Appendix G: Pollution Prevention

Renewable Energy Resources

Renewable energy sources, including solar, wind, hydropower, biomass, and geothermal, currently provide less than 1% (or 5.6 trillion BTUs) of New Mexico's annual energy needs. The contribution of renewable energy has dropped from 6.6 trillion BTUs reported in 1997. This is contrary to the fact that our renewable energy resource base is very large and diverse. Table 6 provides a breakdown of consumption, by sector, for renewable energy in New Mexico.

Table 6. Renewable Energy Consumption in New Mexico, 1999*

Sector	Energy Source	Million KWH Consumed
Residential	Solar	147
	Wood	996
Commercial	Geothermal	29
	Wood	147
Industrial	Geothermal, Wind, and Solar	176
	Wood and Waste	147
	Total	**1,642**

4. Source: DOE/EIA State Energy Data Report 1999, printed May 2001.
5. *most current data available

Table 7. Renewable Energy Production by Resource, 1999*

Resource	KWH	Value ($ Millions)
Fuel Wood	1,026 Million	6.5 (Note 1)
Alcohol Fuels	346 Million	23.3 (Note 2)
Hydroelectric	230 Million	15.2 (Note 3)
Geothermal	119 Million	1.4 (Note 4)
Wind	1.7 Million	0.119 (Note 5)
Total	**1,772.7 Million**	**46.51**

Notes: *most current data available
1. DOE/EIA Energy Price and Expenditure Report, 1999.
2. Data from High Plains Ethanol Plant, Portales, NM; 15 million gal/yr @ $1.559 per gallon.
3. Edison Electric Institute, Yearbook 2000; value based on average NM electricity cost of $0.0663/kWh.
4. Southwest Technology Development Institute, NMSU; average NM natural gas cost of $3.62/million BTU.
5. Southwestern Public Service Company, Amarillo, TX; Clovis, New Mexico wind turbine, average NM electric price.

A significant amount of renewable energy research, development, and demonstration (RD&D) in New Mexico occurs through federal government programs at Sandia National Laboratories (SNL). At the time this was written, before federal government funds were appropriated, SNL funding for solar thermal systems and buildings in FY 2003 is estimated to be $3-4 million and the photovoltaics program is expected to receive $5 million. In other renewable energy RD&D areas, the previous FY 2002 appropriations were: energy storage at $6.5 million; geothermal drilling technology at $6.4 million; wind at $3.9 million; and biopower electricity at $1.1 million.

Solar

Overview. The position of New Mexico as a leader in solar energy in the 1970s and 1980s attracted private, state, and federal funding, resulting in significant benefits to New Mexico and the Nation. Funding has fluctuated since that time. Many solar pioneers of the private sector have survived, evolved, and continued forward to provide innovative products and services to the state and the world. ECMD has been involved in most state-funded solar programs and continues to be the primary contact where the state is involved.

At federal laboratories in New Mexico, research funding for solar technologies was dropped at Los Alamos National Laboratory and has decreased at Sandia National Laboratories (SNL). SNL conducts a wide range of solar energy research, development, and demonstration (RD&D) projects involving technologies such as solar thermal concentrating collectors, photovoltaic (PV) system components, solar buildings, and manufacturing. The new mission of enhanced U.S. energy security appears to have led to increased emphasis at federal laboratories for most types of domestic energy RD&D, including solar energy.

The solar industry is made of manufacturers, equipment suppliers, greenhouse and glazing suppliers, passive solar builders, installers, and service companies that repair systems. Most businesses marketing solar technologies are members of the New Mexico Solar Energy Association (NMSEA) and the New Mexico Solar Energy Industries Association (NMSEIA). In NMSEA's 2001 *Directory of Solar Professionals*, 30 architects and designers, 42 builders, 6 education professionals, 4 engineers, 3 financing institutions, 43 solar technology companies, 6 greenhouse designers and builders, and 25 green building product and service companies are listed. NMSEA's resources can be accessed at www.nmsea.org or 1-888-886-6765.

In the 1980s there existed both federal and state solar tax credits. During that decade over 40,000 active and passive solar systems were installed in New Mexico. When oil prices fell and the federal tax credit for use of solar was eliminated in December 1985, the impact on the solar energy industry was immediate. At the beginning of 1985, approximately 250 solar businesses were in operation employing about 2,000 people. By the end of 1985 about 80% of these businesses had closed. However, in recent years there appears to be increased activity for solar businesses in New Mexico, due to renewed homeowner interest in PV systems.

The Solar Rights Act of 1978 allows property owners to create solar easements for the purpose of protecting and maintaining proper access to sunlight. It also includes provisions allowing local governments to create their own ordinances or zoning rules pertaining to protection of solar rights. New Mexico was first among the 50 states to enact a solar access law and also implement tax incentives for solar systems.

Resources. Energy from the sun is an enormous energy source. New Mexico ranks 2nd among all states in the U.S. in solar energy resources and experiences more than 3,200 hours of sunshine per year. This results in a range of solar energy on a horizontal surface---depending on location and season---of about 900 to 2600 BTUs per square foot per day (3 to 8 kilowatt-hours (kWh) per square meter per day).

The potential for converting solar energy to electricity and heat in New Mexico with existing and emerging technologies is also great. The State's average daily energy consumption is about 904 billion BTUs (265 million kWh) or 161,425 barrels of crude oil, which could also be collected as solar energy within an 18 square-mile area. Table 1 presents the average solar radiation for selected New Mexico communities.
4.

Table 8. Average Solar Radiation in New Mexico

AREA	BTUs/SQUARE FOOT/DAY	
	HORIZONTAL SURFACE	VERTICAL SURFACE
Albuquerque	1,827	1,423
Carlsbad	1,825	1,210
Chama	1,560	1,200
Las Cruces (El Paso)	1,900	1,380
Las Vegas	1,675	1,250
Lordsburg	1,900	1,275
Los Alamos	1,535	1,262
Santa Fe	1,625	1,210
Taos	1,575	1,200
AVERAGE	**1,755**	**1,297**

Source: Los Alamos Scientific Laboratory, USDOE, *Passive Solar Design Handbook*, Vol. 2, 1980; and *New Mexico Climate Manual, Solar and Weather Data*, New Mexico Energy Research and Development Institute 2-72-4523, 1985.

Production. Direct use of the sun's light and thermal energy has long been recognized in New Mexico. Over $4 million worth of energy was supplied by active and passive solar systems in 1990, by system types such as solar water heating, solar thermal space heating, and PV. As an example, a PV collector array the size of a football field would directly produce 1.2 million kilowatt-hours of electricity per year, or the electricity needed to power about 122 homes. Assuming a conservative retail electricity cost of five cents per kilowatt-hour, this PV system could offset $500 per year in utility costs for each home.

Although less than five percent of the solar installations in New Mexico generate electricity, PV systems include a 47-kilowatt array at the Southwest Regional Experiment Station at New Mexico State University in Las Cruces, operated by Southwest Technology Development Institute; and upwards of 250 one-kW irrigation units in various areas. SNL estimated that there were approximately 2,000 PV systems in New Mexico in 1990.

