



Invigorating the **SOLAR** **TECHNOLOGY** **CLUSTER** IN CENTRAL NEW MEXICO

A study by the Mid-Region Council of Governments of the solar industry in the Albuquerque metropolitan area and its viability as an industry cluster

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Solar energy in New Mexico has a strong economic development potential. While global competition makes some areas of the industry volatile, rooftop solar installations are increasing steadily. There is a highly trained workforce, research and development is the highest per capita and consumer demand is on the rise. This interest prompted the Mid-Region Council of Governments (MRCOG) to conduct this study of the solar industry and its viability as an industry cluster.

ABOUT THIS STUDY

This study is the result of feedback from local leaders and key stakeholders during the development of the MRCOG Region's 2010-2015 Comprehensive Economic Development Strategy (CEDS). That strategy identified *Renewable Energy/Green Technologies** as the industry with the highest likelihood of success/with the most momentum at the time.

A facilitated public workshop in late 2010 evaluated the industry in terms of its potential as an economic development cluster for the region. At that workshop, stakeholders from the renewable energy field proposed developing a solar energy cluster map in order to establish base-line data on currently existing activities related to these technologies and to identify opportunities for future development. Other strategies that emerged are provided in Appendix C.

PURPOSE OF STUDY

The purpose of this study is to explore the emerging solar energy and technology cluster in central New Mexico, and specifically in the Albuquerque metropolitan area. To what extent does a solar energy cluster already exist? What are its strengths and weaknesses? Which areas warrant a closer look and represent opportunities for further development?

WHAT IS A CLUSTER?

Industry clusters are concentrations of companies, businesses, and institutions located in a specific region that share similarities and interdependencies. They provide related products and/or services. A geographic concentration of interrelated businesses can generate a special intensity that has the potential to enhance the overall success of a single business.

THE MARKET FOR SOLAR

Capitalizing on solar power in the sunny Southwest seems like a natural and common sense venture. Unfortunately, economic conditions have not been favorable to start-up businesses, water resources are limited and tenuous, and airborne dust presents challenges that require innovative technologies and affordable design of solar energy products. The recession also limited access to venture capital that would have funded startups or expanded existing businesses. According to an article in the Albuquerque Journal on July 16, 2012, venture capital is rebounding nationwide, but in New Mexico, it still has a long way to go to return to pre-recession levels.

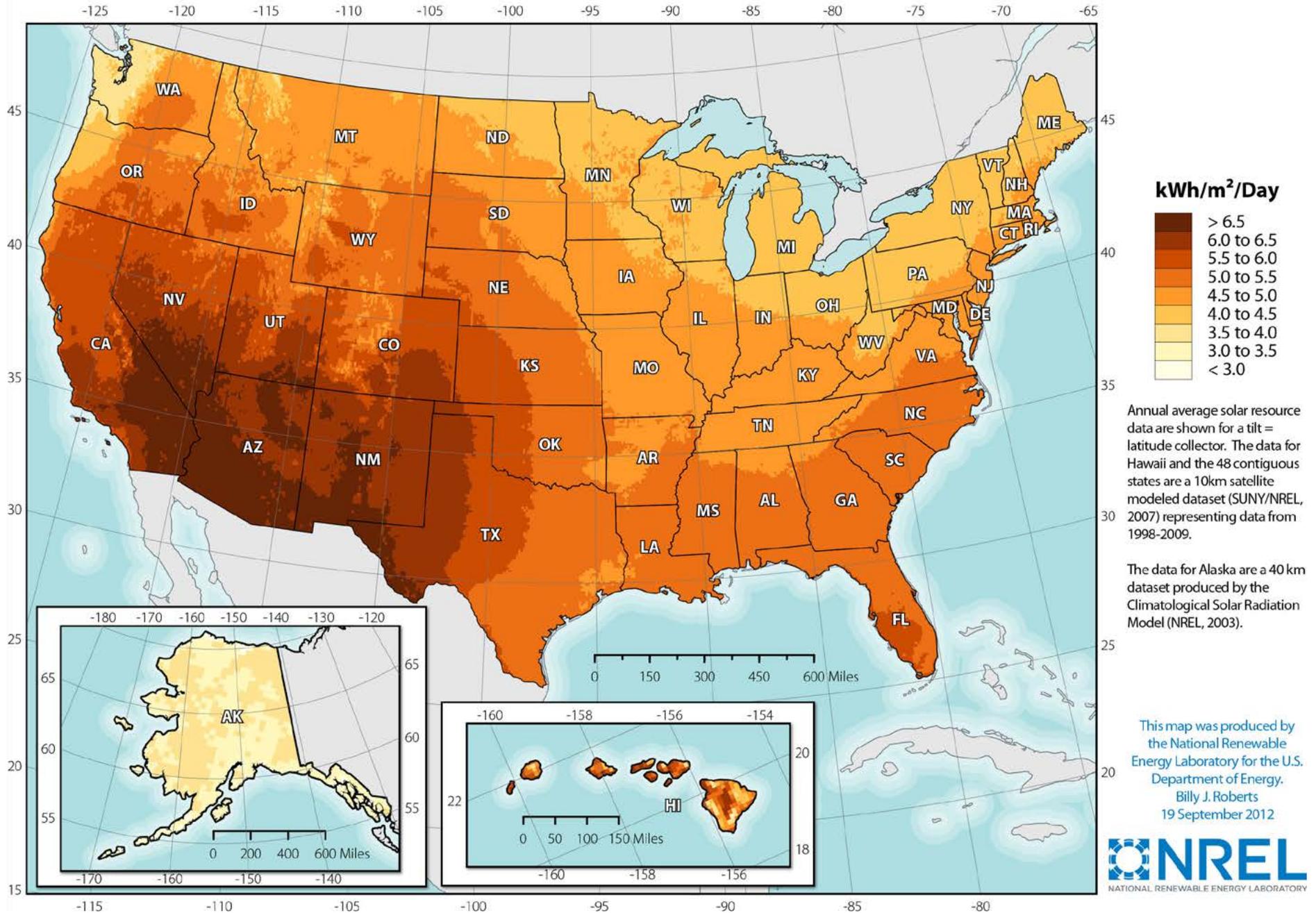
On the other hand, favorable renewable energy policies have increased interest in local solar installation projects in residential, commercial and utility markets. And while solar cell and panel manufacturers have been hit by competition from China, installation companies have prospered. Since 2010, there have been several large commercial solar photovoltaic installations on retail facilities, schools, and health care centers in the region. And currently New Mexico ranks among the highest in installed solar generation capacity.

METHODOLOGY

This study was developed using a selective survey of companies and institutions directly involved in solar energy/technology in this region. MRCOG staff analyzed the results, conducted additional research and wrote the study with industry feedback. The final draft was vetted by members of the NM Green Chamber of Commerce, experts in financial markets, and authorities on educational and training programs (see Appendix D for full list of reviewers).

