

# NEW MEXICO'S GREEN ECONOMY: Capitalizing on Assets and Opportunities



September 21, 2009  
Developed by  
Governor Bill Richardson's Green Jobs Cabinet  
to fulfill Executive Order 2009-002



# NEW MEXICO GREEN JOBS CABINET

Dear Governor Richardson,

We are very pleased to submit to you the Green Jobs Cabinet Report fulfilling a requirement of Executive Order 2009-002. The following report provides an overview of the green economy in New Mexico as well as strategy and policy recommendations for growing this important sector. This report is the result of an extensive public process and reflects the input of businesses, citizens and experts from across New Mexico.

As a result of your long-standing commitment to clean energy, New Mexico's green economy has grown over 50% between 1998 and 2007. Clean energy jobs have grown by 118% and energy efficiency jobs have grown by 184%. New Mexico is now home to leading green economy manufacturers like Schott Solar and Emcore, to wind, solar and geothermal energy projects, to an advanced green building sector, and to new clean technology start-up companies. Local green businesses are growing aggressively. But this is just the beginning of how the green economy can foster prosperity in New Mexico.

Abundant renewable energy resources, world-class clean technology research and manufacturing, attractive incentives, low business costs, and visionary state, federal and local government leadership are drawing international attention to the Land of Enchantment. The New Mexico Economic Development Partnership and the Economic Development Department are in contact on a weekly basis with many clean energy businesses considering New Mexico as their primary North American production location.

However, competition for new investment between states, and internationally, is intense as the United States seeks to regain leadership in the production of clean energy components. In this time of global recession, New Mexico must remain vigilant to ensure it continues to attract investment and grow its green economy.

The Green Jobs Cabinet report outlines five strategies to grow New Mexico's green economy and offers recommendations to achieve these goals:

- GOAL #1: Be the Leader in Renewable Energy Export**
- GOAL #2: Be the Center of the North American Solar Industry**
- GOAL #3: Lead the Nation in Green Grid Innovation**
- GOAL #4: Be a Center of Excellence for Green Building and Energy Efficiency**
- GOAL #5: Have a Highly Skilled and Ready-to-Work Workforce**

The Green Jobs Cabinet looks forward to your review of this report and to implementing priority actions that are identified. Policy and program development to both stimulate job creation and ensure New Mexicans are well prepared to fill those jobs will be needed.

The Cabinet would like to recognize Daniela Glick, former Deputy Secretary of Economic Development, as the key catalyst behind this report, and Brendan Miller, Green Economy Manager, for spearheading its production.

Sincerely,

Fred Mondragon, Cabinet Secretary (Chairman), Economic Development Department

Dr. I. Miley Gonzalez, Cabinet Secretary, Department of Agriculture

Ron Curry, Cabinet Secretary, Environment Department

Dr. Viola Florez, Cabinet Secretary, Higher Education Department

Gary Bland, Officer, State Investment Council

Joanna Prukop, Cabinet Secretary, Energy, Minerals and Natural Resources Department

Sarah Cottrell, Energy and Environmental Policy Advisor, Governor's Office

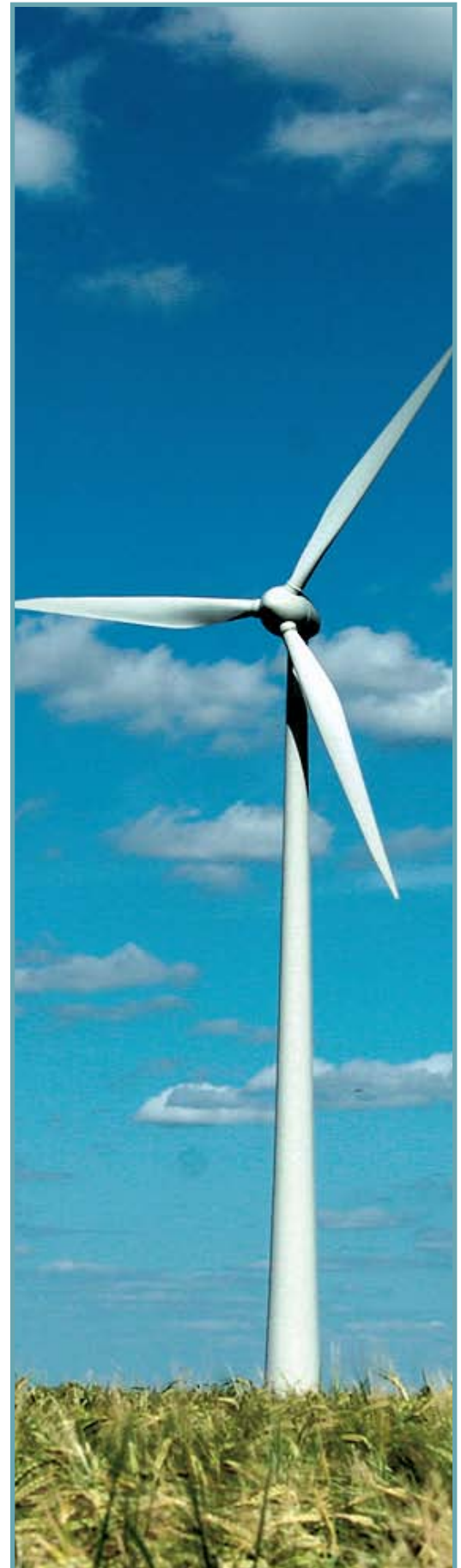
Dr. Veronica Garcia, Cabinet Secretary, Public Education Department

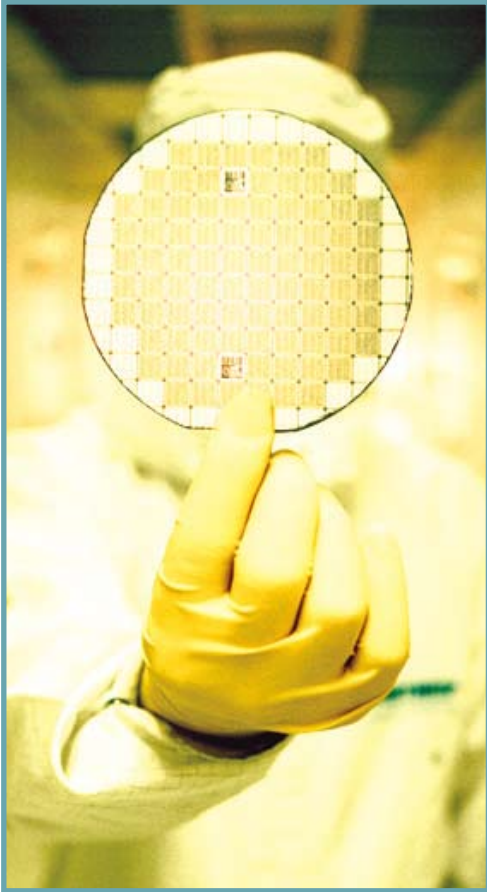
Ken Ortiz, Cabinet Secretary, Department of Workforce Solutions



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## I. ACKNOWLEDGEMENTS & CONTACT INFORMATION

This report was prepared under the leadership and direction of Governor Richardson's Green Jobs Cabinet, created in January 2009.

### Members of the Cabinet Include:

- Cabinet Secretary Fred Mondragón, NM Economic Development Department (Chair)
- Deputy Cabinet Secretary Daniela Glick, NM Economic Development Department (Chair Designee)
- Cabinet Secretary Joanna Prukop, NM Energy, Minerals and Natural Resources Department
- Cabinet Secretary Ron Curry, NM Environment Department
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- Melissa Lomax, NM Public Education Department
- Charles Wollman, NM State Investment Council
- Sandra McCardell, New Mexico Green Collaborative
- Sandra Ely, NM Environment Department
- Melissa Dane, New Mexico Fellow Summer Intern

This report reflects the direct input from over 100 people involved in all aspects of the green economy in New Mexico, and the indirect contributions of many more who have worked in this sector for years. Their sustained leadership over time and their contributions to this report are greatly appreciated.





Special thanks to the Dreaming New Mexico Project, New Mexico First, and New Mexico Community Capital for their recent reports on New Mexico's green economy. A number of the images and portions of the content in this report are drawn from these sources. Thanks also go to former Cabinet Secretary of Workforce Solutions, Betty Sparrow Dorris, for her contributions, and the Economic Development Department's Marketing Division, especially Linda Smith and Michael Moxey, for their help in preparing this report.

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## 2. BACKGROUND ON NEW MEXICO'S CLEAN ENERGY & CLIMATE CHANGE POLICIES

### The Governor's Executive Order

Recognizing the abundant opportunities to grow New Mexico's economy through sustainable and green industries, Governor Richardson signed Executive Order 09-002 on January 21, 2009, establishing the Green Jobs Cabinet. The Governor directed the Cabinet to prepare a report that considers opportunities and strategies addressing:

- New Mexico's unique and sustainable competitive advantages in clean energy and clean technology;
- Manufacturing of renewable energy system components;
- Installation, operation and maintenance of renewable energy systems at distributed- and utility-scales;
- Utility-scale renewable energy for export;
- Green building and energy efficiency contracting for residential, commercial and institutional customers;
- Regionally appropriate biofuels production, research and infrastructure;
- Sustainable agriculture;
- Research and development, commercialization and manufacturing of new clean energy and "green grid" technologies and solutions, identified by New Mexico's Science and Technology Plan, for deployment in New Mexico and outside the state;
- Statewide "green" workforce development pathways and coordination to ensure that all New Mexicans are well prepared for existing and future clean energy jobs. This may include the development of new curricula, educational and training programs, and communication of those programs between secondary and postsecondary education, and industry;
- Strategies to mitigate negative impacts on New Mexico's economy associated with increasing fuel costs; and
- Opportunities to raise New Mexico's profile and attract out-of-state public and private investment.

This report is the outcome of that effort.



The National Solar Thermal Test Facility at Sandia National Laboratories





New Mexico State University's Environmental Chemistry Lab



New Mexico State University's Agricultural Science Center at Artesia is the location for two large ponds where algae is being grown. The brackish water in the ponds is gently stirred by paddlewheels powered by electricity.



### Public Input Process

Significant efforts were made to incorporate comments and suggestions from the public in this report. The public input process included:

- Interviews with over 100 leaders in the green economy.
- Two press releases to inform the public of the creation of the Green Jobs Cabinet and invite them to sign up to receive periodic email updates. A monthly Green Economy Initiative newsletter was established to share information on what is happening in New Mexico. Over 600 people currently subscribe.
- A road show describing areas of opportunity in clean energy and technology was undertaken. Presentations were made in Clovis, Portales, Hobbs, Carlsbad, Artesia, Roswell, Deming, Lordsburg, Silver City, Farmington, Window Rock, Gallup, Las Cruces, Albuquerque and Santa Fe. Presentations were also made at the American Indian Chamber of Commerce Conference in Albuquerque and through the Agricultural Extension Service's remote Centra system.
- A formal Call for Comments was issued in May 2009 to solicit comments and recommendations from the public.
- A draft of this report was made available for review and comment in August 2009 and these comments were incorporated into the final report.
- Information was also gathered from a number of conferences and trade shows including: the Technology Ventures Corporation *Energy Summit in the Sandias* (12/08), the Regional Development Corporation's *Green Jobs Summit* (1/09), Rocky Mountain Technology Alliance's *New Energy Summit* (3/09), New Mexico First *Energy Economy Town Hall* (5/09), *New Mexico Geothermal Working Group* (5/09), *Renew '09 Conference* (6/09) and the *Intersolar Trade Show* in Munich, Germany (6/09).

### Clean Energy and Climate Policy Context

The Governor's Executive Order notes the unique circumstances that make the signing of the order timely for New Mexico, including the development of regional and national clean energy and climate change policies. New Mexico is a member of the Western Climate Initiative, a coalition of 11 U.S. states and Canadian provinces, that is designing a regional greenhouse gas (GHG) cap-and-trade program that is scheduled to begin in 2012. In addition, Congress is currently considering the American Clean Energy and Security Act of 2009 that includes a GHG cap-and-trade component that is also scheduled to start in 2012 according to the House-passed version. States with workforces that can meet clean energy and climate change challenges will be positioned to reap the benefits of the new energy economy. New Mexico's world-class renewable energy sources, nation-leading universities and national laboratories, clean





energy incentives and private investment commitment put the state in a unique position to further grow a green workforce. This report contains recommendations for assuring that New Mexico takes full advantage of existing opportunities to prepare for the new energy economy.

### **The Greening of All Jobs**

In the future, all of our industries and jobs will become “greener” as energy efficiency, waste reduction, and environmental protection increase in importance.

Programs like the Environmental Department’s Green Zia program, the City of Santa Fe’s CoolBiz program, and the Manufacturing Extension Partnership’s initiative to turn energy efficiency and waste reduction into increased profitability are helping business to make this transition.<sup>1</sup>

### **Recent Policy Developments**

In 2004, Governor Richardson declared New Mexico “The Clean Energy State.” Since that time the state has implemented many programs and initiatives to promote clean energy and reduce greenhouse gas emissions under the Governor’s leadership. For more details about these initiatives please see the appendix. Some of the highlights include:

- The Governor established, through Executive Order, the Climate Change Advisory Group (CCAG) to make recommendations for reducing the state’s greenhouse gas emissions to targeted levels. The CCAG delivered 69 recommendations to the Governor in December 2006.
- The Legislature passed, and the Governor signed, numerous clean energy incentives including the Renewable Energy Production Tax Credit, the Advanced Energy Tax Credit and the Manufacturing Tax Credit.
- The Legislature passed, and the Governor signed, amendments to the Efficient Use of Energy Act with aggressive requirements for investor-owned utilities to provide more energy efficiency to customers.
- The Renewable Energy Transmission Authority was

established to deliver New Mexico’s abundant, clean energy to markets in western states.

- The governor established the Environmental Justice Task Force to avoid disproportionate environmental impacts of proposed projects to low-income communities and communities of color.
- The State’s renewable portfolio standard requires 20% renewable energy by 2020 for investor-owned utilities and 10% by 2020 for rural electric cooperatives.
- The Governor established the Clean Energy Development Council to develop policy recommendations to expand clean energy development in New Mexico.

This report from the Green Jobs Cabinet builds on Governor Richardson’s previous policies to ensure that New Mexico remains a leader in clean energy and the green economy.



The SunCatcher™, newly designed solar power collection dishes at Sandia's National Solar Thermal Test Facility. Designed for high-volume production, ease of maintenance, and cost reductions, the dishes could be in commercial service by 2010.



### 3. PURPOSE AND FRAMING OF THIS REPORT

There are four essential purposes of this document:

1. To provide a description and overview of the green economy in New Mexico to citizens, legislators and policy makers;
2. To evaluate opportunities for job creation and economic development;
3. To develop a strategy ensuring New Mexico has a trained workforce for employment in the green economy; and
4. To outline the State’s strategy for growing the green economy, with detailed recommendations.

This report serves as a “master report,” covering multiple, overlapping audiences. In the future, shorter documents covering specific targets areas will be produced from the contents of this report.

Recommendations in this report align with other recent reports dealing with the green economy including the New Mexico First Energy Economy Town Hall recommendations, the State Technology21 Science and Technology Report, and the New Mexico Ecosystem Report.<sup>2</sup> In some cases proposed policies are drawn directly from these reports. Summaries of the reports are provided in the appendix.

#### ***Focus on New Mexico’s Competitive Advantages***

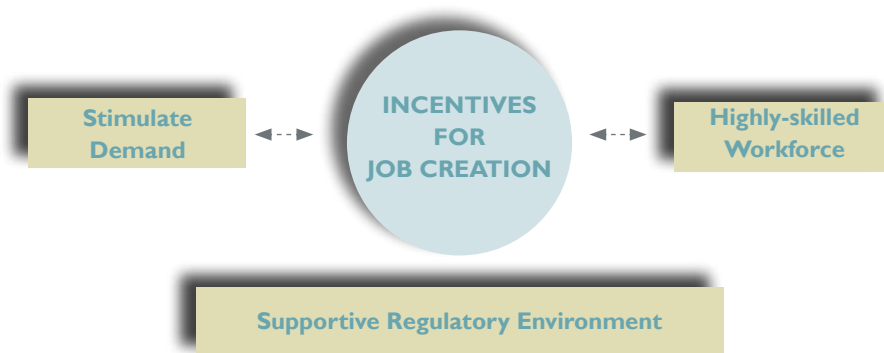
The Green Jobs Cabinet is tasked with promoting economic development through the expansion of clean energy and clean technology industries. This report evaluates how New Mexico can leverage its competitive advantages to grow its green economy and create permanent high-wage jobs.

Although the green economy is projected to grow nationwide, there is intense competition between states for investment dollars, especially given recent job losses created by the global recession. New Mexico must continue to aggressively compete for investment if it wants to capture its share of economic development from clean energy and clean technology. New Mexico is blessed with many natural advantages, but we must remain vigilant to ensure our state is positioned favorably in comparison with other states.



To grow New Mexico's green economy we must:

- Provide incentives for job creation;
- Stimulate or guarantee demand at state and local levels for the products of existing clean tech manufacturers and producers, and assist in attracting new businesses;
- Develop a highly skilled workforce; and
- Provide a supportive regulatory environment.



### **Immediate Investment for Long-Term Return**

New Mexico must not evaluate policies based on cost alone. While it is critical for governments to think in terms of budgets and costs we must also think in terms of how immediate investments will generate long-term returns. Examples of appropriate state investments are targeted tax credits, incentives and direct equity contributions. Allocating funds for incentives for desired industries should be viewed as co-investment by the state in these businesses. Like any investor, the state should expect a return, and that return comes in the form of job creation and new tax revenue. Considering future *return on investment (ROI)* will foster wise investments that will allow New Mexico's citizens to prosper in a greener, cleaner economy.

### **Create Industry Clusters**

The biggest return on investment will come through investing in clusters of related industries because these clusters maximize economic value. Industry clusters are a critical factor in the state's ability to attract sustainable investments necessary for continuous economic development.<sup>3</sup>

#### **Clusters are defined by:**

- Geographically bound concentrations of similar, related or complementary businesses;
- Active channels for business transactions, communications and dialogue;



- Sharing specialized infrastructure, labor markets and services; and
- Facing common opportunities and threats.

**The advantages of clusters include:**

- Giving businesses the edge in knowledge transfer, access to suppliers, customer support services and skilled labor pools; and
- Allowing businesses to focus on their strengths and seek profitable synergies.

Innovation, imitation, and entrepreneurship fuel competitive clusters.<sup>4</sup> Entrepreneurship and new start-ups are especially critical for the emergence and growth of clusters, whereas established firms are more critical for the competitiveness of mature clusters.<sup>5</sup> Research by the Kauffman Foundation indicates that during the period of 1980-2005 the only positive net employment growth in the United States came from startup businesses.<sup>6</sup> Because the green economy is an emerging sector, entrepreneurship is a competency the state will need to cultivate.

Fortunately, New Mexico is home to the largest percentage of Ph.D.s and engineers as a percentage of the workforce,<sup>7</sup> nationally recognized researchers working on clean technologies, a strong venture capital community and a growing clean tech manufacturing cluster. We must build upon these strengths to develop our industrial clusters.



## New Mexico's Strengths, Weaknesses, Opportunities and Threats (SWOT)

New Mexico's SWOT analysis demonstrates the opportunity to strategically position the state for optimum job growth.

	HELPFUL	HARMFUL
INTERNAL FACTORS	<p><b>STRENGTHS:</b></p> <ul style="list-style-type: none"> <li>World-class solar, wind and geothermal resources: depth and diversity of resources</li> <li>Current incentives and tax credits for key green industries</li> <li>Substantial open land and a supportive permitting climate</li> <li>Strategic location at the intersection of three U.S. electricity grids and proximity to demand centers</li> <li>Strong support from Governor, Lt. Governor, state legislature, local governments and New Mexico's entire federal delegation</li> <li>A growing cluster of clean tech manufacturing, particularly solar components supported by a well-developed manufacturing workforce and low costs of doing business</li> <li>Tremendous intellectual capital at our national laboratories and universities</li> <li>Existing, nationally recognized, green job training programs at several state community colleges</li> <li>NM Renewable Energy Transmission Authority</li> <li>A small, nimble, accessible, and responsive state government and local governments</li> <li>Green building expertise</li> <li>Strong agriculture and tourism industries</li> <li>Available brackish water supplies</li> <li>Existing oil and gas wells provide economical access to geothermal resources</li> <li>Proximity and relationship with Mexico</li> <li>A deeply rooted and long-standing respect for the natural environment</li> </ul>	<p><b>WEAKNESSES:</b></p> <ul style="list-style-type: none"> <li>A small-population state with limited tax revenue</li> <li>Limited in-state demand for clean tech products</li> <li>Cheap coal-fired electricity makes renewable energy comparatively expensive</li> <li>State poverty</li> <li>Incentives for utilities are not completely aligned with clean energy economic development</li> <li>Workforce readiness</li> <li>Legislative schedule can limit immediate response to urgent issues</li> <li>Too few entrepreneurs and an underdeveloped entrepreneurial climate</li> <li>Arid state means limited water availability</li> <li>A tax base in need of diversification</li> </ul>
EXTERNAL FACTORS	<p><b>OPPORTUNITIES:</b></p> <ul style="list-style-type: none"> <li>Strong interest in NM from international businesses</li> <li>National energy independence goals</li> <li>Supportive federal government and stimulus funds</li> <li>Renewable energies are quickly becoming more cost effective</li> <li>Solar and other clean tech manufacturers are looking to establish new facilities</li> <li>Proposed national Renewable Energy Standard</li> <li>Proposed national carbon pricing</li> </ul>	<p><b>THREATS:</b></p> <ul style="list-style-type: none"> <li>Global recession</li> <li>Fierce competition from other states for private and public investment</li> <li>Climate change</li> </ul>



### **How to Build New Mexico's Green Economy**

- 1. Be the Leader in Renewable Energy Export:** Establish New Mexico as the leading exporter of renewable energy and renewable energy products, in areas like electricity and biofuels.
- 2. Be the Center of the North American Solar Industry: *Make New Mexico the "Solar Valley" of the United States.*** New Mexico must harness its potential to develop a vertically integrated solar economy from R&D and demonstration to commercialization, startup businesses, manufacturing, and installation. The entire value chain resides in New Mexico.
- 3. Lead the Nation in Green Grid Innovation:** Leverage technology from our national laboratories and universities to create an entrepreneurial engine of new high tech, clean tech businesses. Make the "green grid" a top priority.
- 4. Be a Center of Excellence for Green Building and Energy Efficiency:** Remain a leader in green building and develop a sustainable energy efficiency renovation industry with a supporting cluster of green building product manufacturers.
- 5. Have a Highly Skilled and Ready-to-Work Workforce:** Matching industry growth projections with a highly skilled workforce is paramount to the success of New Mexico's green economy.

## **4. SUMMARY OF RECOMMENDATIONS TO BUILD NEW MEXICO'S GREEN ECONOMY**

Although detailed recommendations are provided for each segment of the green economy throughout the report, it is helpful to group them into a few broad policy statements linked to the state's economic development goals outlined above. Detailed recommendations are linked by their numbers to these policy statements.

### **To be the leader in renewable energy export, New Mexico must:**

- **Incentivize and stimulate renewable energy growth, both electricity and biofuels** (RE-2, RE-6, US-1, B-1, B-2, B-3, B-4, B-5, GE-1, GE-2, GE-3, GE-4, CS-1 through CS-8, COR-1)
- **Get our renewable energy to market** (RE-3, RE-4, RE-5, RE-7)
- **Align incentives for utilities with the state economic development goals** (SE-1, EE-7)
- **Provide a supportive regulatory environment** (RE-1, SE-1, W-1, W-2, E-1, E-2, E-3, E-4, E-5, E-6, RE-6, CS-7, WE-3)
- **Market and promote the state's assets, accomplishments and vision** (RE-8, GE-1, SM-4, CTI-6)



**To be the center of the North American solar industry, New Mexico must:**

- **Stimulate the rapid growth of solar energy with predictable statewide incentives and programs** (US-1, SE-1, SE-2, SE-3, CS-1, CS-2, CS-3, CS-4, CS-5, CS-8, COR-1)
- **Incentivize solar manufacturing** (SM-1, SM-2, SM-3, SM-4, SM-5, SM-6, SM-7, SM-8, SM-9)

**To lead the nation in Green Grid Innovation, New Mexico must:**

- **Promote commercialization of new clean technologies** (CTI-1, CTI-3, CTI-4, CTI-5, CTI-6, CTI-7, CTI-8)
- **Put focus on the Green Grid to leverage limited resources** (CTI-2)

**To be a center of excellence in green building and energy efficiency, New Mexico must:**

- **Develop a building energy efficiency renovation sector** (EE-1, EE-2, EE-3, EE-4, EE-5, EE-6, EE-7)
- **Maintain leadership in new construction of green buildings** (GB-1, GB-2, CG-2, CG-3)
- **Grow our cluster of green building product manufacturers** (GBM-1, GBM-2, GBM-3)

**To have a highly skilled and ready-to-work workforce, New Mexico must:**

- **Create an industry-driven green workforce development sector strategy aligned with these economic development goals** (WD-1)
- **Develop green economy data and career framework** (WD-2)
- **Expand green job training programs across the state** (WD-3)
- **Provide customized just-in-time training solutions for growing green businesses** (WD-4)

**Other important recommendations included in this report:**

- **Increase promotion of clean technology businesses** (CTM-1, WAQ-1, RR-1, RR-2, RR-3, RR-4, RR-5, RR-6, RR-7)
- **Support and grow our sustainable and organic agriculture industries** (SA-1, SA-2, SA-3, SA-4, SA-5, SA-6, SA-7, SA-8, SA-9)
- **Develop New Mexico as an ecotourism destination** (ET-1)
- **Develop low carbon transportation jobs** (e.g. mass transit and alternative fuels) (LCT-1, LCT-2, LCT-3)
- **Recognize and encourage environmental and energy efficiency jobs in all industries, especially the fossil fuel industry** (EEF-1, EEF-2, EEF-3, EEF-4, EEF-5)



## Green Jobs Cabinet Recommendations Summary

#	Recommendation	Policy	Administrative / Executive	PRC	Legislative	Funding	Relevant Goals
<b>Federal Stimulus</b>							
S-1	Preserve Green Jobs Created By the Federal Stimulus	X	X				1,2,4
<b>Renewable Energy</b>							
RE-1	Create an Office of Clean Energy Economic Development and Green Innovation		X		X		1,2,3,4,5
RE-2	Link severance tax funds to renewable energy investment	X		X	X	X	1,2,3,4,5
RE-3	Support New Mexico's Renewable Energy Transmission Authority	X	X		X	X	1
RE-4	Foster a National Renewable Energy Credit Market	X	X				1
RE-5	Work with Federal Government to Accelerate Federal Transmission Process	X	X				1
RE-6	Facilitate Setting a Price on Carbon Emissions By Supporting Regional and National Cap-And-Trade Policies	X	X				1,2,3,4
RE-7	Support Green Grid Innovations and Energy Storage R&D		X			X?	1,3
RE-8	Market and promote New Mexico's clean energy and clean technology assets, accomplishments and vision	X	X				1,2,3,4
<b>Wind Energy</b>							
WE-1	Support Good Local Wind Ordinances		X				1
<b>Geothermal Energy</b>							
GE-1	Make NM a Hot Dry Rock / Enhanced Geothermal System Leader	X					1
GE-2	Engage New Mexico Tech to Map Geothermal Resources		X			X?	1
GE-3	Demonstrate the use of geothermal energy from old oil and gas wells		X			X?	1
GE-4	Support Technology to Generate Electricity from Low Temp Resources		X				4