Electric utilities in the state are required to provide information on alternative energy systems to remote customers with less than a 25-kW load who request line extensions. This requirement applies when the cost of the requested line extension is greater than 15 times the estimated annual revenue from the line extension. In such cases, utilities must provide customers with information on suppliers of alternative energy systems.

Another type of solar energy production is commonly provided in New Mexico through innovative architecture in buildings: passive solar design. Following design guidelines published by the National Renewable Energy Laboratory, it is possible for strategic placement of windows, sunspaces, thermal storage walls, and mass (e.g., concrete, brick, adobe), as well as appropriate orientation and insulation, to enable the sun to provide up to 80% of a home's annual space heating needs in New Mexico. This can be achieved without compromising cooling needs. The

sun can also be utilized to integrate daylighting, thereby offsetting electricity costs associated with lighting. Passive solar design is also applied to commercial buildings and schools in New Mexico.

By integrating passive solar design, solar water heating, and PV in residential home design it is conceivable to greatly reduce or eliminate the need for conventional electricity, heating, and cooling energy sources. Many success stories exist in New Mexico of living "off-grid." As noted above, solar professionals resident in New Mexico are available for design assistance.

Recent Developments. Significant activities have been conducted with solar energy in New Mexico over the past few years. ECMD has implemented major projects that use our extensive solar resource. ECMD each year provides public information and educational activities on solar energy at various conferences, workshops, and other venues, including the *Taos Solar Festival, New Mexico State Fair*, and *New Mexico Solar Energy Association's Solar Fiesta.*

ECMD is refocusing its solar program to feature demonstrations of solar water heating and photovoltaic systems. Solar water heating and photovoltaic systems will be sited at public school facilities in several New Mexico climate zones. System commissioning will include training and establishment of operations and maintenance plans. The demonstrations are intended to educate and involve students, faculty, staff, and communities at public schools; collect system performance data in different New Mexico climate zones; evaluate incentives for solar technology applications; and address, in consultation with the solar industry, related issues such as state agency administration of residential tax credits, system certification, and system monitoring. Solar systems will be designed, installed, and commissioned through a collaborative effort of ECMD, other state agencies, public schools/institutions of higher education, New Mexico Solar Energy Association (NMSEA) and Solar Energy Industries Association (NMSEIA), DOE, and the Solar Buildings Program at Sandia National Laboratories.

ECMD is collaborating with NMSEA, Southwest Research and Information Center, and other organizations to finance and install PV systems for low-income communities without electricity service. Several large areas in New Mexico, such as the Pajarito Mesa west of the City of Albuquerque, remain without utility-provided electricity, but could be served with PV technologies. Similarly, electricity service is not available to 37% of households on the Navajo Reservation, 5% of the Jicarilla Apache Reservation, 3% of Zuni Pueblo, 2% of Acoma Pueblo. The majority of households in unincorporated Colonias communities along the border with Mexico are also without electricity service. These communities often resort to expensive means of producing their own electricity, using power sources such as diesel generators and car batteries. PV systems could possibly be a less expensive alternative for the critical needs of lighting and operating simple appliances.

ECMD provided funding to the All-Indian Pueblo Council to install an 11-kW PV carport at the Indian Pueblo Cultural Center in Albuquerque. This 1999 installation is the largest commercial PV array in the state and the largest PV system on Indian lands. It is expected to produce 25,000 kWh of electricity, save 43 tons of coal, conserve 1 million gallons of water, and reduce carbon dioxide emissions by 27 tons per year. The system will save the Cultural Center over $3,400 per year in electricity costs. The carport also provides shade for 11 parking spaces and will be visible to 400,000 visitors annually.

In September 1999, the New Mexico Public Regulation Commission (PRC) issued a rule requiring all utilities regulated by the PRC to offer net metering for cogeneration facilities and small power producers with systems of 10 kW or less. Municipal utilities are exempt because they are not regulated by the PRC. There is no statewide cap on the number of systems eligible for net metering.

The use of solar energy in our New Mexico State Parks has improved their safety and convenience. ECMD installed 29 PV lighting systems at visitor centers, pay stations, and other locations in 15 State Parks. Also, a PV aeration system was installed in a pond at the Rio Grande Nature Center to create better conditions for aquatic life.

It should also be noted that older systems installed in the early 1980s at state facilities have been kept operational. ECMD made improvements in the 1990s to both 16,000-square-foot solar water heating systems at the Central and Southern New Mexico Correctional Facilities. The Northern New Mexico Community College also received ECMD assistance to reactivate solar air heating systems on two major campus buildings.

Wind

Overview

Wind is a proven, cost-effective, and environmentally attractive source of power. recent technological innovations in wind turbine design have resulted in increased effectiveness and reduced cost. The cost of electricity from wind power plants has dropped to about 3 or 4 cents per kilowatt-hour (kWh), very close to the cost of power from fossil-fuel sources. Public utilities across the country and around the world are beginning to icnldue wind in their mix of energy sources.

In October 2002, the Public Service Company of New Mexico (PNM) announced an agreement with FPL Energy to develop the first commercial-sized wind power plant in New Mexico. Known as the New Mexico Wind Eneergy Center, it will be 204 megawatts in capacity and will be located in eastern New Mexico, about 20 mioes northeast of Fort Sumner, in Quay and De baca c9ounties. It will be the third largest wind power plant in the country.

Construction will betin in late 2002, with the plant operational in less than a year. Construction on a facility of this size typically takes six to nine m onths to complete. The wind facility will be composed of 136 separate towers, each 210 feet tall, with turbine blades that measure more than 110 feet in length. The facility will send power to PNM's electric grid. FPL Energy will construct, own and operate the facility. PNM will purchase all of the power it produces, enough to supply about 90,000 homes.

PNM plans to ask state regulators for approval of a "green tariff" program sometime in 2003 that will allow interested customers to buy wind-generated elecrtricity for a small monthly premium. Any power from the facility not directed toward the residential and business customer subscription program would be sold on the wholesale market, either within New Mexico or outside the state.

PNM sees the power produced by this facility as a way to recognize and respond to interest within New Mexico in renewal energy and to strengthen the company's wholesale generation portfolio for years to come. When PNM plans a new facility or commits to buying power from a new facility, it looks not just at current economic conditions but also at conditions that may exist several years down the road.

Energy produced at the Wind Center will likely replace an equivalent amount of power coming from facilities powered by fossil fuels, since the majority of power on the grid comes from fossil-fuel sources. The addition of energy from the New Mexico Wind Energy Center will change PNM's generation portfolio. Wind will comprise 8 percent of PNM's overall generation capacity, which is the portfolio's peak potential output. However, because of the intermittent nature of wind, the facility is expected to comprise about 4 percent of the energy actually produced by or for PNM over the course of a given year.

The Wind Energy Center will bring more than $40 million into rural De Baca and Quay counties over 25 years. This includes $450,000 per year in payments in lieu of taxes to be made to the county governments and school districts; about $550,000 per year in lease payments to landowners; and an estimated $500,000 in salaries for the permanent jobs to be created. This $40 million figure does not include the infusion of money resulting from the 125-150 temporary jobs that will be created while the facility is being constructed in 2003.

