author.

Since its inception, the New Mexico coal regulatory program has recognized that the SMCRA provisions for elimination of all highwalls and returning disturbed lands to the approximate original contour create conflicting requirements for the mining districts of New Mexico. Sandstone- and lava-capped plateaus, mesas, and questas (hogback ridges) are common and dramatic features that are important to both plant and animal diversity, as well as the aesthetic value of the landscape. The state's initial regulations provided design criteria detailing procedures and applicability for highwall retention. OSM required justification of the regional differences prior to approval of the state program. New Mexico provided a five-page response that described the geography and geology of New Mexico, the vegetation and animal species that benefit from cliff habitats, and the aesthetic value of cliffs. OSM approved the New Mexico regulatory program in December of 1980, with the stipulation that the state clarify that reconstructed cliffs should not exceed pre-mine cliffs in length. Several highwall segments have since been retained as cliff habitat. The most recent example is at the Ancho mine in the northwest part of the state, where a raven established a nest on a reclamation cliff before grading operations had been completed. Cliffs may also enhance moisture accumulation by trapping snow in leeward banks. Runoff from rock surfaces concentrates precipitation and enhances soil

* Presented at the OSM's forum on "Approaching Bond Release: Wildlife Habitat Construction and Wildlife Use of Reclaimed Lands in the Arid and Semi-Arid West," August 27-31, 2001, Gillette, Wyoming

moisture at the base of cliffs. The increased soil moisture often results in tree and shrub establishment, and a depression created at the base of the cliff will often provide a temporary water source.

Small area depressions are frequently used to provide temporary drinking water, control erosion, and create vegetation diversity on reclamation. Depressions must be completely incised and have gentle slopes, and they are re-soiled consistent with adjoining areas. Depending on the climate of the site, these small area depressions may vary from western wheatgrass-dominated communities to seasonal wetlands.

Revegetation can take several seasons to fully establish in New Mexico. A long period during which surface roughness, mulch, and sparse annual weed cover are the only impediments to erosion is thus a concern. Cut and fill terraces are sometimes used to limit erosion, but the long term stability of terraces is doubtful. Complex slopes, talus slopes, and substrates with high coarse rock fragment concentrations are being used as alternatives to terraces for steep-slope reclamation. On complex slopes, erosion control is achieved by effectively shortening slopes through the creation of dendritic drainage patterns. Slopes have an overall concave longitudinal profile, so that gradients are reduced where runoff accumulates. Sinuosity within low-flow channels is used to reduce drainage gradients. In the larger drainages, wider flood stage channels are added to spread and slow the runoff from large precipitation events.

Wetland mitigation is required when springs or other wetland habitat will be impacted by mining.* An example of spring-fed wetland replacement was recently constructed at the Lee Ranch coal mine. Low volume artesian flow was a fortuitous geological occurrence at this site. A well was drilled and cased, and a shallow, one-third acre depression was excavated. A two-foot liner of clay soil and a one-foot topdressing of direct hauled wetland soil were emplaced. Two livestock watering tanks and a flow control valve were connected to the well head. Barbed-wire fence was installed on three sides, with pipe fence and hog wire placed on the fourth side to exclude livestock from the pond shore.

The Gachupin-Brackett unit of the Ancho Mine is a truck/shovel operation that strip-mines the ridges of a highly dissected plateau. Sediment control is thus required in every highly productive drainage bottom that is intercepted by the operation. To avoid the habitat disturbance that results from impoundment construction, the operator has proposed alternate sediment control structures, including vegetative filters, silt fences, and rock check dam/silt fence combinations. These alternatives have been very effective in minimizing habitat disturbance while maintaining sediment control and preventing pollution of perennial streams.

Habitat Preservation for Bats in the Abandoned Mine Lands Program

Bats are so commonly found in all parts of the United States, that it seems surprising for this little animal to need protection of any sort. However, bats in the United States are being affected by the encroachment of human beings into their territory.

In 1998, the OSM and Bat Conservation International (BCI), a non-profit organization formed to promote the conservation of bats and bat habitats, signed a Memorandum of Understanding. The OSM's Abandoned Mine Lands (AML) program, involved with the reclamation of underground mine shaft and portals, now plays a significant role in the protection of critical bat habitat.

In addition to their role as primary predators of various damaging insects (costing billions to farmers and foresters each year), bats figure in the pollination and seed dispersal of many species of plant. *Guano* (bat droppings) supports the ecosystems of unique organisms, including bacteria which can be used to detoxify waste, improve detergents, and produce gasohol.

Bats are important contributors both ecologically and economically to our nation, but over half of the 43 species living in the U.S. are endangered or on the candidate list for endangered species. As their traditional habitats become more disturbed by human intrusion, bats are becoming progressively more dependent on abandoned mine sites for suitable habitat. Many species of bat, including endangered species, have been observed using abandoned mines as temporary stops during migration or as permanent roosts. Abandoned mines provide microclimates similar to caves, and bats find these mines desirable for rearing young, hibernation, and rest stops during migration in the spring and fall. Closure of mine openings without a biological survey can trap and destroy an entire colony of bats.

The Office of Surface Mining and the states, through their Abandoned Mine Land programs, are now committed to the protection and preservation of bats, bat habitat, and bat ecosystems. Most typically, a biological survey is conducted in coordination with wildlife departments to check for bat habitation prior to closure of a mine opening. If bat activity is confirmed, the typical response is to construct a bat gate. Bat gates usually involve a steel grid with openings large enough to allow passage for the bats, yet small enough to prevent human entry. Gates often are installed on mine openings with no visible signs of bat habitation in order to maintain ventilation patterns which may be essential to adjacent or connecting areas which do contain bats. Bat gates must meet the primary objective of protecting the public from a hazardous condition and, are often more economical than conventional mine closure methods. Over 300 bat gates have been funded and constructed since the commencement of the Abandoned Mine Land program. (from OSM website, <http://www.osmre.gov/bats.htm>)

Western Bats and Mining

Michael Bogan, in "Western Bats and Mining" reports about 32 species of bats in the West; of these, 26 are exclusively western in distribution. At least 22 species of these western bats are known to use mines, and all 32 species could be affected by mine-related activities. Mines can provide two critical kinds of roosts for bats: maternity roosts and *hibernacula* (where bats can hibernate). "Factors that contribute to making a mine desirable to bats include location, proximity to foraging and drinking areas, internal structure, volume, temperature, and

* Alluvial aquifers also must be protected under SMCRA.

temperature stability, airflow, ventilation, presence of other species and absence of predation.”(Bogan, 2000) Researchers have noted that of the 8,000 mines surveyed for bats nationwide, 30 to 80 percent showed some sign of use by bats and 10 percent contained important colonies.

Foraging habitats can also be affected by mine wastes, by loss of insect populations or through contaminated water sources. Insect populations can be lost through changes in vegetation. Thus, reclamation with non-native plants can affect foraging habitats for bats. Open-pit mining has a greater potential to modify large areas, thus impacting foraging habitat. Reclamation activities thus have greater potential to support bats by reclaiming with native vegetation and provision of appropriate roosting habitat. (Bogan, 2000)

Bat Conservation in New Mexico on Abandoned Mine Lands

In a paper presented at the Bat Conservation and Mining Forum (St. Louis, November 14–16, 2000), Homer Milford, Environmental Coordinator of the NM Abandoned Mine Lands (AML) Bureau and underground bat habitat expert, noted that two areas of concern have challenged AML programs in bat habitation protection. These are questions on liability increase resulting from bat gates, and perceptions that bat gate provisions increase costs both in time and money.

A search of the legal literature, however, revealed that there are no known cases of injury caused by breaching a bat compatible closure. Though bat closures have been vandalized with blow torches, electric saws, and other devices, allowing unauthorized entry into mines, there have been no cases of people killed or injured in mines entered through breached bat gates, and thus, Milford says, no “Case Law.” Milford concludes that the New Mexico AML program, under the New Mexico Tort Claims Act (which limits governmental liability), is not likely to be subjected to suits for negligence in the issue of bat grates, providing that reasonable caution is followed.

Milford also found the following, with regard to added money and time costs:

- Added cost of bat habitat assessment is minimal in most projects.
- On a program-wide basis, bat grates are a small percentage of the total cost.
- Monitoring and visiting costs are predicted to be small, though vandalism can create additional repair costs
- One and one-half years should be allowed for habitat evaluation
- Engineering delays can be reduced by the exchange of bat grate designs between government agencies
- Construction of bat grates in a project should take a matter of days per gate.

Milford concludes with a caution to his audience:

The more bat species that become threatened, the more restrictive will be the environment in which future mine safeguarding will have to occur. Thus, unless you plan to change occupations in the near future, the future of America's bat species will dictate your working environment. If any additional bat species are added to the endangered species list, it will impact your work conditions and make your job more difficult. Self interest, if not enlightenment, should persuade your agency of the importance of bat habitat preservation. (Milford, 2000)

Other Environmental Problems

Noise

Compressors are by far the noisiest aspect of natural gas development. It is reported that field compressors can be heard three to four miles from the site. People who live near natural gas producing operations can find the noise hard to tolerate. This is becoming a serious concern in the San Juan Basin, where natural gas production is expected to increase through 2020.

Not many compressors were in general use until the early-mid 1990s in the San Juan Basin, when increased gas production in the San Juan Basin introduced many more compressors. Public scoping meetings on the Farmington Resource Management Plan/Environmental Impact Statement (RMP/EIS) revealed that compressor noise was a major concern for local residents.