**Although renewable energy includes solar, wind, fuel cells, biomass, and geothermal technologies, solar energy is the focus industry for this study. This study was designed to survey the companies and institutions that are directly involved in solar energy and solar-related technology as a unique and evolving cluster of industries in the Albuquerque metropolitan area.*

Photovoltaic Solar Resource of the United States



SOLAR CLUSTER: STRENGTHS AND WEAKNESSES

New Mexico's solar cluster has emerged due to the ubiquitous presence of sunshine (310 days each year), proximity to national laboratory and university resources, supportive state and local policies, and workforce training incentives, among others. Currently, New Mexico is ranked 4th nationally for installed solar capacity (166.9 megawatts (MW)).

The spin-off effects of the solar cluster are many. A variety of local companies and institutions is involved in the production, assembly, research, testing, and installation of solar power systems and their components. In addition, electrical and plumbing suppliers, as well as providers of material supplies, manufacturing equipment, and legal, financial, and insurance services are needed to support the development and installation of solar power systems.

Also, a well-educated labor force that specializes in the design and construction of solar systems is needed to meet demand. The Albuquerque area is meeting this need through extensive workforce training programs. In fact, from January 2011 to March 2012, nearly 250 individuals received specialized training in advanced PV system design, solar installation and maintenance. New Mexico is currently ranked second in the nation for the number of solar jobs per capita (2,100 jobs total).

SUPPORTIVE PUBLIC POLICIES

The following are some of the New Mexico state policy incentives that have helped drive the solar industry.

Renewable Portfolio Standard

The New Mexico state government uses a renewable energy standard which currently requires utility companies to obtain ten percent of their energy from renewable energy resources (solar, wind, and/or biomass energy production) when serving utility customers. This standard increases to 15 percent in 2015 and 20 percent by 2020. New Mexico also has incentives for customer-owned solar photovoltaic systems, including net metering billing options and renewable energy certificates (RECs). Utilities purchase RECs from solar electricity generating customers as part of the regular monthly billing process.

The Public Service Company of New Mexico (PNM) has five solar generation facilities with a capacity of 22 MW. In addition, PNM maintains a current supply

The New Mexico state government uses a renewable energy standard which currently requires utility companies to obtain ten percent of their energy from renewable energy resources when serving utility customers.

of 25 MW of distributed power from customer-owned solar systems such as roof-top photovoltaic panels. PNM's renewable resources plan for 2013 was approved by the state's Public Regulation Commission in December of 2012. For customer solar, PNM, in consultation with the local solar industry, reduced the REC price for small projects from nine to four cents per kWh for eight years. Large projects from 10-100 kilowatts (kW) start with a REC price of five cents, also for eight years. Large projects from 100 – 1 megawatts (MW) will continue at two cents through 2020. This new REC Purchase Program started in January 2013. PNM's 2014 Renewable Portfolio Plan was filed on July 1, 2013, and is scheduled to go to hearing on October 23, 2013.

Net Metering and Interconnection Standards

New Mexico law dictates that electric cooperatives and investor-owned utilities must offer net metering and interconnection standards to customers with systems up to 80 MW in capacity. Any net excess generation is credited to the customer's next bill or reconciled monthly at the avoided-cost rate. To be eligible for interconnection, systems up to 80 MW must comply with all local and national standards and follow a specific application process, dependent on system size.

Tax Incentives

New Mexico has a broad base of tax incentives for renewable energy.

Sales Tax Incentives

Businesses are able to deduct from gross receipts the revenue generated by:

- the sale and installation of solar electric, geothermal electric, energy storage or CHP/cogeneration facilities above 1 MW for up to \$60 million
- the sale of certain wind turbines or solar electric equipment to government entities
- the sale and installation of solar heating or electric systems at residential or commercial properties



Ribbon Cutting ceremony for Emcore's new solar array

Property Tax Incentives

Residential solar thermal and electric systems are exempt from property tax assessments.

Personal and Corporate Tax Credits

New Mexico provides a ten percent personal income tax credit (up to \$9,000) to residents and businesses that install solar PV or solar heating and cooling.

The Advanced Energy Tax Credit

This credit allows six percent of the cost of solar electric, energy storage and geothermal projects with a minimum project capacity of 1 MW to be credited against personal and corporate income taxes.

Industry Recruitment Tax Credit

A tax credit is available for companies that manufacture renewable energy products and components. The total amount of the credit may not exceed five percent of the taxpayer's qualified expenditures. Excess credit can be carried forward for five years.

PRIVATE INVESTMENT

The availability of private venture capital to fund start-up businesses nationwide has slowed with the economic downturn, and New Mexico is no exception. However, New Mexico has a unique advantage in that it is able to invest up to nine percent of the State's Severance Tax Permanent Fund in New Mexico venture capital firms, which in turn invest in New Mexico companies. During the last 20 years, 28 venture firms have invested in 63 companies. However, only four of these were solar or energy efficiency companies.

Positive Energy Solar partnered with New Energy Economy and the City of Santa Fe to install solar on the City's largest fire station.



In November 2012, tax advisor Ernst and Young published its long-term solar index ranking New Mexico in the top five states for solar investment.

According to a study by New Mexico State University, New Mexico's renewable energy and energy efficiency companies attracted \$27.5 million in venture capital and private equity investment between 2008 and 2009, but only \$17.9 million in 2010-2011. These numbers correspond with decreased investments in this sector nationwide.*

The decrease in private investment stems from three factors:

1. The economic downturn has left investors with less money for early stage investing
2. Investments in solar manufacturing were continually out-competed by China, especially in the area of solar panel manufacturing
3. Conventional fuel prices stayed low, hurting all renewable energy sources

However, despite the limited venture capital and private equity in this market, shares of solar stock have been steadily rising since the first of the year. In November 2012, tax advisor *Ernst and Young* published its long-term solar index ranking New Mexico in the top five states for solar investment. This was a result of tax credits and other indices that make solar a good investment.

Solar power is expected to be the second biggest source of generating capacity added to the U.S. electric grid in 2013. In 2012, there was 29 percent growth in the amount of installed solar generation. The total U.S. market generated 3.3 gigawatts (GWs) of solar energy and is expected to reach 4.3 GWs by the end of 2013. As rooftop solar costs and utility scale systems become more competitive with conventional electricity, solar energy will be a more attractive investment.

The investment community is now looking at companies that benefit from lower solar panel prices, rather than trying to manufacture them in competition with China. In New Mexico, opportunities exist in advancements for super efficient solar cell technology—research coming out of Sandia National Labs—as well as utility scale systems which are too large and costly to ship from China, but can be produced locally.

*According to a January 15, 2013 article in Bloomberg Businessweek, private equity and venture capital investments in renewable energy in 2012 was the lowest since 2006, down 34 percent from 2011.



Consolidated Solar Technologies rooftop solar panels at Holy Rosary Catholic Church on Albuquerque's West side

In 2010 the solar industry was one of the fastest growing job markets in the country—employing more than 119,000 skilled solar workers and growing at an annual rate of 13.2 percent (New Mexico State University). Today, while it faces challenges like lackluster equity investments and volatility of renewable tax credits, the industry is poised for growth. *Unirac*, a New Mexico company manufacturing solar panel mounting systems, is increasing its workforce to upwards of 150 workers to meet increased demand. *Array Technologies*, with 100 employees, has one-third of the US Market for tracking products, and is considering expansion. These local companies are successful because they can customize their products to meet specific demands, geographic conditions, assure timely delivery, and work directly with suppliers and project managers to produce a quality product that cannot be purchased off the shelf.