Resource Assessment

The Energy Conservation and Management Division (ECMD) of the New Mexico Energy, Minerals and Natural Resources Department, through its Wind Power Program, has performed a critical role in the development of wind power in the state. In particular, the high-quality data ECMD provided to FLP Energy and PNM were very valuable to the development of the recently announced 204-megawatt project described above. ECMD continued data collection at Frio Draw for a third year upon request to assist FPL Energy in their evaluation of potential sites.

The Wind Power Program is continuing detailed wind energy resource assessment of the most promising sites for commercial development. The potential for electricity generation from wind is enormous in some areas of new mexico, especially on the eastern plains. New Mexico ranks twelfth in wind electric potential and is amoung twelve states in the midsection of the country that, together, have 90% of the total commercial wind electric potential in the contiguous United States. The annual wind energy potential of New Mexico has been estimated to be 435 billion kWh. New Mexico has the potential to produce many times its own electrical consumption, which puts it in a position to export wind electric power.

ECMD has provided detailed wind resource assessments of the state and "investment-grade" wind data to 33 wind power developers, PNM, landoweners and others. Several developers are actively working to develop projects in New Mexico. ECMD has provided two years of wind speed data collected at six promising sites. Three years of data have been provided for two of those sites. Monitoring of an additional seventh site on Argonne Mesa, southwest of Santa Rosa, was commenced in August 2002. Such data are vital to commercial development of wind power plants because they allow accurate estimates of power plant production.

ECMD's Wind Power Program has provided studies of the potential economic benefits of wind power operations to five counties: Colfax, Eddy, Lea, Otero, and Quay. The results of these studies have been prestned to public officials and residents of these counties.

In 2002 the program completed evelopment of the following products:

- New Mexico Wind Power Plant Site Screening Model
- Guidelines for Developers and Investors Interested in Wind Power in New Mexico
- New Mexico Wind Development Handbook
- Mesa Redonda Case Study Report. This study addresses the following issues: environmental, archaeological, cost estimating, transmission, permitting, geotechnical, micro-siting, production, and visual impacts.

Currently underway is a project to develop a high-resolution (200 meters) wind map of the state using the latest techniques.

Several pieces of legislation were passed during the 2002 Legislative Session, most notably the Renewable Energy Production Tax Credit (Senate Bill 187) that allows a taxpayer who owns a qualified energy generator, certified by the Energy, Minerals and Natural Resources Department, to be eligible for a tax credit of one cent per kilowatt-hour. The credit may be deducted from the taxpayer's New Mexico corporate income tax liability. In addition, House Bill 143 amended the Industrial Revenue Bond Act to include electrical generation facilities such as wind farms. This legislation (H.B. 143) also amended the Gross Receipts and Compensating Tax Act to exempt from gross receipts taxes certain wind generation equipment sold to public entities.

ECMD hosted in October 2002 the first-every new mexico Wind Conver3ence in partnership with the US Department of Energy and Sandia National Laboratories. The purpose of the conference was to provide information relating to New Mexico's wind resources an dto explore mechanisms by which to encourage greater development and use of this energy resource.

Research

Sandia National Laboratories conducts an ongoing wind energy research program that employs a multi-faceted approach to the development of economical wind systems for power generation. First, it conducts applied research in aerodynamics, structural dynamics, fatigue, materials, manufacturing, controls, and systems integration to understand unsolved technology problems and to provide better design tools. A major new effort in applied research is the investigation of rare atmospheric events that significantly impact wind turbine long-term structural integrity. Second, Sandia applies its analytical and experimental capabilities to solve specific industry technical problems that are impeding the deployment of reliable, cost-effective solutions for domestic and international markets. Finalkly, advanced manufacturing techniques are being used to reduce cost and increase reliability of wind turbine blades. Follow-on efforts will consider the complete product life cycle, with emphases on fully integrated design, agility, and tools to support a design-for-manufacturing process. In all three approaches, Sandia uses formal and informal teaming arrangements to work closely with wind turbine manufacturers, wind farm developers/operators and other DOE laboratories.

Hydropower

New Mexico's hydroelectric capacity is 78.4 megawatts from nine plants: Navajo Reservoir (30 MW), Elephant Butte (24.3 MW), Abiquiu (15 MW), El Vada (8.8 MW), Farmington (200 kW), Alamogordo (60 kW), Raton (30 kW), Cloudcroft (15 kW), Reserve (10 kW). Although not a substantial portion of the state's total generating capacity, hydropower could play a more significant role in meeting site-specific needs.

Many undeveloped small hydropower sites exist in New Mexico, including river sites and existing dams, but numerous constraints limit the potential. These constraints include financing, multiple-use issues, regulatory barriers, economic issues, and environmental impacts.

Bioenergy

Bioenergy is produced from biological feedstock or other products made from such feedstock. The feedstock may be either produced or harvested explicitly for such use, such as grain milo and firewood, or may be a waste stream from agricultural, municipal or industrial sources. Distribution of and access to the resource are critical to the economical use of bioenergy. For this reason the creation of bioenergy is often found at the point of availability of a waste stream, with a facility's size determined by that stream.

Wood burning for heating is perhaps the most traditional use of bioenergy in New Mexico, and this continues to be the largest use. The other common use of bioenergy in New Mexico involves the production of methane from municipal wastewater sludge. This fuel is then burned to heat the digestion process, and in some cases to also generate electricity for operation of the plant.

Resources and Production

The best available research on New Mexico fuelwood indicates that 197,000 cords were harvested in 1986, which is neither a significant drain on the growing stock inventory nor a competitor with the timber products industry. This is equivalent to about 3.6×10^{12} BTU.

Albuquerque and Las Cruces are using the anaerobic digestion of municipal wastewater sludge to generate methane gas. The gas then fuels the production of electricity and heat to power the wastewater facilities. Los Alamos and Carlsbad are using the resulting methane to heat the digesting process and/or water. Several sawmills burn waste wood to provide heat for wood drying kilns.

The waste stream bioenergy resource in New Mexico has been studied in detail. The total potential for energy production in this sector is large, at 35 trillion BTU per year, although a significant share of this resource is allocated for other uses such as particleboard manufacture. The largest sources in this sector are sawmill/wood product waste and municipal solid waste.

Recent Development

The U.S. Forest Service (USFS) is working with the New Mexico Energy, Minerals and Natural Resource Department's (EMNRD) Forestry Division and Energy Conservation and Management Division on a wood chip-fueled power system at Jemez Mountain School.

EMNRD is also leading efforts to investigate forest thinnings energy projects for the Ruidoso and Las Vegas areas. The USFS' Forest Products Laboratory, National Renewable Energy Laboratory and Community Power Corporation are testing the beta version of a small (5-15 kilowatts electricity; 50 kW of useful heat), modular forest products gasifier at local businesses in Glencoe (SBS Wood Shavings) and Cuba (American Medal Products). In addition, the USFS is studying the use of lumber mill residues and forest thinnings for fueling bioenergy projects in Silver City and Angel Fire.

Rapid growth of the New Mexico dairy industry has greatly increased the availability of manure in New Mexico. EMNRD's Energy Conservation and Management Division is working with the US Department of Energy and the Dairy Producers of New Mexico on a project to create electricity and heat from this waste. Doña Ana County pecan growers are exploring the feasibility of using pecan grove waste to fuel generation of electricity.