The draft RMP/EIS for Farmington states that an increase in wellhead compressors used in natural gas production would add to the noise levels in the region. The agency recommends noise mitigation on a case-by-case basis with Alternatives A (current management) and B (resource production). Under alternative C (conservation) and D (recommended plan), noise mitigation would be required by the BLM's proposed Noise Policy.

This policy, whose proposed version was released in August 2001, for development in noise-sensitive areas,

establishes setbacks and boundaries for development in the county's inhabited, recreational, archeological and/or remote areas; and identifies noise-sensitive areas as those which have been deemed necessary to protect from unwanted sound and include the presence of human habitation, recreational resources, endangered species, designated wildlife and wilderness lands or archeological resources. Authorities have identified nearly 60 such areas within boundaries of the Farmington field office, which covers San Juan County, western Rio Arriba County, and northern McKinley County. Proposed regulations would set standards at a maximum of 48.6 decibels within a 300-foot circle surrounding the noise source. Once effective, the rules will apply to all newly installed noise sources. Those already in place will have to incorporate necessary upgrades into the regular maintenance schedule, with a maximum time of five years to reach compliance. (Michele Abbott, "The Science of Sound/Noise Abatement brings Success to Local Company," *Farmington Daily Times*, March 12, 2001)

Currently, regulatory agencies have no mitigation standards for industrial noise, nor is there any legislation pending to establish federal or state standards. Mitigation of compressor noise levels now depends on companies' voluntary compliance with local ordinances. Noise pollution problems are easier to relieve when production companies make a point of responding to public concern.

Such a case occurred in Farmington, reported in the *Farmington Daily Times*. A Farmington company that designs noise abatement systems was called upon to install a noise absorption system near a residential compressor in Farmington in the proximity of a half-dozen homes, which had to meet city standards stating that "compressor noise cannot measure more than 42 decibels compared to the sound level of two voices engaged in a normal conversation at 50 feet from the source, nor can it exceed 1 decibel over the neighborhood's ambient nighttime noise level at 200 feet from the source". (Abbott, 2001) The company was successful, residents were relieved, and production continues.

The Bureau of Land Management also recognizes the potential impact of noise pollution on species that live in the San Juan Basin. The Farmington Office has established a raptor management policy that seeks to minimize disturbance to raptor nests. There are three raptor species of concern: the prairie falcon, the ferruginous hawk, and the golden eagle.

The Farmington Field Office tries to achieve coordinated mitigation solutions by sending producers lists of locations by section number that contain established raptor nests (these are not to be made available to the public to protect raptors). If a producer wants to install or operate a compressor between March 1 and June 30 (nesting season) in a designated section, the compressor cannot emit more than 48.6 decibels at 300 feet from the compressor. An alternative is to request the district Threatened and Endangered Species biologist to evaluate the situation, before a compressor is installed, and recommend a mitigation strategy. The FFO believes that coordinated solutions will be more cost-effective for producers. ((BLM, FFO Raptor Management Policy Update, February 1, 2000)

Proximity

Being too close to the activities of energy industries can bring about a range of problems for the human inhabitants that share space with coal mines, oil, natural gas, and power plant operations. In addition to noise, emissions, dust, leaks, spills, explosions, and occasional collisions (such as the tragic accident in Farmington a few months ago in which two people were killed when they ran into a natural gas well with a car) can beset residents in energy-producing areas. Point sources of water contamination can also be more prevalent in these industrial areas of the state. Residents of areas whose local economies depend on energy-production-related jobs frequently end up with more exposure to pollutants, at the same time as they benefit from the activities of the industries. One case in point is that of San Juan County, where two coal-fired power plants and numerous natural-gas-producing operations all contribute to the rising level of emissions in that area.

The New Mexico Environment Department has noticed recently that ozone levels in San Juan County are unusually high, especially for a rural area. The New Mexico Environment Department monitors ambient ozone levels at two sites in the Farmington area: one near the San Juan Generating Station and one near the Bloomfield Gas Corridor. The original purpose of these monitors was to collect air quality data for modeling purposes.* Although areas with ozone concentrations that exceed the standards are usually big cities like Houston or Los Angeles, the new ozone concentration data from these monitoring sites showed unusually high levels for a rural area. For the year 2000, the fourth-highest 8-hour averaged concentrations near Farmington were 0.079 ppm at the monitor near PNM and 0.080 ppm at the monitor near the Bloomfield Gas Corridor, just below the regulatory limit.†

Previous measurements, under the old standards had never approached or exceeded the NAAQS, although San Juan County's measurements had always been high compared to other sources in the state. The Environment Department has formed a staff team to look into these elevated ozone concentrations:

[if found in nonattainment] EPA would require New Mexico to submit a plan to bring the area back into attainment with the standard... The non-attainment designation would require a federal permitting program for new and modified large industrial sources in San Juan County that emit volatile organic compounds and nitrogen oxides. Given the many oil and gas sources in San Juan County that emit these pollutants, a non-attainment designation would have a significant impact in the area. (New Mexico Environment Department website:
<http://www.nmenv.state.nm.us/aqb/projects/Ozone.html>)

The Department attributes this ozone rise principally to emissions from the three coal-fired power plants in the San Juan area, as well as to the rise in oil and natural gas operations. (*Decisionmakers*, 2002). Data from the Department's emissions inventory for the State that illustrates this trend is available in a spreadsheet at
http://www.nm.env.state.nm.us/aqb/prjects/28Nov2001_EmissionInventory.xls)

* specifically, for predicting industrial emissions of nitrogen oxides in San Juan County.

† "the new ozone National Ambient Air Quality Standard (NAAQS) is a three-year average of the fourth-highest 8-hour concentration that is not to exceed 0.084 ppm. The previous NAAQS for ozone was a 1-hour standard of 0.124 ppm, not to be exceeded more than once per year." (New Mexico Environmental Department website:
<http://www.nmenv.state.nm.us/aqb/projects/Ozone.html>)

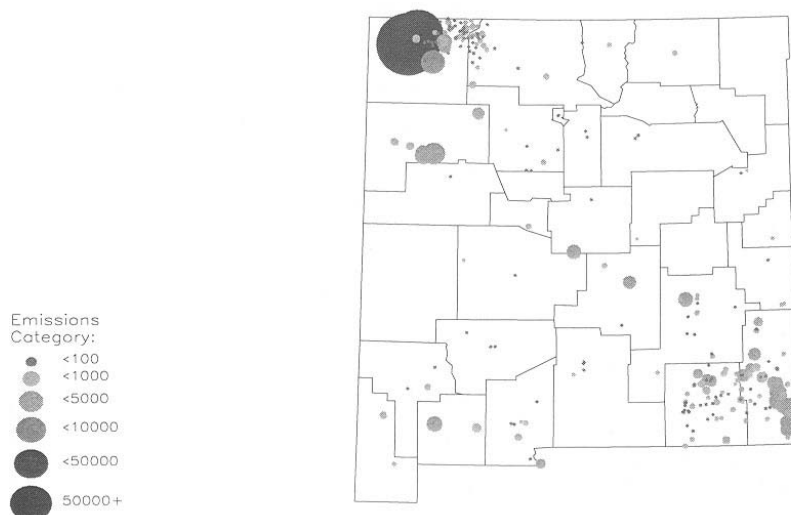


Fig. 11. Emissions map of New Mexico for nitrogen oxides, 1999
(National Emission Trends database, U.S. EPA)

Figure 11 shows the NOx map for New Mexico in 1999, with a large concentration of NOx emission sources in the San Juan Basin (ozone is formed from nitrogen oxides reacting with VOCs and sunlight) (from the US EPA National Emission Trends (NET) database).

It is known that respiratory illness and air pollution are linked: SO₂, NOx and VOCs are known to aggravate respiratory illnesses. It has also been observed that people who live nearer the sources are more prone to these illnesses. There is no national health tracking system that tracks chronic diseases, such as asthma, and their potential links to environmental factors. Individual states may do so, but New Mexico is not one of these. The American Lung Association of Arizona/New Mexico has collected statistics, however, that show the rates of the estimated prevalence of lung disease, by county in New Mexico and Arizona. If the residents of San Juan County are exposed to significantly more airborne pollutants, one might expect the incidence of lung disease to be higher, in general, than that of those counties with lower emission counts, but this does not appear to be true.

Table 13. Data and Statistics from ALA of Arizona/NM: Estimated prevalence of lung disease, (shown as a percentage of population) May 2002

County	Pop	Lung Cancer	Emphysema	Chronic Bronchitis	Adult Asthma	Pediatric Asthma
Maricopa (AZ)	2,861,395	.06%	1.0%	3.2%	6.2%	1.4%
Bernalillo	523,472	.04%	1.0%	3.3%	5.1%	1.3%
San Juan	109,899	.03%	.84%	2.8%	4.5%	1.8%
Socorro	16,500	.04%	1.0%	3.1%	4.9%	1.6%

Bernalillo County is a densely populated urban area, one of the few in New Mexico; Socorro County covers a large area, has practically no industry, and few people, and San Juan County is moderately populated but highly industrialized, with an unusually high emissions level

for rural New Mexico, as we have seen (Maricopa Co. in Arizona is included for comparison, as a highly populous urban area in a neighboring state). However, the incidence of lung disease reported here varies little, and may be statistically insignificant, between San Juan County and the other areas shown. It may be that the pollution levels of San Juan County have not been high enough, long enough, to create the kinds of respiratory distress common in other parts of the United States, where nonattainment is common, population is dense, and industrial activity is high.