DISTANCE TO MARKET

Some of the barriers faced by the solar technology cluster in the Albuquerque area are: distance to major markets, lack of access to capital, regional isolation, and economic conditions that constrain the market demand for converting to solar power systems. Availability of financial resources and venture capital will continue to be a problem for this small metropolitan area cluster, but the entrepreneurial and innovative abilities of local companies and employees may compensate for the small cluster size. Supply chain transportation costs are a problem because New Mexico is not a major population or industrial center, but local capabilities for producing solar system components are improving.

CONNECTIONS

The Albuquerque area offers some excellent transportation infrastructure, with access to two major interstate highways, freight rail, and air transport. Some of the major companies in this cluster have established global markets which improves the competitiveness of the cluster. In other ways, this technological cluster maintains external connections through information exchange, research programs, and outside business contacts.

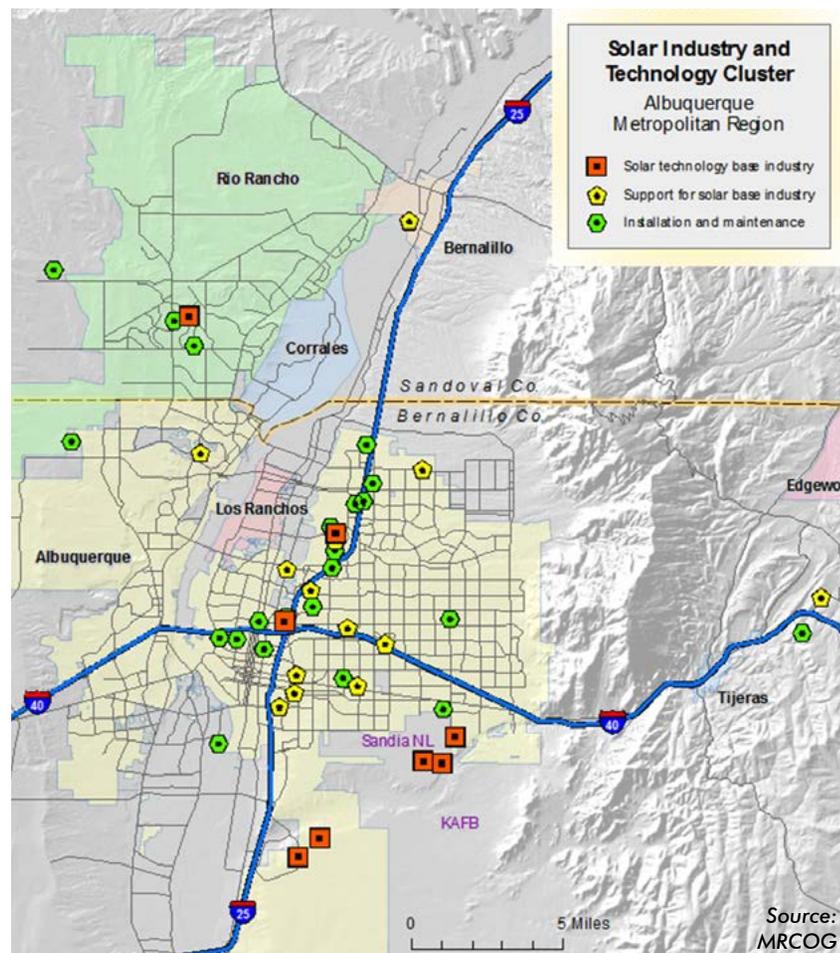
CONSUMER DEMAND

Lastly, consumer demand plays a large part in the success of an industry and interest in green energy is on the rise. According to a 2012 *Colorado College State of the Rockies* poll, 66 percent of New Mexico voters want to encourage the use of solar power and 71 percent feel that increasing the use of renewable energy sources like wind and solar will create new jobs. This push from the consumer side will help the industry, especially if it results in policies that favor increases in renewable energy production.

COMPONENTS OF THE SOLAR CLUSTER

For purposes of this study, the businesses and institutions comprising the solar technology cluster were assigned to one of these sectors:

- Sector 1 — solar technology base industries such as solar system manufacturing or production
- Sector 2 — support services needed by Sector 1 industries
- Sector 3 — local solar system installers and maintenance trades



☀️ SECTOR 1: BASE INDUSTRIES

Solar technology base industries consist of manufacturing and production companies for solar power systems. In most cases, the local production of solar facilities involves the assemblage of components manufactured elsewhere. Advanced technology research, design, and testing of solar power systems and their components are also defined as base industries and are present in the Albuquerque region.

Prominent base industry companies present in this area include *Emcore Corporation* and *Fraunhofer CFV Solar Test Laboratory*. *Emcore* is manufacturing centralized utility-scale facilities and solar arrays (solar farms) as well as space cells. Albuquerque is also headquarters for *Unirac*, a manufacturer of solar panel mounting systems, and *Array Technologies*, making utility scale solar trackers.

In addition, the research institutions in the Albuquerque area play a major role in the viability of the solar technology cluster in this area. *Sandia National Laboratories* and the *University of New Mexico* maintain programs that are focused on innovation and technology of solar energy systems. *Fraunhofer CFV Solar Test Laboratory* is playing a critical role in the testing of solar panels from companies across the globe.

☀️ SECTOR 2: SUPPORT SERVICES

Businesses that provide direct technical and operational assistance to the solar technology base industries are categorized as support services. Support services include companies that provide materials, components, and equipment specifically for solar power products and facilities. Other supporting businesses that are available in this metropolitan area include engineering and technical consultation, marketing and distribution of products, financial and legal assistance, and the education and training of a skilled workforce.

The University of New Mexico and Central New Mexico Community College provide a wide range of career building opportunities in solar power occupations. Such occupations include solar research and development, manufacturing of solar power materials, construction and operation of solar power facilities, and solar system installation and maintenance. In conjunction with New Mexico Workforce Connection and the State Energy Sector Partnership, specialized training programs lead directly to jobs in the solar industry and businesses operating in the Albuquerque area as well as the State of New Mexico.

< See Appendix B for a larger version of this map

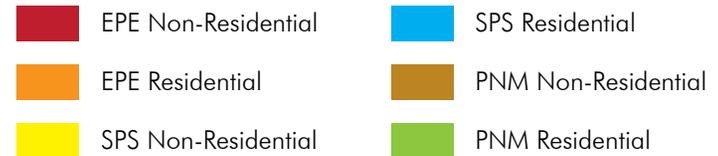
SECTOR 3: RELATED BUSINESSES

Solar-related businesses primarily include solar system installation, integration, and maintenance companies. This is the fastest growing and strongest component of the solar cluster. According to Andrea Sisneros-Wichman, program coordinator for the Central New Mexico Community College's (CNM) Solar Center of Excellence, job growth in the solar installation component of the cluster is rising at a much higher percentage than other industry sectors.