Geothermal

Overview

New Mexico has significant low-temperature (<194 degrees Fahrenheit) geothermal resources long its western border and in close proximity to the Rio Grande from north to sourth. Our state is also blessed with considerable moderate to high temperature resources, including those in the Rincon area of Doña Ana County, near Cotton City in Hidalgo County, and the Vales Caldera area in the Jemez Mountains (Sandoval County). The table below provides a summary of geothermal sites in New Mexico. Common low-temperature applications are space and water heating, while electricity can be generated from high-temperature sources.

Site	Temperature (ºF)	Flow (gpm)	# Wells	Depth (ft.)
Doña Ana County:				
Las Cruces	156.9	3	9	2572
Radium Springs	170.1	NA	8	121
Grant County:				
Faywood	127.4	3	1	NA
Hurley	144	NA	1	521.7
San Juan/Sherman	138.2	3	8	NA
Hidalgo County:				
Cotton City	225	200	13	439
McKinley County				
Ft. Wingate	131	23	1	1942
Rio Arriba County:				
Ojo Caliente/Gallegos	132.1	NA	2	88
San Miguel County				
Las Vegas	131.3	NA	2	NA
Sandoval County				
Jemez/San Ysidro	136	150	1	239
Jemez Springs	163.9	52	6	NA
Valencia County				

Valencia	176	NA	1	721

Source: Witcher, J.C., 1995. A Geothermal Resource Database, New Mexico; Southwest Technology Development Institute, New Mexico State University, Technical Report to Oregon Institute of Technology, Geo-Heat Center, 32 p.

Production and Use

Geothermal resources in New Mexico have been used directly in a significant manner for over 20 years. In the 1980's, a large district heating system was installed at New Mexico State University (NMSU) in Las Cruces; and the largest geothermal greenhouses in the nation were constructed. A key factor responsible for encouraging the development and use of geothermal energy at that time was a $600,000 appropriation from the New Mexico State Legislature for geothermal research, development and demonstration projects. The Energy Conservation and Management Division of EMNRD, with substantial technical assistance from the Southwest Technology Development Institute (SWTDI) at NMSU, established and implemented the geothermal RD&D projects. Subsequently, SWTDI constructed a geothermal greenhouse research and business incubator facility in Las Cruces, as well as a geothermal aquaculture facility co-located on site. As a direct result of these efforts, four commercial greenhouses totaling over 30 acres have been established in southern New Mexico. SWTDI estimates that these four geothermally heated greenhouses represent a capital investment of more than $10 million, generating at least $14 million in annual sales and about 270 jobs.

One of the largest geothermal aquaculture facilities in the nation is also located in New Mexico, in the Animas Valley south of Lordsburg. This facility is owned and operated by Americulture, Inc. The following table provides information on the various direct-use geothermal applications in New Mexico. To date, however, the state has not witnessed construction of any geothermal electric generation plants of commercial scale.

Site	**Temperature (ºF)**	**Flow (gpm)**	**Energy (10^9 BTUs/yr)**	**Application**
Catron County	NA	NA	NA	Resort & Spas – Bubbles Hot Springs
Doña Ana County:				
Las Cruces Area	142	417	45.9	District Heating (NMSU)
	148	50	1.8	Greenhouse – SWTDI (NMSU)
Radium Springs	148	700	27.6	Greenhouse – J & K Growers
	160	2600	119	Greenhouse – 2nd largest nationally Masson Farm
Hidalgo County: Cotton City	245	2000	209	Greenhouse – Largest nationally Burgett Floral
	185	NA	0.7	Greenhouses/Aquaculture – McCants/AmeriCulture
Rio Arriba County	115	60	2.0	Resorts & Spas – Ojo Caliente
Sandoval County	NA	NA	NA	Resorts & Spas – McCauley Hot Springs, Jemez Springs Bathhouse

	165	40	1.3	Space Heating – Jemez Springs Fire Department
Sierra County	113	NA	NA	Resorts & Spas – Truth or Consequences
	Total		407.3	

In FY 2000-01, DOE directly funded a number of private-sector resource assessment and demonstration projects in southern New Mexico, which are now getting underway.

Recent Developments

The Energy Conservation and Management Division (ECMD) of EMNRD has facilitated promotional and technical information exchanges on geothermal energy through a variety of activities. ECMD held the first-ever New Mexico Geothermal Energy Conference in Albuquerque in April 2002, in partnership with DOE and Sandia National Laboratories, to provide information on New Mexico's geothermal resources and to explore mechanisms by which to encourage further development. In addition, ECMD and the Southwest Technology Development Institute (SWTDI) at NMSU secured through a national competition US DOE funding in the amount of $50,000 for development of a Geothermal Information Clearinghouse in New Mexico. ECMD continues to coordinate the efforts of the New Mexico Geothermal Energy Working Group, which was established in partnership with Sandia National Laboratories under the auspices of DOE's *Geopowering the West* program; the group promotes the development and use of New Mexico's geothermal resources. SWTDI remains a leader in providing technical assistance and information for geothermal development in the state.

Summary of New Mexico's Total Energy Sales, Generation Capacity and Production

Public Service Company of New Mexico

PNM provides jurisdictional retail electric service to a large area of north central New Mexico, including the City of Albuquerque and the City of Santa Fe, and certain other areas of New Mexico. For the years 1997 through 2001, retail KWh sales have grown at a compound annual rate of approximately 2.65%. PNM's peak demand for summer (2001) was 1,397 MW; and winter, 1,294 MW

PNM Operating Statistics—New Mexico

	2002	2001
Retail Energy Sales (kWh in thousands):		
Residential	2,298,542	2,197,889
Commercial	3,254,576	3,213,208
Industrial	1,612,723	1,603,266
Other	240,665	240,934
Total retail	7,406,506	7,255,297

Data from 10-K report found at:

http://www.sec.gov/Archives/edgar/data/1108426/000110842602000015/0001108426-02-000015.txt

PNM Generating Capacity—December 31, 2002

Plant Name	Location	Capacity-Net (megawatts)	Fuel Source	% of Total Capacity by Fuel Source
San Juan	Waterflow, NM	765 MW	Coal	Coal: 67%
Four Corners	Fruitland, NM	192 MW	Coal	
Reeves	Albuquerque, NM	154 MW	Gas/Oil	Gas/Oil: 4%
Las Vegas	Las Vegas, NM	20 MW	Gas/Oil	
Palo Verde	Wintersburg, AZ	390 MW	Nuclear	Nuclear: 29%
				Renewables: 0%
Totals		1,521 MW		100%

Notes: PNM also has a power purchase agreement under which it has access to 132 MW of gas-fired capacity, bringing its total available capacity to 1,653 MW.

PNM Electric Plant Ownership:
San Juan—PNM owns 50% of Units 1, 2, 3; and 38.5% of Unit 4
Four Corners—PNM owns 13% of Units 4, 5.
Palo Verde—PNM owns 10.2% of Units 1, 2, 3

Source: U.S. Securities and Exchange Commission, 10-K Report for the year ending December 31, 2002.