Summary

- “Human impact on the environment is a function of population size, per capita consumption and the technology to produce what is consumed.” (United Nations Population Fund)
- The desire to assume stewardship of our natural resources is becoming more prevalent. As a result, industries must continue to develop more environmentally sound technologies in order to keep on producing. We expect the damage to the environment to be repaired and better technology to lead the way.
- Since 1970, aggregate emissions of the six principal pollutants have been cut by 29%. National air quality levels are improving, but regulatory standards are still tightening.
- Special problems for industry: Oil and gas producers in New Mexico are concerned with ground water contamination, disposal of produced water, surface disturbance, air pollution and noise. The main environmental focus for coal mining in New Mexico is reclamation. Regional haze is a major air pollution problem in the West, attributed in part to coal-fired power plants, but to other sources as well, especially fires, mobile sources, and dust.
- The movement towards multi-pollutant legislation is gaining momentum in Congress in order to alleviate the climate of regulatory uncertainty presently existing for the electricity generation industry.
- Coal-burning power plants invest heavily in pollution control equipment to meet federal and state standards, but they are still targeted as major polluters.
- Wastewater from oil and natural gas production is a major environmental concern and expense for the industry for treatment and disposal; though research is underway, no solutions have been found.
- Coal mining has multiple impacts on the environment, but the largest concern in New Mexico is reclamation. A number of habitat enhancements have been accomplished by the State Mining and Minerals Division. Bat protection is now an issue nationally, and in New Mexico as well.

- The noise from compressors is a problem for residents of areas near oil and natural gas operations, which communities seek to control. Better technology in suppressing compressor noise can provide a remedy, as one case in Farmington has shown.
- The people in the most highly industrialized areas are living closest to sources of airborne pollution and their health may be affected; however recent data on lung disease does not yet show a trend towards more illness in the San Juan Basin area of New Mexico.

Part IV. Maximizing Economic Gain, Minimizing Environmental Risk

Introduction

We can also look at the environment/economy/energy development triad from the viewpoint of interdependence between people and resources. Rather than a relationship of exploiter to victim, society and industry, in this view, must create a partnership with the environment—source of all its raw materials, and the ultimate receiver of its byproducts.

To clarify the interrelationship between environment and development, we may ask:

- Must we trade environmental degradation for social improvement?
- Is there a basic incompatibility between a sound environment and sound development policies?
- Does sustainable economic growth require the conservation of natural resources as the fundamental base for productive activity? (The United Nations Development Program, UNDP website at <http://www.undp.org/>)

Most of us see the right kind of economic development as being that which includes environmental conservation coupled with economic feasibility. The hard part, of course, is achieving this balance.

Companies have adopted a number of strategies to maximize economic gain and minimize environmental risk (thereby minimizing penalties also). State and federal governments offer incentives both to maximize fossil energy resources (like the coalbed methane tax credit) and to encourage the development of renewables (wind tax credit). In various energy areas, as in others, advocacy groups develop model legislation to introduce and promote passage of bills on subjects thought to need attention and encouragement. Other states that face the same issues have sought a variety of ways to address the balance of energy use and development, economic gain, and environmental protection.

Management Tools for Business

Waste Minimization Programs

Waste minimization is a waste management approach that focuses on reducing the amount and toxicity of hazardous waste generated. The EPA is very much in favor of it:

Waste minimization is important because it helps protect the environment and it makes good business sense. In fact, businesses can simultaneously manage both business and

environmental objectives by focusing on waste minimization. For example, companies have discovered that waste minimization:

- Saves money through avoided disposal and raw material purchase costs
- Reduces regulatory burdens and compliance costs
- Builds better community relations
- Creates safer working conditions for employees
- Protects human health and the environment
- Demonstrates environmental leadership
- Improves competitiveness through greater efficiencies and decreased overhead costs (EPA <http://www.epa.gov/reg5rcra/wptdiv/wastemin/>)

Large-quantity generators of hazardous waste are already required by the Resource Conservation and Recovery Act, as amended by the Hazardous and Solid Waste Amendments of 1984, to have waste minimization programs. Increasingly more companies, regardless of the amount of hazardous waste generated, are starting to implement waste minimization programs, taking voluntary initiatives to minimize environmental degradation, and to provide economic benefits to companies as being cheaper in the long run. More stringent regulations have resulted in substantially increased treatment and disposal costs for many industries. More costs, better awareness of environmental impacts, and heightened emphasis on environmental protection provide greater incentives for companies to improve their procedures to reduce or eliminate wastes. (Olson, *Decisionmakers*, 2002)

Integrated Resource Planning

Integrated resource planning (IRP) involves the identification of resources or the mix of resources needed by a utility for meeting near and long term consumer energy needs in an efficient and reliable manner at the lowest reasonable cost.

IRPs analyze the costs, effectiveness, and benefits of all practical and available options, supply-side and demand-side. *Supply-side* strategies seek to increase energy supplies (build more power plants) while *demand-side* management aims to maximize use of existing energy resources (consumers change their energy use habits through their practices, and with energy-efficient appliances, equipment, and buildings).

IRPs must consider all facets: the company's financial integrity, size and physical capability, and impacts on consumer, the environment, culture, community lifestyles, the state's economy, and society.

Basically, an integrated resource plan requires utilities to forecast future energy requirements and to identify all the resources available for meeting those requirements.

These might include conventional generating units, power purchased from cogenerators or independent power producers, capacity gained through demand-side management programs, decentralized energy sources such as solar and wind energy, or alternative fuels for conventional generating units, such as biomass, solar-heated turbines, and others.

Next, the utility must analyze each of these various resources for their potential contribution to meeting projected energy requirements and for their cost-effectiveness. Environmental, cultural, and social costs can be considered, as well as direct project costs.

Finally, an optimum mix of energy resources is selected—one that fulfills as many planning criteria as possible: least-cost, reliability, flexibility, social, cultural, and environmental acceptability. (*from*: University of Maui's website: <http://mauicc.hawaii.edu/unit/mist/irp.html>)

For example, utilities that want to significantly reduce air emissions while generating power can incorporate integrated resource planning tools into their overall strategic plan for future power generation efforts. In addition to setting goals for the near future, utilities are developing or expanding pollution prevention options for existing coal, natural gas and oil-fired utility operations.

It is not currently known how integrated resource planning will fare in a deregulated arena. The U.S. DOE's Office of Renewable Energy and Energy Efficiency says:

There is currently much controversy over how the social goals that are considered in the IRP process will be met in the growing trend towards the so-called "deregulation" or "restructuring" of the electric power industry. Proponents of restructuring claim that open competition will allow the market to achieve the same ends that regulating the industry would...Some of the states where restructuring is underway no longer require utilities to undertake IRP, or the measures associated with the IRP process...However, some state's restructuring legislation includes provisions that will require or support investment in renewable energy technologies and energy efficiency. One example is a "renewable energy portfolio standard" where a percentage of each power producer's production must come from renewable resources. Another is a "systems benefit charge," which is basically a tax on power sales with the revenues generated used to provide low-income household energy assistance or funds for renewable energy and/or energy efficiency investments. (EREN, Consumer Energy Information, EREC Resource Briefs, September 2001, at: <http://www.eren.doe.gov/consumerinfo/refbriefs/ja8.html>)

Integrated resource planning is indirectly practiced by companies under the NM PRC's rules. In rate cases, companies must show similar planning steps that have been taken into account. Renewable energy portfolio standards are still under review in New Mexico. A systems benefit

charge is a feature of New Mexico's Electric Utility Industry Restructuring Act. Both may be components of New Mexico's future energy strategy.

Environmental Management Systems

Environmental compliance is now part of many companies' overall management systems. The way in which a company addresses environmental protection issues may have an impact on its long-term fortunes and economic viability.

Many companies now focus on broader, strategic approaches, which go beyond compliance, in their environmental planning. They see that the best way to comply with regulation, minimize environmental impacts and, at the same, increase economic well-being is by developing and implementing an environmental management system, an analytical framework that includes process analysis, problem-solving and decision-making, which results in a series of action plans for implementation.

The US Environmental Protection Agency describes EMS:

An EMS is a continual cycle of planning, implementing, reviewing and improving the processes and actions that an organization undertakes to meet its business and environmental goals. Most EMSs are built on the "Plan, Do, Check, Act" model. This model leads to continual improvement based upon:

- Planning, including identifying environmental aspects and establishing goals [plan];
- Implementing, including training and operational controls [do];
- Checking, including monitoring and corrective action [check]; and
- Reviewing, including progress reviews and acting to make needed changes to the EMS [act]. (US EPA website: <http://www.epa.gov>)

Companies and trade associations are taking an interest in developing industrial environmental codes, and there has been recent government interest in environmental management systems as a possible tool in public policy innovation and decision making. (from EPA, National Database on Environmental Management Systems, <http://www.eli.org/isopilots.htm>)

Many EMS are built on ISO 14000 standards (internationally-recognized environmental standards for environmental management systems, requiring continuous improvement of environmental performance by the company). For example, PNM has implemented ISO 14001 at the San Juan Generating Station (described in Part II).

The New Mexico Environment Department has established a Green Zia program, to help businesses develop prevention-based environmental management systems that focus on increasing profits by reducing waste. Companies that achieve demonstrable results are eligible for

the Department's Green Zia Award, given annually to the highest achievers. Los Alamos National Laboratories, Intel, and Phillips Semiconductors are some of the New Mexico companies that were recognized in 2001.