Solar Energy							
#	Recommendation	Policy	Administrative / Executive	PRC	Legislative	Funding	Relevant Goals
SE-1	Pioneer a New Model for Utility Regulation That Promotes Innovation and Renewable Energy Choices	X	X	X			1,2,3
SE-2	Evaluate Creating a State Performance Based Incentive for Renewable Energy	X			X	X	2
SE-3	Implement Real-Time Electricity Pricing			X or	X		1,2,3,4
Customer Scale Renewable Energy							
CS-1	Roll Out Special Assessment Districts		X				2,4
CS-2	Allow Third-Party Power Purchase Agreements			X or	X		2
CS-3	Put Solar on State Buildings		X			X	2
CS-4	"True Up" Solar Net-Metering Bills Annually			X or	X		2
CS-5	Demonstrate and promote the use of absorption chillers for solar cooling		X			X?	2,4
CS-6	Provide Incentives for Customer-Scale Small Wind				X	X	1,4
CS-7	Allow Meter Aggregation			X or	X		4
CS-8	Promote customer scale renewable energy to home and business owners	X	X			X?	1,4
CG-1	Promote Direct Uses of Geothermal Heat	X	X				
CG-2	Build Consumer Awareness of Ground-Coupled Heat Pumps		X				4
CG-3	Streamline Heat Pump Well Permitting		X				4
Community Scale Renewable Energy							
COR-1	Evaluate and Eliminate Barriers to Community Scale Renewable Energy	X	X	X or	X		1,2
Solar Manufacturing							
SM-1	Maintain Nation-Leading Solar Manufacturing Incentives	X				X?	2
SM-2	Provide Guaranteed Demand for Solar in State	X			X	X likely	2
SM-3	Provide Bonus Incentives for Using In-State Products	X			X	X	2
SM-4	Market New Mexico as the "Solar Valley" of North America	X	X				2
SM-5	Ensure a Trained Solar Workforce	X	X				2,5
SM-6	Support R&D on Next Generation Technologies		X				2
SM-7	Incentivize Manufacturing in Rural Areas	X				In place	2
SM-8	Create Green Industrial Parks	X	X				2

#	Recommendation	Policy	Administrative / Executive	PRC	Legislative	Funding	Relevant Goals
SM-9	Connect In-State Suppliers to Growing Manufacturers		X				2
<b>Clean Tech Manufacturing</b>							
CTM-1	Support All Clean Tech Manufacturing	X					
<b>Clean Technology Innovation and the Green Grid</b>							
CTI-1	Fund and Support the Research Applications Center	X	X			X	3
CTI-2	Focus on the Green Grid	X	X	X		X	3
CTI-3	Be a Catalyst for Seed and Mezzanine Financing	X				X likely	3
CTI-4	Invest in Entrepreneurial Training and Connection	X	X				3
CTI-5	Improve Commercialization	X	X				3
CTI-6	Market and Brand of NM Assets	X	X				3
CTI-7	Evaluate State Policy Effectiveness	X	X				3
CTI-8	Fund the Energy Innovation Fund	X	X				3
<b>Building Energy Efficiency</b>							
EE-1	Add EE to Special Assessment Districts				X		4
EE-2	Retrofit School Buildings Across NM	X	X			Net savings	4
EE-3	Grow the EE Workforce		X				4,5
EE-4	Retrofit State Buildings To Produce 20% Energy Savings by 2015		X			Net savings	4
EE-5	Help Develop Local EE Programs						4
EE-6	Monitor and Ensure Full Implementation of the 2008 Efficient Use of Energy Act	X					4
EE-7	Implement Decoupling	X		X			2,3,4
<b>Green Building Product Manufacturing</b>							
GBM-1	Extend Tax Credits to Green Building Products				X	X	4
GBM-2	Provide Bonus for Using In-State Products				X	X	4
GBM-3	Promote EE Manufactured Homes	X					4
<b>Green Building</b>							
GB-1	Establish 20% More Energy Efficient Green Building Code Statewide		X				4
GB-2	Keep Strong Green Building Incentives	X				In place	4
<b>Biofuels</b>							
B-1	Add Bio-gas to Clean Energy Incentives				X	X	1
B-2	Maintain Strong, Targeted Biofuel Incentives	X					1
B-3	Require Use of Approved, New Mexico Produced Biofuels				X	X?	1

#	Recommendation	Policy	Administrative / Executive	PRC	Legislative	Funding	Relevant Goals
B-4	Support Biofuel Research		X				1
B-5	Use NM Biofuels in State Fleets As Available		X			X ?	1
<b>Low Carbon Transportation</b>							
LCT-1	Evaluate Jobs in Mass Transit		X				
LCT-2	Encourage Mass Transit		X				
LCT-3	Develop Biofuel and Electric Vehicle Infrastructure	X				X ?	
<b>Recycling and Reuse</b>							
RR-1	Establish State Tipping Fee				X		
RR-2	Use Rubberized Asphalt		X				
RR-3	Help Develop Recycling Businesses		X				
RR-4	implement the recycled product provisions of the Solid Waste Act		X			X ?	
RR-5	Expand the Green Film Initiative		X				
RR-6	Require Recycling of Building Materials				X		
RR-7	Create Recycling and Reuse Zones				X	X ?	
<b>Water and Air Quality</b>							
WAQ-1	Extend Tax Credits to Clean Water and Air Products		X			X	
<b>Environmental and Efficiency Jobs in Oil and Gas</b>							
EEF-1	Quantify Efficiency and Environmental Jobs in Oil and Gas		X				
EEF-2	Increase Efficiency and Environmental Jobs in Oil and Gas		X				
EEF-3	Require Advanced Coal Technologies in Air Quality Permitting		X				
EEF-4	Develop an Emissions Performance Standard for all New Electric Generating Facilities		X				
EEF-5	Promote the U.S. Environmental Protection Agency's Gas STAR technologies and practices		X				
<b>Ecotourism</b>							
ET-1	Brand NM as Ecotourism Destination		X				
<b>Sustainable and Organic Agriculture</b>							
SA-1	Develop Local Food Systems		X				
SA-2	Provide Conservation and Agricultural Easements for Small Farms				X		
SA-3	Support Value Added Ag Companies		X				

#	Recommendation	Policy	Administrative / Executive	PRC	Legislative	Funding	Relevant Goals
SA-4	Develop High-Value Ag Niches		X				
SA-5	Help Farmers With Organic Markets		X			X likely	
SA-6	Encourage Sustainable Forest Products		X				
SA-7	Promote Irrigation Efficiencies for Agriculture		X				
SA-8	Provide Training in Sustainable Agriculture		X				5
SA-9	Support of the Development of Agricultural Offsets		X				
<b>Workforce Development</b>							
WD-1	Create a Green Economy Sector Strategy		X				5
WD-2	Develop Green Job Data and a Career Framework		X				5
WD-3	Expand Green Job Training Capabilities		X			X?	5
WD-4	Provide Just-In-Time Customized Training		X				5
<b>Water Use</b>							
W-1	Monitor and Measure Water Use		X				
W-2	Evaluate and promote the use of dry cooling for power generation		X				
<b>Environmental</b>							
E-1	Evaluate Environmental Impacts		X				
E-2	Develop permitting guides for green industries		X				
E-3	Support Sensible Local Ordinances		X				
E-4	Protect high-value agricultural land and potable water supply		X				
E-5	Proactively Establish Permitting for New Tech		X				
E-6	Utilize Supplemental Environmental Project (SEP) Dollars to Fund Green Jobs Initiatives		X				

## 5. OVERVIEW OF THE GREEN ECONOMY IN NEW MEXICO

### ***A Definition of the Green Economy***

The state defines green jobs as “family-supporting, career-track jobs that directly contribute to preserving or enhancing environmental quality.” Green jobs can be found in green industries like renewable energy, but also in a range of industries.

New Mexico industries that are considered green include:

- Renewable energy development, including solar, wind, geothermal and biomass power
- Clean technology manufacturing
- Commercialization of new clean technologies, especially “green grid” technologies
- Biofuels (algae, drylands farmed and manure-derived biogas)
- Energy efficiency and green building
- Environmental protection, cleanup and restoration
- Recycling and reuse
- Ecotourism (e.g., Eco Lodges and Eco Ranches)
- Organic and sustainable agriculture
- Low-carbon transportation

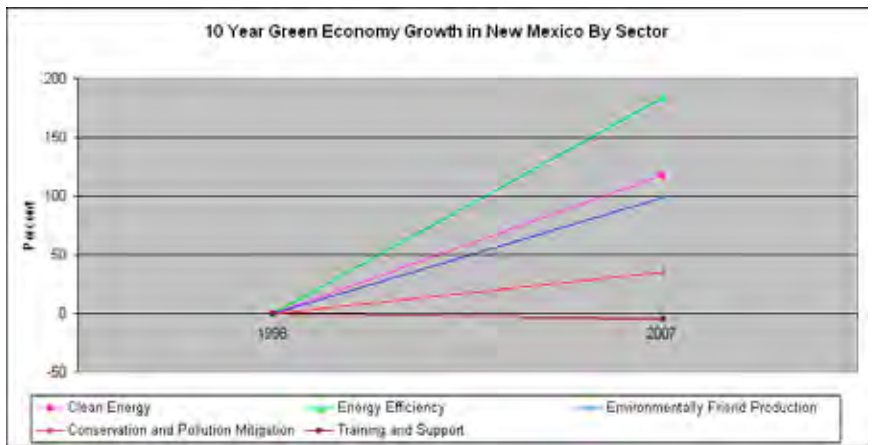
Green jobs exist outside these specific industries as well. These jobs are as varied as environmental analysis and design, green sales and marketing, energy efficiency and waste reduction, and environmental education. As our green industries grow, so will our support, supply and service businesses. Additionally, all our jobs will become increasingly green as energy efficiency and environmental awareness enter the mainstream. Green jobs promote environmental justice and provide “pathways out of poverty.” A detailed definition of green jobs is provided in the appendix.

### ***The Green Economy in New Mexico***

Between 1998 and 2007, green jobs grew by 50% overall in New Mexico, which is 25 times the rate of overall job growth.<sup>8</sup> New Mexico’s green economy is growing quickly, and has created jobs in both rural and urban areas. Over the past ten years New Mexico’s Clean Energy sector grew by 118%, Energy Efficiency by

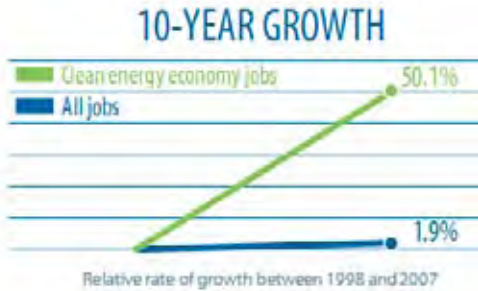


Mesalands Big Wind turbine



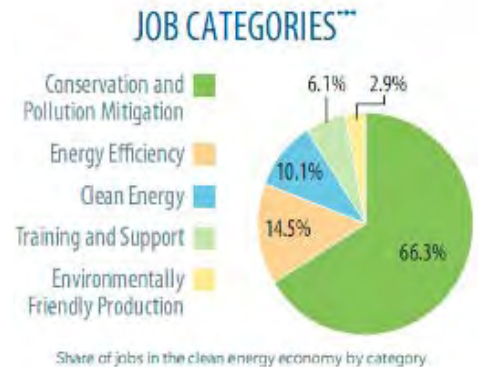
184%, Environmentally Friendly Production by 99%, Conservation and Pollution Mitigation by 35%, and Training and Support shrank by 5%. Unemployment in New Mexico was at 6.5% compared with 9.4% nationally in July 2009.<sup>9</sup>

Because the green economy is an emerging industry sector, additional detail on the number of green jobs in specific fields is needed and is being developed. Available federally approved tools do not provide the necessary coding to fully analyze and track green jobs. The State's Department of Workforce Solutions is seeking competitive funds from the federal government to undertake a comprehensive study of the green economy that will answer these questions.



### The Green Economy Will Generate Many New Jobs in New Mexico

Clean energy and energy efficiency create more jobs than other sources of energy. National estimates indicate that each \$1 million invested in clean energy and energy efficiency will create 16.7 jobs compared with 5.3 created through spending on oil, gas and coal.<sup>10</sup> The American Solar Energy Society estimates that the renewable energy and energy efficiency industries could create 37 million new jobs in the United States by 2030. New Mexico's share of that would be 236,800 jobs.<sup>11</sup>

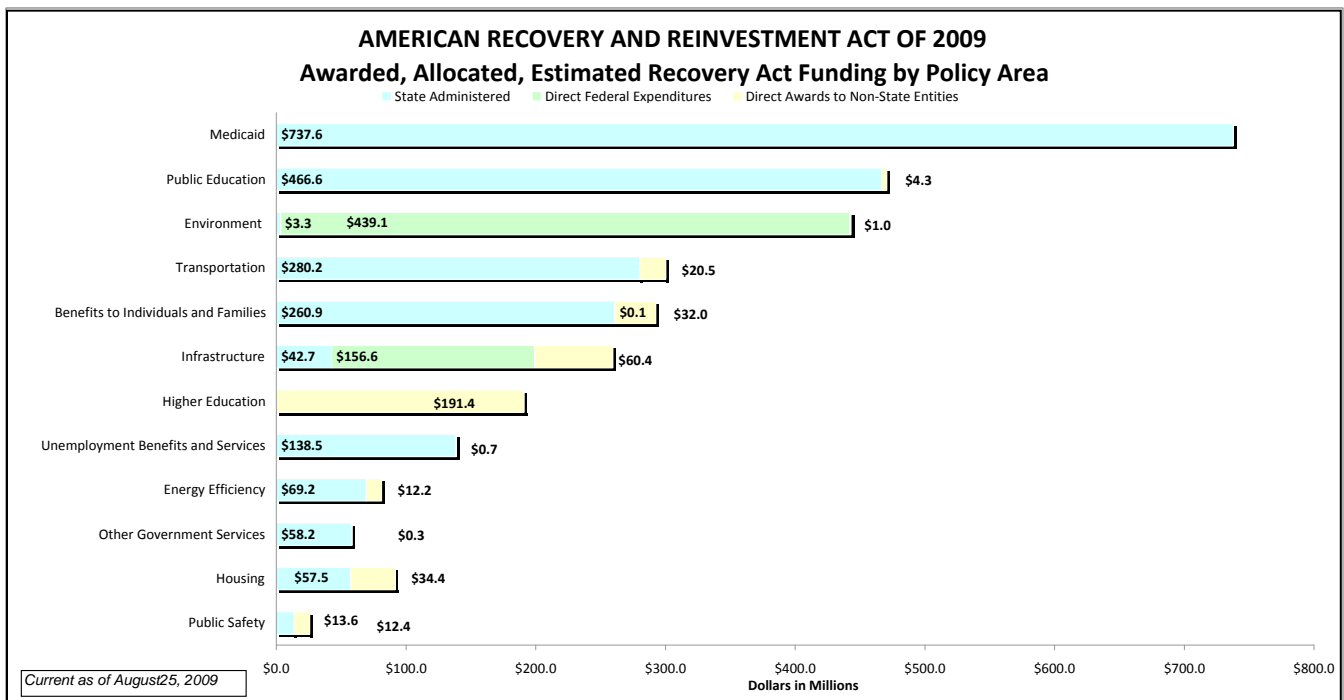


Significant input was also gathered from industry and business partners across New Mexico. Comments from these partners indicate that New Mexico is well positioned to experience job growth in a number of green industries and occupations. In particular, renewable energy, solar manufacturing, biofuel production, green building, building energy efficiency renovations and eco-tourism all show significant promise. These industries are discussed in detail below.

### Job Creation through the American Recovery and Reinvestment Act (ARRA)

In February 2009, the U.S. Congress passed the American Recovery and

Source: Pew Charitable Trusts



(Dollars in Thousands)

	State Administered	Direct Federal Expenditures	Direct Awards to Non-State Entities	TOTAL
Public Safety	13,642.6		12,416.4	26,059.0
Housing	58,905.2		51,612.4	110,517.6
Other Government Services	58,242.5		345.0	58,587.5
Energy Efficiency	70,556.2		67,647.6	138,203.8
Unemployment Benefits and Services	137,511.1		2,953.6	140,464.6
Higher Education			191,422.2	191,422.2
Infrastructure	42,735.6	167,710.5	71,407.9	281,854.0
Benefits to Individuals and Families	262,509.4	2,279.1	32,312.4	297,100.9
Transportation	264,900.0		36,229.7	301,129.7
Environment	3,320.0	460,264.2	1,000.0	464,584.2
Public Education	466,565.2		4,254.2	470,819.4
Medicaid	737,635.4			737,635.4
<b>TOTAL</b>	<b>2,116,523.1</b>	<b>630,253.8</b>	<b>471,601.4</b>	<b>3,218,378.3</b>

Current as of June 30, 2009

Reinvestment Act to provide stimulus to the nation's economy. This act focused significantly on renewable energy and energy efficiency. Nationally, this act provides \$11 billion for smart grid infrastructure, \$6 billion for loan guarantees for innovative renewable energy technologies, \$3.2 billion for Energy Efficiency Block Grants to local communities, \$3.1 billion to State Energy Programs, \$5 billion for the weatherization of the homes of low income citizens, \$3.6 billion for energy research, \$500 million for green job training, as well as other funds for improving the quality of drinking water, environmental cleanup and habitat restoration, public transportation and electric vehicle infrastructure.

Governor Richardson created the New Mexico Office of Recovery and Reinvestment to oversee New Mexico's

allocations of formula funds and ensure that competitive funds are attracted to New Mexico as well.<sup>12</sup> A summary of the funds received in New Mexico follows. Approximately \$81 million was received for energy efficiency and renewable energy projects, and \$443 million for environmental projects, funds that will create green jobs. Other funding streams, like housing and school construction, may also create green jobs. Data on job creation through this spending is not available as many of these funds have not yet been disbursed.

The ARRA will provide valuable stimulus to New Mexico's economy, but efforts will be needed to ensure that the jobs created can be sustained once the federal funding has been exhausted. This will require close collaboration between the state and industry partners over the next two years.





eSolar power plant technology utilizes small, flat mirrors which track the sun with high precision and reflect the sun's heat to a tower-mounted receiver, which boils water to create steam. This steam powers a traditional turbine and generator to produce solar electricity.

## Recommendations

### S-1 Preserve Green Jobs Created By the Federal Stimulus:

The state should engage with industry to find ways to permanently preserve temporary jobs created by the federal stimulus. Planning for the end of stimulus funds should begin now to allow time to develop job preservation strategies.

## 6. RENEWABLE ENERGY

Renewable energy generation presents a huge opportunity for economic development in New Mexico.

The production of renewable energy can be a big business for New Mexico, building on our tradition as an energy-exporting state. New Mexico has the second-best solar resource, the 12th best wind and the seventh-best geothermal resource of any state in the country.<sup>13</sup> No other state has this depth and diversity of renewable energy resources. As a state with a small population and large renewable energy resources, New Mexico has the potential to sell renewable energy to demand centers around the United States that are not able produce enough on their own. Renewable energy can create jobs all across New Mexico, both in rural and in urban areas and for our Native American Pueblos and Tribes.

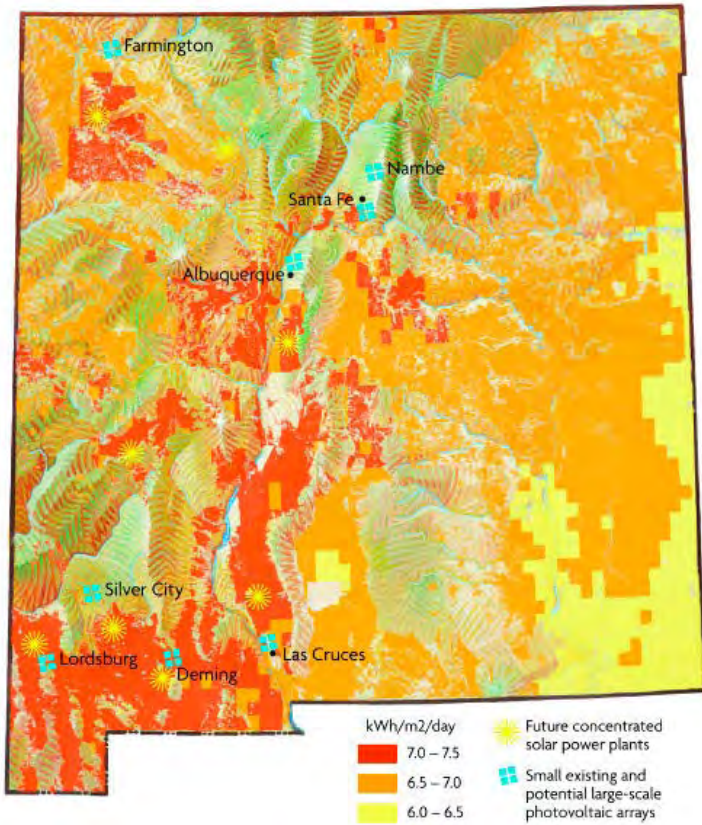
Demand for renewable energy is expected to increase in the coming decades. President Obama has made renewable energy and energy security a national priority. CNA Analysis and Solutions has produced a report entitled *Powering America's Defense* for the Department of Defense that identified climate change, dependence on fossil fuels and our aging electricity grid as threats to our national security. Their report promotes the development of biofuels, energy efficiency, renewable energy and a smart energy grid as national security issues.<sup>14</sup> With declining reserves of domestic fossil fuels, renewable energy will be the only alternative to meet our national needs. New Mexico is poised to take advantage of these possibilities. A 100 x 100 mile tract of New Mexico desert could produce more than one third of our nation's electricity need.<sup>15</sup>

WGA WREZ Capacity	Total MW
<b>New Mexico</b>	<b>27,124</b>
Arizona	23,824
California	23,693
British Columbia	21,315
Nevada	20,863
Colorado	18,183
Wyoming	14,869
Montana	10,206
Baja California	7,928
Alberta	6,497
Texas (panhandle)	4,787
Oregon	4,378
Washington	3,905
Idaho	2,249



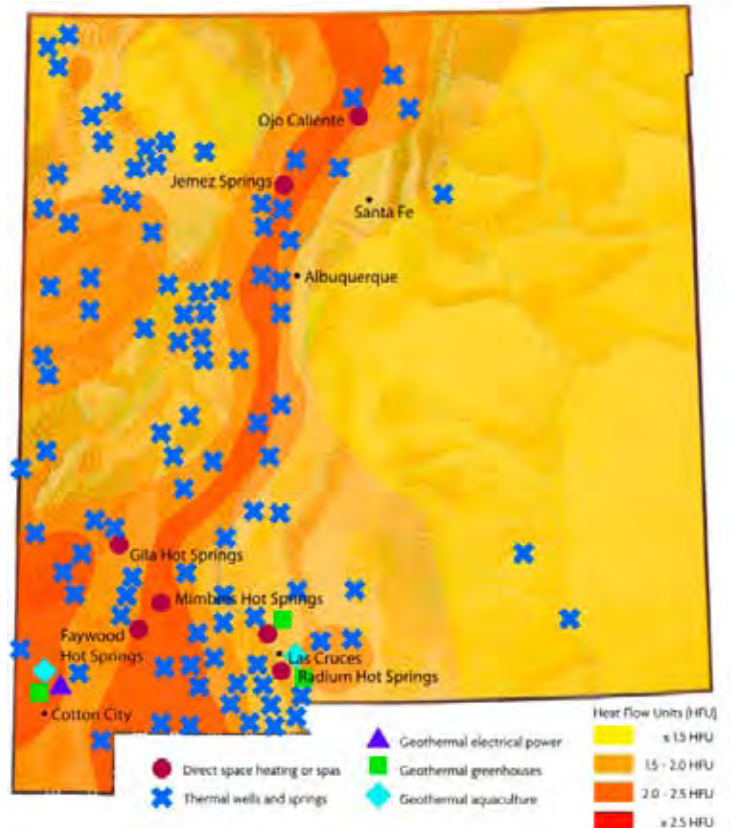


# SOLAR POTENTIAL



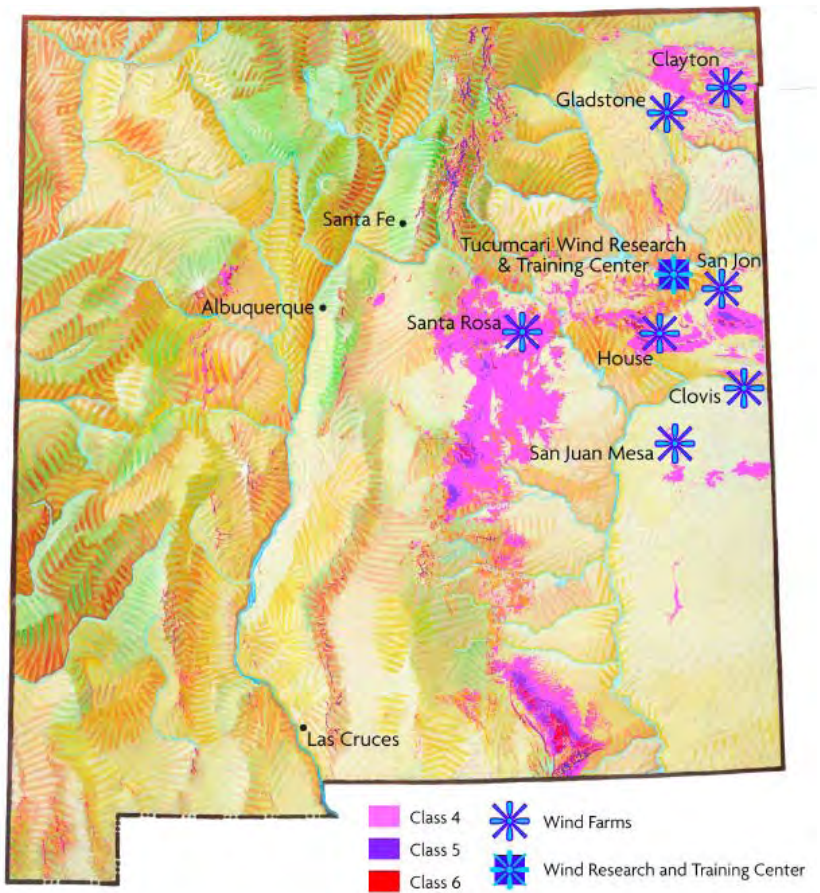
Source: Dreaming New Mexico  
<http://www.dreamingnewmexico.org/>

# GEOHERMAL + HYDROPOWER





## WIND POWER



Source: Dreaming New Mexico  
<http://www.dreamingnewmexico.org/>

New Mexico has already been identified as a future leading provider of renewable energy for the country. The Western Governors’ Association’s Western Renewable Energy Zones (WREZ) process has identified New Mexico as having the leading developable renewable resources in the western grid, which includes western Canada and Baja California.<sup>16</sup>



Source: DOE EERE

New Mexico is strategically positioned at the intersection of three of the United States’ 10 major electricity grids. Electricity does not easily flow between these grids and they are largely independent. Being at the intersection of three grids provides a unique opportunity to sell power to load centers in all directions. Our diverse intermittent renewable energy sources can be combined together to provide a higher “load factor” for the transmission lines that carry this power. This strategic location can make New Mexico a hub of renewable energy trading, which would also create new jobs in that field.

Selling these large quantities of renewable energy is called “utility-scale” renewable energy. Utilities or energy developers build large systems of many megawatts of capacity and send the electricity generated, generally over long distances, to areas where it is needed, usually cities or large industrial operations. Utility-scale is in contrast with “customer-scale” renewable energy, which is much smaller, usually serving one or a small number of customers. Customer scale renewable energy is

sometimes called “energy harvesting” because it collects the energy on the site where the customer is located.