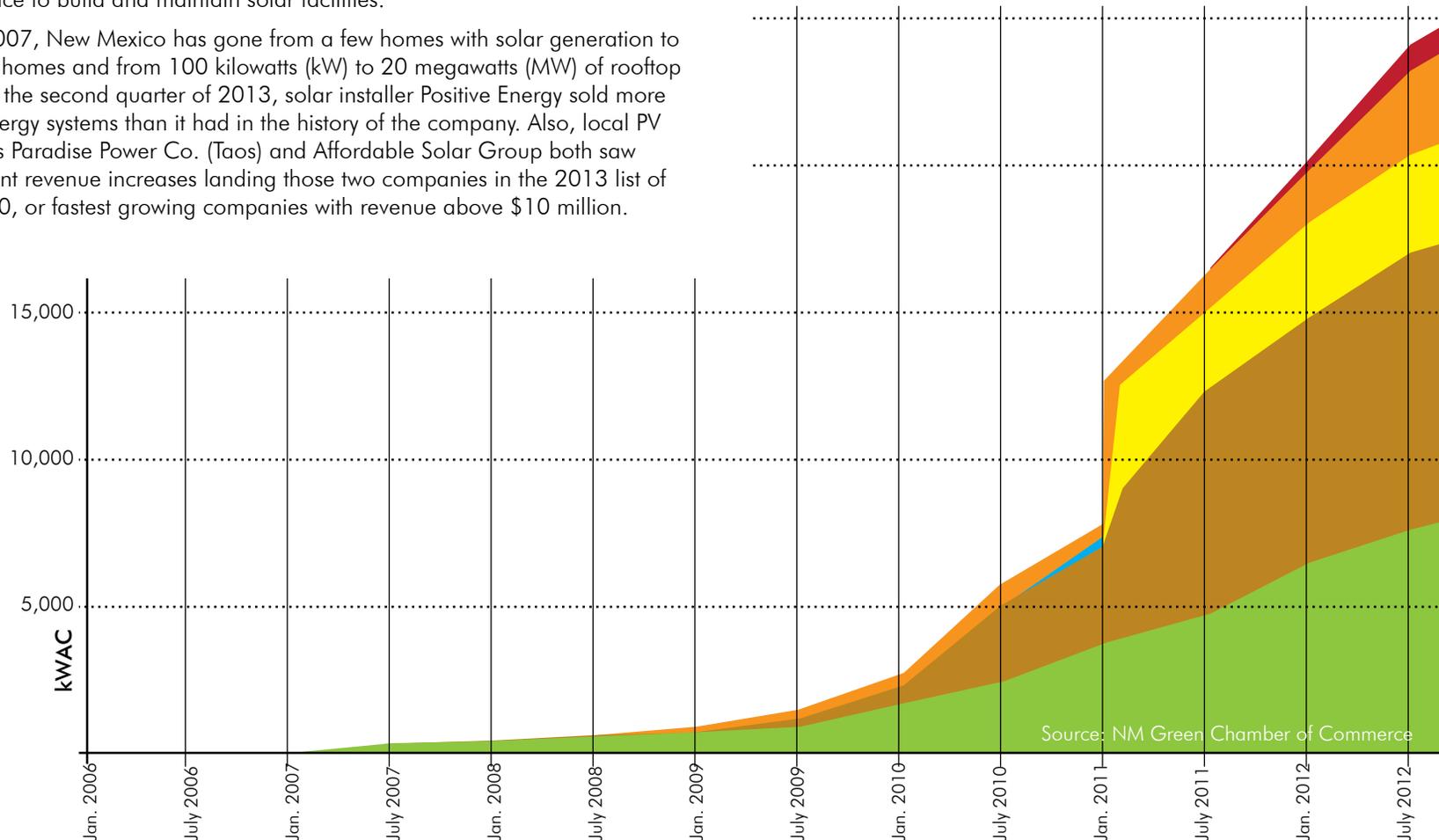
Solar energy system installation is a specialized field that requires a certified and skilled work force. Career advancement opportunities available in the educational institutions within this region include certification programs such as the North American Board of Certified Energy Practitioners (NABCEP) and various funded programs for on-the-job training. Consequently, there are numerous construction companies that are in place with the capability and experience to build and maintain solar facilities.

Since 2007, New Mexico has gone from a few homes with solar generation to 50,000 homes and from 100 kilowatts (kW) to 20 megawatts (MW) of rooftop solar. In the second quarter of 2013, solar installer Positive Energy sold more solar energy systems than it had in the history of the company. Also, local PV installers Paradise Power Co. (Taos) and Affordable Solar Group both saw significant revenue increases landing those two companies in the 2013 list of Flying 40, or fastest growing companies with revenue above \$10 million.

INSTALLED DISTRIBUTED SOLAR **Customers of New Mexico Investor-Owned Utilities**



EPE= El Paso Electric
 SPS= Southwestern Public Service
 PNM= Public Service Company of New Mexico
 kWAC= Kilowatt Hour Alternating Current



SURVEY RESULTS

MRCOG determined at the onset of this study that a general survey of local companies and organizations involved in various aspects of solar power systems would provide a basis for characterizing the solar technology cluster in the Albuquerque metropolitan area. Also, the issues and concerns expressed by the local companies would help to formulate recommendations for strengthening the solar technology cluster.

MRCOG distributed a targeted survey to about two-thirds (29 of 44) of the solar industries and institutions listed in the solar cluster inventory (see Appendix B). A diverse range of responses led to a broad understanding of the local functions, concerns, and expectations of the solar-related industries and institutions in the Albuquerque metropolitan area. The respondents represented all three sectors (Base Industries, Support Services, and Related Businesses) of the solar field. MRCOG obtained additional information via informal interviews. A composite summary of the responses for each of the topics in the general survey is provided below.

Goods and/or services produced locally

The breadth of locally-produced solar power facilities and services that were identified by the survey respondents was wide and varied. Products that are manufactured or assembled locally mostly involve the procurement, assembly, and adaptation of photovoltaic modules and solar electric systems. One of the local manufacturers specializes in solar power systems for spacecraft in addition to terrestrial systems. Wholesale distribution of solar products is another notable business activity within the cluster. In addition to performance testing, solar systems are designed, customized, and retrofitted for new and existing structures. An obvious strength in this cluster is the significant level of research and development in solar technology. The presence of a national laboratory (*Sandia National Laboratories*) is a major constituent and international attraction for the variety of solar technology goods and services in the cluster.

Location of markets for local products and/or services

Markets for local products and services included the local region (Albuquerque metropolitan area) and the State of New Mexico; but the preference is to serve a national and worldwide market, if possible. Some of the solar industry companies do in fact distribute goods and services to a worldwide market from this cluster and associated company facilities located elsewhere. Local markets include both governmental and private sector customers. Several respondents indicated that the installation of solar systems is largely influenced by markets in

Both the University of New Mexico and Central New Mexico Community College were complimented for their efforts to educate students on renewable energy technology and to train the workforce in technical skills for solar system integration and installation.

states and regions with regulations that incentivize solar energy. This proved true in the Albuquerque region as well.

Local markets for local products and/or services

Respondents were asked to describe the condition (size and growth) of local markets for locally-produced solar energy systems and services. Although the potential demand is high, some respondents indicated that the local market could be improved by an increase in incentives, grants, and Renewable Energy Certificates.