Incentives

Most people will agree that rewards are useful tools for motivating behavior. A number of incentives, at the state and federal level, attempt to provide rewards to individuals and businesses for certain energy-related behaviors. Some are successful; some are successful but due to expire soon unless renewed; others are based on previous successes, and some have not been implemented on a large scale.

Federal Renewable Energy Tax Credits

There are several federal tax credits available to businesses, individuals, and homeowners for the use of renewable energy. These are listed here briefly. (all summaries taken from DSIRE, The Database of State Incentives for Renewable Energy website, <http://www.dsireusa.org/>)

Alcohol Fuel Credit

For businesses that sell or use alcohol (methanol, including that from methane formed from solid wastes, or ethanol) as a fuel, this credit consists of a straight alcohol credit, an alcohol mixture credit, and a small ethanol producer credit. Credits range from \$0.3926 to \$0.60 per gallon, depending on the proof and type of alcohol.

Deductions for Clean-Fuel Vehicles and Refueling Property (exp 12/04)

This credit is a limited deduction for the cost of a clean-fuel vehicle for individuals and businesses in the tax year the property is placed in service. The vehicle must be for the owner's use and its original use must begin with the owner claiming the deduction. The maximum amount of the deduction is \$2,000 for cars and smaller vehicles, \$5,000 for a truck or van with a gross vehicle weight rating over 10,000 pounds but not more than 26,000 pounds, and \$50,000 for a truck or van with a gross vehicle weight rating over 26,000 pounds or for a bus with a seating capacity of at least 20 adults (excluding the driver).

A phase-out of the clean-fuel vehicle deduction will occur starting with a 25% reduction in 2002, a 50% reduction in 2003, and a 75% reduction in 2004. The deduction will be phased out completely by 2005. (Electric vehicles that qualify for the electric vehicle credit are not eligible for this deduction.)

The IRS also allows a limited deduction for the cost of clean-fuel vehicle refueling property. The maximum deduction one can claim for clean-fuel vehicle refueling property placed in service at one location is \$100,000. Recharging property includes any equipment used to

provide electricity to the battery of a motor vehicle propelled by electricity (except solar panels or windmills) and does not include the battery used in the vehicle.

Energy Efficient Mortgage

The Energy Efficient Mortgage (EEM) can be used by homeowners to pay for energy efficiency measures for new and existing homes. EEMs are federally recognized and can be applied to most home mortgages. Both government insured (e.g., FHA, VA) and conventional (e.g., Fannie Mae) EEMs are available. All buyers who qualify for a home loan qualify for the EEM. The EEM is intended to give buyers additional benefits on top of their usual mortgage deals. The lender will use the energy efficiency of the house, as determined by a Home Efficiency Rating System (HERS) rating, to determine what these benefits will be. EEMs can also be used to finance technologies such as photovoltaics, solar water and space heating, and energy efficiency.

For existing home improvements, a lower interest rate and a fixed-term loan program is available for high-efficiency residential heating and cooling. For new construction, mortgage financing is available at a lower total monthly cost when compared to standard mortgages for the purchase of homes that are at least 30% more efficient than the 1992 Model Energy Code.

Renewable Energy Production Incentive (REPI)

This incentive provides financial incentive payments for electricity produced and sold by new qualifying renewable energy generation facilities (those owned by state and local government entities, such as municipal utilities) and not-for-profit electric cooperatives that start operations between October 1, 1993 and September 30, 2003. Qualifying facilities are eligible for annual incentive payments of 1.5 cents per kilowatt-hour (1993 dollars and indexed for inflation) for the first ten-year period of their operation, subject to the availability of annual appropriations in each Federal fiscal year of operation. Qualifying facilities must use solar, wind, geothermal (with certain restrictions as contained in the rulemaking), or biomass (except for municipal solid waste combustion) generation technologies (complements sections 1914 and 1916 of the Energy Policy Act of 1992).

Solar and Geothermal Business Energy Tax Credit

The federal business energy tax credit is a 10% tax credit available to commercial businesses that invest in or purchase energy property (either solar or geothermal) in the United States. Energy property is defined as either solar or geothermal energy. For electricity produced by geothermal power, equipment qualifies only up to, but not including, the electrical transmission stage.

The energy property must be operational in the year in which the credit is first taken. The property must also be constructed and used by the taxpayer. Energy property does not include public utility property, passive solar systems, pool heating, or equipment used to generate steam for industrial or commercial processes. Credit may not be taken if financing for the project is subsidized or from tax-exempt private activity bonds. The tax credit is limited to \$25,000 per

year, plus 25% of the total tax remaining after the credit is taken. Remaining credit may be carried back to the three preceding years and then carried forward for 15 years.

Solar, Wind, and Geothermal Modified Accelerated Cost Recovery System (MACRS)

Under the Modified Accelerated Cost Recovery System (MACRS), businesses can recover investments in solar, wind, and geothermal property through depreciation deductions. The MACRS establishes a set of class lives for various types of property, ranging from three to 50 years, over which the property may be depreciated. For solar, wind, and geothermal property placed in service after 1986, the current MACRS property class is five years.

Wind and Biomass Renewable Electricity Production Credit (REPC) or Wind Energy Production Tax Credit (PTC) (expires 12/31/03)

The Renewable Electricity Production Credit (REPC), also called the Wind Energy Production Tax Credit (PTC), is a per kilowatt-hour tax credit for electricity generated by qualified energy resources (wind, closed-loop biomass, or poultry waste). Available during the first 10 years of operation, the REPC provides a 1.5 cents per kWh credit adjusted annually for inflation. The adjusted credit amount for 2002 is 1.8 cents per kWh. Enacted as part of the Energy Policy Act of 1992, the credit expired at the end of 2001 but was extended in March 2002. It is now set to expire on 12/31/03. (from DSIRE, The Database of State Incentives for Renewable Energy, website, <http://www.dsireusa.org/>)

Proposed: H.R. 2147: Save America's Valuable Energy Resources Act of 2001

This bill would provide tax credits for improvements in energy efficiency to existing homes or the construction of new energy efficient homes. H.R. 2147 would encourage energy efficient construction and retrofits by providing a tax credit worth 20 percent of the cost of the energy efficiency improvements on residences. The credit is capped at \$2,000. To qualify for the tax credits, the energy efficiency components must beat the certification standards set by the 1998 International Energy Conservation Code. The credits will apply to investments made between January 1, 2001 and December 31, 2005. The bill was referred to the House Committee on Ways and Means on June 13, 2001. (from "Thomas," the Library of Congress' Bill Finder, at <http://thomas.loc.gov/>)

State Incentives

The State of New Mexico also offers incentives for use of renewable energy, as well as for produced water disposal (covered in Section II). These were all enacted in 2002.

Renewable Energy Production Tax Credit, SB187

“A taxpayer that owns a qualified energy generator certified by the energy, minerals and natural resources department is eligible for a tax credit in an amount equal to one cent (\$.01) per kilowatt-hour for the first four hundred thousand megawatt-hours of electricity produced by the qualified energy generator using a qualified energy resource in the taxable year. A taxpayer shall be eligible for the tax credit for ten consecutive years, beginning on the date the qualified energy generator begins producing electricity. The tax credit provided in this section may be referred to as the "renewable energy production tax credit".”

There is a 20 MW minimum for claiming the credit, however, that excludes all existing and proposed small projects

Electric Generation Facilities Tax Credit, Section 8, HB143

“Receipts from selling wind generation nacelles, rotors or related equipment to the United States or New Mexico or any governmental unit or subdivision, agency, department or instrumentality thereof, if such equipment is installed on a supporting structure, may be deducted from gross receipts.”

Coalbed Methane Tax Credit: A Hydrocarbon Production Incentive

Conventional energy sources have a long history of incentives. Historically, the federal government has sought to stimulate coal, oil and natural gas production with tax incentives, starting around 1918. In the 1970s, federal policy focus shifted. The long-standing argument that oil and gas production did not warrant special tax treatment gained more credence in the face of large revenue losses by the industry and increasing federal budget deficits. Additionally, heightened awareness of environmental degradation and increasing pollution led to a loss of political support for the oil and gas industry. Finally, the two energy crises of the 1970s focused policymakers’ attention on the failures of the energy market. While production tax credits were retained, they were much diminished compared to those of former years. In the 1980s, the free-market energy policies proposed that all production taxes that favored any kind of energy production should be eliminated, in order for the market to determine energy prices. Oil, coal, and natural gas depletion and intangible drilling cost expensing, however, were retained and still exist, together with other tax credits. For coal, oil and natural gas, for example, there are percentage depletion allowances (10% for coal and 15% of sales for oil and natural gas; higher for marginal wells); the Enhanced Oil Recovery Credit for oil production, and the expensing of intangible drilling costs (IDCs) that are 100% deductible in the first year of production. (Lazzare, S., CRS IB10054, “Energy Tax Policy, U.S. Library of Congress, Congressional Report Service, August 24, 2001)

Coalbed methane has historically been considered as an alternative energy source. The §29 Tax Credit for Unconventional Fuels, instituted in 1980, is a production tax credit to

stimulate the supply of selected unconventional fuels that include coalbed methane, gas from biomass, and synthetic fuels from coal.

A study performed recently (January 2002) by the Energy Information Administration (EIA), the independent statistical and analytical agency within the U.S. Department of Energy, found that the availability of tax credits for non-conventional fuels production (mostly coalbed methane) under Section 29 of the Windfall Profit Tax Act appeared to be responsible for much of the growth in natural gas production by the major* U.S. energy producers in the 1990s.