Utility-scale renewable energy can be solar, wind, geothermal, biomass or hydroelectric powered. Given that New Mexico is an arid state, hydroelectric power is not available in large quantities here and is not addressed by this report. Other forms of renewable energy are discussed individually below.

As in the rest of the United States, the biggest barrier to the expansion of utility-scale renewable energy generation in New Mexico is a lack of transmission capacity. Generally these projects will be built in rural areas lacking the infrastructure to carry the megawatts of power that will be generated. In addition, transmission projects can take years to build which delays development of renewable energy that depends upon it.

There is a variety of initiatives underway to address this barrier:

- The Renewable Energy Transmission Authority (RETA), created by the State Legislature and Governor Richardson, will develop new transmission to serve renewable energy installations in New Mexico. RETA also coordinates with multi-state transmission projects like SunZia, High Plains Express and others to ensure New Mexico’s needs for transmission capacity are met.
- Utilities are expanding transmission as needed to serve their customers, but this is a relatively small potential. Utilities are in the business of providing power to local users, not to selling retail power to other regions.
- Proposed federal energy legislation has provisions that will accelerate transmission siting and permitting processes, and provide some financing solutions.<sup>17</sup>
- Several private developers and public companies have plans for transmission projects that will go through New Mexico.

# REGIONAL GRID



Source: Dreaming New Mexico <http://www.dreamingnewmexico.org/>

In the short term, it may be possible to expand the market for New Mexico’s renewable energy by strengthening the national Renewable Energy Certificate (REC) and carbon markets. A national Renewable Energy Standard for renewable electricity, such as Congress is considering this session, would create additional demand for RECs. Currently, REC markets are regional, but an integrated national REC market would allow renewable energy generated in New Mexico to benefit states in other regions with a renewable energy deficiency, like the Mid-Atlantic.<sup>18</sup> Through this process, the lowest cost renewable energy resources in the U.S. would be developed first, and many of these resources are in New Mexico.

There are other challenges that slow renewable energy development nationwide. Uncertainty about the longevity of incentives, caps on incentives, backlogs in the transmission interconnection queue, and lack of national carbon pricing are all problems. These are challenges in other parts of the country as well. First, when incentives do not extend for several years into the future, developers cannot easily plan because the incentives may disappear before they can use them, resulting

in years of wasted time. Second, interconnection queues are filled with many speculative projects that are not feasible and will never be built. We need to move feasible, funded projects to the head of the line. Finally, if national carbon pricing (e.g., cap and trade) were implemented, the price of existing fossil fuel-driven generation would rise and renewable energy would become more cost competitive.

## ***New Mexico and Carbon Regulation***

New Mexico is a founding member of the Western Climate Initiative (WCI). The WCI is a collaboration of seven U.S. states and four Canadian provinces that are working together to address climate change. Six U.S. states, six Mexican states and one Canadian province are observers to the WCI process. Over the past two years, the WCI has worked with stakeholders to design an economy-wide cap-and-trade program. The framework design was completed in September 2008 and represents the most comprehensive U.S. cap-and-trade program designed to date. The program is scheduled to



**BLUE = WCI Partners**  
**YELLOW = WCI Observers**

start in 2012. By 2015, when the program would be fully implemented, it is expected to cover 90% of the emissions in our states and provinces. Since September, the WCI has been working on the detail of the design and developing the essential elements each state and province will use to develop or adopt administrative regulations to implement the program.

Currently, Congress is considering a national cap-and-trade program. When the environmental costs associated with greenhouse gas emissions are internalized (e.g., through a cap-and-trade program), the price of existing fossil fuel generation is expected to increase and renewable energy will become more cost competitive.

Ideally, the federal government would enact aggressive federal legislation to combat climate change and support clean energy. Lacking that, New Mexico will continue to actively participate in the WCI.

In addition to utility-scale renewable energy, there are many opportunities for customer-scale renewable energy (e.g., solar panels on rooftops). These opportunities will be explored in a separate section below.

### **Recommendations**

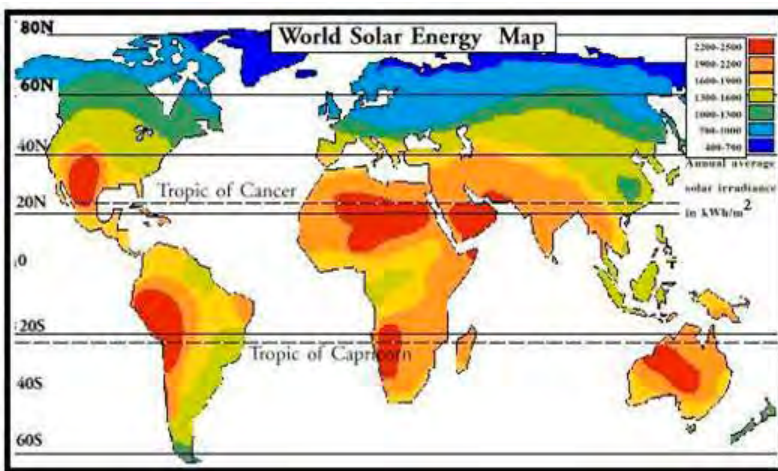
- **RE-1 Office of Clean Energy Economic Development and Green Innovation:** Create an Office of Clean Energy Economic Development and Green Innovation, either in the Governor’s Office or the Economic Development Department, to provide targeted support for these industries.
- **RE-2 Link severance tax funds to clean energy investment:** Link a portion of severance tax revenue to incentives and programs for growing the clean energy economy and workforce education. This will invest in and preserve our tradition as an energy exporting state.
- **RE-3 Support and Fund RETA:** Support and fund RETA to provide “feeder” transmission lines to new renewable energy projects. Work with RETA to ensure national and regional transmission projects serve New Mexico and move forward as quickly as possible. Pass any necessary amendments to RETA’s enabling legislation to ensure it has the tools necessary to accomplish its mission.
- **RE-4 National Renewable Energy Credit Market:** Explore alternative mechanisms for developing markets for New Mexico’s renewable energy. This includes a more efficient, cross-regional national market for Renewable Energy Credits (RECs) and carbon credits that allow out-of-state users to purchase the renewable components of our power without actually receiving delivery of the electricity. Work with our federal delegation to Congress to encourage this market. Ensure that state policy gives generators of renewable electricity ownership of their RECs and that they have unfettered access to markets.
- **RE-5 Improved Federal Transmission Process:** Advocate for expedited federal transmission processes and “queue reform” with our federal delegation to Congress and the FERC.
- **RE-6 Facilitate Setting a Price on Carbon Emissions By Supporting Regional and National Cap-And-Trade Policies:** A cap-and-trade system is a market mechanism in which greenhouse emissions are limited or capped at the specific level, and those participating in the system can trade permits (a permit is an allowance to emit one ton of carbon dioxide equivalent). Creating a market price for carbon dioxide and other greenhouse gas emissions will make renewable energy more cost competitive with fossil generated electricity.
- **RE-7 Green Grid and Energy Storage R&D:** Work with our national laboratories and universities to support the development of “Green Grid” and

economical utility scale storage technologies that make renewable energy “dispatchable” for utilities.

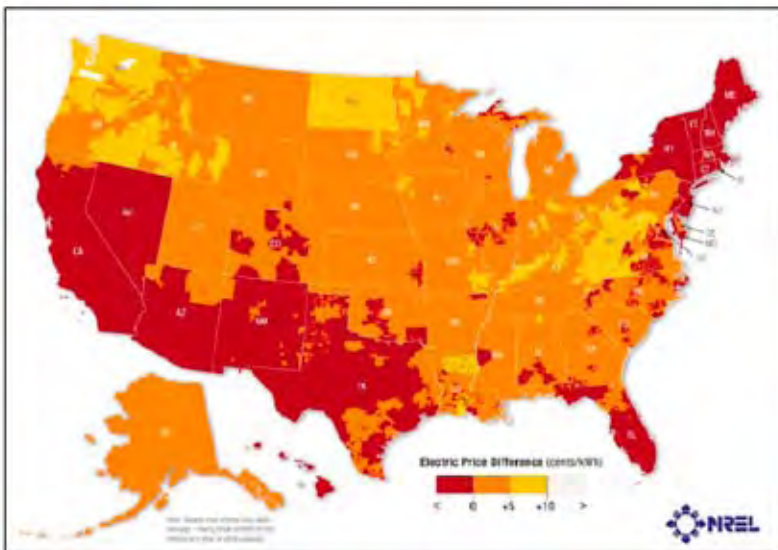
- **RE-8 Market and promote New Mexico’s clean energy and clean technology assets, accomplishments and vision:** New Mexico’s achievements and potential have largely been relatively unheralded. Efforts to increase the state’s profile will be rewarded with additional public and business attention and investment. An existing state brand, “Pure.Energy.Innovation.” should be more widely used.

## A. Solar Energy

*The future of solar energy in New Mexico is very bright.*



With the second-best solar resource in the country, New Mexico is very well positioned to benefit economically from the installation of solar energy systems. Our climate is ideal for both solar thermal and photovoltaic technologies, both at the customer and at the utility scales. Not only are our resources among the best in the country, they are among the best in the world, which is why companies from Europe, Asia and elsewhere have an interest in developing solar power here.



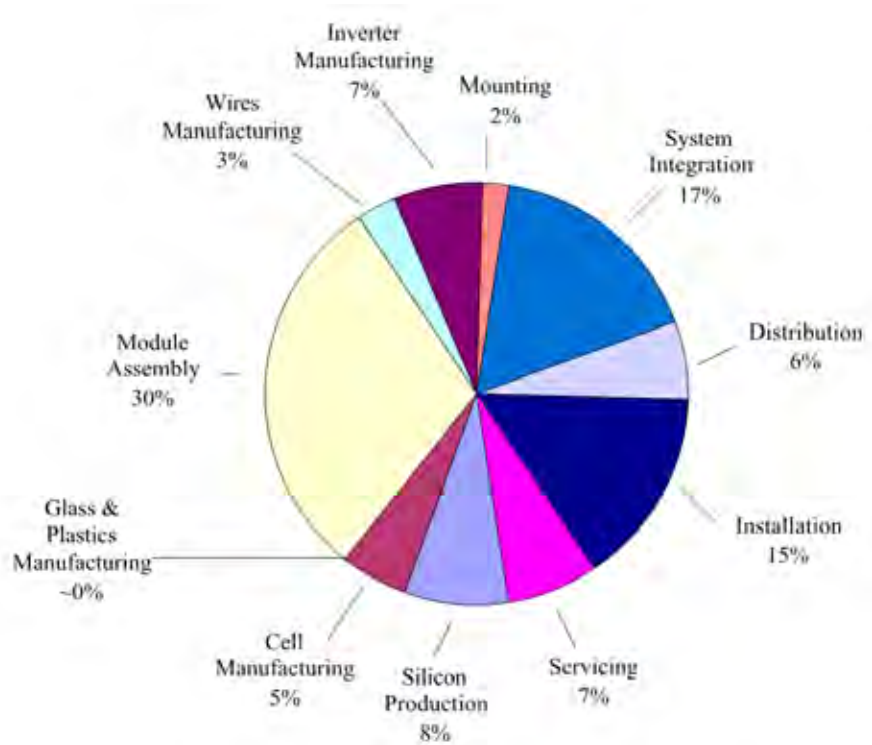
The National Renewable Energy Laboratory projects that New Mexico will have solar power at prices comparable to standard electricity rates by 2015.<sup>19</sup> As prices move closer to “grid parity” with electricity, demand will accelerate exponentially. The Solar Energy Industry Association anticipates 19,000 new solar jobs will be created in New Mexico by 2016,<sup>20</sup> the highest per capita gain in the country.

***New Mexico can develop a vertically integrated solar industry and become the “Solar Valley” of North America.***

Growth in solar installations will not only create installation, operation and maintenance jobs, but manufacturing jobs as well as research, development and start-up jobs. Manufacturing firms will be attracted by the demand for their solar products in-state. Our research institutions already have many talented

2015 PV and Electricity Price Differences for Residential Systems without Incentives and Moderate Increase in Electricity Prices.

scientists working on solar and other renewable energy technologies and their ranks will increase. New Mexico venture capitalists will help to commercialize these technologies into new products and businesses, creating other jobs. Every job created in the installation of solar systems will be multiplied several times in the rest of the solar value chain.



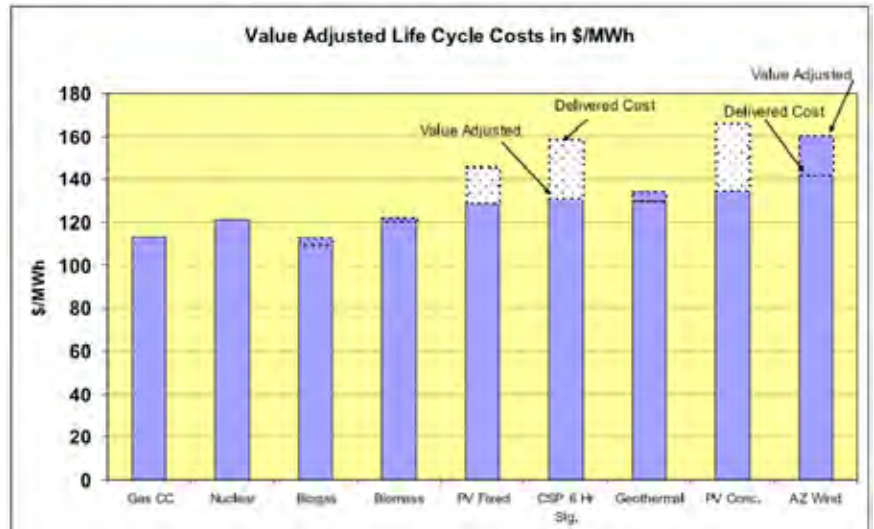
Breakdown of Jobs in the solar industry from Job Creation Studies in California for VOTESOLAR, 2004.

### Utility-Scale Systems

Utility-scale solar systems that generate electricity can be either solar thermal or photovoltaic and announcements have been made for both types in New Mexico. El Paso Electric has announced a 92 MW solar thermal facility near Santa Teresa, and Tri-State Generation has announced 30 MW of photovoltaics near Cimarron. The El Paso Electric project is estimated to employ more than 20 people full time and 400 people during an 18-month construction phase. Sandia National Laboratory is a leader in solar research. A joint project between Sandia Labs and Stirling Energy Systems has set the world record for the efficient conversion of



LANL developed a technology for the production of higher-density microchips than can be made today, while also eliminating the need for vast amounts of water and many of the hazardous chemicals used in current fabrication processes.



Source: Arizona Public Service. Costs adjusted to be comparable on a capacity and energy basis and include system integration costs

solar thermal energy into electricity.<sup>21</sup> Stirling engines are attractive in the arid west because they require significantly less water during operation than a steam engine.

Although solar power is perceived as expensive, its benefits of being co-incident with peak demand load make it more attractive than it appears on initial inspection. The chart from Arizona Public Service illustrates how this value affects costs. The comparative benefits of solar power are likely to increase, making it a more frequently deployed technology, further driving growth in this sector.

### RPS and Demand for Solar Power

Deployment of these systems is driven by our state Renewable Portfolio Standard and by our state Production Tax Credit. (See appendix for a summary of the RPS.) But our Renewable Portfolio Standard is not likely to stimulate much additional growth in solar in the next few years, as utilities are already on track to meet the limited requirements established by the RPS for 2015. Additional steps will need to be taken to stimulate demand. For example, increasing the cap on the Production Tax Credit from 500,000 MWh to 1 million MWh will help to ensure that incentives for utility-scale renewable energy continue to exist.

### Recommendations

- **US-1 Raise the Cap on the Solar Production Tax Credit and Harmonize with the Advanced Energy Tax Credit:** Raising the cap for solar energy on the state Production Tax Credit (PTC) from 500,000 MWh to 1 million MWh will help to ensure that incentives exist for the



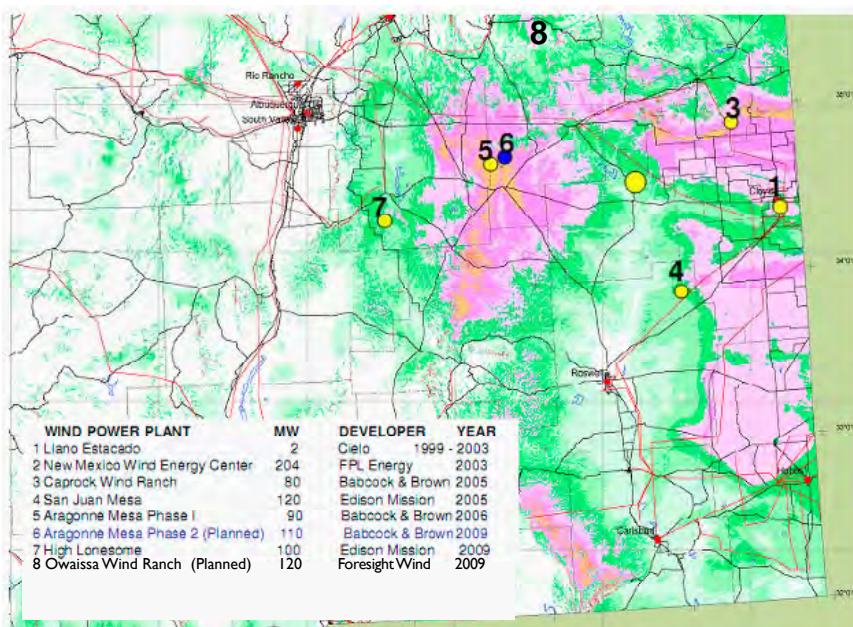


continued development of utility-scale renewable energy. Ensure that the PTC and Advanced Energy Tax Credit (AETC) can be claimed together by solar projects and that the AETC works as originally intended. Ensure solar projects receive the same tax advantages already received by wind projects.

## B. Wind Energy

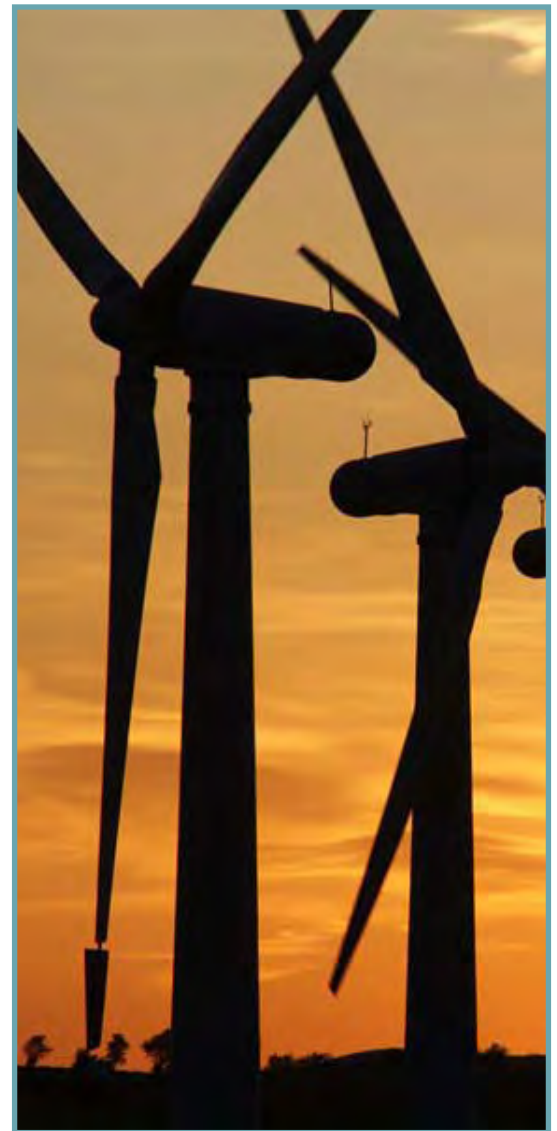
**Wind energy is already providing rural jobs and can provide many more.**

Currently, New Mexico has 600 MW of installed wind capacity. Over 200 MW of additional capacity is nearing construction, with many more megawatts in various stages of planning. These installations are generally in the eastern plains of New Mexico where the highest classes of wind are located. New Mexico's wind resource ranks 12th in the nation, and is in the top 10 when less economical offshore wind production is excluded. New Mexico has the highest per capita wind energy usage of any state in the country, and Public Service Company of New Mexico (PNM) has one of the highest percentages of wind grid penetration of any utility, with about 4% of its annual energy production coming from wind.<sup>22</sup>



WIND POWER PLANTS IN NEW MEXICO

Mesalands Community College in Tucumcari is home to the North American Wind Research and Training Center. It is one of the leading wind technician training programs in the country and the only one with a turbine that can be stopped for educational purposes. GE Wind has made a pledge to hire all recent graduates as a testament to their program.<sup>23</sup>



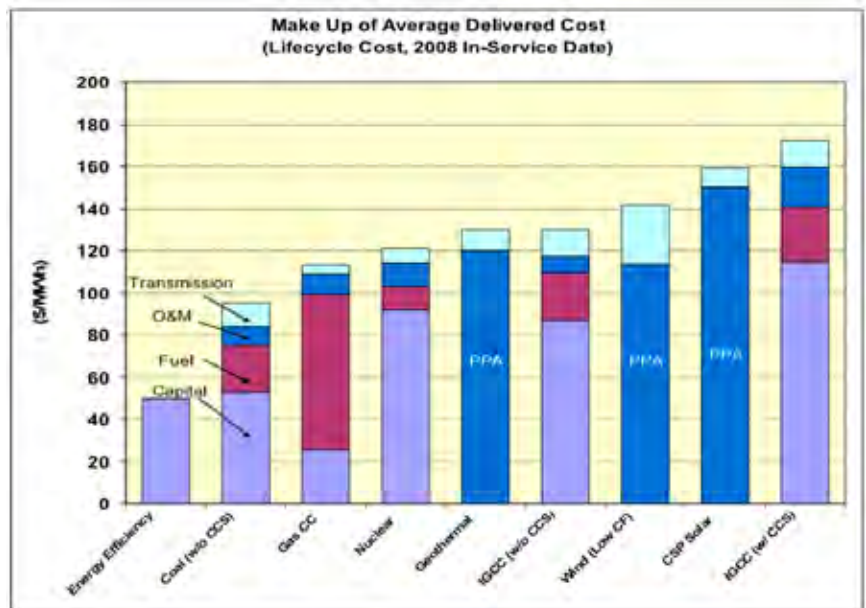


Mesalands construction

Recently, over 2,000 landowners representing over 2 million acres of land in New Mexico came together to form the Coalition of Renewable Energy Landowner Associations.<sup>24</sup> This coalition will enable landowners to share information, better negotiate land deals, and provide an access point for interested developers.

Wind energy is currently among the most available and cost competitive renewable energy sources in the southwest. The DOE estimates that the country could get 20% of its energy from wind sources by 2030 with only a 2% cost premium over fossil fuel generation.<sup>25</sup> The drawback of wind power for utilities, however, is that the most wind energy is produced during “off peak” periods. This creates a mismatch that allows wind to serve only 20-25% of a utility’s demand without storage technology, which is not yet economical. But wind remains in high demand and expansion will proceed quickly.

Wind creates approximately one operation-and-maintenance job per three or four MW of wind installed.<sup>26</sup> Using this rule of thumb, 600 MW of wind has created 150 - 200 new wind technician jobs in New Mexico. However, the impact of these systems also has indirect and induced effects that should be considered. Using NREL’s standard JEDI wind model, 100 MW of wind creates 588 jobs during construction and 28 jobs on an ongoing basis. (See appendix for summary of this analysis.)



Source: Arizona Public Service

## Recommendations

- **WE-I Support Local Wind Siting Ordinances:** Work with rural communities to develop sensible codes for the installation of large and small wind turbines, following national best practices. Joint Memorial HJM075 from 2009 calls for similar action.

## C. Geothermal Energy

### Geothermal energy will create jobs as the technology matures.

Geothermal heat from the earth can be used profitably in two primary ways:

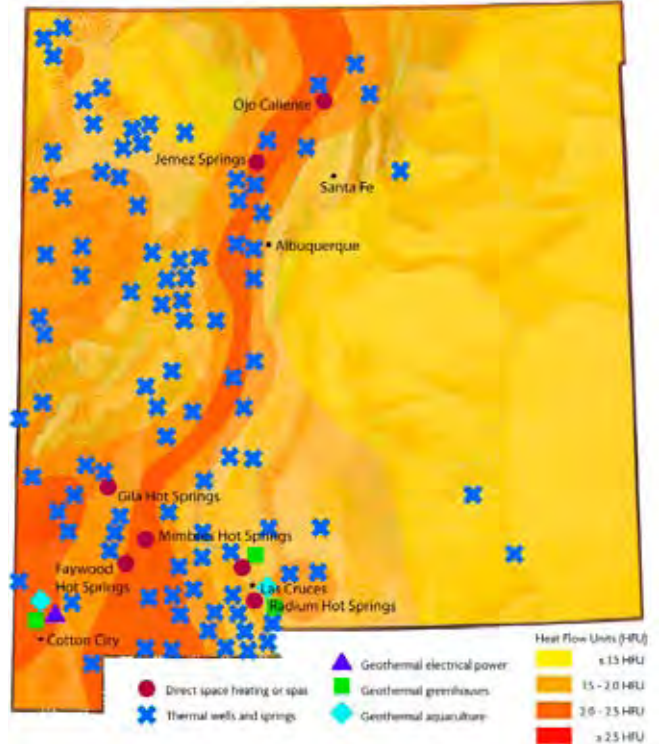
- To generate electricity
- To generate heat for “direct use” applications

Generating electricity economically from geothermal sources generally requires a heat source of 250 degrees Fahrenheit or greater, to generate the necessary steam to drive a turbine, although advances in technology are allowing power to be generated from lower and lower temperatures. Most often, high temperature resources require deeper wells to access, but there are some high temperature resources at the surface in New Mexico. There have been proposals to build a 10 MW geothermal power plant near Lordsburg, and researchers at Los Alamos National Laboratory have operated a “hot dry rock” (HDR) demonstration facility in the Jemez Mountains. New Mexico Tech also has leading geothermal researchers and is developing a geothermal educational program.

Because of the state’s limited water resources, an appropriate geothermal power generation technology for New Mexico is “binary” power, which is a closed-loop system that recycles the water used. In particular, New Mexico is very well positioned to be a leader in Hot Dry Rock, otherwise known as Enhanced Geothermal Systems (EGS). This technology is able to exploit geothermal heat even where no natural hot springs exist.

Geothermal power is attractive to utility companies because it generates power 24 hours a day and is “dispatchable” in contrast with wind or solar power (until storage becomes economically viable at scale). It is a renewable energy “baseload” source that can support other renewable power and replace fossil fuel baseload sources like coal over time. The strength of our geothermal resource in southwestern New Mexico in the path of the proposed SunZia transmission line is a state asset.<sup>27</sup>

## GEOTHERMAL + HYDROPOWER



Source: Dreaming New Mexico  
<http://www.dreamingnewmexico.org/>



Industry experts estimate approximately five employees are required to run every 10 MW of geothermal power, and 125 construction workers are needed for six months during construction.<sup>28</sup>

### ***Synergies with the Oil and Gas Industry***

One of the largest costs in geothermal power systems is the drilling of the wells necessary to access the high temperature resources. These wells may need to be 10,000 ft deep or more. The two industries could collaborate on the use of wells. Instead of capping spent oil and gas wells where there is a high temperature resource, the wells could be reused for geothermal power. This would create a synergy between our conventional fuels industry and our growing renewable energy industry. Many of the jobs associated with the oil and gas industry are identical in geothermal power, which may help to buffer the booms and busts in fossil fuels and keep people employed.