Adequacy of skills and knowledge of the local labor force

Respondents agreed that there is a small but growing contingent of trained and certified labor to develop, install, and maintain local solar systems. Specialized training programs for solar industry jobs are becoming more accessible, particularly at CNM in Albuquerque and other community colleges in the State. Funding is improving for training and certification, and placing solar industry employees into local jobs. Several respondents indicated that they could provide on-the-job training for solar system installation. One company noted that skilled employees could be found locally who had an understanding of PV technology, manufacturing and testing principles, and laboratory experience. In fact, 212 individuals completed basic photovoltaic systems training in 2012, 106 individuals currently employed with the solar industry (incumbent workers) completed training for skills upgrade, and 93 completed advanced PV training.

Availability of specialized training provided by local educational institutions

Nearly all of the respondents were optimistic about the availability of specialized

training programs in the Albuquerque area for jobs in the solar industry. Both the University of New Mexico and Central New Mexico Community College were complimented for their efforts to educate students on renewable energy technology and to train the workforce in technical skills for solar system integration and installation.

Utilization of local support industries and/or services

Support services identified by respondents covered a wide range of business activities available locally. Typical support services included machine shops, electricians and electronic fabrication, equipment providers, legal services, accountants and financial services.

Local support industries and/or services that are lacking

Although most of the survey respondents were satisfied with local support services, a lack of certain services was noted: glass and optics suppliers, low cost metal fabricators, semiconductor wafer suppliers, financing for start-ups and spinoffs from Sandia Labs, venture capital investors, and agents with national and international connections. Also lacking were electricians and electronic fabrication, equipment providers, legal services, accountants and financial institutions, office supplies and printing, design and construction companies, security services, personnel services, janitorial services, and many other services.

Existence of a solar technology cluster in the Albuquerque area

Though many respondents didn't initially know the meaning of a "cluster," most of the respondents believed there were indications that a local solar technology cluster did exist, although small in size. Two respondents stated they were not aware of such a cluster in the Albuquerque area. One respondent mentioned that the Green Chamber of Commerce and the Renewable Energy Industrial Association were helpful in drawing the solar technology companies together.

Benefits of a solar technology cluster

Respondents were very positive about the benefits of a solar technology cluster in the Albuquerque area. While some believed that the cluster would generate more business opportunities, others felt that a common cluster structure serves to unify a specialized business community. None of the respondents indicated that they felt threatened by competition for market share; although the local market is volatile as a result of the economic downturn and limited incentives for solar installations.

A solar cluster could foster technology transfer and/or business commercialization potential. The University of New Mexico is currently working on commercializing a technology and is receiving GAP funding to start up to



Consolidated Solar Technologies photovoltaic system at Sandia Preparatory School in Albuquerque

three companies. Potential also exists to transfer solar technology from Sandia Labs to benefit the solar industry.

Benefits of a solar technology cluster association

An organized and active association for the solar technology cluster would be useful according to most survey respondents. A solar cluster association could strengthen the viability of solar technology in the region. One of the respondents, however, indicated that it would depend on the purpose and direction of a solar association. A number of the respondents felt that similar associations already existed in this area. The Renewable Energy Industrial Association (REIA) of New Mexico, the New Mexico Solar Energy Association (NMSEA), and the New Mexico Green Chamber of Commerce were named as examples. However, these associations are statewide organizations and are not limited to the local cluster of businesses, institutions, and support services that have been identified in the Albuquerque metropolitan area.

Suggestions to improve the New Mexico business climate for solar industries

Survey respondents were very outspoken about the local and national business climate for solar power development. Although New Mexico is a leader in solar technology development, there was a general concern expressed by the majority of respondents that the State government could be providing more support through tax breaks and incentives for investing in solar power. Several respondents emphasized that incentives are particularly important due to the relatively high cost of solar systems and the often long-term period for return on investment. Respondents stated that State economic development programs should be promoting the solar industry in general and educating the financial

community about the potential for solar power. It was mentioned that the State could set an example by installing solar systems on state government facilities. Another issue regarding the solar industry was the administration of rules and regulations for solar facilities and the sluggish and often inconsistent permitting and inspection process for building or installing solar systems.

RESPONSES FROM EDUCATIONAL INSTITUTIONS

A separate survey questionnaire was sent to several key individuals in educational institutions who responded to the following topics:

Existence of a local solar technology cluster

Respondents were unanimous that a solar technology cluster was evident in the Albuquerque area.

Description of preparation and training for solar technology jobs

Within the Albuquerque metropolitan area there are numerous educational programs offered by the University of New Mexico and several community colleges, particularly Central New Mexico Community College, for educating students about solar technology jobs. Relative courses at UNM include a diversity of classes about solar thermal, solar photovoltaic technology, electricity storage, and renewable power in general. Energy-related courses at UNM are taught in the College of Engineering, School of Architecture and Planning, and the Water Resource Management program. Both Masters' Degrees and PhDs are available in energy/solar technology.

Job training is extensive for the solar system installation field. The Central New Mexico Community College through its Solar Center of Excellence Program provides customized training. The Workforce Connection of Central New Mexico (WCCNM) assists CNM in obtaining certification under the North American Board of Certified Energy Practitioners. WCCNM pays half of the salary of an employee for six months as part of its on-the-job training program. Students can earn college credit through a photovoltaic installation training program.

Connections with solar technology companies

Survey respondents all indicated that they had established connections with the local solar industries and with construction contractors. WCCNM has contracts



with numerous solar companies and cross-promotes its trainings with Central New Mexico Community College.

Description of research on solar technologies

Solar technology research is conducted at the University of New Mexico. This research covers everything from materials, devices, and systems for the production of electricity, PV and concentrating solar systems, to electricity storage, and fuel cell batteries.

Description of programs for the solar industry

UNM is working with some start-up businesses, adapting UNM technologies to their business model. In addition, UNM provides support to start-ups in terms of human capital, through a licensing agreement or by loaning a doctoral candidate. The State Energy Sector Partnership (SESP) provides grants for the Centers of Excellence program to local Community Colleges.



CNM's Sustainable Technology Lab grand opening in October 2011



CNM's Photovoltaic instructor Jessie Harwell describing a solar mount



Clean Energy Roundtable with Senator Martin Heinrich at the UNM Solar Array

RECOMMENDATIONS

The anticipated benefits of a solar technology cluster in the Albuquerque metropolitan area include:

1. the establishment of specialized information-sharing networks,
2. nurturing and sustaining skilled labor,
3. support and encouragement for innovative entrepreneurs,
4. promotion of research breakthroughs, and
5. enabling capitalized start-ups in the solar power industry

In order to strengthen this specialized industry cluster, there are several strategies that may be implemented even though economic conditions and incentives for solar energy production are uncertain.

Based on the survey findings and additional research undertaken for this study, the Mid-Region Council of Governments, together with private sector partners, offer the following recommendations for invigorating the solar cluster:

1. A concerted effort should be made to initiate a **local cluster association** representing the solar technology industry in the Albuquerque metropolitan area. The principal goal for such an association would be to enable collaboration among the common business interests and serve as a unified advocate for public policy and promotion of the solar power industry.
2. **Incentive programs** such as tax credits for solar power installations need to be maintained at the State and Federal levels in order to preserve the return on investment for solar power users. Other incentives include tax breaks for renewable energy manufacturers, grants for clean technology startups, and funding for training programs for green jobs.