Production of coalbed methane (natural gas from coal seams) comprised 60% of the overall growth in U.S. natural gas production between 1990 and 2000. Before 1990, coalbed methane production was negligible. The tax credit is from natural gas produced from wells drilled between 1980 and 1992 inclusive, for sales of fuel between 1980 and 2002 inclusive. The credit is determined by a formula that varies with the price of oil and inflation, with an average of \$1.02 per thousand cubic feet for the decade. The EIA states that the credit added 53% to the effective price received for eligible production, based on the U.S. wellhead price. (EIA, *Performance Profiles of Major Energy Producers 2000, 2002*)

Ongoing CBM projects and recent acquisitions indicate a continuing interest in CBM by the majors even if eligibility for Section 29 credits expires. Legislation currently introduced would extend the section 29 credit past its expiration date of December 31, 2002.

New Mexico, with two other states, Colorado and Alabama, holds 75% of US coalbed methane reserves. Although CBM production has been predicted to wane, it is still significant (and expected to hold strong, according to the RFD for the San Juan Basin we referred to in Part II). Keeping in mind our state's numerous taxes, rents, royalties and fees generated from natural gas production, Section 29 has proven beneficial for our economy, and may well continue to do so in the foreseeable future.

Cap-and-Trade Incentives: Emissions-Trading Credits

Cap-and-trade incentives are market-based incentives that allow businesses flexibility in meeting regulatory goals for emissions. The National Energy Policy favors such incentives, like the Acid Rain cap and trade program, instituted by the EPA in 1990 to lower sulfur dioxide emissions throughout the nation.

Allowance trading, or "cap and trade" programs, offer these key features:

- **An emissions "cap":** a limit on the total amount of pollution that can be emitted (released) from all regulated sources (e.g., power plants); the cap is set lower than historical emissions to cause reductions in emissions

* "The selection criteria for a U.S.-based company to be designated as a major require ownership of 1 percent or more of U.S. production or reserves of oil or natural gas or 1 percent or more of U.S. refinery capacity or refined product sales." (EIA)

- **Allowances:** an allowance is an authorization to emit a fixed amount of a pollutant
- **Measurement:** accurate tracking of all emissions
- **Flexibility:** sources can choose how to reduce emissions, including whether to buy additional allowances from other sources that reduce emissions
- **Allowance trading:** sources can buy or sell allowances on the open market
- **Compliance:** at the end of each compliance period, each source must own at least as many allowances as its emissions (from the EPA website, “Clean Air Market Programs,” <http://www.epa.gov/airmarkets/trading/basics/index.html>)

With a cap-and-trade program, large amounts of emissions from a group of sources are expected to be controlled at lower costs than those from individually regulated sources. An overall cap, or maximum amount of emissions per compliance period, is set that is expected to achieve the desired environmental effects. Authorizations to emit in the form of emission allowances are then allocated to affected sources, with the total allowances not exceeding the cap. Individual control requirements are not specified for sources, but sources must measure and report all emissions and turn in the same number of allowances as emissions at the end of the compliance period.

For example, in the Acid Rain Program, sulfur dioxide (SO₂) emissions were 17.5 million tons in 1980 from electric utilities in the U.S. Beginning in 1995, annual caps were set that decline to a level of 8.95 million allowances by the year 2010 (one allowance permits a source to emit one ton of SO₂). At the end of each year, EPA reduces the allowances held by each source by the amount of that source's emissions. (EPA, “Clean Air Market Program,” <http://www.epa.gov/airmarkets/trading/basics/index.html>)

The success of the acid rain program is evinced through the results: sulfur dioxide (SO₂) emissions have fallen significantly, and costs have been lower than the designers of the program expected. The EPA says, “The U.S. Acid Rain Program has achieved greater emission reductions in a short time than any other single program to control air pollution.”

The Administration’s Clear Skies Initiative (announced in February 2002, with legislation recently sent to Congress) also recommends market-based incentives, based on the Acid Rain Cap-and-Trade program, to achieve similar success in reducing SO₂, NO_x and mercury in a multi-pollutant program.

Performance-Based Regulation Incentives

As the country reconsiders its energy policies, it also moves towards new ways (at least in the United States) of regulating transmission and distribution.

The Background Report has already related how uncertainty about recovery of transmission system investments has been a barrier to new construction of transmission facilities. Currently, many state-owned and investor-owned utilities are regulated by state and federal rules with the costs of transmission recovered in authorized rates (under *rate-of-return* regulation). New investments in transmission must be assured of recovery by making the risk of investment adequately rewarded. The industry has asserted that current rates of return are not high enough to accomplish this end.

Authorizing higher rates is not enough to stimulate investment in new transmission. Regulatory uncertainty is also a factor in the lack of new transmission. For example, rate freezes that may be promulgated by state regulators can be strong disincentives for new transmission investment, even though a whole region might benefit from new transmission.

One way suggested to further eliminate regulatory uncertainty is the shift of congestion responsibilities (both costs and benefits resulting from investment to reduce costs) to transmission owners, thus giving them an incentive to reduce transmission bottlenecks. The U. S. DOE's *National Transmission Grid Study* says:

The current form of rate-of-return regulation is based on investment costs. Simply passing costs of congestion through to consumers disconnects the decision to invest from the benefit to the consumer of the investment and thus provides no incentive to transmission owners to address bottlenecks. (*NTGR*, 2002)

One proposal that has come under scrutiny is a move to *performance-based* regulation (PBR) in the governance of transmission and distribution activities. Performance-based regulation depends on rewarding investors (in this case, transmission companies) through incentives based on the value and innovativeness of their actions, rather than their investments. In other words, results are the basis of this type of regulation; rather than prescribing behavior, the regulatory body sets the goals allowing the flexibility for companies to meet in the most cost-effective way. Performance-based regulation is being used in the US telecommunications industry and other US industries, and in regulated utilities throughout the world. From the *NTGR*:

PBR is attractive because it provides targeted incentives to regulated firms to achieve specific objectives (e.g., to increase market efficiency, ensure reliability, and make timely investments). In order to ensure that these objectives are met, it is necessary to define performance measures that directly relate to the objectives and to ensure that firms have adequate control over the means of meeting the objectives. If the goal is to minimize the cost of transmission service, a firm must be able to balance improvements in operations with investments in new transmission facilities, including the deployment of advanced technologies. Similarly, if the transmission owner bears no responsibility for costs of congestion, there is no incentive to reduce it. (*NTGR*, 2002)

The National Energy Policy leans towards PBR, and national regulatory bodies like the National Association of Regulatory Utility Commissioners (NARUC) are looking at PBR with pragmatic advice to regulators on how to achieve this end effectively, so that good performance leads to higher profits for the utility without unduly increasing costs to customers. NARUC is focusing on how to design and evaluate PBR rules in this time of rapid change in the industry. In a recent report on PBR for distribution utilities, NARUC advises that designing a PBR is a three-step process involving: 1) identification of goals (i.e., cost reduction and incentives); 2) selection of a structure that addresses these goals (price caps or revenue caps, which are preferred by NARUC); and 3) getting the numbers right (setting the cap at a level that effects a satisfactory outcome for the utility). (NARUC, "Performance Based Regulation for Distribution Utilities," December 2000).

Performance-based regulation could be very important to the success of distributed resources. A 2000 report by the Regulatory Assistance Project (funded by NARUC) entitled "Profits and Progress through Distributed Resources," discusses how DR's impact to a utility is negative under rate of return regulation, but could be positive under PBR. The report finds that distributed resources won't be encouraged by utilities until a well-designed PBR captures the value of DR (Moskowitz, D. "Profits and Progress through Distributed Resources," Regulatory Assistance Project, 2000).

Twenty-eight utilities in 16 states are already using some form of PBR for electric utility regulation. This number is predicted by one source to expand as deregulation of wholesale power expands, and regional transmission services become implemented.* There are other examples where PBR failed completely however. PBR is a vigorously debated subject, and only the future will tell whether it will be successful.

Model Legislation

Model legislation is formulated to help boost new ideas into state laws. Model legislation is usually prepared when there is a perceived need on someone's part for legislation dealing exclusively with a particular matter. These proposals are frequently stated broadly, so they can be tailored to a specific state's conditions and needs. Often, critics of particular model legislation will argue that the proposed legislation is stated *too* broadly, inviting unforeseen consequences. Many forms of model legislation are simple in format, with a fill-in-the-blanks design that makes it useful for replicating and passing around as an advocacy measure. Other model legislation can be exceedingly complex, to address complicated issues.

* "RTO compliance filings show that there is significant interest in applying PBR to RTOs (or transmission owners within RTOs). Many believe that PBR will encourage transmission owners to undertake the investment required to expand the high-voltage grid." (Sappington, D.M. , et al. "The state of performance-based regulation in the U.S. electric utility industry," *Electricity Journal*, (Oct. 2001))

Frequently, organizations and advocacy groups participate in the construction of model legislation, usually the same groups that see a need for reforming existing laws or adding new ones. For example, the “Sustainable Communities Act” (subtitled “A Proposal for Reforming New Mexico’s Planning and Land Use Laws”), aimed at modernizing New Mexico’s comprehensive planning statutes, was drafted by a number of groups forming the New Mexico Coalition for a Livable Future. There was substantial discussion of smart growth in the legislative session, but comprehensive planning statutes have not yet been adopted in New Mexico.