### ***Recommendations***

- **GE-1 Make NM a Hot Dry Rock / Enhanced Geothermal Systems Leader:** Set the goal of pioneering the productive use of these resources in New Mexico.
- **GE-2 Engage New Mexico Tech to Map Geothermal Resources:** Work with in-state researchers to better map and assess potentially high-value geothermal resources across the state.
- **GE-3 Demonstrate the use of geothermal energy from oil and gas wells:** Demonstrate ways to leverage existing wells drilled by the oil and gas industry for geothermal energy.
- **GE-4 Technology to Generate Electricity from Low Temp Resources:** Work with researchers in-state to explore technologies that will allow electricity to be generated economically from low temperature resources.

## **D. Customer-Scale Renewable Energy**

There are customer-scale solutions for homes, businesses and institutions that harness solar, wind and geothermal energy. These markets and their growth potentials are discussed below. “Community-scale” systems that serve a neighborhood or town are also considered.

### ***Solar Energy: Customer-Scale Photovoltaics***

Generally, any single-story, energy-efficient building can obtain all of the energy it needs with installation of solar systems on its roof. This makes these systems



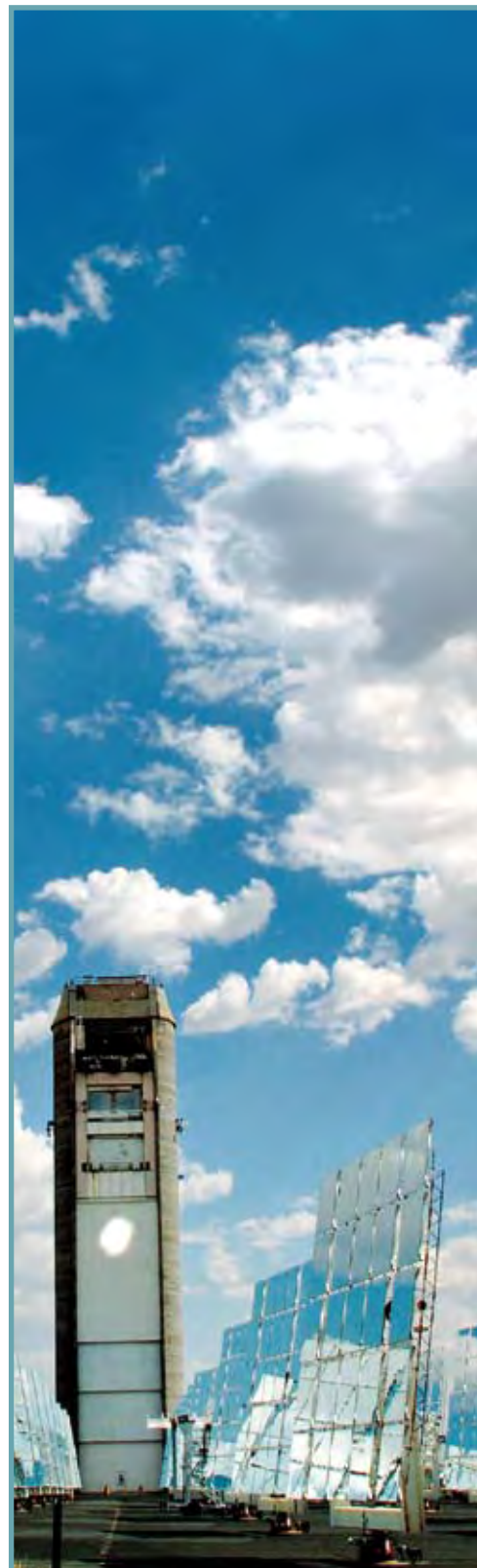
attractive to many types of users. In addition to the environmental benefits of installing such systems, they also allow customers to lock in a cost of electricity for life of the system (generally 20 years or more). In the face of expected increases in the cost of electricity over time, this is an attractive solution for many.

The customer-scale photovoltaic market, while modest, is displaying strong growth. In 2007, 104 applications for solar tax credits were processed in New Mexico. In 2008, there were 186 applications, representing an increase of 75%.<sup>29</sup>

But there is much further to go for solar energy in New Mexico. Real installations have not yet matched the potential of our solar resource. For example, PNM ranked 44th out of 93 utilities in terms of photovoltaic watts installed per customer on the customer side of the meter and 49th on the utility side.<sup>30</sup> In addition, the Renewable Energy Portfolio Procurement Plan submitted by PNM for 2010 only calls for a total maximum of 4.2 MW of solar in their commercial “Large PV” program and an annual cap of less than 1108 kW for their “Small PV” residential program.<sup>31</sup> These very low caps will not be sufficient to grow our solar industry in New Mexico.

There are many reasons for this mismatch between our potential and what has been realized, but the primary reasons are economics and regulations. Consider the situation for customer-scale photovoltaic residential and commercial installations:

- **Cheap electricity creates a large gap:** Perhaps the most important factor is the availability of cheap electricity powered by coal. Solar energy can cost 20 cents per kilowatt-hour (kWh) or more and retail electric rates in New Mexico can be 9 cents per kWh. This creates a gap of 11 or more cents per kWh that must be bridged with incentives to stimulate widespread adoption. This is a cost that must ultimately be borne by the ratepayer or the taxpayer but will generate returns in terms of job creation and new tax revenue. Requiring that utilities use solar energy in a Renewable Portfolio Standard only results in those costs being passed on to the ratepayer. Other states that are leading the nation in solar deployments, like New Jersey and California, have much higher electricity costs and thus the gap that must be bridged is smaller.
- **A state with a small population has less to invest:** As a state with a relatively small population and therefore, limited tax revenues, it can be difficult to match the incentives put in place in larger states. As a percentage of total budget, larger states can invest more and spread it over more





consumers, reducing the impact on a per capita basis. For example, New Mexico's budget for state solar incentives in 2008 was \$5M, whereas in California it was \$295M. New Mexico would have had to spend \$15M on an equivalent per capita basis. Even per person, California has made a large investment: \$8.06 per person in the state vs. New Mexico's investment of \$2.50 per person. (From data provided by DSIRE.<sup>32</sup> See appendix for spreadsheet.)

- **A lack of low-interest financing:** Solar systems require a large upfront investment, but generate benefits every month that offset electric charges. Low-interest financing can help to make these systems affordable on a monthly basis. HB 572 and SB 647 from the 2009 legislative session allow cities and counties to create special assessment districts that should help to reduce financing costs.
- **No real time electricity pricing:** This is an economic and regulatory issue. Electricity is significantly more expensive for a utility to produce or acquire during "peak" hours in late summer afternoons. But there is significant overlap between when a solar system is producing power and when peak demand occurs. In New Mexico it is possible to get on-peak and-off peak rates, but "real time" pricing that varies moment to moment does not presently exist. This type of pricing requires a "smart meter" to use. Several other states have made this type of pricing available. If customers were able to access real time pricing, the economics of solar power get much more attractive because they can offset their most expensive power with solar power.
- **Absence of "third-party provider" rules that allow power purchase agreements (PPAs):** This is a regulatory issue with economic consequences. The Public Regulation Commission is currently considering whether to allow PPAs that allow a customer to contract with a third party to own and operate a solar system on their home or business and simply pay the third party a fixed price for each kWh generated.<sup>33</sup> This is currently allowed in 11 other states and has been critical to the expansion of commercial-scale solar power in those states. It is difficult for many businesses to own and operate their own systems so they prefer these arrangements. Non-profit organizations like the state, municipalities, Tribes, schools and universities are not able to access tax credits, so contracting with a for-profit third party provider is essential to make these systems economical. There is approximately 100 million square feet of commercial roof area in New Mexico, so this is a large potential market for solar.<sup>34</sup> The roof area of government buildings and schools presents a large opportunity as well.



- **Solar net metering “true up”:** Solar systems produce the most power in the summer and less in the winter. As a result, it is most economical to generate excess power in the summer and use this credit in winter. Currently this option is not available in New Mexico and bills must be trued up monthly, resulting in lower payments being made by the utility to the rooftop solar owner.
- **The Reasonable Cost Threshold and ability to invest for the future:** The Reasonable Cost Threshold (RCT) that the utilities must meet can make it difficult to invest today in improvements that will save consumers money in the future or that have economic development implications. Nuances in how this threshold is evaluated and calculated and what investments are allowed need to be given a close look to remove any unintended consequences.

In the absence of significant regulatory changes, the New Mexico Renewable Energy Industry Association is projecting a doubling of the market for each of the next several years. They conservatively estimate a need for 58 new workers in 2010 and 145 in 2011. (See appendix for details.) However, given the strong interest from New Mexico citizens in seeing greater growth of solar energy and the steady reduction in cost of these systems, this projection could be exceeded.

***A New Business and Regulation Model for Utilities is Needed***

Currently, utilities in New Mexico earn their profits by selling electricity that they have generated. A fundamental concern about this model in the emerging age of renewable energy and energy efficiency is that *both* of these economic development opportunities erode utility revenues and therefore, profits. Every time a customer installs a solar panel or improves the insulation in his or her roof, the utility company will make less money because it will sell less electricity to that customer. This results in a major misalignment of incentives in a state that is seeking to grow these sectors. In addition, the traditional centralized utility electricity generation model makes it difficult for third-parties to enter the electricity market, which stifles innovation.

The State of New Mexico should engage the Public Regulation Commission and the utilities in exploring new, innovative business and regulation models that better align profit-making incentives for utilities and create opportunities for innovation to allow our economy to grow and thrive. There is a growing recognition that a major shift is necessary and the American Recovery and Reinvestment Act encourages regulatory changes. Investor-owned utilities struggle to recover their



costs and provide a return to their shareholders, rate payers do not benefit from incentives that could save them money in the long term, and New Mexico citizens are left without jobs that might otherwise have been created. Changes that foster innovation, third-party participation and the rapid adoption of energy efficiency and renewable energy will help New Mexico's green economy to grow. Separating the responsibility for electricity generation from the provision of transmission and distribution should be considered.

The PRC's Utility Division mission as provided in New Mexico legislation is to protect the "public interest."<sup>35</sup> The statutory language continues, "In order to represent the public interest, the utility division shall present to the commission its beliefs on how the commission should fulfill its responsibility to balance the public interest, consumer interest and investor interest." It is time to reexamine how public interest is interpreted and this balance advocated to move beyond a narrow interest on enforcing low *rates*, to look more broadly at producing low monthly *bills*, at protecting future ratepayers from foreseeable cost increases, and even more importantly, at *economic development* impacts that affect all citizens. This change will be difficult, but ultimately very worthwhile. What is commonly referred to as "decoupling" is one proposal to address some of these issues.

This is a problem all across the United States, but is a particularly acute problem in New Mexico given the challenges outlined above. New Mexico should take national leadership in developing a next generation model for utilities that unlocks growth and innovation, allowing new market entrants to provide value for ratepayers and citizens. Policy development support is available from organizations like the Galvin Electricity Initiative, California's Public Utilities Commission, the Regulatory Assistance Project, the National Association of Regulatory Utility Commissioners and other sources.<sup>36</sup>

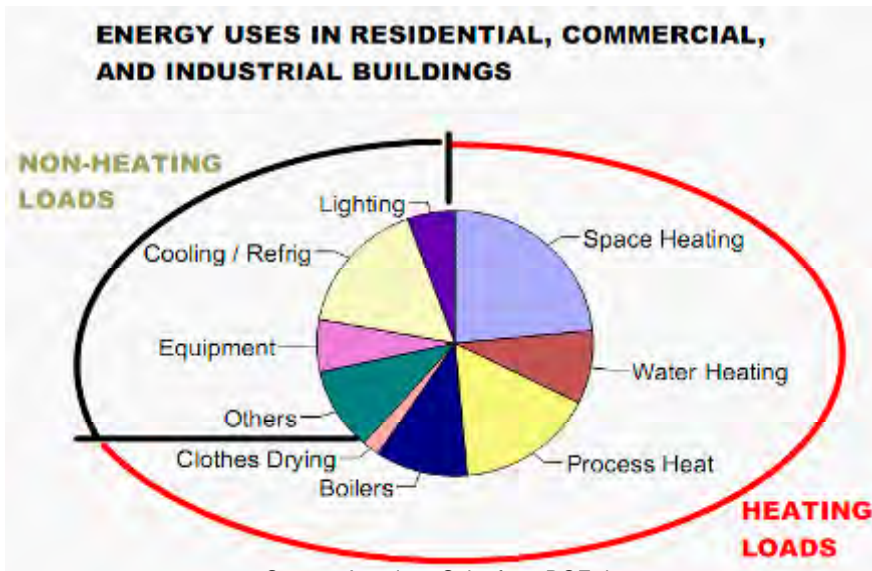
### **Customer-scale solar thermal systems**

Solar energy systems can be used to heat *or cool* homes or domestic hot water. In New Mexico, the payback period for these systems is currently about 10-12 years when tax credits are considered, although the new solar special assessment districts may reduce this period. More energy is used in solar heating than in electricity applications in typical homes, so there is a large market for solar thermal in the long run. Solar hot domestic water heating is particularly cost effective and should be pursued aggressively. In contrast with photovoltaic panels which typically convert 10-20% of the solar energy that falls on them, solar thermal systems can convert up to 70% to usable energy.<sup>37</sup>



Courtesy, Schott Solar





Because of its high efficiency, solar thermal is an excellent option for reducing energy use and saving consumers money. The public should be educated on the benefits of solar thermal energy in order to encourage wider adoption in New Mexico. Homebuilders can be encouraged to include solar thermal systems on new homes they sell.

Solar cooling may sound like an oxymoron, but through the use of emerging systems like absorption chillers, cooling is also possible using solar energy. Customers should be encouraged to use such systems rather than install refrigerated air conditioning which uses much more energy. Costs of these systems can be high but are becoming more affordable.<sup>38</sup>

### Customer-Scale Wind Systems

In addition to large wind turbines, there are opportunities for small (customer-scale) wind turbines as well, particularly in rural areas. Ranches, rural businesses and residences all can potentially benefit from turbines on their property to offset some of their electricity use.

### Recommendations

- **SE-1 Pioneer A New Model for Utility Regulation That Promotes Innovation and Renewable Energy Choices:** Use the Governor's leadership to engage the Public Regulation Commission and New Mexico utilities in developing a pioneering new business and regulation model that stimulates innovation, third-party involvement and aligns citizen, rate payers



Caprock Wind Ranch

and utility interests. A new model that can unlock the state's full clean energy and energy efficiency economic development potential and opens renewable energy choices should be devised.

- **SE-2 Provide Strong and Consistent “Bridging” Production-Based Incentives (PBIs) Statewide:** To drive the deployment of solar technologies, production-based incentives that bridge the gap between the costs of these systems and current electricity rates should be established. These incentives should apply equally across the state regardless of utility territory and be designed to decline as solar costs naturally come down over time. A state “feed in tariff” would be one such model, but other models should be considered. The state Renewable Energy Production Tax Credit is a PBI for systems larger than 1 MW. The Renewable Energy Credit (REC) payments currently offered by some New Mexico utilities are also examples of PBIs, but they exist at the discretion of those utilities. For example, PNM is proposing to reduce rates and caps on their distributed generation program this year, which will impact our solar industry. (See appendix for a summary of utility REC programs.) If the state wants to promote economic development objectives through renewable energy, directly establishing targeted PBIs may be preferable. A statewide PBI would provide the clarity and consistency that supports sustained industry development. Such a policy is being considered in California and is acknowledged to be the reason that Germany is the solar capital of Europe. If needed, an economic analysis to demonstrate the positive benefits of making this investment should be commissioned. Statewide consistency will help to ensure rural areas and electric coops benefit equally and a predictable, long-lived incentive will attract business growth.
- **SE-3 Real-Time Electricity Pricing:** Make real-time electricity pricing available to all interested parties in New Mexico.
- **CS-1 Roll Out Special Assessment Districts:** Support counties and municipalities in establishing the special assessment districts for solar and wind energy and promoting small wind and solar systems for residential and commercial customers. Ensure that low cost financing is available to participating counties to maximize the benefits of these districts. The New Mexico Association of Counties has plans to facilitate the development of these districts across the state in partnership with the State Energy Department.
- **CS-2 Allow Third-Party Power Purchase Agreements (PPAs):** Make the use of third party provider PPA agreements legal in New Mexico.
- **CS-3 Put Solar on State Buildings:** Set binding goals for the deployment of solar on public schools and state buildings.



Schott production facility



- **CS-4 Solar Net-Metering Annual “True Up”:** Require that solar net-metering arrangements between a customer and a utility be “trued up” or reconciled annually to improve the economics of these systems.
- **CS-5 Demonstrate and promote the use of absorption chillers for solar cooling:** This emerging technology has many benefits for New Mexico.
- **CS-6 Provide Incentives for Customer-Scale Small Wind:** Provide financial incentives to promote wider adoption of small wind turbines among residential and commercial users in rural areas.
- **CS-7 Allow Meter Aggregation:** Allow rural customers seeking small wind or solar to aggregate their electricity meters to improve economics.
- **CS-8 Promote customer scale renewable energy to home and business owners:** Customer-scale renewable energy of all types can make good sense for a range of home and business owners, but they may still be unfamiliar choices. The costs and benefits should be explained to the public to assistance provided in evaluating their options.

### **Customer-Scale Geothermal: Direct Uses**

In New Mexico, we have substantial low-temperature geothermal resources that have a range of direct uses.

Some examples of direct use applications are:

- The heating of commercial greenhouses
- Aquaculture of fish
- Hot spring spas
- District heating systems for industrial and commercial parks or residential neighborhoods

New Mexico currently has a large commercial greenhouse (Masson Greenhouse in Radium Springs) and a tilapia farm (Americulture near Lightning Dock) using geothermal heat in southwestern New Mexico. Given the large agricultural presence in New Mexico, direct use of geothermal power is a sector that should be explored. Geothermal heat can save greenhouses and other agricultural users money, allowing them to better compete on price. Additional synergies with agriculture should be explored.

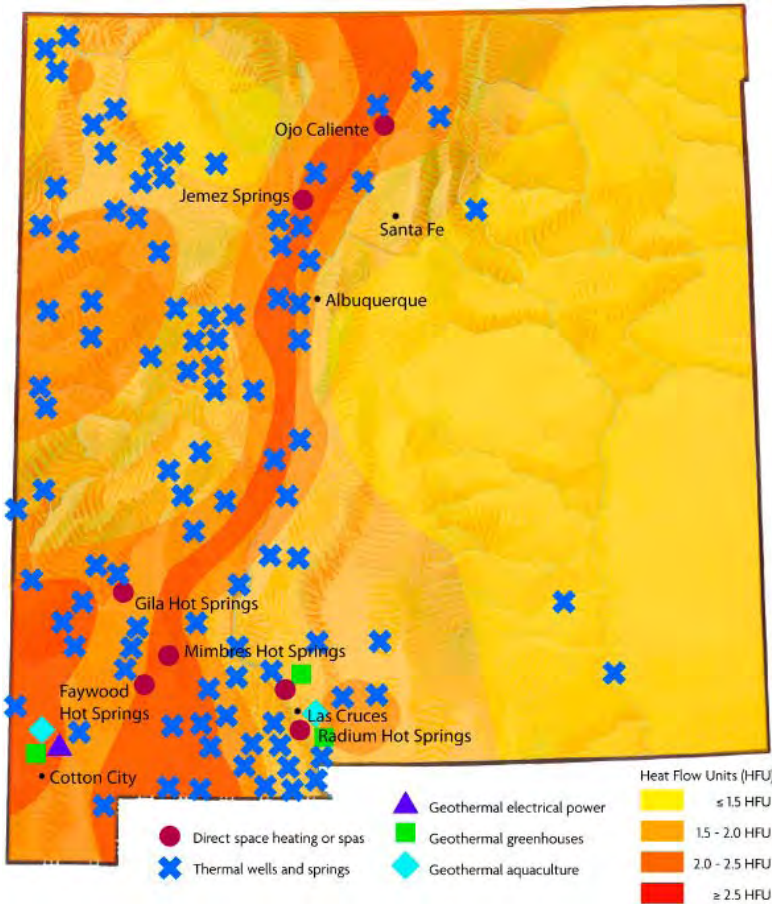
### **Heat Pumps Can Be Installed Across New Mexico**

Ground-coupled heat pumps do not require hot rocks and can be used anywhere in New Mexico. The constant temperature of the earth six feet below ground



Geothermal testing site, Sandia Labs

# GEOHERMAL + HYDROPOWER



Source: Dreaming New Mexico <http://www.dreamingnewmexico.org/>

allows these systems to heat and cool buildings more efficiently, saving energy. Pumps circulate fluid through coils several feet below ground to either heat or cool a house as needed. These systems can be sized for residential or commercial users, and they can be particularly good for public schools. For example, the Alamogordo Public Schools has implemented a district-wide retrofit plan that integrates ground-coupled heat pumps with energy efficiency measures to improve building performance and reduce cost.<sup>39</sup> These systems can be installed by qualified plumbers. This year, the federal tax credit for geothermal systems was significantly expanded and a state tax credit was added (HB 375). This will drive adoption of the systems and create jobs.

## Recommendations

- CG-1 Promote Direct Uses of Geothermal Heat: Direct uses of geothermal heat can fill a valuable niche in New

Mexico, by creating new businesses and saving other businesses money.

- CG-2 Build Consumer Awareness of Ground-Coupled Heat Pumps: Promote consumer awareness of the benefits of ground-coupled heat pumps. Consider them for public schools and state buildings.
- CG-3 Streamline Heat Pump Well Permitting: Facilitate the permitting of the wells necessary for heat pumps by consolidating permit applications into one per agency per project. It should be possible to permit all heat pump wells required for a single project through one application, rather than one application per well, which is what is required now.

## E. Community Scale Renewable Energy

In between utility scale and customer scale renewable energy systems are “community scale” systems. These systems, generally on the order of 1 to 10 MW, provide power to a neighborhood or small town and are usually located close to where their power is needed.

There can be a number of advantages to these types of systems:

- They can be easier to finance and quicker to construct than large utility scale systems
- They can be more cost-effective for users than customer-scale systems
- By locating closer to where the energy is used, these systems need less transmission infrastructure and can also help to support voltages and stabilize energy grids in those areas.
- They can be attractive to communities seeking a measure of energy independence who want a direct connection to the clean energy they use. New “green” residential or industrial developments may also want to use community-scale renewable energy to brand themselves and meet the desires of their target market.
- They can provide stand-alone power to remote rural

communities, including those on Tribal lands. This power may prove to be more affordable than running transmission lines to connect them to the grid. There are approximately 18,000 Navajo who still have no available electricity, for example, so there may be an opportunity for these types of systems.<sup>40</sup>

- By locating these facilities close to where their power is used, new opportunities for Combined Heat and Power (CHP) systems are opened up. These CHP systems can provide both electricity and heat and as a result can help meet the energy needs of communities more cost effectively. Instead of simply releasing “waste” heat to the atmosphere this heat can be put to productive uses heating buildings, etc.

Communities can engage renewable energy developers to design and develop systems for them, and there are a number of ways to contract for these services including leases, power purchase agreements, direct purchase, etc.

Unfortunately, the third-party Power Purchase Agreement rules described under the customer-scale solar energy

section that are currently being considered by the Public Regulation Commission impact this sector as well. For this sector to flourish, it must be decided that developers of community scale renewable energy do not infringe on the monopoly rights of our state utilities and electric cooperatives. This will open innovation and new choices for communities.

In addition, some of the technical rules governing interconnection of these facilities in New Mexico may need to be addressed to clarify how these systems connect to the grid and are compensated for the energy they generate. Finally, some of the other challenges faced by customer scale renewable energy may also be faced by community scale renewable energy.

### Recommendations

- **COR-1 Evaluate and Eliminate Barriers to Community Scale Renewable Energy:** Work with the Public Regulation Commission and utilities to ensure community-scale renewable energy options are available to New Mexico towns and communities.



Governor Richardson at the Grand Opening of Albuquerque's Schott Solar facility

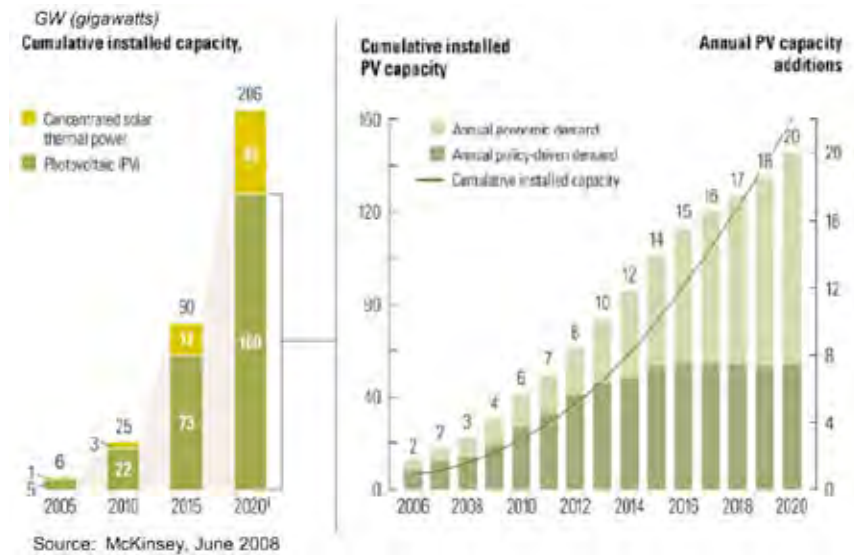


Courtesy: Schott Solar

## 7. SOLAR MANUFACTURING AND CLEAN TECH MANUFACTURING

**Clean technology manufacturing, especially solar component manufacturing, has tremendous potential in New Mexico.**

A quickly growing cluster of solar manufacturers and startups is already established in New Mexico. These manufacturers make products for both utility- and customer-scale systems. Emcore, Schott Solar, Advent Solar, Berken Solar, Skyfuel, Sundrop, eQsolaris, Bluenergy Solar Wind, and Sustainable Resources, Inc., among others, are already operating in New Mexico. We also have numerous manufacturers of solar components including UniRac, Direct Power and Water, and Array Technologies. Signet Solar and Solar Array Ventures have both announced they will be locating manufacturing facilities in New Mexico, employing hundreds of people. The Economic Development Department, the New Mexico Partnership and the Energy, Minerals and Natural Resources Department talk with prospective solar employers on a weekly basis. The New Mexico Ecosystem Report also recommends focusing on this cluster.



Solar manufacturing is an extreme growth industry. Globally, it is expected to expand 500% by 2020, with the United States growing at an even faster rate. Solar component costs are dropping each year, which exponentially increases demand. This growth is expected to continue well beyond the next two decades.