Emcore solar array at Sandia Science and Technology Park

“A concerted effort should be made to initiate a local cluster association representing the solar technology industry in the Albuquerque metropolitan area.”

3. There are opportunities for the State of New Mexico to improve the **permitting process** in both the manufacturing and installation of solar power systems. For small systems in particular (10 kW or smaller), state regulations can be revised to cut unnecessary red tape, streamline the permitting and inspection process, and reduce the time and money required for a permit.
4. **Economic development programs**, both locally and statewide, should invest in recruiting and attracting solar energy research companies, suppliers, and support services that would be compatible with the existing solar technology cluster in the Albuquerque metropolitan area.
5. The **education and training institutions** in the Albuquerque area need to continue the programs that provide talent and credentials for occupations in the solar energy technology field. Continuing education is also necessary in order to meet the requirements for the rising skill levels and local availability of a specialized labor force. The University of New Mexico should seek to increase enrollments in graduate and post-graduate level programs in solar technology research, innovation, and related sciences.
6. Encourage a **Renewable Energy Certificate (REC) program** for schools and education facilities to help drive the market for increased distributed solar.
7. Municipalities, the University of New Mexico, Central New Mexico Community College and other **public facilities** such as Kirtland Air Force Base and Sandia National Labs are encouraged to move forward with solar power programs for energy self-sufficiency as a means to achieve “net zero” energy use.
8. Increase communication, awareness and utilization of solar resources at **Sandia National Laboratories** including:
 - o Solar Research and Test Facilities
 - o Licensing and Partnership Opportunities
 - o The New Mexico Small Business Assistance Program



Solar Array at the Albuquerque Academy

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APPENDIX A

STUDY METHODOLOGY

The methodology chosen for this study involves five phases including a literature review, a survey research and interview process, as well as private industry vetting.

Phase 1: Compile an inventory of cluster businesses and institutions. This phase involved the gathering of information from various data bases and other sources which identified solar-related industries and related businesses in the Albuquerque area. For example, solar company listings were obtained from the New Mexico Solar Energy Association, the New Mexico Green Chamber of Commerce, and the Solar Industry Council of Workforce Connection of Central New Mexico. Appendix B of this report contains the full inventory of solar-related industries compiled for this study, presented as a matrix table with contact information for the solar-related businesses, industries, and institutions in the Albuquerque metropolitan area, and as a map.

Phase 2: Conduct research to define cluster characteristics. This phase involved categorizing the cluster businesses, industries, and institutions into the three sectors as defined in Part II of this report. Information from company websites revealed products and services provided by each participant business in the industry cluster. Follow up interviews helped to clarify information and obtain permission to survey via a questionnaire to be completed by phone, mail-back, or face-to-face interview. One of the objectives in this study was to determine the linkages and relationships of the primary businesses and occupations comprising the cluster.

Phase 3: Design and distribute targeted survey questionnaire and follow up with in-person interview. This phase involved the preparation of two survey instruments, one to send to solar-related businesses selected from the inventory compiled during Phase 1 of the study, and one for educational and training institutions for purposes of understanding the adequacy of the labor pool to fill solar-related jobs within the cluster region. The solar-related businesses were not selected at random, but rather targeted to ensure a diverse representation of the various types of solar-related businesses and industries located in the Albuquerque metropolitan area. The two survey instruments designed for this study are provided in Appendix C.

Select individuals outside the MRCOG staff knowledgeable about the local solar power industry and economic development reviewed and pre-tested the questions developed for the survey. Some of the survey questionnaire forms were sent and returned by e-mail, and others occurred via face-to-face or phone interview. MRCOG staff followed up with many of the survey respondents to clarify responses and ask follow up questions.

Phase 4: Prepare a survey analysis with findings. This phase involved collecting and analyzing the survey forms from the respondents to inform researchers about the key issues related to the solar industry cluster. Since the format of the survey questionnaire was a series of open-ended questions, there was no statistical analysis to conduct, the overall content of the responses was the basis for a qualitative analysis.

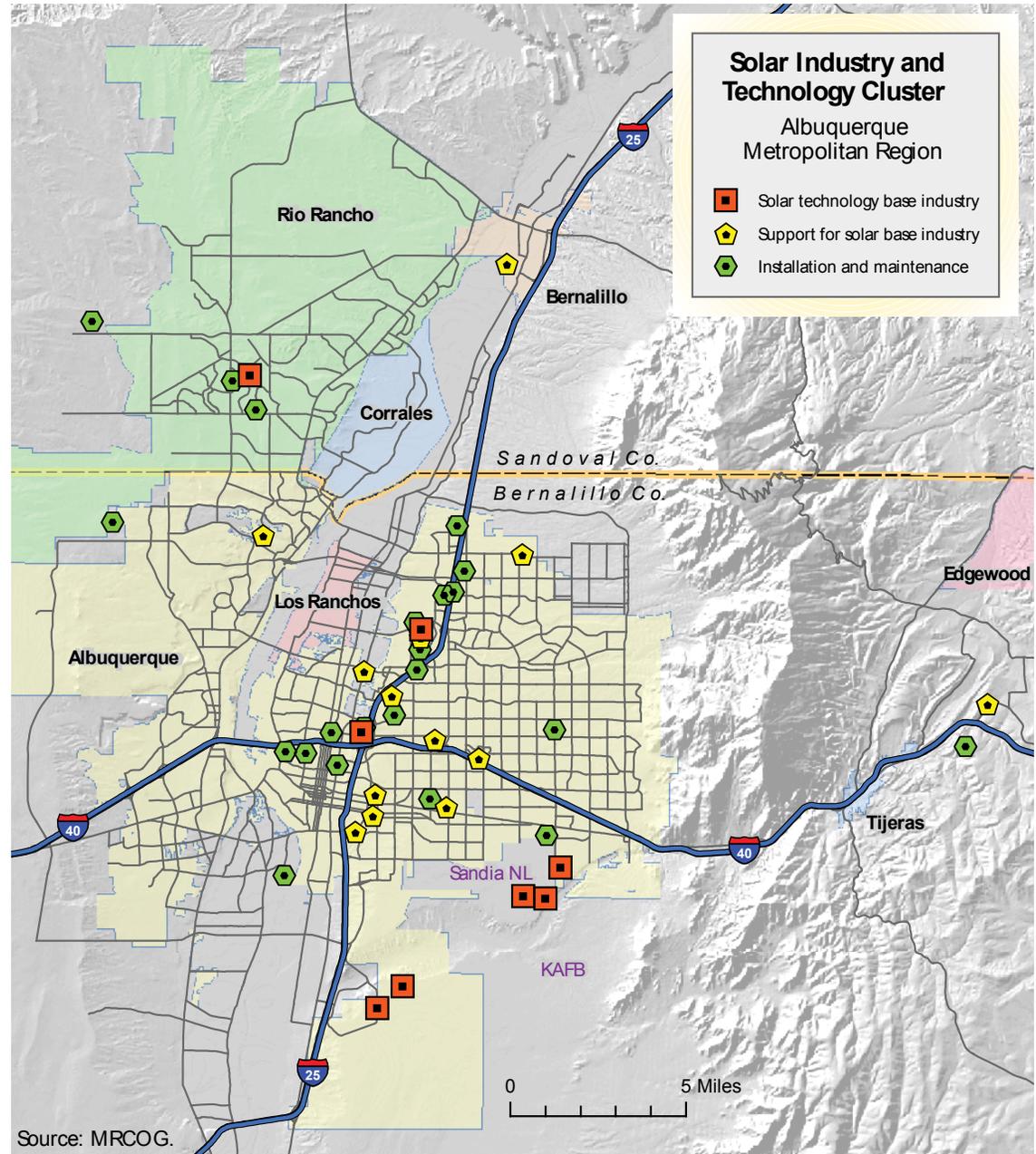
Phase 5: Pull out recommendations and receive industry feedback. This phase established the general findings and conclusions gleaned from the survey questionnaire, associated research concerning the local solar industry, and feedback from industry leaders. Responses from those interviewed became the basis for the study and recommendations on ways to strengthen the solar energy and technology cluster in the Albuquerque metropolitan area.