Another example of model legislation pertaining to energy issues, which might be of interest in New Mexico, is legislation concerning energy efficiency standards for appliances. It is promulgated by the American Council for an Energy-Efficient Economy and the Appliance Standards Awareness Project. “A Model Act Authorizing Establishment of Minimum Energy Efficiency Standards for Certain Products Sold in the State,” is a simple model that sets specific standards on selected products, based on a variety of federal and state regulations. It is attached as an appendix at the end of this document. <http://www.standardsasap.org/modelstd.pdf> (Reproduced courtesy of the Appliance Standards Awareness Project.)

Some model legislation exists that, if promulgated, would result in laws that might cause consternation in certain quarters. For example, the American Legislative Exchange Council (ALEC) has drafted a model Power Plant Siting Act for states that would create a single Board with the authority to permit all government approvals necessary to site a Power Plant in the State: Section 2 {Findings} of the Act states:

E. The authority to regulate many aspects of the issues involved in the siting of Power Plants currently exists in a variety of departments and agencies within the government of the state and political subdivisions of the state; there is overlapping jurisdiction among several state agencies in the siting of Power Plants; and there is the potential for conflicting decisions being issued by the various agencies having authority over different aspects of the siting process.

F. There is a need for coordinating and expediting the review of applications for the siting of Power Plants and the authority and responsibility to perform that function should be consolidated in a single body that will render final decisions concerning the siting of Power Plants (ALEC website, at: <http://www.alec.org/viewpage.cfm?pgname=2.1ee29>)

ALEC’s model legislation creates a Siting Board that is part of state government, which would be able to speedily permit construction of a power plant without going through a number of agencies, whose requirements might conflict or at least prolong the permitting process. Such a Board would certainly streamline power plant siting (which is a growing concern in the country), offering a one-stop process for power companies, but it wouldn’t give opponents (such as environmentalists or possible host communities) of a particular power plant much time or means to gather forces to stop it. In New Mexico, for example, before the PRC approves a company’s

power plant siting plan, it makes sure that the necessary permits have been issued by the New Mexico Environmental Department and the State Engineer's Office.

Another very different sort of model legislation is the "Clean Power Act," drafted by the Center for Policy Alternatives, an organization that pursues a "progressive" agenda with a state focus. If enacted by a state, this Clean Power Act would sharply reduce emissions of four major pollutants from electric generating power plants, which must:

- a. Emit no more than 1.5 pounds per megawatt hour of total nitrogen oxide emissions by January 1, 2003, and reduce aggregate nitrogen oxide emissions by 75 percent from 1997 levels by January 1, 2007.
- b. Emit no more than 6 pounds per megawatt hour of total sulfur dioxide emissions by January 1, 2003 and no more than 3 pounds per megawatt hour of total sulfur dioxide emissions by January 1, 2007.
- c. Reduce aggregate mercury emissions by an amount equal to 90 percent from 1999 levels by January 1, 2007.
- d. Reduce aggregate carbon dioxide emissions to 1990 levels by January 1, 2007. The Department may establish or employ an emissions credit trading mechanism to facilitate compliance with carbon dioxide requirements. (At the Center for Policy Alternative's website: <http://www.stateaction.org/issues/cleanpower/legislation.cfm>)

What Have Others Done?

On some fronts, other states, including our neighbors, might be making more progress in energy-related matters. On the other hand, when we look at what other states have done, we can see what not to do. California is the first example that comes to mind, as the Public Regulation Commission has stated.

Other countries may have something to show us too, like Denmark, who ranks third internationally in wind generation capacity, and is the world's leading exporter of wind turbines, despite limited land availability. Denmark is one of several European countries that has a *feed-in tariff*—a price support mechanism in which private renewable energy producers are granted a fixed price by law, which utilities are obliged to pay. This mechanism, Denmark's "Windmill Law," has enabled the development of wind power in Denmark to 2,417 MW of installed capacity at the end of 2001. Denmark's strategy was to divert research and development money for renewable energy to simple feed-in rates that rewarded any technology that provided renewable energy to the grid with payments per kWh that actually exceeded market rates. Rewarding successful technologies was a boon to Denmark's wind industry, enabling the rapid technological developments that make them a major force today in wind energy manufacturing. (Bundesverband WindEnergie, English version at <http://www.wind-energie.de/englischer->

[teil/europe/wind-of-change.htm](#); European Wind Association, <http://www.ewea.org/>; personal communication)

Denmark also has a strong petroleum industry, able to export more than it consumes. In 2000, Denmark produced 85 million barrels of crude oil from its North Sea operations and 7,100 million m³ (250,734 million ft³) marketed production in natural gas. (U.S.G.S.)

A few excursions into what other states have done in various areas of energy production, use, and development are presented in this section.

State Renewable Energy Programs

Oklahoma

Zero emissions tax credit

An income tax credit is available to producers of electric power using renewable energy resources from a zero emission facility located in Oklahoma. The zero-emission facility must have a rated production capacity of fifty megawatts (50 MW) or greater. Renewable energy resources include wind, moving water, sun, and geothermal energy. The construction and operation of the zero-emission facility must result in no pollution or emissions that are or may be harmful to the environment, as determined by the Department of Environmental Quality.

Net metering

Net metering has been available in Oklahoma since 1988 under Oklahoma Corporate Commission Order 326195. This ruling requires investor owned utilities and rural cooperatives under the Commission's jurisdiction to file net metering tariffs for customer-owned renewable energy and cogeneration facilities of 100 kW* or less in capacity. The program is available to all customer classes and there is no statewide limit to the amount of net metering capacity.

Utilities are not allowed to impose extra charges for customers signed up for net metering, but utilities are also not required to purchase net excess generation from customers. The ruling, however, does allow customers to request that utilities purchase the net generation. In this case, the utility purchases the generation at the utility's avoided cost. Although all renewable energy sources are eligible, only wind generating systems have used net metering in Oklahoma to date. In most cases, customer generation does not exceed demand.

Equipment certification

Oklahoma statutes require that wind turbines and photovoltaic modules be certified by the Solar Rating and Certification Corporation (SRCC), the American Wind Energy Association (AWEA), the Oklahoma Solar Energy Industries Association (OK-SEIA), or other nationally recognized certification agency. This certification requirement was originally established for

systems that applied for Oklahoma's tax credits, which have since expired. The statute further stipulates that purchasers be provided with solar and/or wind energy resource information, as well as product performance specifications conforming to the Solar Energy Industries Association (SEIA), SRCC, Jet Propulsion Laboratory (JPL), or AWEA standards. Another protection required is that qualifying renewable energy generating equipment must carry, as a minimum, a three-year warranty against defects in design, manufacture or installation. (DSIRE Data Base)

Texas' Renewable Portfolio Standard (RPS)

Texas' RPS is regarded as one of the most successful in the nation. In 1999, Texas enacted RPS legislation that called for 2000 MW of new renewable generating capacity by 2009, with 400 MW to be installed by 2003. This legislation also includes a renewable energy credits trading program for qualified renewable energy generated and metered in Texas.

Although it is still very young, Texas' renewable energy development program has already encouraged significant renewable energy development in the state. Wind power has emerged as a competitive technology; Texas is second in the nation for installed wind capacity at 1000 MW at the end of 2001, with more than 900 MW installed in that year.

Austin, Texas: Greenchoice Program

In Austin, Texas, Austin Energy's GreenChoice program aims to provide 5% of electricity from renewable resources by 2005. Under the GreenChoice program, residential and business customers can have the standard charge (from fossil fuel sources) on their electric bill replaced entirely by the GreenChoice power charge of 2.85 cents per kWh, which will remain fixed for 10 years, even if the current standard charge rises.

The program includes construction of 59 wind turbines and six landfill gas recovery projects in other parts of Texas. Austin also plans to add to its current stock of 28 solar installations.

Just 10 months after officially launching its GreenChoice green pricing option, Austin Energy has fully subscribed the initial 40 MW of renewable energy supply. The utility continues to seek additional renewable energy supplies to expand the program. In total, over 3,075 customers have signed up for the service. Unlike with many other utility green pricing programs, business customers have committed to purchase a majority of the available power—nearly 85%—with one company alone committing to 60% of the initial green power pool. (DSIRE)

Austin Energy aggressively advertised and marketed the program with billboards, brochures, and GreenChoice booths at community events and outside major businesses to sign up customers. Austin's environmental community was also involved in promoting the program (from

* New Mexico's present net metering rule has also been in effect since 1988, but is limited to facilities generating 10kW or less.

the Database of State Incentives for Renewable Energy (DSIRE) of the North Carolina State University Solar Center, <http://www.dsireusa.org>).

Green Building Program Austin, TX

The City of Austin is regarded as a leader in environmental building practices. Its Green Building Program provides incentives and technical assistance programs for all building projects (and serves as a model for Albuquerque, as we saw in Part II). All municipal buildings must be built with sustainable standards. The program is primarily funded through Austin's municipal electric utility and supplemented by other municipal departments. The program is considered successful, although, to date, the City of Austin has not been able to accurately quantify results on peak power capacity reduction, total energy use reduction, water treatment reduction, air and water pollution reduction, landfill reduction, and total use reduction. However, the program was able to calculate avoided emissions of 3,644,066 kg CO₂, 3,882 kg SO₂, and 7,365 kg NO_x by energy conservation in 1999. The program also avoided more than \$50,000 of annual costs through electric savings. (http://www.ci.austin.tx.us/greenbuilder/fs_toc.htm)

Low-Emission Coal Gasification Power Plant, IN

Indiana, like New Mexico, gets the majority of its electric power from coal (84% in 1999, according to EIA statistics). Indiana is not very much like New Mexico in other respects, however. Its coal-fired generating capacity is about five times that of New Mexico and its emissions are correspondingly large (Indiana generates four times more carbon dioxide and nitrogen dioxide, and fourteen times the amount of sulfur dioxide than does New Mexico; EPA statistics for 1999 [latest]). Indiana is also located in the heart of the heavily populated, industrial Midwest, where it contributes its airborne emissions to westerly winds that carry it off to New York, contributing to very large urban pollution problems in that state. Thus, Indiana has an interest in reducing pollution from coal generation.