Market Sector	Current U.S. Market Price Range (c/kWh)	Cost (c/kWh) Benchmark 2005	Cost (c/kWh) Target 2010	Cost (c/kWh) Target 2015
Residential	5.8-16.7	23-32	13-18	8-10
Commercial	5.4-15.0	16-22	9-12	6-8
Utility	4.0-7.6	13-22	10-15	5-7

Source: U.S. DOE

This cluster is growing in New Mexico based on a number of advantages reported by companies recruited:

- A low cost of doing business
- Strong state incentives, particularly the Job Training Incentive Program (JTIP), the High-Wage Jobs Tax Credit and discretionary Capital Outlay, when available
- Strong capabilities in customized “just-in-time” employee training programs administered through our universities and community colleges
- The second best solar resource in the country
- The presence of leading research institutions active in this sector including our two national laboratories and universities and skilled engineers
- Small, nimble and business-friendly state and local governments
- Good quality of life for employees

### **The Next Five Years Present a Crucial Opportunity for New Mexico**

Several factors converge over the next five years, making this a particularly important time for the development of this sector in New Mexico:

- Federal policy is aggressively pushing the deployment of solar technology and seeking to lower costs after decades of neglect. This is creating a discontinuous jump in solar growth in the United States that is suddenly attracting manufacturers from other countries and accelerating the plans



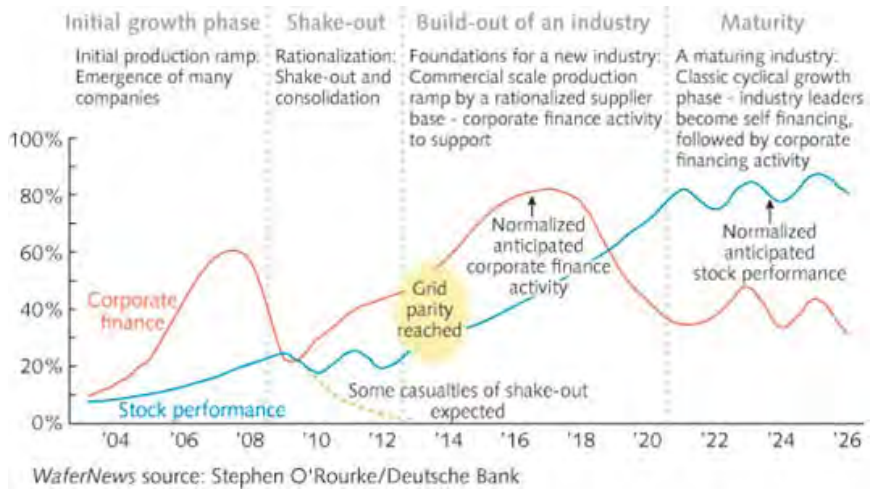
UNM professors Andrea Mammoli (left) and Peter Vorobieff examine solar thermal collectors on the roof of the Mechanical Engineering Building on the UNM campus. Sandia is helping upgrade the solar system to the latest technologies.



First Solar, Inc., partner on planned 30MW photovoltaic facility in New Mexico for Tri-State Generation.

of domestic manufacturers. The interest of international manufacturers in establishing U.S.-based facilities is sharpened by “Buy American” provisions in the American Recovery and Reinvestment Act (ARRA) legislation.<sup>41</sup>

- Cost projections indicate that solar power will be competitive with existing electricity prices within five years (see above chart). This is the point at which solar energy will go mainstream and achieve previously unimaginable.
- Unlike the wind manufacturing industry, the regional clusters for the solar industry have not yet been established. These clusters will be established in the United States over the next five years.
- States are competing very aggressively for the investment of the solar industry. In particular, New Mexico has lost potential employers to Oregon, Texas, New York, North Carolina, and South Carolina.



Although New Mexico is reasonably well positioned to benefit from these developments, there are also significant threats. The two most important are the potential of lagging demand and complacency.

- Our Renewable Portfolio Standard (RPS) will drive growth of the solar industry unevenly, as utilities work to hit time-based targets. Once a utility has achieved its 2015 targets, there may be a delay in new project announcements related to its 2020 targets. These fluctuations in demand could negatively impact solar businesses that need consistent orders to survive. In addition, utilities can choose how to meet targets, and their choices may or may not align with state economic development goals. RPS “carve outs” for certain types of renewable energy can help, but utilities still have significant latitude in their implementation. Finally, the penalties for non-attainment are not specified. Some states like New Jersey have established a penalty schedule to ensure compliance.



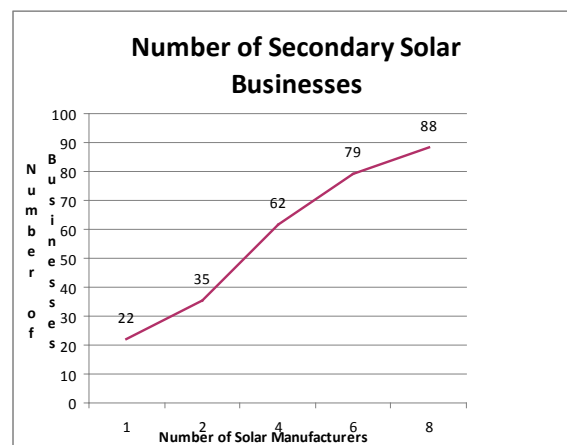
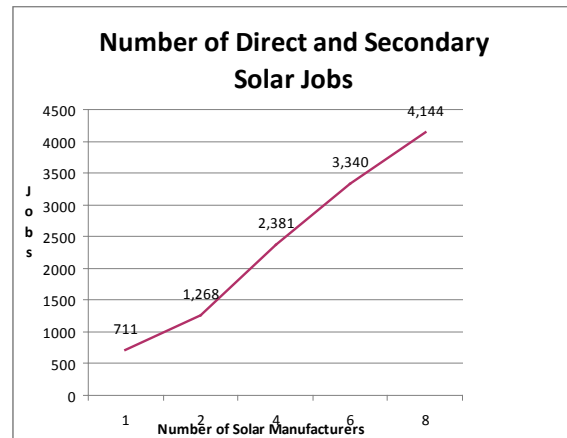
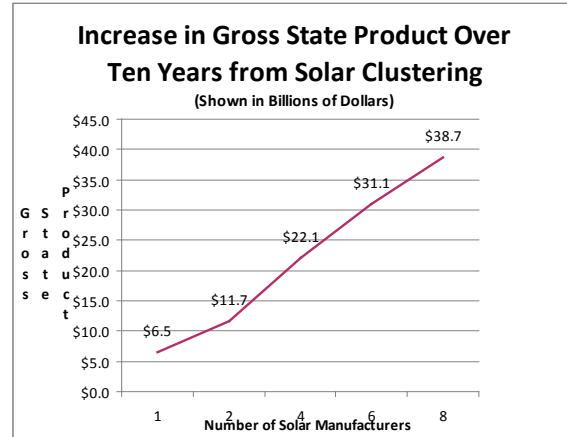
- As a state with a small population, our in-state demand for solar is limited; therefore, we must export solar energy to fully benefit from our large resource. This will take time to develop given the lack of transmission capacity and the number of years it will take to build it. States with large populations, like California and Arizona, will find it easier to drive demand for solar by providing it for their citizens without radically expanding infrastructure.
- New Mexico's state incentives for solar manufacturing are currently among the best in the nation, but instead of becoming complacent, we must vigilantly monitor incentives offered by competing states and be prepared to make New Mexico's incentives more aggressive. Given the magnitude of the opportunity and the relatively short time frame in which siting decisions will be made, there is no time to play catch up. It is only Governor Richardson's and legislators' foresight that has allowed us to experience the success we have seen so far.

**Investment in Recruiting Solar Manufacturers Will Pay for Itself Several Times Over.**

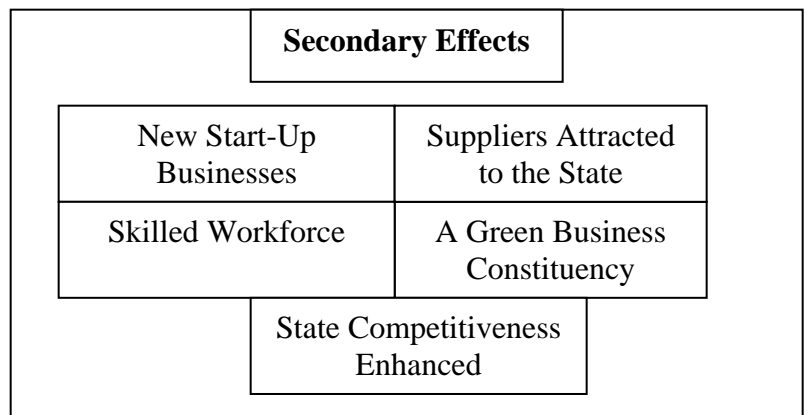
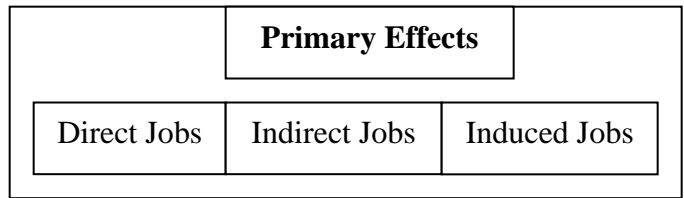
The New Mexico Partnership, the state's recruiting arm, indicates that solar manufacturing companies are focused on the bottom line first and foremost, especially in these times of economic recession. They cannot afford to make the long term decision: they need to do what makes sense today, and that means they must locate where their costs are lowest and near short term demand. This favors heavily populated states, but New Mexico can choose to compete and win with strong incentives in combination with our other natural advantages.

Some preliminary economic analysis suggests that investing in strong incentives will produce an excellent return on investment. States leading in recruiting these companies are investing approximately 20% or more of the plant capital costs.<sup>42</sup> Assuming this level of state investment, the total return on this investment to the state and its citizens over 10 years will be on the order of 350%.<sup>43</sup> (See the appendix for details of this analysis.)

There are direct benefits from these employers, but there are also secondary benefits derived from expanding our solar cluster. Each new large employer will help to indirectly contribute to secondary growth of start-up and other support firms. For example, the addition of four firms may result in 62 new secondary businesses. Staying competitive with other states is crucial to reaping these benefits. The appendix provides a list of some incentives available through our primary competitors of Oregon, Texas, New York, North Carolina and South



Carolina. In addition to these statutory incentives, some state governors use discretionary funds to provide further incentives.



***A Growing, Self-Sustaining Green Economy***

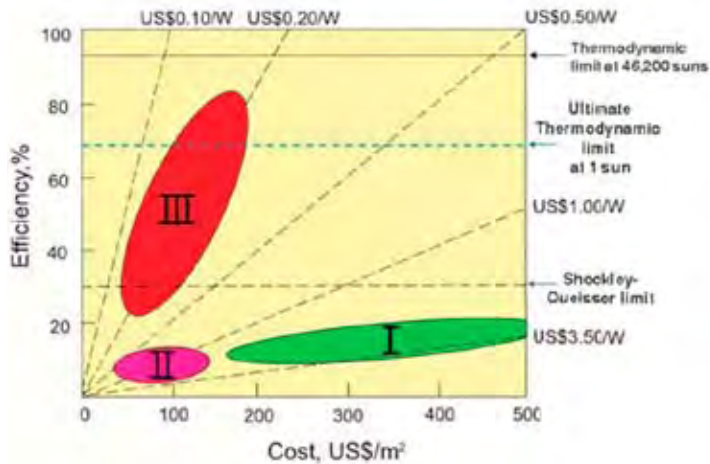


Emcore Generation II system

**Recommendations**

- **SM-1 Maintain Nation-Leading Solar Manufacturing Incentives:** Continue to invest in solar manufacturing incentives. Evaluate our competitive positioning annually and provide analysis and recommendations to legislators.
- **SM-2 Provide Guaranteed Demand for Solar in State:** Guarantee that market demand for solar equipment in New Mexico is strong by establishing purchase programs through state government or in partnership with utilities. Monitor annual sales and stimulate demand with incentives and requirements as needed.
- **SM-3 Bonus Incentives for Using In-State Products:** Provide bonus incentives to those installing solar equipment in New Mexico for using products manufactured in state. New Jersey currently offers this type of incentive.<sup>44</sup>

- **SM-4 Market New Mexico as the “Solar Valley” of North America:** We should not be shy about touting New Mexico’s strategic advantages to the business community in-and-out-of-state, with citizens, and with the American public.
- **SM-5 Ensure a Trained Workforce:** Monitor the pool of available trained manufacturing technicians and engineers and ensure state educational institutions are providing a sufficient pipeline of workers.
- **SM-6 R&D on Next Generation Technologies:** Collaborate with our national laboratories and universities to commercialize next-generation solar technologies to ensure New Mexico remains a leader in new high-efficiency, low-cost technologies.



Cost and Efficiency of I,II, and III Generation Photovoltaic Cells Source: EPRI



Sandia Labs is testing whether solar power may be used to transform CO<sub>2</sub> into carbon monoxide, which can be converted to methanol, jet fuel, or gasoline.

- **SM-7 Incentivize Manufacturing in Rural Areas:** Continue to offer rural job creation tax incentives to attract employers to rural areas. Berken Solar has located in Roswell and Signet Solar will be locating in Belen partially as a result of these incentives.
- **SM-8 Create Green Industrial Parks:** Establish targeted “green energy industrial parks” in several appropriate locations around the state. Green employers like to be a part of a larger green community and can benefit from aggregation economies by locating in the same area. Identify what these employers are looking for and support the creation of these parks. Facilitate this process by working with existing industrial parks like Mesa del Sol in Albuquerque, and the Arrowhead Center or the West Mesa Industrial Park in Las Cruces. Brand these campuses and ensure they provide services desired by target companies. Link these parks with our state research institutions.
- **SM-9 Connect In-State Suppliers to Growing Manufacturers:** Connect existing suppliers and contract manufacturers around the state,

including Tribal enterprises, with our growing solar industry to provide them with new sources of business. Strengthen industrial networks.

### **Other Clean Tech Manufacturers**

Although the solar industry presents a special opportunity, clean tech manufacturing in general should be encouraged. We have a number of clean tech manufacturers including Altela and Miox in the arena of clean water, for example. Although large wind manufacturing clusters have already been established in other states, it may be possible to attract a cluster of small wind manufacturers. For example, VAWTPower manufactures 75 kW wind systems and is located in Albuquerque and Bluenergy Solar Wind is located in Santa Fe. Electric vehicles and their components may also prove to be a suitable cluster for New Mexico.

An initial estimate of the return on investment to the state in terms of job creation and new tax revenue from a \$1 million investment in incentives indicates a return on the order of 400% for green economy industries over a 10-year period. (See appendix for details. Analysis performed by Impact DataSource for the Economic Development Department.)

### **Recommendations**

- **CTM-1 Support All Clean Tech Manufacturing:** Support the expansion of clean tech manufacturing in New Mexico.

## **8. CLEAN TECHNOLOGY INNOVATION AND THE GREEN GRID**

***Commercialization of clean technology will create high-wage jobs and leverage our R&D and manufacturing assets.***

New Mexico is home to many clean energy research, technology, and venture capital resources. An overview of our resources follows.

### **Research, Development and Tech Transfer**

New Mexico:

- Benefits from four national laboratories and federal research centers: Los Alamos and Sandia National Laboratories, the Air Force Research Laboratory, and the White Sands Missile Range
- Has three research universities: the University of New Mexico, New Mexico Tech, and New Mexico State University



Bluenergy Solar Wind turbine



- Ranks second in Science and Technology Ph.D.'s as a percentage of the workforce<sup>45</sup>
- Ranks first in R&D intensity (R&D spending / gross state product) <sup>46</sup>
- Ranks fourth in the nation in Technology Concentration and Dynamism according to the Milken Institute's 2008 Science and Technology Index<sup>47</sup>
- Has tech transfer offices working to commercialize new technology at all our labs and universities. UNM's STC program is one of the best in the country. New Mexico has clean technology research capabilities in advanced materials, renewable energy systems, electric control, and grid integration, biofuels, modeling, energy storage, among other areas.

### High-Tech Businesses

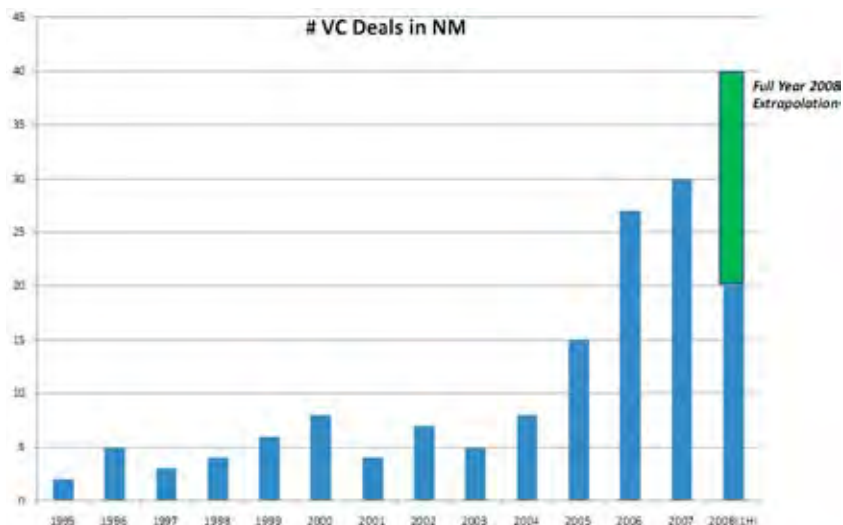
- New Mexico has over 1,000 high-tech companies and is ranked eleventh in the nation in R&D.
- New Mexico high-tech industry accounts for over 45,000 jobs with an annual payroll of over \$3 billion with average salaries of \$47,655.

### Venture Capital

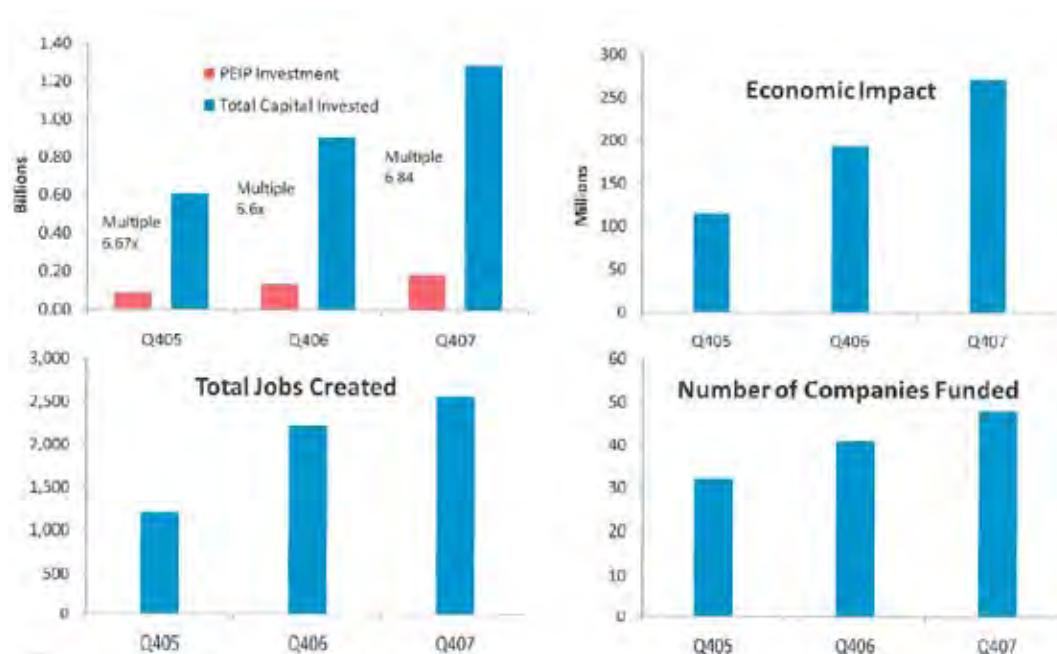
- Although the recession has placed a damper on venture capital across the nation, New Mexico venture capital investments have been growing among the fastest in

the nation.<sup>48</sup> New Mexico has a strong community of venture capitalists with an established professional association and an organized network of angel investors supported by the state's Angel Investors Tax Credit.<sup>49</sup> Channeling more of this investment into the clean-tech sector will be important for the green economy.

- New Mexico's State Investment Council (SIC) ranks first in the nation in dollars invested in local clean technology on a per capita basis – 0.61%.<sup>50</sup> The SIC makes these investments through its New Mexico Private Equity Investment Program (PEIP). On average, SIC PEIP investment has leveraged and attracted private investments 6.4 times the state's investment according to Sun Mountain Capital, which works with the SIC.<sup>51</sup> This has created jobs with wages 50% above the state average (\$62,402).
- Despite this tremendous growth and impact, there is still much more opportunity in New Mexico. Our venture capital investments in New Mexico as a percentage of total R&D spending (federal, private and academic) are .005%, one of the 10 worst deficits of venture capital in the country. A mismatch of venture capital funding relative to R&D spending indicates an opportunity for new venture capital investments to greatly improve commercialization efforts. For comparison, California has the best ratio with



Source: New Mexico State Investment Council



Source: New Mexico State Investment Council

.182% venture capital dollars per R&D dollars, representing 36 times more venture capital for each dollar of R&D spending compared with New Mexico.<sup>52</sup>

This fact presents our opportunity and challenge. New Mexico will benefit greatly from efforts to commercialize technologies out of our laboratories and universities and turn them into profitable businesses employing people at above-average wages. These high wage, high tech jobs fill an important need in New Mexico’s economy. Although New Mexico’s unemployment rate is lower than the U.S. average, our average wage is also much lower than the U.S. average.

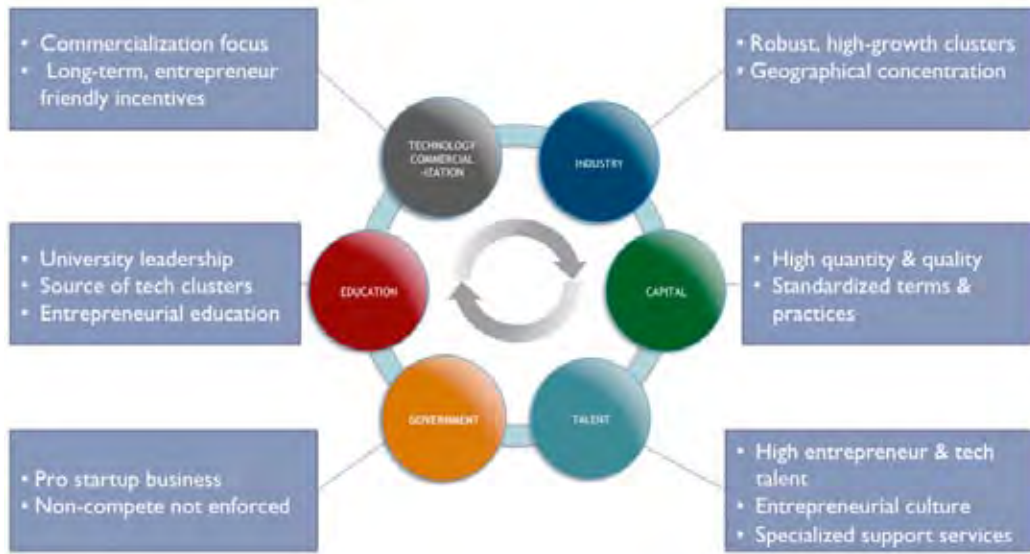
### **Entrepreneurship**

New Mexico has a number of organizations working to develop and support our entrepreneurial capacity, including the Technology Ventures Corporation and the Department of Workforce Solutions-WIRED project. But we face many future challenges. Although the research done in our labs and universities has a great deal of clean-tech potential, without entrepreneurs to partner with, the technology will never reach the marketplace.

### **New Research Applications Center Will Help Turn Technology into Economic Development**

In an effort to accelerate commercialization and generate more economic benefits for the state, the State Research Applications Center (RAC) was created during the 2009 legislative session (SB 205). This center will bring researchers, entrepreneurs and companies together to get technology out of the labs and into businesses. New Mexico Community Capital has produced the *New Mexico*

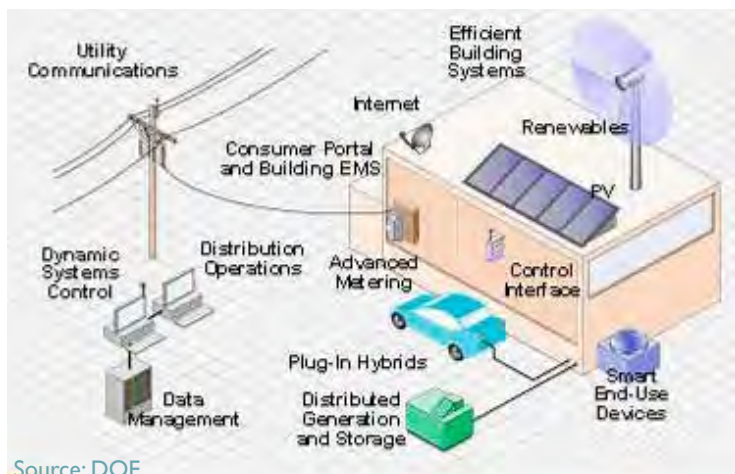
*Ecosystem Report*, outlining the status of our venture capital, innovation and entrepreneurship ecosystem. Their report is an invaluable resource for New Mexico and should be read in its entirety. Their recommendations follow.



Source: New Mexico Community Capital

### **Focusing on the Green Grid**

Recognizing the importance renewable energy will have for New Mexico’s economy, the Research Applications Center’s first focus will be developing solutions for the “green grid.” The Green Grid is essentially a smart network of controls and devices that allows renewable energy and energy efficiency to play larger roles on our electrical grid. Experts project that up to 20 or 25% renewable energy (i.e., a minimum of 75% fossil fuel energy) can be put on the grid without requiring grid improvements that would be cost prohibitive.<sup>53</sup> But above this percentage, a “green grid” with these advanced controls and devices linked together in a smart network will be needed. Automated buildings incorporating passive and active



Source: DOE



Sandia researcher Cy Fujimoto demonstrates his new flexible hydrocarbon polymer electrolyte membrane, which could be a key factor in realizing a hydrogen car. (Photo by Randy Montoya)

solar energy and thermal storage are also a part of the integrated green grid vision. A green grid is also necessary to move from a centralized power model where electricity flows one way to customers to a decentralized model where customers are both consuming and generating power.

If New Mexico seizes leadership in developing green grid solutions, the economic benefits could be large because the potential market is large. Nationwide, the American Society of Civil Engineers estimates that \$1.5 to \$2 trillion dollars will need to be invested in upgrading America's electricity infrastructure by 2030.<sup>54</sup>

Developing the Green Grid has four primary economic benefits for New Mexico:

- A green grid will allow more renewable energy to be developed in New Mexico.
- As new technologies and solutions are developed, they will be commercialized and sold globally. This commercialization, in turn, will create more high-wage jobs.
- A green grid is more efficient than the existing grid, which will save consumers money that can be used for other purposes.
- A green grid is more decentralized, which allows new entrants into the power market and stimulates innovation. (Think of the internet applied to electricity.)
- A green grid will create jobs during the construction and operations phase.

The Galvin Electricity Initiative estimates that implementing a Green Grid will save rate payers four times the amount invested in a period as short as five years.<sup>55</sup> Implementing a green grid creates technician and electrician jobs, in addition

to science and engineering jobs. A recent national report suggests that implementing a green grid in New Mexico could create 1783 jobs during a three-year construction period and 894 thereafter.<sup>56</sup>

### Recommendations

- **CTI-1 Fund and Support the Research Applications Center:** Funding and supporting the Research Applications Center will help to support commercialization of clean technologies.
- **CTI-2 Focus on the Green Grid:** Commit to developing the first statewide Green Grid in the nation. The Green Grid represents a tremendous opportunity for economic development in New Mexico. Target resources toward it.
- **CTI-3 Seed and Mezzanine Financing:** Address financing gaps in New Mexico that would allow technologies to be demonstrated, commercialized and taken to scale.
- **CTI-4 Entrepreneurial Training and Connection:** Dramatically strengthen entrepreneurial training by extending it to technologists, existing companies, and coordinating existing college training programs. Develop more supports for entrepreneurs. Develop an entrepreneurial web portal.
- **CTI-5 Improve Commercialization:** Standardize, streamline and incentivize technology transfer.
- **CTI-6 Marketing and Branding of NM Assets:** Greatly expand awareness of what New Mexico has to offer. Attract experienced entrepreneurs and investment.
- **CTI-7 Evaluate State Policy Effectiveness:** Evaluate effectiveness of existing tax credits and other programs directed at the entrepreneurial sector.
- **CTI-8 Fund the Energy Innovation Fund:** Provide ample recurring funding for the state Energy Innovation Fund.