The MRCOG together with the New Mexico Green Chamber of Commerce held a roundtable meeting with approximately 20 industry leaders, including businesses, research institutions, government, and workforce representatives. The purpose of the roundtable was to vet the study for accuracy, and to glean additional recommendations for ways to strengthen the cluster. For a listing of roundtable attendees, see Appendix D.

APPENDIX B

SURVEY INSTRUMENTS

Locations of Solar-Related Businesses and Institutions



Listing of Solar Technology Businesses and Industries

Sec.	Industry	Products/Services	Contact	Location	Phone	E-mail Address
3	1A Solar Design	Installation of solar thermal and photovoltaic systems	Jim O'Brien	881 Nicklaus Dr. SE, Rio Rancho, NM 87124	505.507.2623	jimbrien@1asolar.design.com
3	AAA Solar Supply Inc.	Solar equipment supply house.	Chris Meech	2021 Zearing Ave. NW, Albuq. NM	505.243.4900	don@aaasolar.com
3	Affordable Solar Group Affordable Solar Installation	Designs and distributes solar energy systems	Rob Davis	4840 Pan American Frontage Rd. Albuq, NM 87109	505.944.4254	rob.davis@affordable-solar.com
3	All Star Electric	Designs, installs, services and repairs solar and wind power generation systems	Mike LaVine	10000 Trumbull Ave. SE, Albuq. NM 87123	505.856.1010	mike@allstarelec.com
2	Alpha-Omega Power Technologies, LLC	Solar simulator design, manufacturing, and testing	William Cravey	8504 Calle Alameda NE, Albuq. NM 87113	505.341.4828	cravey@alphaomegapt.com
1	Array Technologies, Inc.	Manufacture active solar tracking systems	Wendy Beach	3901 Midway Place NE, Albuq. NM 87109	505.881.7567	wbeach@arraytechinc.com
2	Central New Mexico Community College (CNM)	Education and training	Jessie Hornbull	525 Buena Vista SE, Albuq. NM 87106	505.224.4000 ext. 50245	jhornbull@cnm.edu
2	ConSolar Energy Consulting	Solar energy consultant	Julie Stephens	4800 Congress NW, Albuq, NM 87114	505.877.7716	consolarenergy@stephenses.com
3	CST: Consolidated SOLAR Technologies	Design, installation, and maintenance of solar photovoltaic systems	Mike Mattioli	5225 Pino Ave. NE, Albuq. NM 87109	505.792.6359	mmattioli@gocstsolar.com
3	Desert Sky Designs	Residential passive solar techniques	Robert Maze	3400 Alvarado Dr. NE Albuquerque, NM 87110-2004	505.884.3304	bob@desert-sky-designs.com
2	Direct Power and Water (DPW) Corporation	Photovoltaic systems integrator and manufacturer of PV racks and equipment enclosures	Loyda Najarro	4000 Vassar Dr. NE, Albuq. NM 87107	505.889.3585	dirpowdd@directpower.com
3	DKD Electric	Designs and installs photovoltaic solar systems	Josh Brokaw	6801 Academy Parkway West NE, Albuq, NM 87109	505.346.5185	jbrokaw@dkdelectric.com
3	Earth Smart Solar, Inc.	Installs solar systems	Jim Ritchie	2010 Virgin Wood Road, Rio Rancho, NM 87124	505.350.2756	jimritchie@earthsmartsolar.com
3	Eco Logic Air LLC	Provides green energy heating and cooling using solar and geothermal equipment	Eleanor Porter	1305 Hall Ct. SW, Albuq. NM	505.353.7997	ecologicair@yahoo.com

Sec.	Industry	Products/Services	Contact	Location	Phone	E-mail Address
1	Emcore Corporation	Research, design, and manufacturing of components and subsystems for solar photovoltaics, fiber optics technologies, and spacecraft power.	Mark Gaiser	10420 Research Rd. SE, Albuquerque, NM 87123	505.332.5000	Mark_Gaiser@Emcore.com
2	Enchanted Solar	PV solar applications	John Bodnar	9998 Montgomery NE Albuquerque, NM 87111	505.750.0372	johnb@enchanted solar.com
2	Environmental Dynamics Inc.	Architecture and sustainability consulting firm	Kent Beierle	142 Truman St. NE, Albuquerque, NM	505.242.2851	kent@edi-arch.com
3	Erica Enyart, LLC-UrbanEcos	Green design	Erica Enyart	69 Circle Dr. NE Albuquerque, NM 87122	505.877.8047	enyart@urbanecos.com
3	EverGuard Solar	Specializing in design, engineering and installation of photovoltaic systems	Dave Simmons	220 Menaul NW, Albuquerque, NM 87107	505.242.6511	dave@everguardroofing.com
1	Fraunhofer CFV Solar Test Laboratory	Testing and certification of photovoltaic modules	Martin Plass	5600-A University Blvd. SE, Albuquerque, NM 87106	505.9980100	info@cfvsolar.com
1	Goodrich ISR Systems	Develops space qualified solar power electronics	Freddie Hidalgo, Tech. Manager	6600 Gulton Court, NE, Albuquerque, NM 87109	505.345.9031	freddie.hidalgo@goodrich.com
1	Gratings, Inc.	Solar cell and panel manufacturing	Saleem H. Zaidi, CEO and Chief Scientist	2700-A Broadbent Pkwy. NE, Albuquerque, NM 87107	505.345.9564	Saleem@gratingsinc.com
2	GreenOffers, Inc.	Provides eco-friendly green promotion and marketing	Joe Rodriguez	6565 Americas Pkwy NE, Albuquerque, NM	505.563.5750	jrodriguez@greenoffers.com
3	Integrated Design & Architecture	Sustainable design services	Bob Hall	906 1/2 Park Avenue SW Albuquerque, NM 87102	505.243.3499	bob@integrateddesignarch.com
3	Koch Mechanical Co.Inc	Soar installation	Duane Koch	6131 Edith Blvd. NE Suite C Albuquerque, NM 87107	505.344.2025	kochmechanical@msn.com
3	LUZ Energy Corporation	Provides solar energy systems and services	Tina Padilla-Albano	1451 12 th Street NW, Albuquerque, NM 87104	505.877.3304	info@luzenergy.com
1	Mirasol Solar Energy Systems	Custom designed solar heating, cooling, power and green living systems	Linda Martin	101 Spring Road NE, Rio Rancho, NM 87124	505.892.6406	mirasolsolarenergy@gmail.com
3	Mud and Sun Construction	Installation and repair of solar systems	Carl Rudnick	PO Box 1206 Tijeras, NM 87059	505.281.2202	crudnick@thuntek.net
2	NM Radiant Supply Inc	Hot water solar panels	William Randolph Sommer	3448 Girard Blvd, NE Albuquerque, NM 87107	505.884.1630	info@nmradiant.com
2	NM Solar Energy Association	Educational non-profit organization dedicated to promoting solar energy and related sustainable practices	Ragan Matteson	1009 Bradbury SE #35, Albuquerque, NM	505.246.0400	info@nmsea.org