El Paso Electric Company

In 2001, El Paso had retail jurisdictional sales in New Mexico of 1,305,122 MWh. [EPE testimony before the NM PRC, April 15, 2002, Utility Case #3619] Comparisons of retail kWh sales by sector are shown below (in thousands of kilowatt-hours):

El Paso Operating Statistics—Texas and New Mexico

	2002	2001	2000
Retail Energy Sales (kWh in thousands):			
Residential	1,870,931	1,789,199	1,767,928
Commercial and industrial, small	2,076,758	2,069,517	2,026,768
Commercial and industrial, large	1,161,815	1,174,235	1,142,163
Sales to public authorities	1,212,180	1,185,521	1,177,883
Total retail	6,321,684	6,218,472	6,114,742

Data from 10-K report found at:
http://www.sec.gov/Archives/edgar/data/31978/000093066103001165/d10k.htm#tx715_5

El Paso Generating Capacity—December 31, 2002

PLANT NAME	LOCATION	**Capacity-Net (megawatts)**	FUELSOURCE	**% of Total Capacity by Fuel Source**
Four Corners	Fruitland, NM	104 MW	Coal	Coal: 6%
Newman	El Paso, TX	482 MW	Gas/Oil	Gas/Oil: 25%
Rio Grande	Sunland Park, NM	246 MW	Gas/Oil	
Copper	El Paso, TX	68 MW	Gas/Oil	
Palo Verde	Wintersburg, AZ	600 MW	Nuclear	Nuclear: 52%
Hueco Mt.	Horizon City, TX	1.32 MW	Wind	Renewables: <1%
Totals		1,521 MW		100%

El Paso Electric Plant Ownership:
Four Corners—El Paso owns 7% of Units 4, 5.
Palo Verde—El Paso owns 15.8% of Units 1, 2, 3

Source: U.S. Securities and Exchange Commission, 10-K Report for the year ending December 31, 2002.

Southwestern Public Service Company/Xcel

Table 13. SPS/Xcel Operating Statistics—Texas and New Mexico

	2002	**2001**	**2000**
Retail Energy Sales (kWh in thousands):			
Residential	3.300	3,212	3,467
Commercial and industrial	12,044	12,404	12,383
Public Authorities and other	549	549	608
Total retail	15,893	16,165	16,458

Data from 10-K report found at:
http://www.sec.gov/Archives/edgar/data/92521/000095013403003112/c75034e10vk.htm

SPS/Xcel Generating Capacity—December 31, 2002

PLANT NAME	LOCATION	**Capacity-Net (megawatts)**	FUEL SOURCE	**% of Total Capacity by Fuel Source**
Harrington	Amarillo, TX	1,066 MW	Coal	Coal: 74%
Tolk	Muleshoe, TX	1,080 MW	Coal	
Jones	Lubbock, TX	486 MW	Gas	Gas: 26%
Plant X	Earth, TX	442 MW	Gas	
Nichols	Amarillo, TX	457 MW	Gas	
Cunningham	Hobbs, NM	267 MW	Gas (steam)	
Cunningham	"	220 MW	Gas (turbine)	
Maddox	Hobbs, NM	118 MW	Gas (steam)	
Maddox	"	65 MW	Gas (turbine)	
Moore County	Amarillo, TX	48 MW	Gas	
Riverview	Electric City, TX	23 MW	Gas (turbine)	
Carlsbad	Carlsbad, NM	13 MW	Gas (turbine)	
CZ-1, 2	Pampa, TX	39 MW	Steam/Nitrogen	N/A
Wind Turbine	Texico, NM	0.66 MW	Wind	Renewables: <1 %
Totals		4,324 MW		100%

Source: U.S. Securities and Exchange Commission, 10-K Report for the year ending December 31, 2002.

Texas-New Mexico Power Company

Purchased Power. TNP has no operating generation facilities in New Mexico. All power purchased and distributed to its customers comes from Public Service Company of New Mexico; this arrangement continues through December 31, 2006.

Purchased Power Costs. During 2002, TNP's consolidated average cost per Kilowatt-Hour (kWh) of purchased power was 4.05 cents per kWh. In 2001, prior to retail competition, TNP's average cost of purchased power was 4.58 cents per kWh.

TNP Operating Statistics—Texas and New Mexico

Sales (MWh):	**2002**	**2001**	**2000**
Residential	2,622,978	2,555,472	2,582,081
Commercial	2,095,666	2,089,978	2,069,046
Industrial	1,957,920	1,466,178	4,610,059
Sales for resale	1,978,194	291,958	281,017
Other	110,592	99,884	101,563
Total	8,766,350	9,203,470	9,643,766

Data from 10-K report found at:
http://www.sec.gov/Archives/edgar/data/22767/000093066103001293/d10k.htm

Regional Modeling Analysis

The WRAP Air Pollution Prevention Forum commissioned the ICF Consulting Group to analyze the potential emission reductions, costs, and secondary regional economic impacts of meeting the 10/20 goals and energy efficiency recommendations (ICF, 2002). The analysis of this case incorporates the results of the ICF analysis for the Air Pollution Prevention Forum in a scenario that includes 2018 milestone case emission estimates for non-utility point sources.

The estimated sulfur dioxide (SO_2) and oxides of nitrogen (NO_x) emissions by utility unit for existing facilities, and by State for new sources, were provided by the ICF Consulting Group. The percentage changes in SO_2 and NO_x emissions by unit were applied to the 2018 Milestone Case emissions to estimate air pollution prevention case emissions for this analysis. The ICF model also provided estimated SO_2 and NO_x reductions for new sources. These new source emission reductions were applied to the utility units in each State in proportion to 2018 milestone case emissions. Because of the regional SO_2 trading program, the regional SO_2 emissions total is the same in the air pollution prevention case as it was for the milestone case. There is some shifting of SO_2 emissions among units and States, though. Regional NO_x emissions decline by about 14 thousand tons (air pollution prevention case versus milestone case). A State-level summary of utility emission changes by State from the 2018 milestone case is provided below. The tribal new source changes were allocated to Arizona. States not listed had no emissions change.

	Air Pollution Prevention Case Emissions Change	
State	**NO_x tpy**	**SO_2 tpy**
Arizona	-3,267	5,558
Colorado	-1,370	-1,119
Nevada	-430	-307
New Mexico	-7,053	-5,135
Utah	-780	-595
Wyoming	-1,374	1,598
Regional Changes	-14,274	0

The following table presents the air pollution prevention case results for point sources in the GCVTC transport region States. In the air pollution prevention case, GCVTC transport region point source SO_2 emissions are 510,000 tons.