## 9. GREEN BUILDING CONSTRUCTION AND RENOVATION

Green construction industries are likely to create many green jobs in the coming years. Jobs in this industry include developers, contractors, architects, engineers, weatherizers, real estate agents, building raters/certifiers, building code officials, and all other professionals needed to build new structures.

### ***Green Building Has Excellent Long-Term Job Creation Potential***

Green building, for the purposes of this report, refers to the construction of new residential, commercial and institutional buildings or the remodeling of these buildings. The buildings would have to meet stringent energy efficiency and green building standards, like U.S. Green Building Council's LEED Standard, Build Green NM, Energy Star and Home Energy Rating System (HERS) Index of 70 or better (30% more energy efficient than building code). New Mexico has a strong green building industry, especially in the Santa Fe, Taos and Albuquerque metro markets, but green developers and builders are rapidly becoming more active in other parts of the state including the Las Cruces and Farmington areas. New Mexico is home to nationally-recognized green builders, architects and other professionals.<sup>57</sup> Santa Fe has one of the best residential green building codes in the nation.<sup>58</sup> Executive Order 2006-001 requires that all new construction of state buildings over 15,000 SF meet LEED standards.

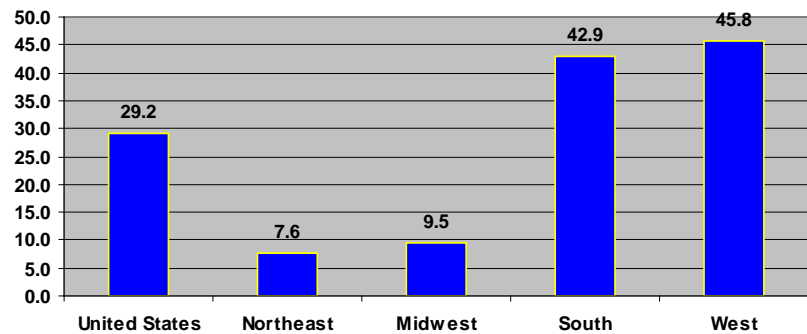
New Mexico has the best green building incentives (the Sustainable Building Tax Credit) in the region and some of the best incentives in the nation, which is a competitive advantage for this sector.<sup>59</sup> Unfortunately the economic recession has negatively impacted the growth prospects of the building industry in general over the short term, although New Mexico has not fared as badly as Nevada, California, or Arizona. The downturn in the housing market must correct before this industry will again see sustained growth.

Fortunately, the southwest United States is a desirable place to live and population growth (through immigration from other states) is likely to create strong demand and a recovery sooner than many other parts of the country. In addition, our economy will recover faster than other hard-hit regions like the Rust Belt, which will drive people to relocate here for work. Albuquerque, Santa Fe, Las Cruces and Silver City have all been recognized as top 10 places to live in the country.<sup>60</sup> Finally, green building is increasing in demand as a percentage of



Photovoltaic collectors for producing electricity soak up the sun from the rooftop of this Santa Fe home. It has earned Platinum certification from LEED for Homes and Gold certification from Build Green New Mexico, the programs' highest ratings.

**Figure 1: Interim Projections: Percent Change in Population by Region of the United States, 2000 to 2030**



Source: U.S. Census Bureau, Population Division, Interim State Population Projections, 2005

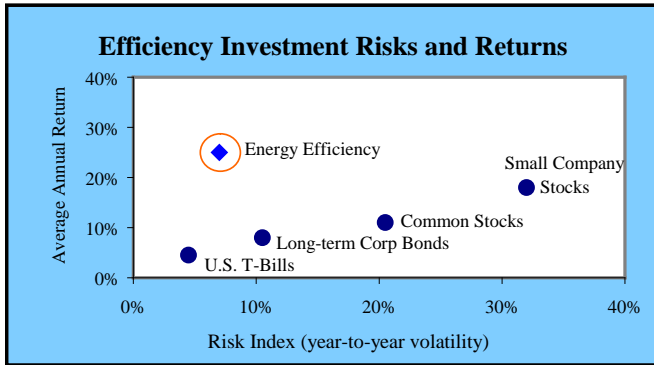
the building market as appreciation for energy efficient features grows. Energy self-sufficient production green homes are available now at prices comparable to other buildings through New Mexico builders like Artistic Homes.<sup>61</sup> Federal regulations require new federal buildings achieve LEED standards and other institutions are following suit.

Green building requires that workers acquire new knowledge and skills to meet the more specific requirements of energy efficiency and green construction standards. There are a number of emerging construction trade certifications that should be offered in New Mexico include those from Green Advantage, the Building Performance Institute (BPI), North American Training Excellence.<sup>62</sup> In addition, there are new jobs that will be growing quickly, like building energy raters (e.g. HERS), building code enforcement, specialized energy efficiency engineers, and certifiers (e.g. LEED AP). California has established its own energy certification program called CHEERS.<sup>63</sup>

A further challenge for workers involved in all aspects of green building is the level of coordination that is required to build energy efficient homes. Every professional needs to know proper techniques or a building can fail to perform as designed, frustrating consumers, and leading to lawsuits and other problems. This requires a more complex process and close collaboration. For example, if an architect does not work closely with his or her mechanical engineer, or if the contractor is not familiar with energy efficient construction, the heating and ventilating system may fail to perform as expected, creating problems for the homeowner.



Industry associations like the New Mexico chapter of the U.S. Green Building Council, regional Homebuilders Associations, local building trade unions and contractor associations, CASA, and the Urban Land Institute will play necessary leadership roles in the evaluation and growth of this industry.



Source: ACEEE

### Energy Efficient Renovation Jobs Can Grow Quickly

Energy efficient renovation is a small sector with very large growth potential. Pike Research estimates this market for commercial retrofits to be \$400 billion in the United States with growth expected to triple by 2013.<sup>64</sup> New Mexico's per

capita share of this market would be \$25 billion. This does not even include the potential in the residential sector nor the opportunities in the weatherization of the homes of low-income citizens. Many energy efficient improvements pay for themselves in energy savings in the matter of only a few years.<sup>65</sup> This market can put our idled contractors to work soon. State government buildings alone use more than 150 million kWh each year at a cost in excess of \$12M.<sup>66</sup> Executive Order 2007-053 requires that state buildings be 20% more efficient by 2015, which will help to stimulate this industry.

Industry challenges are primarily those of financing and customer awareness. Consumers are paying for improved building performance, so improvements must actually make a difference. General skepticism, lack of experience with these renovations, and the lack of standard warranties on renovation work can make consumers reluctant to undertake these improvements even if there is potential money to be saved. In addition, good financing is needed to ensure that the savings on their energy bills is greater than the cost of the improvements.



Sandia's MESA Microsystems Fabrication facility was recently certified under the Leadership in Energy and Environmental Design Green Building Rating System developed by the U.S. Green Building Council.

Building owners can pay directly for improvements made, or they can enter into a “performance contract” which essentially splits the savings for the energy efficient improvements between the contractor and the building owner over time. The first is more common in the residential market and the latter is more prevalent for large institutional building owners.

It is critical that the state be at the forefront in creating demand for these services. Increasing industry capacity, coupled with growing consumer awareness and comfort levels will lead to a sustainable market. The state will also need to develop policies to create the trained workforce necessary. If it is successful, not only will new jobs be directly created but jobs will indirectly be created by redirecting money previously spent on energy towards other expenditures in the state. The 2008 Efficient Use of Energy Act amendment and its requirement for utilities to pursue energy efficiency will also play a positive role.

### **Manufactured Homes**

New Mexico ranks third in the nation in the percentage of families living in manufactured homes at 16.6%,<sup>67</sup> a very significant component of the housing sector. Purchasers of manufactured homes are often low income, so limiting monthly energy bills through energy efficiency is important. Unfortunately there is a catch-22 in that energy efficient construction is often slightly more expensive up front, even if it saves money in the long run. Improving consumer awareness and low-cost financing mechanisms will ensure that green manufactured homes begin to enter the market in larger numbers.

Manufactured homes can be Energy Star rated,<sup>68</sup> and there are manufacturers like Clayton Homes building such units in New Mexico.<sup>69</sup> Thus, expansion of this market would not only save low-income people money but create new jobs as well.

### **Green Building Product Manufacturing**

In addition to Clayton Homes, New Mexico is also home to

a number of green building product manufacturers like American Clay, RASTRA, EarthStone, GrowStone, and Glass Scapes. Given New Mexico’s leadership in green building, developing a cluster of green building product manufacturers would have positive synergies. Despite the global recession, the market for green building products is expected to grow by 5% by 2013.<sup>70</sup>

## **Recommendations**

### **Energy Efficient Renovations**

- **EE-1 Add EE to Special Assessment Districts:** Add energy efficient renovations to the renewable energy special assessment districts enabled by HB 572 and SB 647. This will allow municipalities and counties to provide low-cost financing for these types of improvements.
- **EE-2 Retrofit School Buildings Across NM:** Develop a comprehensive program for energy efficient renovations of all public schools in New Mexico. The school system is the largest owner of public buildings in the state. These retrofits should be designed to pay for themselves in a matter of less than 10 years. Institute a clear preference for the use of New Mexican workers. Develop financing mechanisms that reflect full life-cycle costs. Partner with industry and training providers like community colleges and unions to develop a roll-out plan to ensure sufficient trained workers are available from within New Mexico.
- **EE-3 Grow the EE Workforce:** Expand the number of trained energy efficiency raters and engineers, building code officials, and contractors. Show them how to work together practically and successfully to produce verifiable results.
- **EE-4 Retrofit State Buildings To Produce 20% Energy Savings by 2015:** Implement Executive Order 2007-053. Develop the necessary legal and financing mechanisms to make this feasible.
- **EE-5 Help Develop Local EE Programs:** Work with municipalities to develop local energy efficient retrofit



programs. Resources are available nationally<sup>71</sup> and some guidelines can be found in the appendix. One program, I4x, has been devised by local expert Ed Mazria.

- **EE-6 Monitor and Ensure Full Implementation of the 2008 Efficient Use of Energy Act (Statute 62-17)** This act requires that utilities and electric co-ops “include all cost-effective energy efficiency and load management programs in their energy resource portfolios.”
- **EE-7 Implement Decoupling:** Implement “decoupling” or similar alternatives that make it financially viable for utilities to promote energy efficiency.

### Green Building Product Manufacturing

- **GBM-1 Extend Tax Credits to Green Building Products:** Extend the state’s Alternative Energy Product Manufacturer’s Tax Credit to green building products. Ensure New Mexico has nation-leading incentives for this industry.
- **GBM-2 Bonus for Using In-State Products:** Create a bonus in our green building incentives for the use of products manufactured in-state to stimulate demand.
- **GBM-3 Promote EE Manufactured and Modular Homes:** Promote the use of energy efficient manufactured and modular homes.

### Green Building

- **GB-1 Establish 20% More Energy Efficient Green Building Codes Statewide:** Develop statewide energy efficient green building codes that exceed 2006 code by 20% or better. These codes will need to be reviewed and approved by the Construction Industries Division with the Regulation and Licensing Department and the Construction Industries Council.
- **GB-2 Keep Strong Green Building Incentives:** Ensure New Mexico remains a leader in green building incentives.

## 10. BIOFUELS

### ***Biofuel production provides an excellent opportunity for job creation in New Mexico***

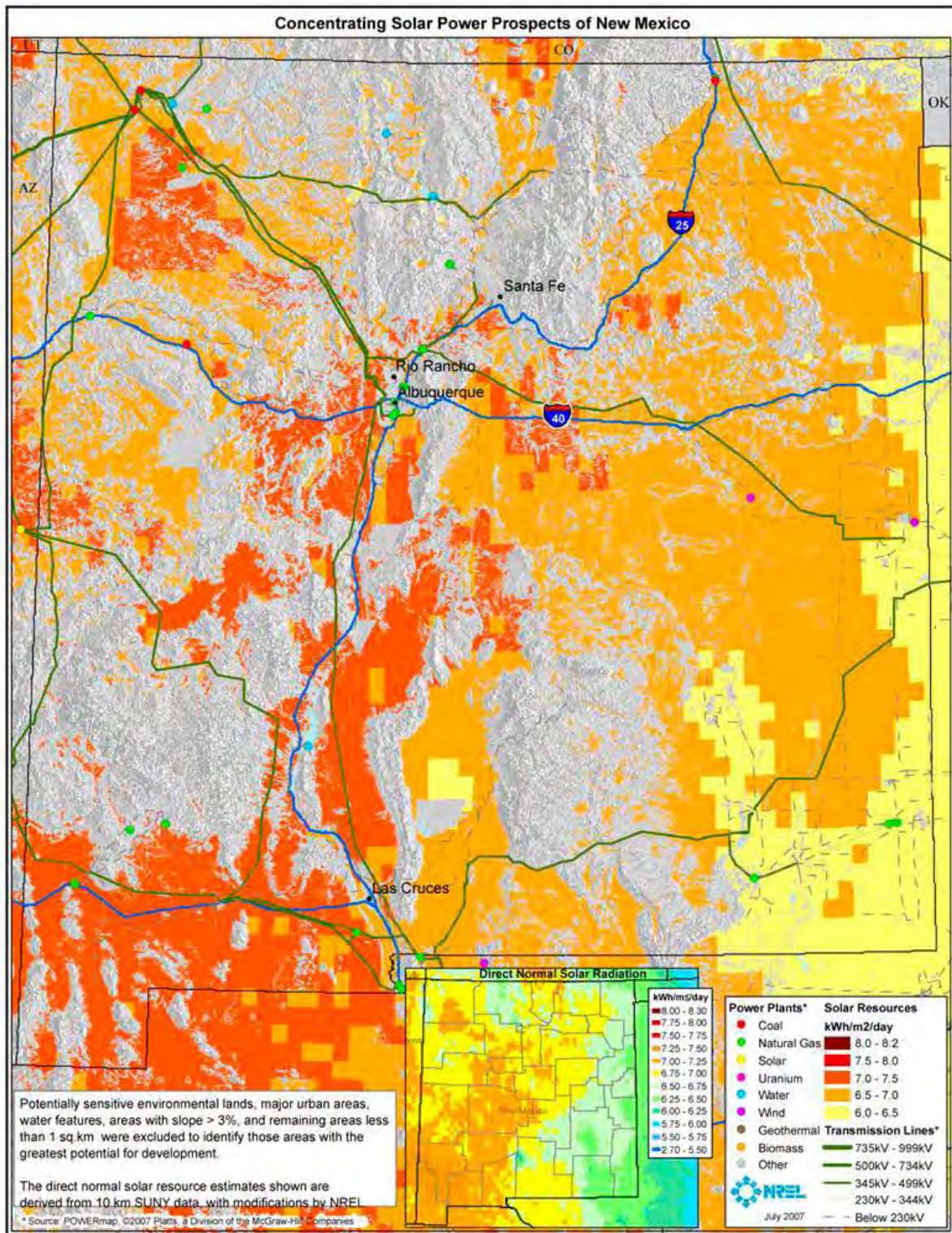
Domestically produced biofuels are becoming increasingly important as the United States looks for liquid fuel sources that do not threaten its national security.<sup>72</sup> This will stimulate growth of this sector.



Closed-loop algae cultivation system







Our fresh water supplies need not be affected. Another benefit of algal biofuels is that they can be used to remove carbon dioxide from the environment naturally or through forced injection.

This map from NREL displays areas in New Mexico that are both reasonably flat and receive abundant sun. The more sun, the faster algae grows. Thus, any place that is a candidate for solar facilities is also good for algal biofuel production.

There are a variety of approaches to developing productive strains of algae and fuel from the oil it produces:

- Natural selection vs. genetic modification
- Growing under natural conditions vs. injecting carbon dioxide
- Conversion of oil to biodiesel (may require engine modifications for 50% blend) or conversion to “green crude” (can be used in existing engines in any concentration)

In addition to Sapphire Energy, the CEHMM Center in Artesia and NMSU have nation-leading capabilities in algal biofuels research. Our solar resource and abundant open land inside U.S. borders will make New Mexico an attractive location for algal biofuel production.



Camelina

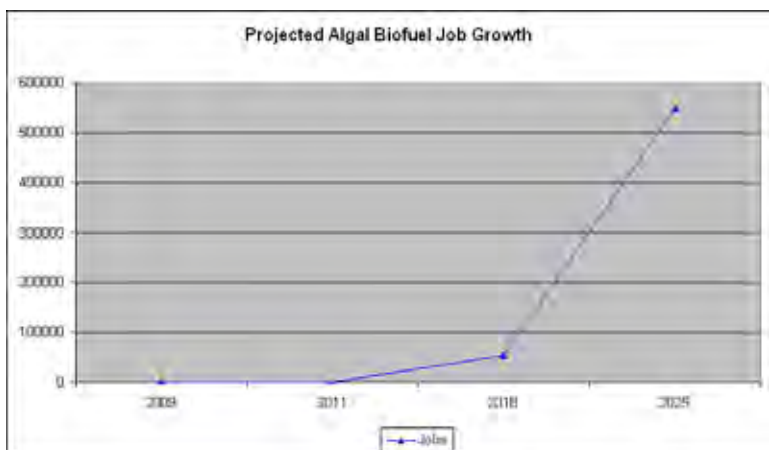
sensitive land to expand New Mexico’s agricultural jobs by providing a high-value crop in growing demand. Jobs are created in the processing of these products into fuel. With sufficient feedstocks, processing facilities will naturally be attracted to the state as well.

### **Biogas Derived From Cow Manure**

It is possible to produce methane through the anaerobic digestion of manure from farm animals, especially cattle. This methane can be used in any application that calls for natural gas, and can even be put into existing natural gas pipelines without modification.

New Mexico is home to a large dairy industry.<sup>77</sup> The state’s 355,000 dairy cows produce manure that can be an environmental challenge in concentration. But, through the digestion process, waste is turned into an economic asset, simultaneously reducing environmental hazards. Capturing and harnessing methane from manure prevents this powerful greenhouse gas from contributing to global warming. The greatest numbers of dairy cows in the state are concentrated in eastern New Mexico near Portales and Roswell and southern New Mexico, near Las Cruces.

Biogas production could augment the incomes of existing dairy farmers and create new jobs. Several companies have proposed building such facilities in New Mexico, and it is likely that one or more will be building in the next few years. PNM has recently proposed to build a biogas facility at their Luna Energy Facility.<sup>78</sup> One of these companies has estimated that 1.5 jobs are created for every 1000 cows

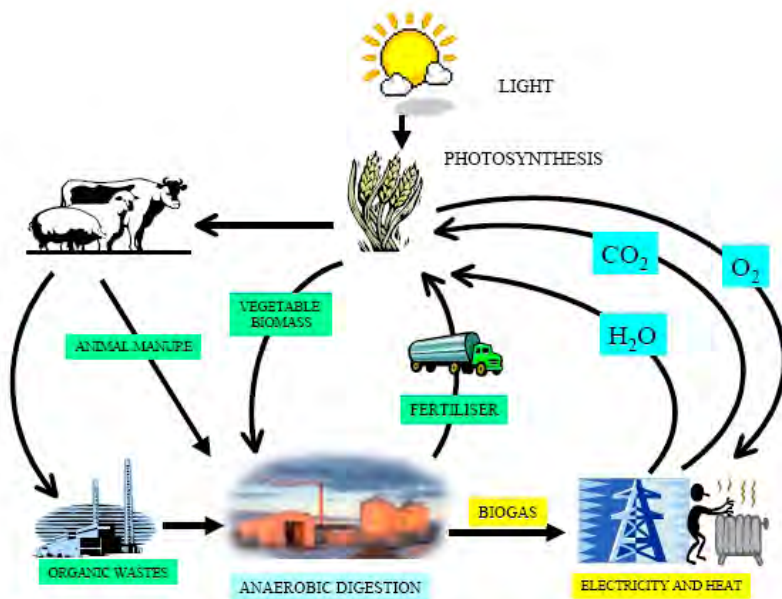


### **Dryland Farmed Non-Food Biofuels**

There are a number of crops that have high oil content and can be grown in our climate with little irrigation. Additionally, they need not affect food supplies or food production. These include camelina and the Pongamia pinnata tree, among others. Camelina is 30-40% oil, can be grown with 6-9 inches of rain, and can produce approximately 100 gallons of oil per acre. The Pongamia pinnata tree can be grown in 10-15 inches of annual rain and survive periods of deep drought. It produces up to 250 gallons of oil per acre.

These biofuel crops can be grown on marginal agricultural land that is not currently under cultivation or environmentally-





Source: <http://www.makinemeklinik.com/?cat=7>

feeding a digesting plant. This means that over 530 jobs could be created through the expansion of this business.

### Woody Biomass

Electricity and heat can also be generated by burning woody biomass from the wood produced from sustainable forest thinning, sawmill residue and forest residues. As research progresses on cellulosic biofuels, woody biomass may become a source of liquid fuels as well.

Woody biomass is considered a carbon neutral fuel source because a sustainably managed forest sequesters back the carbon released in burning it for energy. Using woody biomass for productive uses can also help to reduce carbon emissions because it helps to pay for needed forest thinning. As forests are sustainably thinned, they are less prone to wildfires. Abnormally large wildfires are themselves a major source of carbon emissions. The journal Science concludes that even a small amount of global warming could turn our western forests from a carbon sink into a carbon source through increased wildfires.<sup>79</sup>

There is currently a significant backlog of thinning required in our forests to reduce fire hazards. The State Forestry Division estimates that 9.5 million acres of private land and 1.8 million acres of state lands are in need of thinning. There is also a significant need for thinning on federal and Tribal lands in New Mexico.



Woody biomass



NMSU's algae biofuel research site

The State Forestry Division estimates that one-third to one-half of thinned forest material remains in piles after the thinning treatment. This is a waste of renewable energy resource. NM could turn the green waste into high value products including syngas, methanol, ethanol, electricity heat and other highly marketable forest products. The utilization of woody biomass can create markets for the by-product of forest health and forest restoration initiatives in order to lower the cost of forest health and restoration efforts. Additionally, diverse and robust markets for the full spectrum of woody biomass materials allow landowners and forest managers to practice sustainable forestry.

Two concerns will need to be evaluated on a case by case basis in leveraging this resource in New Mexico. The first is ensuring that facilities that use this biomass be sized appropriately to avoid creating pressure for resources that could result in unsustainable demand for local forest products. New Mexico Administrative Code 19.20.4 "Commercial Timber Harvesting Requirements," helps to prevent such abuses. In addition, those harvesting timber need to demonstrate

sustainability through a resource plan to qualify for state tax credits.

The second concern is the impact of emissions on adjacent communities. Because these plants generally require burning, there is an air quality impact that some communities may be averse to and that will require evaluation by the Air Quality Division of the State Environment Department. Technological solutions exist for addressing most emissions concerns.

### Recommendations

- **B-1 Add Bio-gas to Clean Energy Incentives:** Include the production of bio-gas in state clean energy incentives.
- **B-2 Maintain Strong, Targeted Biofuel Incentives:** Ensure New Mexico retains nation-leading tax credit incentives for the production of selected biofuels. Ensure the credit applies only to fuels that use minimal fresh water and do not displace food crops or sensitive wildlife habitats. Extend the Biofuels Production and Sales Tax Incentive. See the appendix for a summary of biofuel requirements and incentives around the country.
- **B-3 Require Use of Approved, New Mexico-Produced Biofuels:** Ensure New Mexico retains nation-leading tax credit incentives for the production of selected biofuels. Ensure the credit applies only to fuels that use minimal fresh water and do not displace food crops or sensitive wildlife habitats. NM currently has a 5% by 2012 requirement for biodiesel. As our biofuel production increases, this should be extended in time and in percentage to ensure a ready local market for biofuels produced in state.
- **B-4 Support Biofuel Research:** Support and encourage relevant biofuel research at our research institutions.
- **B-5 Use Biofuels in State Fleets:** As local biofuels are available, convert state fleets to be able to use them.

## II. MASS-TRANSIT AND LOW CARBON TRANSPORTATION

In addition to the development and use of biofuels, there are other green jobs that will be created in the area of transportation. The introduction of the Rail Runner between Belen and Santa Fe has been a great success, and there are likely to be a number of positive consequences for the green economy.

- Citizen awareness, experience and personal comfort with public transportation options will increase, leading to increased ridership over time.
- Other mass transit projects are being considered in other parts of the state, for example, between Las Cruces and El Paso and Las Cruces and Belen.
- Governor Richardson and Senator Udall have announced plans to study high-speed rail between El Paso and Denver through New Mexico.<sup>80</sup>
- The combination of the recession and President Obama's policies will likely stimulate additional ridership of bus and rail.
- New Mexico is home to major north-south and east-west freight rail access. As fuel prices increase, rail will become a more attractive freight option, creating jobs in that industry. We are also likely to see increased rail traffic exporting solar and other clean tech products and importing other components, like wind turbines, from other states.

- New Mexico's 2030 Statewide Multimodal Transportation Plan has several provisions promoting public transportation linked to "smart growth" land use planning, and expansion of pedestrian and bike transportation infrastructure.

Given New Mexico's low population density per square mile, private transportation remains a requirement for many. To this end, we should seek to increase transportation options that protect our citizens from price increases. A robust in-state biofuels industry will help with this. Electric vehicles also have great promise in New Mexico given our ability to produce vast amounts of clean electricity.

### Recommendations

- **LCT-1 Evaluate Jobs in Mass Transit:** Evaluate job creation potential in the mass-transit industry in New Mexico.
- **LCT-2 Encourage Mass Transit:** Encourage mass transit options.
- **LCT-3 Evaluate Biofuel and Electric Vehicle Infrastructure:** Monitor trends in New Mexico biofuel production and electric vehicle availability. Provide infrastructure to support them.



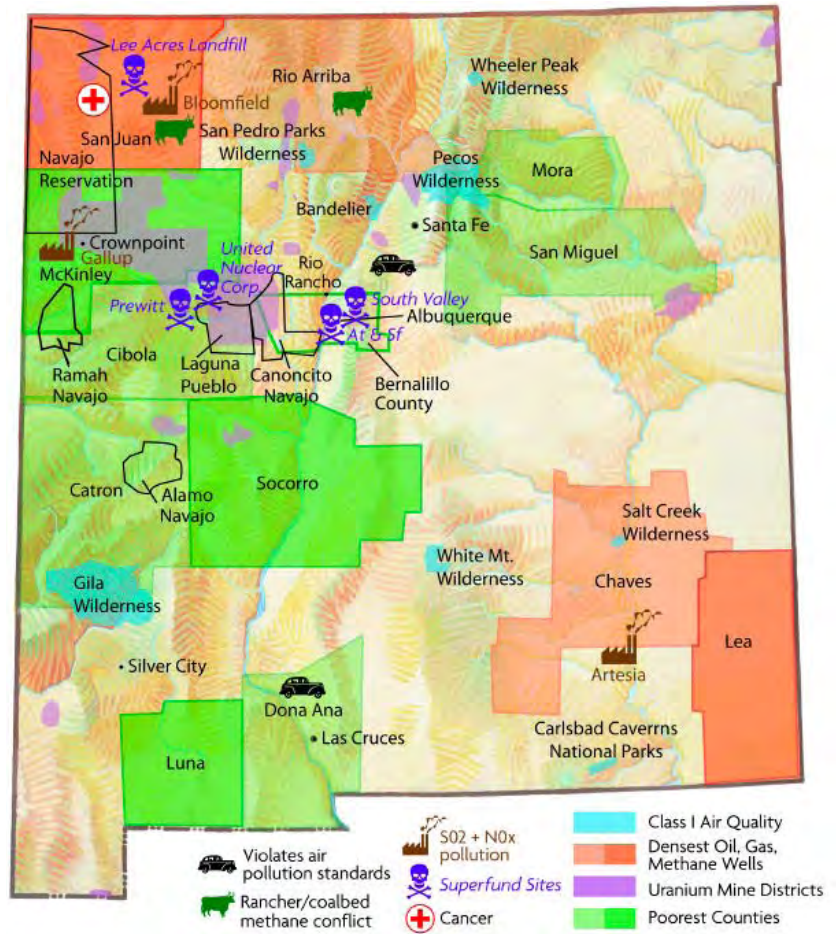
New Mexico Rail Runner Express



## 12. ENVIRONMENTAL CONSERVATION AND MITIGATION

***Environmental conservation and mitigation create green jobs.***

Jobs in this sector include environmental scientists, engineers, cleanup workers, policy and enforcement specialists, water quality and conservation professionals, recycling and reuse jobs, emissions monitoring and control positions, among others. New Mexico will need these workers who address pollution and its impacts on environment well into the future, although they do not represent a significant growth sector.