Indiana is the site of one of the most advanced "clean coal" burning plants in the nation, a Department of Energy technology showcase. Instead of burning coal like a conventional power plant, the Wabash River plant (in West Terre Haute) breaks coal apart into a gaseous mixture. More than 97 percent of the pollutant-forming sulfur impurities are cleaned from the gas before it is sent to a gas turbine to generate electric power. To boost power generating efficiencies, the turbine's hot exhaust is captured and used to make steam for a conventional steam turbine. With this type of gasification system, there are virtually no sulfur, nitrogen, or ash particle emissions.

The 260-megawatt Wabash River plant has been operating since November 1995 and is currently one of only two commercial-scale coal gasification power plants running in the United States. Recently, plans were made to install a two-megawatt fuel cell power plant at the plant in a move that will give the power industry an earlier-than-expected preview of a super-clean, high-efficiency, coal-fueled generating system. The fuel cell generates electricity with no combustion, using instead an electrochemical reaction between fuel and oxygen from the air to produce electric power. Since no fuel is burned, none of the pollutants commonly associated with

hydrocarbon combustion are emitted (many states have classified fuel cells as the environmental equivalent of wind and solar energy). (*Techline*, U.S. DOE, National Energy Technology Laboratories news release, July 30, 2002)

Texas Railroad Commission's Waste Prevention Program

Texas is the largest oil-and-natural-gas-producing state in the union, with 356,000 oil, gas and injection wells. Texas, therefore, has considerable stake in environmental protection and oil and gas production economics.

The Texas Railroad Commission, which oversees petroleum production in Texas, operates a Waste Minimization Program for the oilfield that is aimed at environmental protection through voluntary industry initiatives to reduce and recycle wastes. The program trains operators to recognize opportunities to reduce waste and gives them the technical assistance to do so. The TRRC has published a handbook for waste minimization (Texas RR Commission, *Waste Management in the Oilfield*, July 2001), and supplements their manual with technical assistance, on-site help (housecalls) and software with which operators can create a customized waste minimization plan for themselves or a specific area of their operation.

Operators can also realize economic benefits from voluntary waste minimization practices. Many of the TRRC's case histories report savings: from \$23.00 per drilling rig saved in oil costs (from \$64 to \$41/day) by altering the oil change and lubrication schedules, plus decreased maintenance requirements, to \$10,000 per well saved through reduced drillsite construction and closure costs, reduced waste management costs, and reduced surface damage payments by installing a closed-loop drilling fluid system for the operator's wells.

This program is the first state program for waste minimization specifically created for oil and natural gas operations. It is supported in part by the EPA, under the Pollution Prevention Grants program (formerly "Pollution Prevention Incentives for States" (PPIS) program) and serves as a model for other oil and gas exploration and production waste minimization programs in other states, and in other countries.* (<http://www.rrc.state.tx.us/divisions/og/key-programs/manual/wastemin.pdf>)

Oklahoma Energy Resource Board

The Oklahoma Energy Resource Board (OERB) is a program voluntarily funded by Oklahoma's oil and natural gas producers and royalty owners that restores abandoned or orphaned oil sites and offers educational materials on the oil and natural gas industry.

* It should also be mentioned that the New Mexico Oil Conservation Division (OCD) has a two-volume manual available for oil and natural gas production, *Pollution Prevention Best Management Practices*, for operators in New Mexico. The manual contains some specifics for New Mexico, but can be generally applied.

The OERB's budget is funded through a check-off system: a one-tenth of one percent assessment on the sale of oil and natural gas in Oklahoma. Although producers can request a refund, 95 percent of all OERB contributions have remained in the fund, making the OERB one of the most strongly supported programs of this kind in the country. OERB works on several fronts:

- Environmental Restoration (largest single budget allocation) Over 3,700 abandoned well sites have been restored; approximately 500 more are in some phase of the restoration process.
- Education: Petro Pros are oil and natural gas professionals who volunteer their time to the state's schools, with rocks, fossils, drill bits and maps to demonstrate how oil and natural gas are formed, discovered and produced. The program reaches 13,000 students in the first through twelfth grades each year.
- Safety: *Play It Smart!* is a five-minute video, available free from the OERB, featuring some of the Dallas Cowboys, designed to show children the dangers of playing on or around oilfield equipment.
- Educational Materials: The "Fossils to Fuel" curriculum helps students in grades three through six learn basic concepts about the creation of hydrocarbons and how energy is derived from them. "Petro Active", for middle-level students, comprises information about the formation and recovery of oil and natural gas, along with energy experiments that can be performed in the classroom. In the Oklahoma Petroleum Challenge for high schoolers, participating students must compete for a cash award by writing an essay relating to the oil and natural gas industry. The OERB also sponsors energy exhibits in the state's museums and a newspapers-in-the-classroom program.

North Dakota Wind Energy Development

North Dakota is first in the nation for wind potential (NM is twelfth); say supporters, "North Dakota is the Saudi Arabia of wind." How much wind power is there? The most recent complete assessment is 138,400 MW. With increased energy transmission capacity and storage capability, these estimators say that North Dakota alone could provide nearly 33 percent of all U.S. energy needs.

North Dakota is working very hard at encouraging wind energy. In 1999, the governor sent out a factbook with a letter to wind developers inviting wind development on a large scale. North Dakota is starting to manufacture towers, blades, and turbines significantly (one factory works for a Danish wind equipment company) and is joining forces with Iowa and Minnesota to promote midwestern wind development.

There's also a lot of rural interest in wind power, specifically wind farm potential. North Dakota farmers could stand to benefit from wind farm development by leasing out their land. North Dakota's The Farm Bureaus of North and South Dakota's project, "Harnessing Dakota

Wind” is scheduled to start in September 2002. This program is a joint initiative of North Dakota and South Dakota Farm Bureaus, to conduct research and provide public information, education, and technical assistance to enhance the development of agriculture related energy development and to ensure that farmers and rural communities are equitable energy partners and beneficiaries.

Early this year (January 2002), the North Dakota Farm Bureau (NDFB) Board of Directors passed their Wind Resolution, calling upon North Dakota’s governor to announce a wind power objective of having 10,000 megawatts of installed wind turbine capacity in ND by the end of 2020, and for the State to begin committing state resources toward achieving that objective in 2002.

The Director of the NDFB says:

“North Dakota has a tremendous wind energy resource, and the benefits to farmers and rural communities – if that resource is capitalized on – could be substantial,” Each megawatt of turbine capacity installed in the state would equal approximately \$1 million in capital investment. “Wind energy development will happen with or without us, and quite frankly, our farmers and ranchers can’t afford to be left behind. We won’t stand by and eye the scraps that might fall from the table.” North Dakota Sustainable Energy for Economic Development (ND Seed), an organization dedicated to large-scale wind farm development for North Dakota, has published a brochures for landowners about how to lease their land for windfarms. Seed claims that “landowners could earn \$2,000-4,000 per year per turbine for twenty years. A fully developed section of land could return \$30,000 a year. 95% of that land would still be farmable. Combines could keep harvesting below while turbines above take off our top crop of wind.” (North Dakota Farm Bureau, “Farm Bureau Initiates Wind Energy Project,” press release, February 20, 2002)

In addition to ND Seed, there are other wind energy organizations in North Dakota. The Wind Energy Council was formed early in 2002 as a trade organization to promote wind energy development in North Dakota. And economic development groups in North Dakota have banded together to form Wind Interests of North Dakota (WIND) whose mission statement is: “To share resources in addressing issues of statewide significance to allow for the development of wind power projects at the local level.”

North Dakota has several wind (as well as geothermal and solar) incentives on the books now too. The Geothermal, Solar and Wind Credit allows an individual or corporation to claim an income tax credit of 3% per year for five years (year of installation and four subsequent years) for the cost of equipment and installation of a geothermal, solar, or wind energy device. If the eligible device is part of a system that uses other energy sources, only the portion of the system that uses geothermal, solar, or wind energy is eligible. The Geothermal, Solar, and Wind Property Exemption allows exemption from local property taxes for any solar, wind, or geothermal energy device during the five year period following installation. Qualifying systems can be stand alone or part of a conventional system, but only the renewable energy portion of the total system is eligible.

There are tax incentives for large wind systems also, passed in 2001. The Large Wind Property Tax Incentive reduces property taxes by 70% for wind facilities of 100 kW or larger. To be eligible, construction must begin by January 1, 2011. The state also has a sales tax exemption for these systems, the Large Wind Sales Tax Exemption, for wind facilities of 100 kW or larger, for which construction must begin by January 1, 2011. (ND Seed, at <http://www.ndseed.org/>)

So how are they doing? Installed wind capacity in North Dakota is now at 1.29 MW, not much better than New Mexico. What's holding them up? According to the American Wind Energy Association (AWEA), in their report "Fair Transmission Access for Wind," (July, 2000), the current transmission system in the United States is a barrier to the development of significant, large-scale wind generation.

The problems:

- Wind is intermittent.
- Good wind sites are often located remotely from electric loads, so wind facilities are more dependent on long-distance transmission (and also less able to avoid transmission problems).
- Wind is a relatively new entrant into the generation arena; policies that favor existing generation can be a barrier.