2018 Air Pollution Prevention Case Scenario - Point Source Emissions by Sector
(GCVTC transport region States)

MTF	Ftype	FIPSST	State Code	State	2018 Emissions (tpy) VOC	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	NH_3
1	Utility	04	AZ	Arizona	700	91,331	7,205	67,085	3,434	1,659	8
		08	CO	Colorado	602	80,785	7,122	46,918	1,624	1,006	6
		32	NV	Nevada	369	43,825	3,073	19,294	5,607	2,506	3
		35	NM	New Mexico	783	84,762	7,077	65,756	9,161	2,707	4
		41	OR	Oregon	51	10,094	424	3,935	257	177	0
		49	UT	Utah	430	75,229	5,317	23,763	2,561	1,135	3
		56	WY	Wyoming	1,238	102,439	11,346	69,383	11,100	6,612	0
					4,173	**488,465**	**41,564**	**296,134**	**33,744**	**15,802**	**24**
2	Smelters	04	AZ	Arizona	231	1,345	407	44,564	2,282	1,283	0
		35	NM	New Mexico	10	772	141	35,236	1,247	248	0
		49	UT	Utah	8	230	92	1,036	322	130	47
					249	**2,348**	**639**	**80,836**	**3,850**	**1,661**	**48**
3	ALL Others	04	AZ	Arizona	9,844	41,938	24,305	2,267	21,021	6,583	22
		06	CA	California	104,337	106,707	152,122	31,197	45,419	24,400	26,900
		08	CO	Colorado	43,784	48,767	47,858	10,701	29,746	17,246	175
		16	ID	Idaho	275	7,295	6,410	13,613	6,979	4,314	2
		32	NV	Nevada	1,740	8,601	26,741	3,354	16,652	5,856	86
		35	NM	New Mexico	23,148	63,171	52,616	32,129	1,328	523	128
		41	OR	Oregon	23,583	21,794	107,888	4,453	13,380	9,563	18
		49	UT	Utah	12,811	27,851	55,474	11,434	18,094	10,979	1,111
		56	WY	Wyoming	27,473	35,741	59,242	23,880	20,940	13,145	1,153
					246,995	**361,865**	**532,656**	**133,028**	**173,559**	**92,609**	**29,595**
Point Source Totals					**251,417**	**852,678**	**574,859**	**509,998**	**211,153**	**110,072**	**29,667**

The 22-State region criteria pollutant emission summaries for the air pollution prevention case are presented in the following table.

2018 Air Pollution Prevention Case Scenario - Point Source Emissions by State
(22-State Region)

MTF	Ftype	FIPSST	State Code	State	2018 Emissions (tpy) VOC	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	NH_3
1	Utility	04	AZ	Arizona	700	91,331	7,205	67,085	3,434	1,659	8
1	Utility	05	AR	Arkansas	918	50,964	7,248	71,496	1,654	1,140	98
1	Utility	08	CO	Colorado	602	80,785	7,122	46,918	1,624	1,006	6
1	Utility	19	IA	Iowa	943	76,811	8,537	107,006	3,141	1,803	18
1	Utility	20	KS	Kansas	1,192	91,664	9,207	81,153	2,166	1,370	65
1	Utility	22	LA	Louisiana	1,973	75,803	17,077	75,680	3,116	1,933	925
1	Utility	27	MN	Minnesota	1,007	84,056	7,833	61,025	4,172	2,024	21
1	Utility	29	MO	Missouri	2,053	113,515	13,678	261,759	3,061	2,014	26
1	Utility	30	MT	Montana	405	26,030	3,382	12,862	4,136	2,062	5
1	Utility	31	NE	Nebraska	514	46,631	4,070	45,946	1,014	703	8
1	Utility	32	NV	Nevada	369	43,825	3,073	19,294	5,607	2,506	3
1	Utility	35	NM	New Mexico	783	84,762	7,077	65,756	9,161	2,707	4
1	Utility	38	ND	North	1,357	108,558	15,808	132,836	3,604	2,095	15

MTF	Ftype	FIPSST	State Code	State	2018 Emissions (tpy) VOC	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	NH_3
				Dakota							
1	Utility	40	OK	Oklahoma	1,614	88,543	15,797	79,824	2,389	1,682	314
1	Utility	41	OR	Oregon	51	10,094	424	3,935	257	177	0
1	Utility	46	SD	South Dakota	130	17,542	615	11,102	55	40	1
1	Utility	48	TX	Texas	11,173	219,850	127,621	471,544	23,362	17,182	2,583
1	Utility	49	UT	Utah	430	75,229	5,317	23,763	2,561	1,135	3
1	Utility	53	WA	Washington	257	19,152	2,133	8,721	2,955	2,033	0
1	Utility	56	WY	Wyoming	1,238	102,439	11,346	69,383	11,100	6,612	0
					27,708	**1,507,582**	**274,569**	**1,717,088**	**88,569**	**51,884**	**4,105**
2	Smelters	04	AZ	Arizona	231	1,345	407	44,564	2,282	1,283	0
2	Smelters	35	NM	New Mexico	10	772	141	35,236	1,247	248	0
2	Smelters	49	UT	Utah	8	230	92	1,036	322	130	47
					249	**2,348**	**639**	**80,836**	**3,850**	**1,661**	**48**
3	All Others	04	AZ	Arizona	9,844	41,938	24,305	2,267	21,021	6,583	22
3	All Others	05	AR	Arkansas	18,150	22,037	116,921	8,972	32,693	17,331	25,325
3	All Others	06	CA	California	104,337	106,707	152,122	31,197	45,419	24,400	26,900
3	All Others	08	CO	Colorado	43,784	48,767	47,858	10,701	29,746	17,246	175
3	All Others	16	ID	Idaho	275	7,295	6,410	13,613	6,979	4,314	2
3	All Others	19	IA	Iowa	12,553	30,194	10,551	38,779	10,999	6,168	13,746
3	All Others	20	KS	Kansas	33,283	103,540	78,427	5,510	18,801	13,120	19,237
3	All Others	22	LA	Louisiana	150,180	241,227	576,864	89,299	35,746	26,038	72,214
3	All Others	27	MN	Minnesota	45,040	93,179	95,580	22,024	127,527	56,388	1,267
3	All Others	29	MO	Missouri	91,069	42,155	194,103	76,648	77,163	28,954	36,372
3	All Others	30	MT	Montana	7,451	18,536	57,226	14,578	11,105	5,882	293
3	All Others	31	NE	Nebraska	12,954	15,074	21,165	6,602	11,163	4,418	19
3	All Others	32	NV	Nevada	1,740	8,601	26,741	3,354	16,652	5,856	86
3	All Others	35	NM	New Mexico	23,148	63,171	52,616	32,129	1,328	523	128
3	All Others	38	ND	North Dakota	610	11,493	7,939	50,975	1,981	1,439	16
3	All Others	40	OK	Oklahoma	75,019	117,685	240,024	16,566	11,559	6,248	27,010
3	All Others	41	OR	Oregon	23,583	21,794	107,888	4,453	13,380	9,563	18
3	All Others	46	SD	South Dakota	1,423	4,534	0	172	714	392	1
3	All Others	48	TX	Texas	336,691	404,510	458,311	170,562	42,770	27,800	1,756
3	All Others	49	UT	Utah	12,811	27,851	55,474	11,434	18,094	10,979	1,111
3	All Others	53	WA	Washington	26,253	45,665	273,848	22,562	11,365	7,974	6,660
3	All Others	56	WY	Wyoming	27,473	35,741	59,242	23,880	20,940	13,145	1,153
					1,057,674	**1,511,694**	**2,663,616**	**656,277**	**567,147**	**294,759**	**233,509**
Totals					**1,085,632**	**3,021,623**	**2,938,824**	**2,454,201**	**659,566**	**348,303**	**237,661**

The following table shows the electricity generating units in the GCVTC Transport Region with predicted SO_2 and NO_x emission changes in the air pollution prevention case.