Source: Dreaming New Mexico

Some factors that will help to create or preserve jobs in this sector are:

- Increasing public environmental awareness and desire for mitigation
- The presence and size of our fossil fuel industry and the likely coming regulation of carbon dioxide. Depending on how carbon regulation is implemented, additional monitoring, carbon trading and carbon mitigation jobs will be created



- Our relatively low current recycling rate and anticipated increases in recycling
- The importance of water quality and conservation in the arid west and growing populations in this region
- The presence of contaminated sites in New Mexico and available federal funding for remediation

### 13. RECYCLING AND REUSE

According to the New Mexico Recycling Coalition, the recycling industry in New Mexico directly employs approximately 250 people. Although this is a relatively small niche of the green economy, our recycling rate is also low, at only 11% compared with 33% nationally. Approximately 2.1 million tons of waste are produced each year in New Mexico and 230,000 tons are recycled. Over the past six years the statewide rate has doubled.<sup>81</sup> Unfortunately, New Mexico’s recycling rate is one of the lowest in the nation (western states tend to be lower on average).

New Mexico recycling officials and businesses are to be applauded for improvements to date and should be encouraged to continue with their progress. If the state could double its recycling rate to 22% over the next five years it could see another 250 direct jobs and more indirect jobs created in this sector. As the table below indicates, recycling creates many more jobs than traditional waste disposal methods.

Type of Operation	Jobs per 10,000 tons/year
Computer Reuse	296
Textile Reclamation	85
Miscellaneous Durables Reuse	62
Wooden Pallet Repair	28
<b>Recycling-based Manufacturers</b>	25
Paper Mills	18
Glass Product Manufacturers	26
Plastic Product Manufacturers	93
<b>Conventional Materials Recovery Facilities</b>	10
<b>Composting</b>	4
<b>Landfill and Incineration</b>	1

Table 1 Source: Institute for Local Self-Reliance, 1997.





GrowStones Manufacture

The manufacture of products, especially green building products, from recycled materials could be an attractive niche in New Mexico. Some existing businesses of this type include:

- American Clay (uses recycled glass in exterior stucco)
- RASTRA (Uses Styrofoam mixed with concrete as a building block)
- Durango McKinley Paper Company (Mill in Prewitt, NM creates 100% recycled cardboard)
- GrowStone & EarthStone (Use recycled glass for sanding and growing medium products)
- Roses Southwest Papers (Manufacturers almost 100% recycled-content napkins, bags, toilet tissue, paper towels and tissues)
- P&M Plastics (Composite plastic and wood waste products)
- Wood U Recycle (Takes scrap wood and creates wood stove pellets),
- Firefly Lighting (Interior lighting fixtures for homes and commercial made from recycled tin/steel cans)
- Glass Scapes (Recycled glass tile)
- Perennial Enterprises (Recycled plastic toy company)
- Recycle Santa Fe Art Market, recycled artistry (for a list refer to the Recycle Santa Fe website [www.recyclesantafe.org](http://www.recyclesantafe.org))

### Recommendations

- **RR-1 Establish State Tipping Fee: Institute a statewide tipping fee at landfills.** A small fee on the order of 60 cents per ton would have dual benefits. First, it would encourage recycling (which would not be subject to such a fee). Second, it would create a fund that could be used for grants, training and technical assistance, and end-marketing for recycling products. A bill of this nature was introduced as HM 548 in 2009. 75% of other states have a fee similar to this one.
- **RR-2 Rubberized Asphalt: Increase the use of rubberized asphalt on state and municipal roads.** Tires are one of the most problematic waste streams in New Mexico. Turning large quantities of old tires into rubberized asphalt creates a beneficial use for them. HM 6, which requested the Department of Transportation to evaluate the use of rubberized asphalt, passed the legislature this year.
- **RR-3 Help Develop Recycling Businesses: Encourage the development of businesses that turn recycled materials into saleable products.** The development of end-markets for recycled materials is key to the expansion of these businesses. Plastics and chip board (i.e. cereal boxes) currently have no market in the area and glass has a limited market.



- **RR-4 Fully implement the recycled product provisions of the Solid Waste Act (74-9-19):** Implementation of the recycled product preferences in this act would help to stimulate this sector.
- **RR-5 Green Film: Expand the Green Film program in New Mexico to help movie and TV productions evaluate and reduce their waste streams.**
- **RR-6 Require Recycling of Building Materials: Ensure that New Mexico building codes and green building tax credits create incentives for the reuse of recycled building materials.**
- **RR-7 Recycling and Reuse Zones: Create Recycling and Reuse Zones that incentivize these activities.** Utah has used this approach to some effect. See Utah state statues 63M - 1 - 1101 through 1111.<sup>82</sup>

## 14. WATER QUALITY AND CONSERVATION

There are many jobs in water quality and conservation, including municipal drinking and wastewater engineers and workers, water quality and stream monitoring professionals, jobs reusing produced water, water rights lawyers, manufacturing technicians building water quality devices, and desalination business employees.

Some emerging opportunities are listed below:

- The New Mexico Environment Department has indicated that many municipal water officials are near retirement age and will need to be replaced with newly trained individuals over the coming years.
- The Miox Corporation in Albuquerque manufactures leading solutions for water purification that are sold around the globe.
- The oil and gas industry produces large amounts of deep, contaminated water in the process of extracting fossil fuels. With sufficiently low-cost treatment technology or applications that are tolerant of such water, this water could be put to productive use. One possibility is use of this water for the cooling towers associated with electricity generation, either conventional or renewable energy sources. Another possibility is the growth of algal biofuels, which are tolerant of contaminated water.
- New Mexico has approximately 300 times more brackish water than fresh water supplies.<sup>83</sup> New Mexico State University has a nationally recognized research capability in desalination.<sup>84</sup> Underground brackish water has different mineral characteristics than ocean water. Consequently, desalination faces different challenges in these environments. NMSU is doing the leading

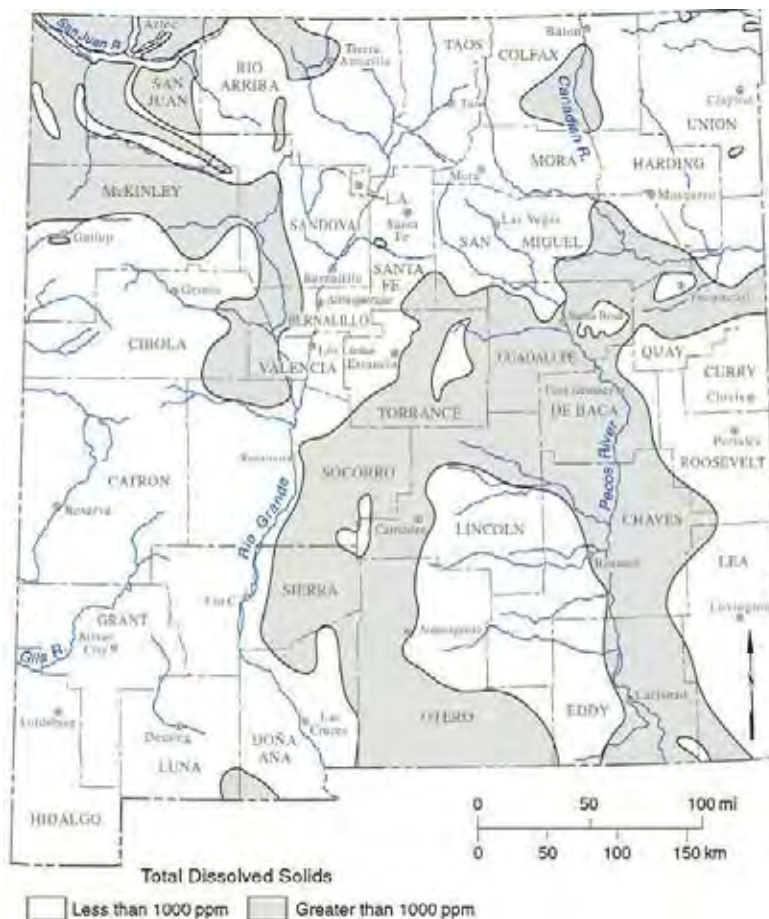


research in this area. As research progresses, the costs of inland desalinations will decline from the current costs of \$3-5 per 1000 gallons and new business models will become viable.

- There are also a number of companies and entrepreneurs in the state working on desalination-related technologies, including Altela and Sustainable Resources, Inc.
- New Mexico Tech has strong resources in geology and the mapping of deep and brackish water resources that could be deployed for economic development.

### Recommendations

- **WAQ-1 Extend Tax Credits to Clean Water and Air Products:** Extend the state's Alternative Energy Product Manufacturer's Tax Credit to water and air quality products.



Brackish Water in New Mexico, map courtesy Peggy Johnson, NMT





## 15. EFFICIENCY AND ENVIRONMENTAL JOBS IN THE FOSSIL FUEL INDUSTRIES

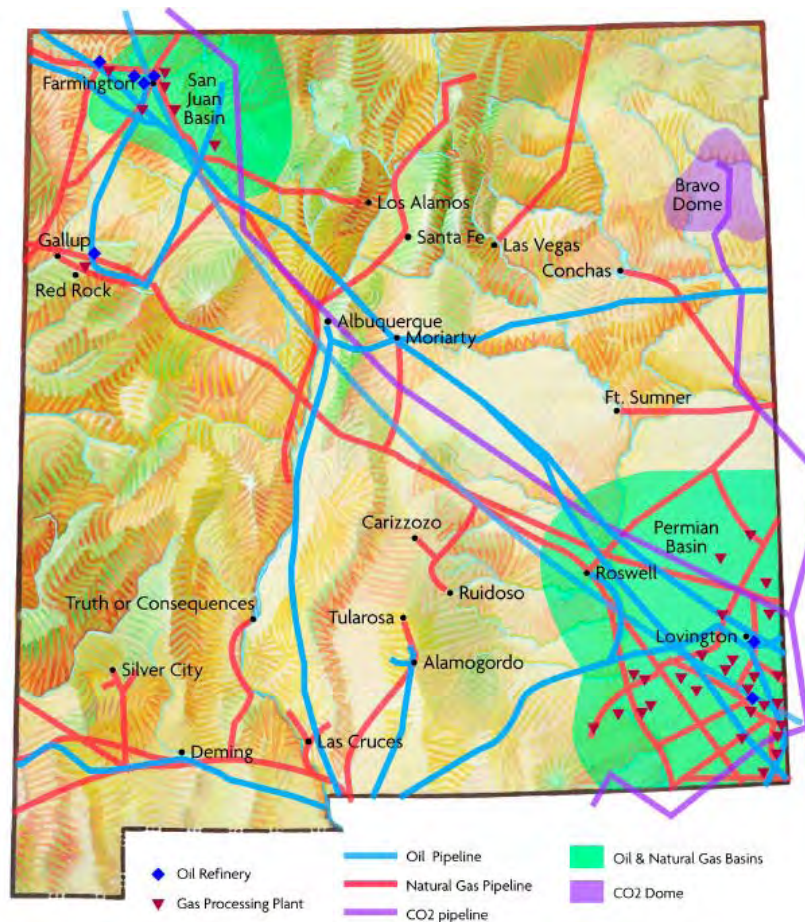
### *Opportunities for green jobs exist in New Mexico's fossil fuel industry.*

The oil and gas industries in New Mexico employ approximately 23,000 across the state and provide approximately \$2.5 billion in state tax revenue annually. In 2007, the state produced 1.6 trillion cubic feet of natural gas and 65.4 million barrels of crude oil.<sup>85</sup> These industries play a vital role in the state's economy, and are an important source of the domestic energy that is critical to our national energy independence. New Mexico has significant reserves of natural gas that can be extracted, and there have been recent advances that allow for extraction of previously inaccessible reserves.

Oil and gas production provides opportunities for the creation of green jobs in the areas of waste reduction, environmental protection, and efficient production.

Some examples of green jobs in the oil, gas and fossil fuel industries are:

- Installation of the U.S. Environmental Protection Agency's Gas STAR technologies and practices; for example, replacement of high-bleed pneumatic devices with low- or no-bleed devices to reduce emissions and waste
- Oil and gas pipeline leakage repair
- Efficient production processes that reduce the venting and flaring of waste gases
- Deployment of new technologies that allow low grade resources, like sour gas, to be used productively
- Carbon dioxide capture and sequestration
- Conversion of vehicle fleets to natural gas from petroleum or diesel
- Conversion of 18-wheel diesel trucks to natural gas. These trucks use over one-third of all imported oil



Source: Dreaming New Mexico

and if converted to natural gas would reduce carbon dioxide emissions and create many jobs. These trucks cannot be powered by current electrical or biofuel alternatives given their weight and size.<sup>86</sup>

- Blending of biodiesel with diesel to reduce emissions
- Conversion of vehicles to biofuels or electricity
- Using solar thermal power to preheat steam for use in coal plants to reduce the amount of coal needed
- Strategically locating new natural gas generating stations to support the expansion of intermittent renewable energy

- Clean up of environmental contaminants related to the fossil fuel industry
- Research and development related to all of the above

Some examples of note:

- Senators Bingaman and Udall have announced \$1.5 million in stimulus funds for cleanup of underground petroleum leaks.<sup>87</sup>
- Los Alamos National Laboratory is a leader in carbon capture and sequestration research.<sup>88</sup>

As fuel prices rise, efficiency and waste reduction become more and more economically viable investments. We are likely to see these jobs increase in the future.

### **Natural Gas Can Support Renewable Energy**

Natural gas is likely to play a role in the expansion of renewable energy generation. Solar and wind power are intermittent energy sources. In order to provide consistent power to customers when it is needed, utilities need to balance generating sources. This can be accomplished by combining diverse sources of renewable energy that are generating power at complementary times of the day. For example, solar power in Deming could be combined with wind power from Torrance County. But there is still a need for a “dispatchable” power source to back up these intermittent energy sources. One renewable option is geothermal power, which is available 24 hours a day, but this technology is still relatively new. The most likely dispatchable source in the near future is natural gas. It may be necessary to add some efficient natural gas capacity in strategic locations to support the expansion of renewable energy. This is another way that oil and gas jobs are linked to the growth of the renewable energy economy in New Mexico.

### **Advanced Coal Electric-Generating Facilities**

The state’s three conventional coal-fired power plants emit contaminants into the air including oxides of nitrogen, sulfur dioxide, particulates, mercury and carbon dioxide.

These pollutants adversely impact public health, visibility, and the global climate. Because of these adverse impacts, there has been significant opposition to permitting new conventional coal-fired power plants in New Mexico and around the country.

Of the advanced coal-based generating technologies in existence today, integrated gasification with combined cycle technology (IGCC) appears to be the most promising for reducing emissions, though there are newer technologies on the horizon. Coal gasification is a process that converts coal into a fuel gas (syngas) consisting of carbon monoxide and hydrogen. The fuel gas is then treated to remove contaminants before being combusted in a gas turbine to generate power. IGCC can more readily capture CO<sub>2</sub> for geologic sequestration or reuse.

Deep saline formations make up a large portion of the United States’ storage capacity. In New Mexico these formations have great capacity for storage and are in close proximity to carbon dioxide point sources.

New Mexico has significant coal reserves and electricity generation. Establishing policies that reduce the pollution from these operations can create jobs in New Mexico.

Some examples of note:

- Tri-State Generation and Transmission has established a pilot project using solar energy to preheat steam at a coal plant in New Mexico<sup>89</sup>
- Los Alamos National Laboratory is a leader in carbon capture and sequestration research<sup>90</sup>
- The Department of Energy’s Southwest Regional Partnership for Carbon Dioxide Sequestration Project Office is housed at New Mexico Institute of Mining and Technology. Carbon dioxide injection studies are currently being conducted in both the San Juan and Permian Basins.
- Approximately two-thirds of the heat generated by a coal plant is waste heat released to the atmosphere.<sup>91</sup>

Advanced technologies to economically capture and productively use this heat would result in significant energy savings and reduce coal emissions.

### Recommendations

- **EEF-1 Quantify Efficiency and Environmental Jobs in Oil and Gas:** Recognize and quantify green jobs in the fossil fuel industry
- **EEF-2 Increase Efficiency and Environmental Jobs in Oil and Gas:** Work with the New Mexico oil and gas industry to increase the number of waste reduction and efficiency jobs
- **EEF-3 Require Advanced Coal Technologies in Air Quality Permitting:** Advanced coal technologies such as integrated gasification combined cycle (IGCC) with carbon capture and sequestration could enable significantly lower CO<sub>2</sub> emissions from coal-fired electric generating units. The air quality permitting process requires the application to consider the best available emissions control technologies.
- **EEF-4 Develop an Emissions Performance Standard for all New Electric Generating Facilities:** An emissions performance standard (EPS) requires utilities to construct electric generating units with an average emission rate below a specific mandatory level. Some states have set this limit at the amount of greenhouse gases that would be emitted by a new natural gas combined cycle unit (about 1100 pounds per megawatt hour).
- **EEF-5 Promote the U.S. Environmental Protection Agency’s Gas STAR Technologies and Practices:** These practices can reduce loss product, reduce GHG emissions and promote jobs and may be promoted through training and rulemaking.

## 16. ECOTOURISM

### *Ecotourism is a growth industry for New Mexico*

Tourism is an important industry in New Mexico. Accommodations, food service, arts, entertainment and recreation account for 87,000 jobs in New Mexico, which is approximately 10% of all jobs in the state.<sup>92</sup>



Ecotourism is defined as “responsible travel to natural areas that conserves the environment and improves the well-being of local people.”<sup>93</sup> Many people think of ecotourism as involving travel outside the United States, often to the remote areas of the developing world. However, there is a

growing awareness of ecotourism possibilities in the United States, and a growing



Rafting on the Rio Grande

interest in such destinations given the reduced travel budgets created by the economic recession.

New Mexico is uniquely positioned to be the premier ecotourism destination in the United States.

- New Mexico already is a recognized and well-loved tourism destination.
- New Mexico's people have a longstanding and deeply rooted respect for the natural environment.
- We have tremendous natural resource assets and excellent recreation opportunities. These include rafting the Taos Box and the Chama River, fly fishing in northern New Mexico, biking the Continental Divide Trail, bird watching in the Bosque del Apache and horse riding on trails across the state. These recreation opportunities include both serene encounters with nature and high adrenaline adventures.
- NM also possesses tremendous cultural assets as a result of its Spanish colonial heritage, its large Hispanic population, its 22 Indian Pueblos and Tribes, and its Wild West history.

- Other states may have some of these assets, but not in the same quantity or diversity. Competitively, our small population is also an asset because more industrialized and populous states will find it difficult to have credibility as an ecotourism destination. The untainted natural and cultural experiences ecotourists are looking for can best be found right here in New Mexico.

The New Mexico Department of Tourism issued a Request for Proposals in June 2009 for the development of an Ecotourism Program for the state.<sup>94</sup> This will likely be the first such program in the country. This program will involve efforts to brand the state as an ecotourism destination, to develop an infrastructure for recognizing and promoting New Mexico establishments as ecotourism attractions, and possibly creating new attractions.

### Recommendation

- **ET-I Brand NM as an Ecotourism Destination:** Brand New Mexico as an ecotourism destination and develop an infrastructure to help tourists connect with ecotourism attractions



Bosque del Apache

## 17. SUSTAINABLE AND ORGANIC AGRICULTURE

### *Sustainable agriculture in New Mexico*

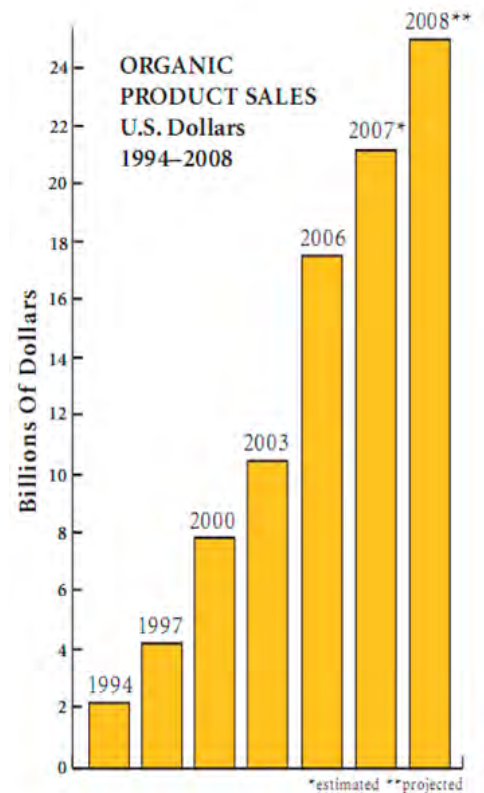
There are several components to New Mexico's sustainable agriculture economy.

These are:

- Organic food producers and processors
- Small farms using natural growing methods
- Free and natural range grown livestock
- Natural food companies, processors, wholesalers and retailers
- Farmers markets and local food markets
- Sustainable harvest of forest products
- Possible range enhancement for carbon sequestration

In New Mexico, 16% of all jobs are farm-related, which translates into over 147,000 jobs. According to the New Mexico Department of Agriculture, there were 17,500 farms in New Mexico in 2004 comprising 44,700,000 acres, of which 3,586 are considered small farms of 1-9 acres. In NM, the value of agricultural products sold directly to consumers (via farmers market and other venues) was \$6.6 million.<sup>95</sup> The state's strong tradition of small farms is an asset in our green economy. Many of our farms have never converted to, or relied upon, the extensive use of petroleum-based fertilizers and toxic pesticides. Their proximity to population centers also provides an opportunity for direct sales to consumers.

New Mexico is also home to over 180 small and large certified organic food businesses and 180,000 acres of certified organic land across New Mexico.<sup>96</sup> Of particular note are two large producers, Sunland Peanut and Nature's Way Management dairies in Portales, NM. Sunland is the largest organic peanut butter producer in the United States. New Mexico's organic sales were \$45M in 2008, with \$23M coming from these two largest producers.<sup>97</sup> Organic agriculture is also a growth industry nationally (See chart to the right.). The New Mexico Organic Commodity Commission (NMOCC) indicates that there is a supply shortage in organic agriculture, such as hay for dairy cows and peanuts for Sunland's processing facility, creating an unfulfilled market need. Organic agriculture requires fewer inputs than conventional agriculture, which saves producers money, and also commands a higher price premium. These factors make it an attractive area for growth.



Source: Organic Trade Association



Santa Fe Farmers Market

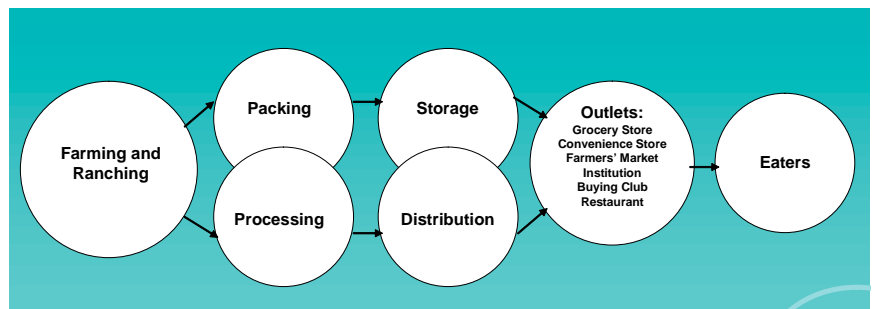
### **New Mexico's sustainable agriculture sector faces challenges**

Currently, much of New Mexico's agricultural product leaves the state. Our farmers and ranchers do not earn as much of the final food dollar as might be hoped.

- 91% of NM cattle must be sent out of state for processing<sup>98</sup>
- Agriculture is New Mexico's 3rd largest industry, contributing \$2.5 billion to the state economy.<sup>99</sup>
- 97% of NM's agricultural products leave the state, while the state imports more than \$4 billion in food products.<sup>100</sup>
- On average, farmers receive only 20% of the final food dollar.<sup>101</sup>
- Northern NM farmers earned \$45 million less from farm production in 2005 than they had earned in 1969 (measured in 2005 dollars).<sup>102</sup>
- 44% of NM farmers require off-farm income to support their families.<sup>103</sup>

### **Investing in developing a local sustainable food system has many benefits**

If consumers bought 15% of their food directly from local farmers, farm income would increase over \$375 million. For every dollar that goes to local farmers, at least \$1.80 is re-spent in the community. Thus, a 15% increase in purchases from local farmers would generate \$670 million per year in new community wealth for New Mexico.<sup>104</sup> An analysis of USDA data has estimated that 72% of the food we consume in New Mexico could be provided locally.<sup>105</sup> This is in contrast with some states like New Jersey and Massachusetts that can only produce 7% and 4% respectively of what they need.



Source: Farm to Table NM

Farm to Table NM, a local nonprofit group, has proposed a number of ways to increase linkages in our local food system, which would create additional community wealth:

- Linking food produced locally by our farmers for healthy school lunches to help ensure that our agricultural products have a market in-state.

- Investing in packing, processing, and distribution infrastructure for local, fresh-food outlets in both rural and urban areas.
- Making healthy local food available to low-income New Mexicans using state and federal funding to provide farmer's market vouchers for WIC clients and seniors. Allow EBT purchases at markets.

A number of initiatives are already under way:

- The New Mexico Organic Commodity Commission conducts workshops to assist producers interested in transitioning to organic, farm walks to educate producers about ecological farming practices, and offers one-on-one consultation in production, market development and organic certification.
- The New Mexico Human Services Department (HSD) has made it a priority to work with farmers' markets associations and EBT vendors to develop strategies that would restore SNAP recipients' ability to utilize Supplemental Nutrition Assistance Program at farmers' markets. HSD is also working to link community gardens to farmers markets.
- New Mexico State University has created the Small Farm Institute to address the special needs of small farmers and support their ability to live profitably. NMSU also operates the Sustainable Agriculture Science Center at Alcalde, and is an active collaborator with Western Sustainable Agriculture Research and Education (WSARE).
- The New Mexico Organic Farming Conference, held annually since 1989, is a joint project of the New Mexico Department of Agriculture, NMSU, NMOCC and Farm to Table. This conference draws over 500 producers for education on water conservation practices, soil improvement, integrated pest management, rangeland restoration, building biodiversity and other organic and sustainable practices.
- The Santa Fe Alliance is working with Northern New Mexico communities to help develop their local food systems.

- A coalition of land conservation organizations have come together to explore ways to more easily put small farms under conservation easements as a way to preserve these working farms.
- Federal funds are available through a number of USDA programs to support producer transition to organic, and adoption of practices to conserve water and improve soil and rangeland. This summer nearly \$975,000 in federal Organic EQIP funds was obligated to help 31 producers transition to organic and to assist 9 organic farmers and ranchers in improving their conservation practices. The NMOCC is working with Natural Resources Conservation Service to extend the reach of these programs that reward producers for greener practices.