AWEA finds many problems with the current transmission system; embedded costs, schedule deviations, rate pancaking, equitable allocation of congested capacity among competing users, and (probably the most important) discriminatory interconnection of wind generation facilities. AWEA also finds that FERC has already taken a step forward in solving these critical transmission issues, most notably in Order 2000, although here the future remains uncertain. *

As in New Mexico, there is a need for more transmission infrastructure in North Dakota that would have to be implemented before development of wind energy potential on a significant scale could take place. Even though North Dakota, by all appearance, is very committed on many levels to making large-scale wind generation a reality, the right conditions have yet to be created, or to occur.

Summary

* FERC's newest proposed rulemaking of July 31, 2002, may have implications for wind generation. "Remedying Undue Discrimination through Open Access Transmission Service and Standard Electricity Market Design," or the SMD rule, would give FERC jurisdiction over the transmission component of "bundled" retail transactions in addition to the wholesale transactions it already regulates. The rule will also offer a single flexible transmission service called Network Access Service, providing one set of rules for all transmission customers (Part I discusses this in more detail).

- The environment/economy/energy development triad can be seen as interdependence between people and resources. Many view the right kind of economic development as including environmental conservation coupled with economic feasibility
- Companies adopt management strategies that maximize economic gain and minimize environmental risk (and penalties). Waste minimization is a strategy that focuses on reducing the amount and toxicity of hazardous waste generated. This approach is favored by the U.S. EPA. Integrated resource planning involves the identification of resources or the mix of resources needed by a utility for meeting near and long-term consumer energy needs in an efficient and reliable manner at the lowest reasonable cost. However, it is not currently known how integrated resource planning will fare in a deregulated environment, although the U.S. Department of Energy favors measures similar to the IRP process. Environmental management systems can be built into a company's overall management system, as the way in which a company addresses environmental protection issues can impact its viability and long-term survival.
- A number of state and federal incentives exist that reward certain energy related behaviors: credits for the use or development of renewable energy and energy efficiency credits. A tax credit promoting hydrocarbon production (Section 29 of the Windfall Profit Tax Act) is attributed with promoting much of the growth in coalbed methane production by US producers in the 1990s. If current legislation expanding the credit is passed, it may continue to influence CBM production in New Mexico's San Juan Basin.
- Cap-and-trade incentives, market-based incentives allowing flexibility in meeting regulatory emission goals, have been found to be effective and are being promoted for further use in federal pollution regulation.
- Performance-based regulation is coming into favor for the future as a way of rewarding investors (in this case, transmission companies) for desirable performance, rather than the magnitude of their investments. At this time, both great success and utter failure have been claimed for PBR; only time will tell whether it will be generally accepted.
- Model legislation is formulated to inject new ideas into state law.
- In some energy related areas, other states (as well as other countries) may have made more progress than has New Mexico. A number of strategies have been tried: in-feed tariffs, renewable energy programs and renewable portfolio standards (RPS), green building programs, waste minimization programs, advanced-technology coal gasification power plants, voluntary industry organizations, and aggressive promotion of state natural resources.

Conclusions

Energy, economy, environment. As in the previous Background Report on Energy, we raise far more questions than we've answered here. There are many details presented here; almost too many to think about. Our "Conclusions" attempt to provide a few generalizations in a quick summary.

New Mexico's energy industries are vital to our economy and at this point, irreplaceable. We are doing well at diversifying our economy, attracting the high-tech industries that we want, but currently these are not enough to sustain us. Many New Mexicans view more oil and natural gas development, northwest and southeast, with misgivings, even though the industry has steadily improved its environmental record. The San Juan Basin, one of the largest natural gas-producing areas in the lower 48 states, is forecast to be developed steadily at least until 2020, and this development is certain to stimulate some strong disagreements among advocates of natural resource development, at least some residents of the area, and environmentalists. Already, the state Environmental Department is measuring elevated ozone levels in the area, resulting from the production activity as well as coal-fired power plant emissions. Increased access to federal lands for oil, coal, and natural gas extraction, and streamlined permitting processes are strongly desired by the extractive industries at this time; there may be significant changes in the regulation of these areas in store.

Currently, the regulatory climate for electric utilities is uncertain, though it is apparent that major changes are on the way in this area also. Electricity restructuring has been postponed in New Mexico until 2007, with the expectation that fewer uncertainties will obstruct the path of transition into a national wholesale power environment. Regulatory changes affecting the nation's power transmission grid look like a certainty now, but the ways in which these changes will be carried out are still not clear. The FERC wants to create a level playing field for all the contenders in the wholesale power marketing arena. That seems like a good idea, but the states (especially the western states) are not convinced that a "one size fits all" approach is going to be adequate for the differing needs of every region. They would prefer to keep more of a grip on their own jurisdictions. New emissions standards are being formulated by the U.S. Environmental Protection Agency, flexible and market-based. The Administration has introduced "Clear Skies Initiative" legislation for such a program, which includes multi-pollutant standards and cap-and-trade programs.

The renewable energy resources of New Mexico, according to many sources, are poised to become very significant. Public interest in them as a clean source of power that will never be used up is growing, and the potential for commercialization (especially wind power) is steadily increasing. It may be that the regulatory changes in store for the nation will favor the penetration of commercial renewable resources into the market at last. If a Renewable Portfolio Standard is mandated for New Mexico, as it has been in several other states, utilities will be required to offer renewable energy to customers, and a minimum of 10% of electricity generated from renewable

resources will eventually be established in the state. Even lacking that, renewable energy in New Mexico occupies a strong niche and is, in its own way, irreplaceable. Another innovative approach to power generation is the decentralized, small, localized sources of power provided by distributed generation—another technology that needs more help entering the market. It is possible that the same regulatory changes and technology development will assist distributed resources to penetrate the mainstream.

Our desire to protect our environment and our special New Mexico quality of life is very strong; what we disagree over is the way to do it. “Quality of life” for a great many New Mexicans can be defined as “enough income to live on.” It is possible that many of us are willing to make the tradeoffs that come with economic growth and put up with diminished air quality, fewer wide-open spaces, and more neighbors, which might include power plants or natural gas well compressors.

But is this inevitable? Energy companies may be compelled to comply with environmental regulation, but it is also true that many companies have seen the business sense in designing environmental compliance right into their overall management systems. As more businesses take this route, it seems reasonable to predict that a more environmentally sensitive, or even environmentally friendly, industry is emerging. The promotion of incentives over “command-and-control” regulation may very well help the process along.

In this report, we have mentioned, many times over, what the National Energy Policy wants to do, or says we should do. It is important to remember that there are many opponents of the National Energy Policy, and that it has far to go before it is written into law. Many of its critics find the NEP too friendly to industry and not protective enough of the environment. We can look at the future it prescribes in general terms, but there’s no guarantee that the recommendations of the National Energy Policy will be carried out, or even make it through Congress. Passage of the National Energy Policy act will bring about changes in the nation that will have effects in New Mexico, but only the future will tell what exactly what these changes will be, and the nature of their outcomes.

It is clear that we are depending heavily on technology to procure the desired outcomes in our energy future. Since all of the energy-related advances that human civilization has experienced have been brought about through advanced technology, it’s reasonable to assume that human ingenuity has not seen its limits yet. For example: hybrid cars, using both electricity and gasoline, are on the market this very minute, and you can go to a dealership in Albuquerque and order one (can’t drive it right off the lot—they’ve got a long list of customers waiting). That wasn’t true ten years ago, or even two years ago, when the last energy report was written.

Developing advanced technology, however, is expensive. Thus, the call goes out for significant amounts of government-funded research to move it along. New Mexico is a great place for that, too. We have two national, energy-related laboratories and several state institutes of higher learning that would be very willing to obtain funding for their research projects in the national interest.

Finally, the biggest question in many minds may be that of domestic energy security. The capacity to become self-sufficient and the ability to protect our energy supplies and infrastructure are critical issues, and we can expect to see policies changed and new policies made to support that end. These will certainly impact New Mexico, but these changes are still in the making.

In the face of change and uncertainty, the potential for many different scenarios is great. We can picture New Mexico as the home of many new merchant power plants, contributing jobs and revenues to our economy. On the other hand, new regulations administered at the federal level may expedite the rise of distributed resources—small, decentralized power sources close to the power loads. It is also possible that the hotly debated Otero Mesa project might be developed into the fantastic natural gas strike that the energy company hopes it will be. Or, our renewable energy resources might become not only enabled but highly stimulated as a result of the changes in federal and state regulation, and might make New Mexico the number-one renewable energy state in the nation.

There are also darker scenarios. It is also possible that New Mexico will not attract significant transmission investments, enough to carry new generation from potential new power plants. But if we did, and a host of new high-voltage transmission lines were built, and so were all the new merchant power plants—whose back yard would they occupy? We might be able to attract new high-tech, relatively clean and well-paying industries in flight from California, but Texas and Arizona might beat us to the punch, too.

It is often hard to know what we can and cannot affect or control. Making informed choices and talking things over with the best will in the world sometimes is not be enough to influence events set in motion on a national or global level. There is, however, ample evidence — for example, the list of accomplishments for the 24th Town Hall's Implementation Team, presented in the Introduction to this report—that New Mexico's citizens know how to make informed choices, form plans of action based on those choices, and see them realized.

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Appendix A.

An Example of Model Legislation

(Reproduced courtesy of the Appliance Standards Awareness Project)