Air Pollution Prevention Case Electricity Generating Unit Emissions

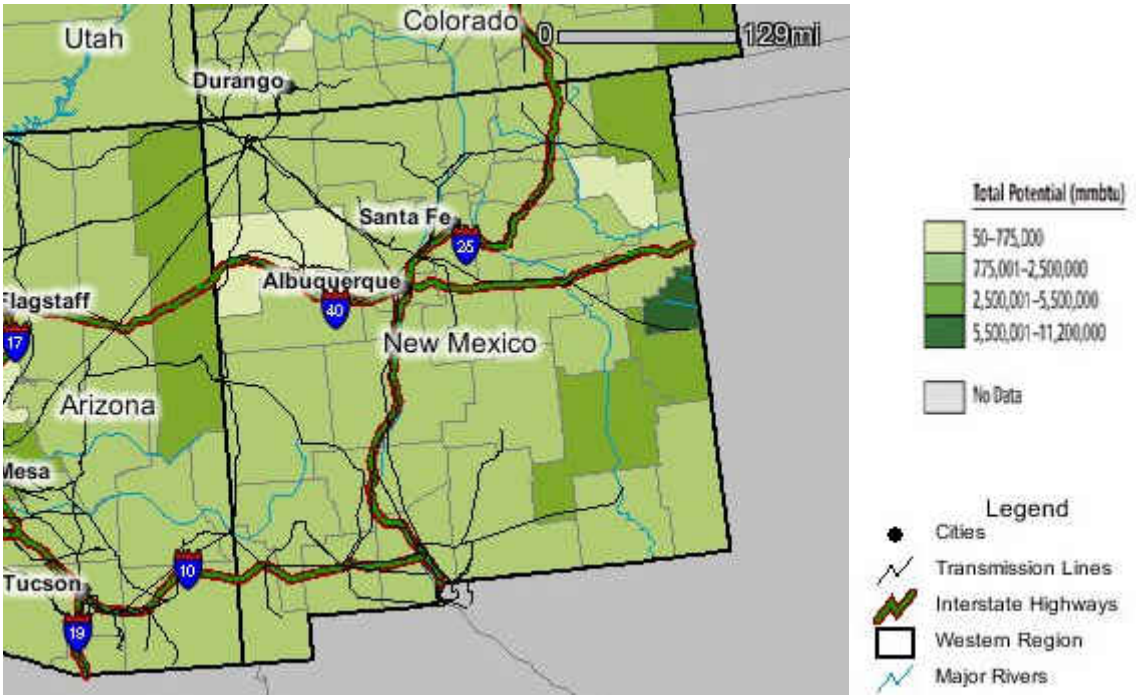
					Percentage Change*		Milestone Case 2018		Pollution Prevention Case 2018		Difference	
State	**County**	**Unit ID**	**ORISID**	**Plant**	**NOx**	**SO_2**	**NOx**	**SO_2**	**NOx**	**SO_2**	**NOx**	**SO_2**
AZ	Navajo	1	113	APS Cholla	-40.52%	-40.51%	2,066	1,050	1,229	625	-837	-425
AZ	Navajo	3	113	APS Cholla	0	344.45	4,081	2,292	4,081	10,189	0	7,896
CO	Montrose	1	527	Nucla	0	-2.36	1,038	1,530	1,038	1,494	0	-36
NM	San Juan	1	2451	San Juan Generating	-36.25	-36.25	6,926	7,170	4,415	4,571	-2,511	-2,599
NM	San Juan	3	2451	San Juan Generating	-40.48	-25.07	9,911	8,459	5,899	6,338	-4,012	-2,121
WY	Sweetwater	BW72	8066	Pacificorp-Jim Bridger	-0.04	55.42	10,171	4,838	10,167	7,519	-4	2,681
							34,193	**25,338**	**26,829**	**30,734**	**-7,364**	**5,396**

*Compared with the 2018 Milestone Case.

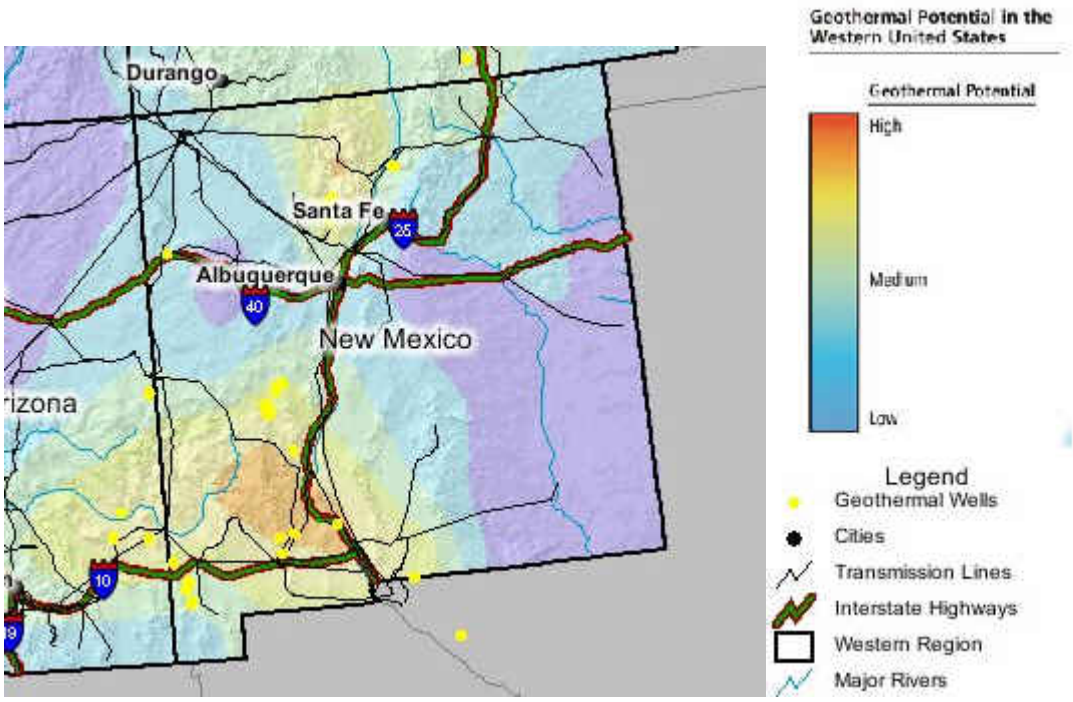
These model-estimated changes occur at 6 units at 4 plants in 4 States (Arizona, Colorado, New Mexico, and Wyoming). Expected SO_2 emission increases occur at Cholla #2 and Pacific Corp-Jim Bridger. These emission increases are offset by decreases in SO_2 emissions at Cholla #1, 2 San Juan Generating Station units, and at Nucla. NO_x emissions in the air pollution prevention case are always lower than or equal to those in the milestone case. The largest NO_x emission reductions in the pollution prevention case occur in New Mexico at San Juan Generating Station.