### Recommendations

- **SA-1 Develop Local Food Systems: Invest in developing local and state food systems that provide markets for New Mexico agricultural products.** A 15% increase in purchases from local farmers would generate \$670 million per year in new community wealth for New Mexico
- **SA-2 Conservation or Agricultural Easements for Small Farms: Facilitate preservation of small and large farms and ranches for agricultural purposes through conservation or agricultural easements.** Ensure all processes work effectively for both small and large properties, irrigated and non-irrigated properties, and especially for traditional farmers who may be land rich but cash poor.
- **SA-3 Support Value Added Ag Companies: Support the development of viable businesses selling value-added products made from local agricultural commodities, both for local consumption and for export.** Examples of this include salsa, fruit preserves, and frozen meat products, among many others.
- **SA-4 Develop High-Value Ag Niches: Seek out high-value niche markets for small farmers.**



Santa Cruz Farm

Medicinal herbs and unique, gourmet food products are two examples of this strategy.

- **SA-5 Help Farmers With Organic Markets: Work with farmers to help them evaluate the economics and requirements of serving the organic market.** The organic market expects double annual digit growth on average. The current economic recession has slowed demand, but this is expected to be a temporary setback.<sup>106</sup> Provide needed funds for the Organic Commodity Commission.
- **SA-6 Sustainable Forest Products: Support the development of businesses selling products from sustainably harvested forest products.** Such products include vigas, firewood, non-toxic composite building materials and electricity and/or heat from burned waste wood. Many of our forests are in dire need of thinning for fire safety reasons and viable businesses can further this goal at low or no cost.
- **SA-7 Irrigation Efficiencies for Agriculture: Evaluate the feasibility and financing of more efficient irrigation systems, including measuring and metering devices, that would verify that excess water is available to be put to other economic uses.** These plans should be coordinated with the Office of the State Engineer to ensure that these changes do not disrupt water consumption and flow patterns. Economic uses could include industry, other agriculture, power generation, recreation and ecotourism.
- **SA-8 Training in Sustainable Agriculture: Continue and expand training in sustainable agriculture practices.**
- **SA-9 Support of the Development of Agricultural Offsets: Offsets are green- house gas emission reductions for which emission reduction credits may be issued if certain criteria are met. Offset credits can be traded and, when used within a cap-and-trade program, offsets credits come from emission sources not covered by the cap. Offset projects are voluntary. Examples of agricultural offsets include methane reduction at dairies and no-till farming.**

## 18. WORKFORCE DEVELOPMENT

A well-trained workforce is essential to the development of the green economy in New Mexico. Several efforts are underway to develop this workforce. In addition, many of the opportunities in the green sector are in new and emerging industries, so entrepreneurship will be an important skill that the state can cultivate.





The grassroots Green Collaborative<sup>107</sup> is composed of several hundred organizations around the state and includes all of the major colleges and training providers. This collaborative came together to ensure training programs were in place or were being developed to meet the needs of the green economy. The state is participating and coordinating with them as they develop into a thriving organization.

The Education Subcommittee of the Green Jobs Cabinet has begun efforts to develop job projections for these industries, integrate green jobs into our state career cluster framework, and provide information for students and educator/trainers. This work is ongoing, but a New Mexico Green Jobs Guidebook, an overview of green jobs, has been developed.

In addition, the state is seeking grants to develop better information on green jobs. This is a national challenge. Current federal industry (NAICS) and occupation codes (SOC) do not make it possible to track green jobs. The challenge is that not all businesses in a given NAICS code or a given SOC code can be considered green jobs. For example, there is no NAICS code for sustainable agriculture, nor is there an SOC code for wind technicians. There is no way to distinguish between an architect who does green building and one who does not. The standards for what Knowledge, Skills and Abilities (KSAs) are needed to allow an architect to practice green building have not been codified. This grant would aim to help correct these deficiencies in the data. Other Department of Labor grants are being sought by the state and regional consortia to develop new programs in key green industries that are projected to grow.

There are already nationally recognized green job training programs in New Mexico and more programs are quickly emerging. For example, San Juan College has the oldest solar installer program in the state and it has received much recognition. Mesalands Community College has a national-caliber wind technician program. CNM has a long and distinguished record of providing customized training for industry. Santa Fe Community College has a long-standing commitment to sustainability and its new Sustainability Training Center will be among very few such facilities in the country.

In the short term, customized industry training is likely to be important in continuing to meet the needs of employers. New Mexico has a strong capacity in this area. It should be leveraged and extended.





Solar power heats NASA space shield material. The tests at Sandia Labs apply heat equivalent to 1,500 suns to spacecraft shields

## Recommendations

### WD-1 Create a Green Economy Sector Strategy

1. Develop an industry-driven green economy sector workforce education strategy aligned with the economic development recommendations in this report.

### WD-2 Develop data and a career framework

2. Map green industries and occupations
3. Develop job growth projections for green jobs
4. Identify national certifications and industry skill standards
5. Integrate green jobs into the state career cluster framework, providing pathways from elementary and high school, through apprenticeships and higher education

### WD-3 Expand green job training capabilities

6. Identify plans to retrain displaced workers for emerging jobs
7. Develop green training centers of excellence around the state
8. Build new green job and entrepreneurship-training capacity in New Mexico communities where it is needed to meet job demand
9. Identify and development curriculum
10. Provide teacher training and support
11. Build student-and-displaced-worker awareness of opportunities. Ensure pathways out of poverty exist and that career pathways exist for special populations like returning veterans.
12. Provide recurring funding for the above educational activities

### WD-4 Provide just-in-time customized training

Provide just-in-time customized training for growing employers as a stop-gap measure to ensure they have the trained workforce they need. Increase this capability across the state. Brand and promote this asset with employers and businesses that are being recruited to the state.

## 19. WATER USE AND THE GREEN ECONOMY

In an arid Western state like New Mexico, the availability and use of water are extremely important issues. The State Engineer was consulted in preparing this report to understand any new issues or concerns that might emerge with the expansion of renewable energy and the green economy.



Fortunately, existing planning, monitoring and permitting processes appear to be sufficient to ensure water security and availability, even as shifts in water use take place. Currently 78% of the water in New Mexico is used for agriculture.<sup>108</sup> If agriculture uses less water through advances in irrigation techniques, with proper verification through monitoring and measuring, the excess water can be used for other purposes. Many renewable energy technologies use significantly less water than fossil fuel or nuclear electricity generation, which requires large amounts of water for cooling purposes. For example, the 20% Wind Energy By 2030 Plan from U.S. EERE estimates saving 4 trillion gallons of water in the process.<sup>109</sup>

Wind energy and solar photovoltaics use almost no water. Concentrating solar thermal installations usually do require water for cooling, although dry cooling is also possible. The manufacturing of solar photovoltaics requires substantial water for processing, but this load appears manageable. (Combined industrial uses in New Mexico consume 0.5% of the total water used in the state.<sup>110</sup>) Modern “binary” geothermal systems do not consume much water because water is simply recycled in closed loops.

In general, the economical use of dry cooling for electricity generation should be evaluated and promoted to protect water resources as much as possible. Xcel Energy operates a dry-cooled plant in New Mexico. This 550 MW combined-cycled natural gas plant has been operating since September 2008 near Hobbs. This plant uses 90% less water than comparable wet-cooled plants.<sup>111</sup>

All biofuels being considered for New Mexico are either non-food crops using very little water that need not be grown on current farmland (e.g., crops like camelina), or crops that can be produced using brackish water (e.g., algal biofuels) that is not already a part of the fresh water supply. There should be no threat to water or food supplies as a result.

Additionally, the State Engineers Office has been moving towards an “active water resource management” model that will facilitate the temporary reallocation of water in times of drought for water security and to preserve economic development. For example, holders of water rights may enter into voluntary agreements in advance that establish their willingness to temporarily lease their water to other users. A system is being developed to manage these temporary transactions in real time. In this way, the water will flow to the highest and best uses and will be available for important economic development projects, while still protecting and compensating the water-right owner.

<b>Water Use in New Mexico, 2005</b>	
<b>Use</b>	<b>Percentage</b>
Irrigated agriculture	78%
Public water supply	8%
Livestock	1.50%
Mining	1.50%
Power	1.50%
Self-supplied domestic	1%
Commercial	1%
Industrial	0.50%

Table 2 Source: NM OSE, 2005



Researchers examine experimental crops grown in Artesia

There can be constraints on available water in particular regions of the state but generally, water appears to be available for desired uses. One of the more stressed water regions is the Clovis and Portales area, but this will be mitigated by the planned Eastern New Mexico Rural Water Authority's pipeline project.

### **Recommendations**

- **W-1 Monitor and Measure Water Use:** Use existing planning, monitoring, measuring and permitting processes to ensure water security and sufficient water for economic development purposes. Promote the completion of ongoing adjudications and consider implementation of licensing water rights in the Middle Rio Grande (MRG) as a precursor to a MRG adjudication to assist with market transfers in support of economic development.
- **W-2 Evaluate and promote the use of dry cooling for power generation:** Dry cooling is an important way to conserve water. The economics of making greater use of dry cooling should be evaluated.

## **20. ENVIRONMENTAL EFFECTS OF THE GREEN ECONOMY**

Even businesses identified with the green economy have some sort of environmental impact: they are simply less than conventional alternatives. Nonetheless, the anticipated growth of green industries like renewable energy will have some effects that should be considered.

Some environmental effects of renewable energy to anticipate, prepare for and monitor are:

- Avoiding prime bird and bat migration paths when locating wind farms.
- Mitigating effects on sensitive wildlife corridors in siting transmission and renewable energy installations.
- Monitoring the quality of water used by solar and other clean tech manufacturers as well as plant emissions into the air.
- Monitoring groundwater effects from geothermal power plants and the cooling towers used by other technologies.
- Evaluating air quality impacts of any technology requiring combustion. For example, woody biomass power plants generally burn the fuel and produce various emissions. This may or may not be a problem in certain localities.
- Considering whether technologies allow for multiple uses on the same land. For example, wind installations generally allow for coexisting grazing, but



solar plants generally must be fenced off from livestock. On the other hand, a solar installation can produce an equivalent amount of power on a much smaller parcel of land.

- Considering whether technologies require graded surfaces. Some solar technologies require that the area to be developed be graded flat while others do not. Wind, biomass and geothermal plants generally do not. Some counties in southwestern New Mexico, for example, have limits on the dust created by grading that may affect project construction timelines.
- Visual impacts on the landscape that will need to be negotiated with communities in the area of proposed renewable energy projects. However, efforts should be made to educate and address concerns of communities to prevent overreaction that could undermine economic development opportunities.
- Algal biofuels present some new permitting questions. These should be addressed proactively by the appropriate officials and biofuel company representatives.

Planning and monitoring processes are in place to address these concerns.

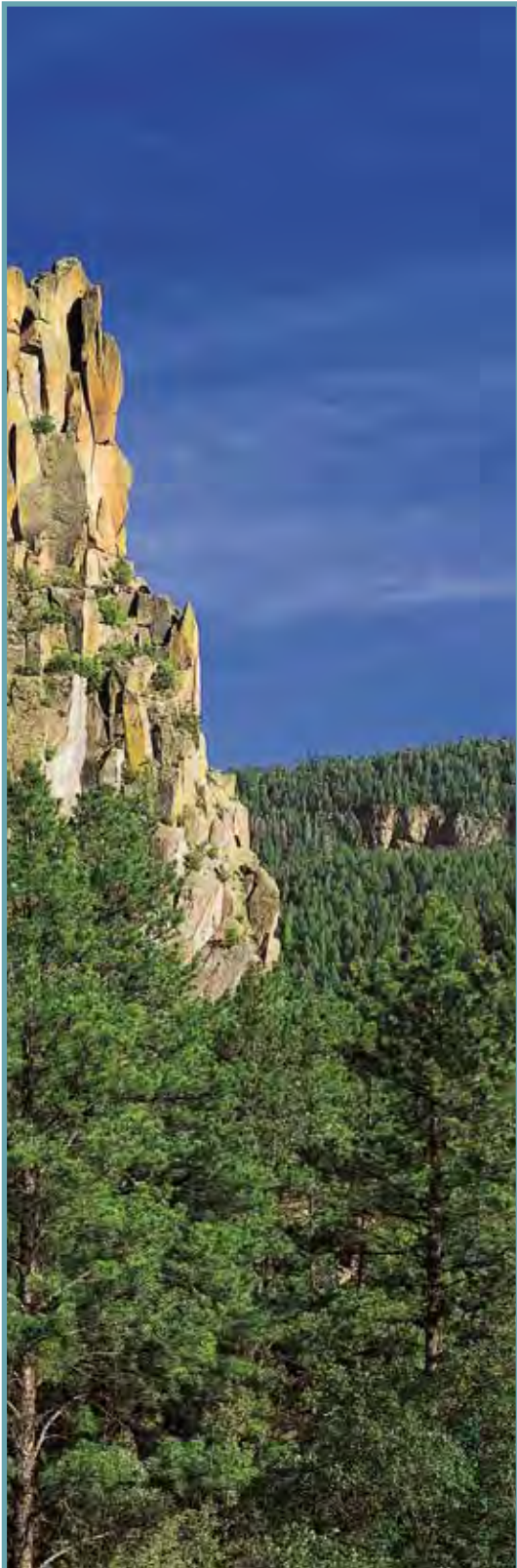
### **Recommendations**

- **E-1 Evaluate Environmental Impacts:** Use existing state, county and federal processes to evaluate environmental impact of proposed companies and projects.

- **E-2 Develop Permitting Guides for Green Industries:** Environmental permitting varies from state to state. A guidance document with general permitting information and contacts for regulatory agencies would facilitate the permitting of new sources in New Mexico.
- **E-3 Support Sensible Local Ordinances:** Work with communities in areas of likely renewable energy installations to develop clear and sensible municipal and county ordinances that enable clean energy economic development and provide protections for local communities based on national best practices. Do this proactively rather than reactively.
- **E-4 Protect High-value Agricultural Land and Potable Water Supply:** Do not pursue economic development options that degrade or displace our high-value agricultural lands or threaten our potable water supplies.
- **E-5 Proactively Establish Permitting for New Tech:** Work with companies promoting emerging technologies to address any permitting issues proactively in order to ensure their growth is not hampered by uncertainties in permitting.
- **E-6 Utilize Supplemental Environmental Project (SEP) Dollars to Fund Green Jobs Initiatives:** During negotiations of environmental enforcement actions, violators are sometimes given the opportunity to offset their monetary penalty by agreeing to pay for a SEP. SEP money provides a good opportunity to implement environmentally beneficial projects that may not be easily accomplished another way.



Rio Grande, with Sandia Mountains



Battleship Rock, Santa Fe National Forest

## 21.GLOSSARY OF TERMS

**Absorption chillers:** A technology for converting solar energy into air conditioning.

**Anaerobic digestion:** Bacterial digestion of biomass produces methane gas.

**Baseload power:** The electricity-generating capacity needed 24 hours a day, 7 days a week, in contrast with peak power which is needed only at times of high demand.

**Binary power:** A geothermal power technology that uses re-circulating fluid to generate power. Uses less water than flash geothermal power.

**Brackish water:** Salty water, not suitable for human consumption.

**Build Green NM:** A green building rating system devised by the Central NM Homebuilders Association.

**Carbon dioxide capture and sequestration (CCS):** Techniques for capturing carbon from the air, reducing greenhouse gases.

**Carbon pricing:** Placing a price on the emissions of carbon dioxide. Cap and trade is one mechanism to do this, as is a direct tax.

**Cap and trade:** A strategy for placing a price on carbon. Sets a total cap for carbon dioxide emissions and allows trading of carbon credits in an open market. In theory, this is more efficient economically than a direct tax.

**Carve out (in an RPS):** Requiring that a utility meet certain requirements for particular types of renewable energy in an RPS, for example customer-scale solar energy.

**CCAG:** New Mexico Climate Change Advisory Group

**CEHMM:** Center for Excellence in Hazardous Materials Management. An algal biofuels research center in Artesia, NM.

**CHEERS:** California Home Energy Efficiency Rating System



**Customer Scale:** Renewable energy that provides power for a single residential or commercial customer or small group of customers, in contrast to utility scale.

**Decoupling:** One policy proposal for “decoupling” utility profits from the sale of electricity. In theory, it can provide utilities with incentives for renewable energy, energy efficiency, reliability and other goals.

**Dispatchable:** Electricity-generation sources that are available whenever they are needed by a utility at a moment’s notice, in contrast to intermittent sources.

**Distribution grid:** The portion of the electricity grid closest to where the electricity is delivered, usually between the substation and the residence or business, in contrast to transmission grid.

**DOE:** U.S. Department of Energy

**DSIRE:** National Database of State Incentives for Renewable Energy (and Energy Efficiency)

**EGS:** Enhanced Geothermal Systems. Geothermal power generation that does not require the existence of a hot spring. It uses a closed-loop binary power system.

**Energy Star:** A federal energy efficiency rating program for appliances, homes and other products.

**EPS:** Emissions Performance Standard

**Feed-in tariff:** A type of performance-based incentive. Provides a consistent price for each kWh that is generated by a renewable energy system. Usually used in conjunction with net-metering.

**Feeder transmission lines:** Transmission lines that connect (renewable) energy generation stations with the transmission grid.

**Feedstock:** A source of biomass used in the production of biofuels. For example, camelina, corn, yellow grease and manure can all be feedstocks.

**FERC:** Federal Energy Regulatory Commission



Catron County storm





Cerro Alesna

**GHG:** Greenhouses gases, such as carbon dioxide or methane.

**Green Grid:** A smart grid with a significant percentage of renewable energy on it.

**Grid parity:** The price of electricity provided by the existing utilities and electricity grid. A renewable energy generation source is said to have reached grid parity when it is no more expensive than the conventional (fossil fuel) energy sources powering the grid.

**HDR:** Hot Dry Rock. Another term for Enhanced Geothermal Systems.

**HSD:** NM Human Services Department

**HERS:** Home Energy Rating System

**IGCC:** Integrated Gasification Combined Cycle. An efficient type of natural gas generation.

**JEDI model:** NREL's Job and Economic Development Impact modeling tool.

**kWh:** Kilowatt-Hour. A measure of energy use.

**KSAs:** Knowledge Skills and Abilities associated with various occupations. These are standardized by the federal government.

**LANL:** Los Alamos National Laboratory

**LEED:** Leadership in Energy and Environmental Design. A building rating system maintained by the US Green Building Council

**MW:** Megawatt

**NAICS codes:** North American Industry Classification System. The US standard for classifying businesses and industries.

**Net Metering:** A type of interconnection of a renewable energy (or other) electricity generation system that allows the electricity meter to run backwards, resulting in a credit for each kWh generated.





**NMSU:** New Mexico State University

**NREL:** National Renewable Energy Laboratory

**Organic Commodity Commission:** Oversees organic certification in New Mexico.

**Pathways out of poverty:** A goal for workforce education and economic development. To provide career pathways out of poverty and into family-sustaining jobs.

**Peak hours:** Those times of the day and of the year when the most electricity is needed by utility customers. Generally late afternoon and late summer.

**Peak power:** The electricity required to meet demand during peak hours.

**Performance contract:** A contract between a customer and a third party provider of energy efficiency improvements. The third party agrees to pay for energy efficiency improvements and split the energy savings with the customer. Generally performed by Energy Service Companies (ESCOs).

**PNM:** The Public Service Company of New Mexico. The largest utility in New Mexico.

**PPAs:** Power Purchase Agreements. A contract between a customer and third party. The third party pays for, installs, and operates a renewable energy system and in return the customer pays a prearranged price for each kWh generated by that system. The most common way that businesses and institutions install solar systems in the U.S.

**PRC:** NM Public Regulation Commission

**Production-based Incentive (PBI):** An incentive that provides a payment for each kWh generated. In contrast with capacity-based incentives that subsidize the initial investment of a renewable energy system.

**PV:** Photovoltaics. A type of solar panel that generates electricity.

**Queue reform:** Reform of the transmission interconnection queue to ensure that ready-to-go projects are not delayed by infeasible or ill-conceived projects.



El Malpais National Monument



**RAC:** NM Research Applications Center. Created by SB 205 from the 2009 legislative session.

**RCT:** Reasonable Cost Threshold

**Real time electricity pricing:** Electricity pricing that reflects the moment-to-moment costs for the utility to generate that power.

**RECs:** Renewable Energy Credits (or Certificates)

**RETA:** NM Renewable Energy Transmission Authority

**RPS:** Renewable Portfolio Standard (also known as a Renewable Energy Standard). A statutory requirement for utilities to generate a given fraction of their power from renewable sources.

**Sandia:** Sandia National Laboratories (SNL)

**SEP:** Supplemental Environmental Project. Projects financed from penalty fees assessed by the NM Environment Department.

**Severance tax revenue:** Tax revenue generated by the extraction of oil and gas in New Mexico. A significant source of state revenues.

**SF:** Square Foot

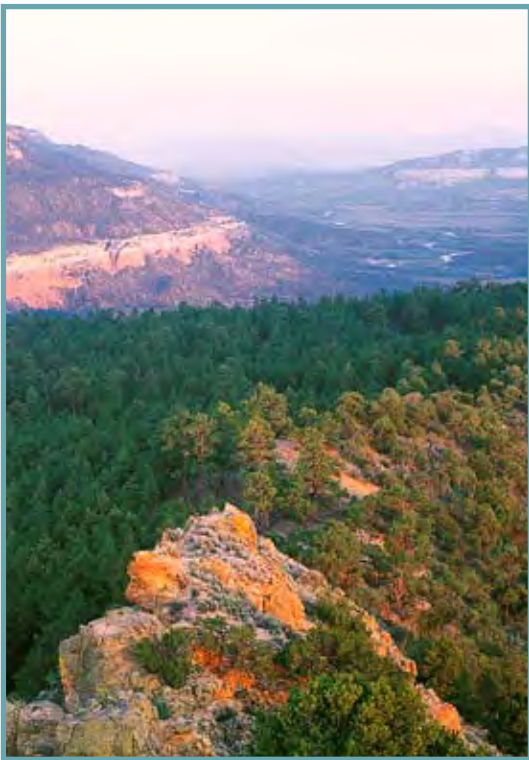
**SIC:** NM State Investment Council

**Smart grid:** An electricity grid that includes smart devices, two-way communications and other advanced controls that allows for real time monitoring, communication and adjustments.

**Smart growth:** A land-use system that promotes neighborhood livability, better access and less traffic, thriving cities, suburbs and towns, shared benefits, lower costs and taxes, and preservation of open spaces.<sup>112</sup>

**Smart meter:** An electricity meter that can receive price signals and send usage information, among other advanced functions.

**SOC:** Standard Occupation Classification. The US standard for categorizing occupations.



Mesa Golondrinas, Santa Fe National Forest



**STC:** The University of New Mexico's technology transfer and entrepreneurship center.

**Syngas:** Synthetic gas

**SWOT:** Strengths, weaknesses, opportunities and threats. A type of competitive analysis.

**Tipping fee:** A fee for leaving trash at a landfill.

**Third-party provider:** A third party that provides renewable energy or energy efficiency improvements under contract, in contrast with a customer or a utility.

**Transmission grid:** The portion of the electrical grid that moves bulk electricity from one locale to another, in contrast to the distribution grid.

**UNM:** University of New Mexico

**USDA:** US Department of Agriculture

**USGBC:** US Green Building Council

**Utility-Scale:** Large-scale (renewable) electricity generated by a utility or power developer, designed to generate power for many users. Often 10 MW or more, in contrast with customer-scale, which is smaller.

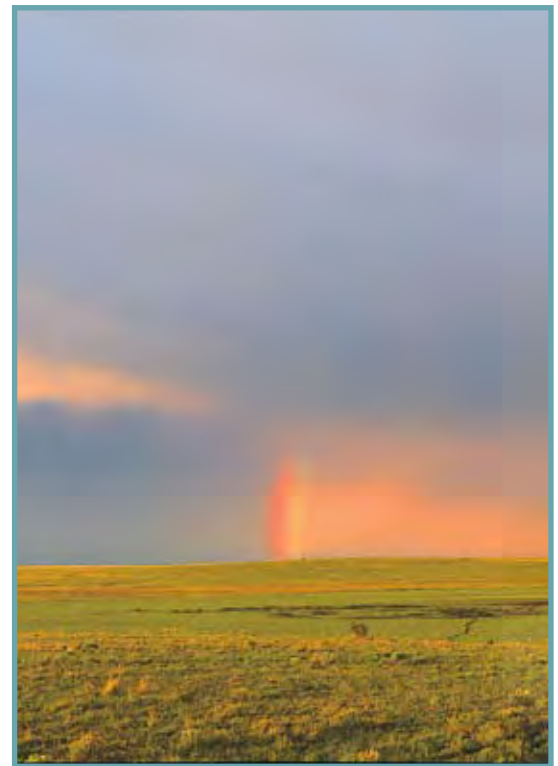
**VC:** Venture capital or venture capitalist

**WCI:** Western Climate Initiative

**WIRED:** Workforce Innovation in Regional Economic Development

**WREZ:** Western Renewable Energy Zones. A project of the Western Governor's Association

**WSARE:** Western Sustainable Agriculture Research and Education.



Storm near Las Vegas



Rio Grande

## 22. END NOTES

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Jemez Mountains



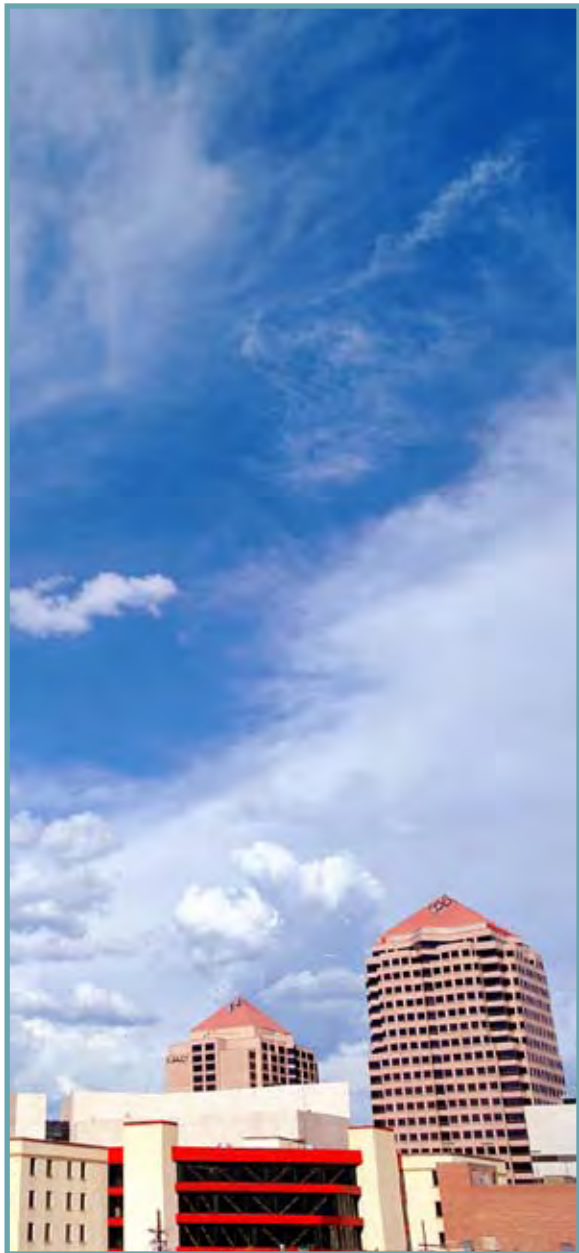
Albuquerque Bio Park

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Albuquerque skyline

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## 23. APPENDICES

Appendices are available online in digital format at <http://www.edd.state.nm.us/greenEconomy/overview/index.html>



Aztec National Monument





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