Renewable Resource Potential Maps

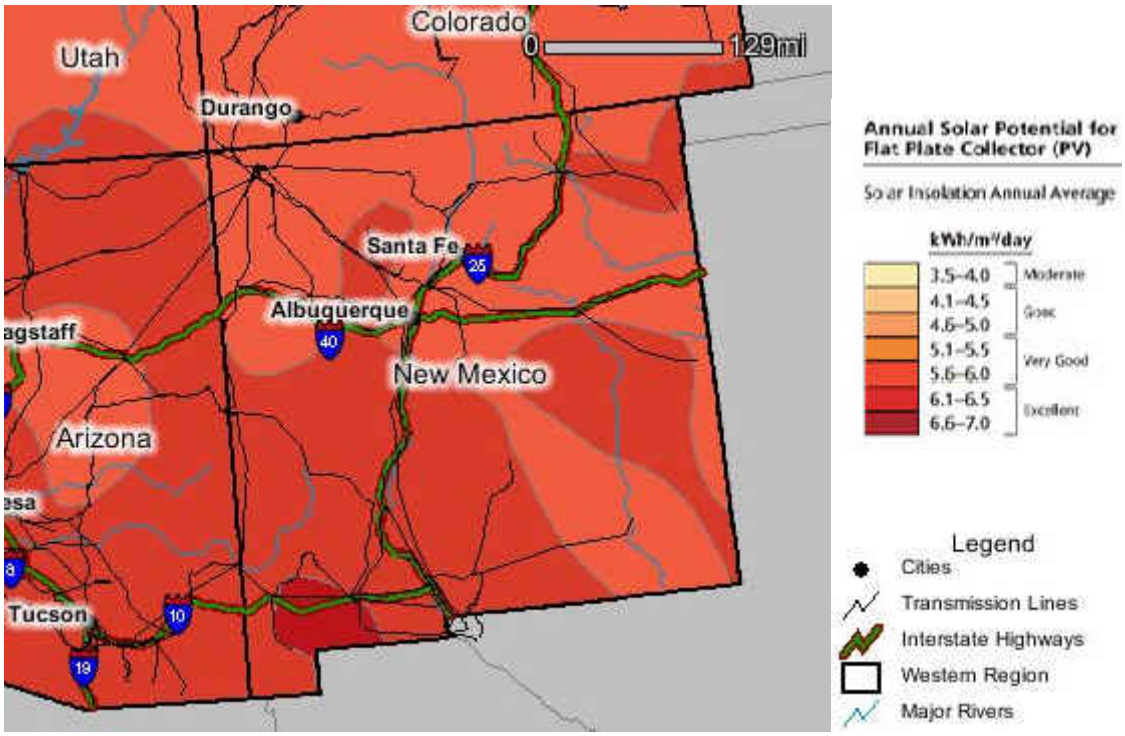
New Mexico Biomass Potential (from Renewable Energy Atlas of the West, Land and Water Fund of the Rockies, DATE)



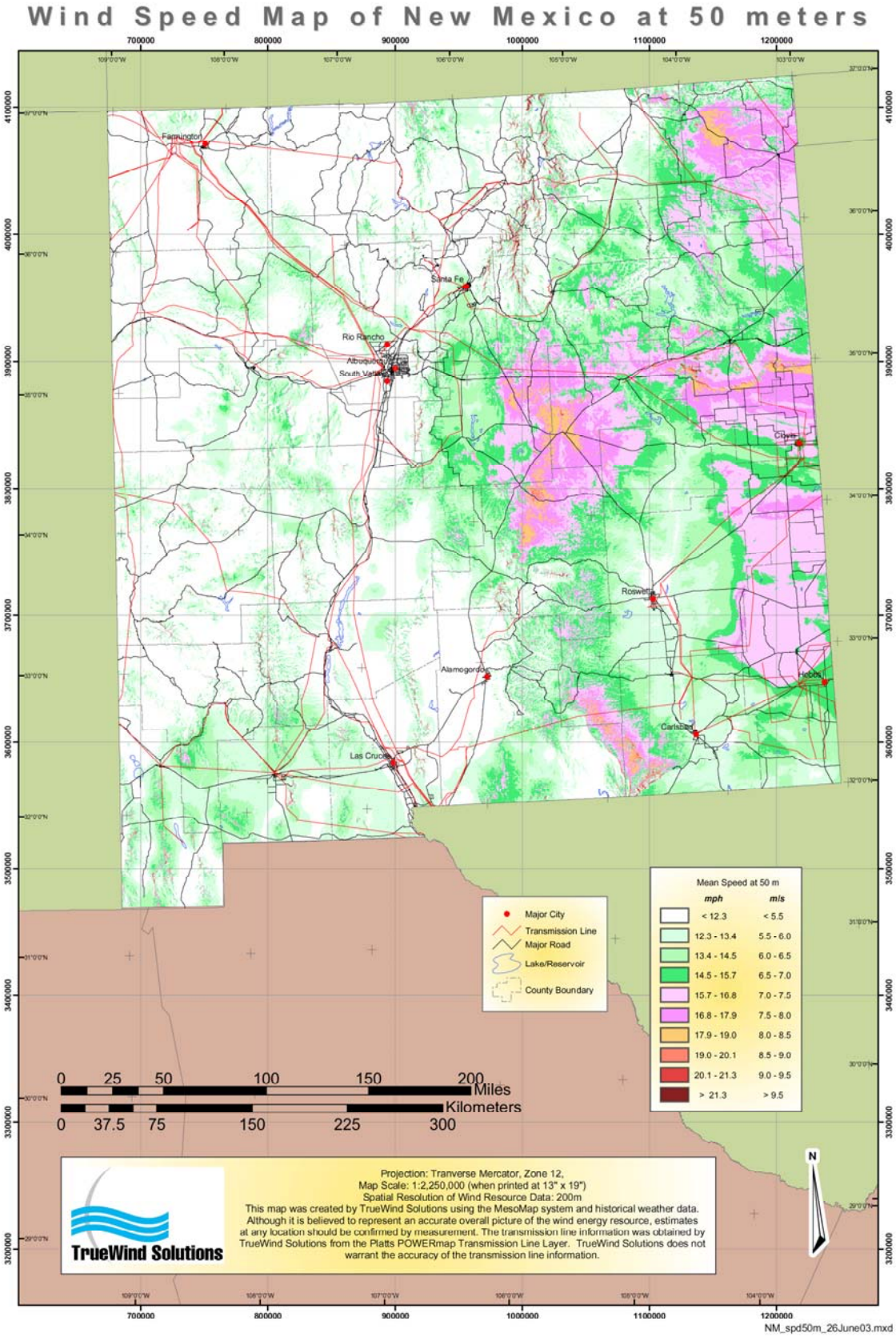
New Mexico Geothermal Potential (from Renewable Energy Atlas of the West, Land and Water Fund of the Rockies, DATE)



New Mexico Solar Potential (from Renewable Energy Atlas of the West, Land and Water Fund of the Rockies, DATE)



The following wind potential map is from the New Mexico Energy, Minerals and Natural Resources Department, Energy Conservation and Management Division.



Renewable Energy Generation and Consumption in New Mexico

New Mexico produces 684 MW of electricity. Of this total, 0.66 MW are produced from wind energy. Renewable energy generation is less than one percent of total energy generation in New Mexico. Renewable energy consumption in New Mexico is 1,642 million kilowatt-hours. Total energy consumption in New Mexico is 251 billion kilowatt-hours. Renewable energy sources, including solar, wind, hydropower, biomass, and geothermal, currently provide less than one percent of New Mexico's annual energy needs.