Sec.	Industry	Products/Services	Contact	Location	Phone	E-mail Address
3	Positive Energy	Installation and service of photovoltaic systems	Regina Wheeler	2809 Broadbent Parkway NE, Suite D Albuquerque, NM 87107	505.344.0071	Regina@positiveenergysolar.com
1	Precision Solar Technologies Corp	Manufacturing of solar tracking control mechanisms	T. M. Leonard	10 Camino del Senador, Tijeras, NM 87059	505.281.0399	TMLeonard@TapTheSun.com
3	Solar by Prime Electric, Inc.	Installation of solar systems	Ron Gutierrez	3312 Girard Blvd. NE, Albuquerque, NM 87107	505.827.0020	rgutierrez@prime-electricusa.com
3	Rio Grande Solar	Installation of solar systems	Ben Rodefer	5130-B San Francisco NE, Albuquerque, NM 87109	505.877.6527	benrodefe@gmail.com
3	Rocky Mountain Enterprises, LLC	Designs and installs solar energy systems	Steven Chavez	5 Venado Road, Tijeras, NM 87059	505.281.1646	sschavz@msn.com
3	Sacred Power Corporation	Provides renewable and distributive energy and telecommunications to Tribal communities	Odes Armijo-Caster	1501 12 th Street NW, Albuquerque, NM 87109	505.242.2292	odes@sacredpowercorp.com
1	Sandia National Laboratories, Photovoltaic and Grid Integration	Provides technical assistance to industry for photovoltaic energy systems	Charles Hanley, Manager	PO Box 5800, Albuquerque, NM 87185-1033	505.844.4435	cjhanle@sandia.gov
1	Sandia National Laboratories, Concentrating Solar Technologies	Develops and tests concentrating solar technologies	Ellen B. Stechel, Manager	PO Box 5800, Albuquerque, NM 87185-1127	505.845.1277	ebstech@sandia.gov
2	Solar Automation, Inc.	Design & manufacture equipment for solar modules	Patrick Gallagher	2520 Jefferson St. NE, Ste E, Albuquerque, NM 87110	505.830.3100	info@solarauto.com
2	Solarearth LLC	Sustainable design	Steven Stephens	PO Box 40614 Albuquerque, NM 87196	505.450.3486	Solarearth1@earthlink.net
3	Solar Power Evolution	Local builders offering solar photo-voltaic system and energy management services	Alexa Knight	2518 Eubank Blvd. NE, Albuquerque, NM 87112	505.299.8343	knight.alexah@gmail.com
3	Solar Shield Technologies LLC	Supply and install energy efficient coatings and window films	Jann Pierce	335 Washington St. SE, Albuquerque, NM 87108	505.554.3500	info@nmsolarshield.com
1	Solstar Energy Devices	Portable solar modules and foldable solar panels	M. Brian Barnett	1009 Bradbury Drive SE Suite 32 Albuquerque, NM 87106	505.217.1430	info@satwest.com

Sec.	Industry	Products/Services	Contact	Location	Phone	E-mail Address
2	Solar, Wind & Efficient Energy Consultants	Energy audits	Eugene Duran	241-A La Entrada, Los Lunas, NM 87031	505.865.1986	bocaloca@earthlink.net
3	Southwest Green Building Center	Environmentally friendly building and green living products	Cathy Kumar	5620 Venice Ave. NE, Albuquerque, NM 87113	505.821.6259	cak@swgbc.com
3	SUNBAYSOLAR, LLC	Designs and installs packaged solar panels	Kris Ramani	8115 Long Mesa Place NW, Albuquerque, NM 87114	505.897.1158	kris@sunbaysolar.com
2	Surplus Solutions LLC	Provides green recycling services	Steve Jones	5445 Edith Blvd. NE, Albuquerque, NM	505.506.8968	steve@surplussolutions.org
3	310 Solar, LLC	Designs and installs photovoltaic systems	Steve House	5811 Carmel Ave NE, Ste B Albuquerque, NM 87113	505.822.9200	stevch@310solar.com
3	Unirac, Inc.	Provider of mounting and infrastructure for solar power systems	Marcelo Gomez	1411 Broadway Blvd. NE, Albuquerque, NM 87102	505.242.6411	Marcelo@unirac.com
2	University of New Mexico	Education and research	Office of VP for Research	MSC05 3480, Scholes Hall #327, UNM 87131-0001	505.277.6128	vpr@unm.edu
2	Waterworks Mechanical, Inc.	Full service solar thermal, plumbing, installation, etc.	Mike or Chris Montes	1500 Cochiti, SE Albuquerque, NM 87108	505.292.8464	www.wwmech.com
2	Workforce Connection of Central New Mexico	Training and certification	Patrick Gannon	501 Mountain Road NE Albuquerque, NM 87102	505.843-1940	pgannon@wccnm.org
2	Zomeworks Corporation	Production of photovoltaic racking and trackers, passive solar systems	Andrea Sarracino	1011A Sawmill Road, Albuquerque, NM 87104	505.242.5354	zomework@zomeworks.com

Table Notes

Column One

Sector 1 – Solar technology base industry

- Research, design and testing
- Manufacturing and production

Sector 2 – Provides support services to Tier One industries

- Engineering consultation
- Materials and components
- Marketing and distribution
- Financial and legal services
- Education and training of workforce

Sector 3 – Solar installation and maintenance

- System installers
- System maintenance and operations

Column Two – Name of company or corporation

Column Three – Solar products or services provided

Column Four – Contact person for information

Column Five – Physical location of the company or corporation production facility or service headquarters

Column Six – Local contact phone number

Column Seven – Local contact e-mail address

Targeted Interview Questionnaire

Regional development clusters are generally defined as groups of companies and institutions co-located in a specific geographic region and linked by interdependencies in providing a related group of products and/or services.

The Mid-Region Council of Governments is conducting a study of the evolving development cluster of solar energy and technology industries in Central New Mexico. An element of this solar technology cluster study involves targeted interviews with some of the key industries engaged in the development, production, and/or installation of solar energy systems. Your participation will be greatly appreciated as a contribution to this study. [Send completed form to MRCOG, Attn: Joe Quintana, 809 Copper Av. NW, Albuquerque, NM 87102 or e-mail to jlquintana@mrcog-nm.gov or call 724-3622].

[1] What is the official name of your organization?

[2] Can you generally describe the goods and/or services that you produce/ provide locally?

[3] Where are the markets for your products or services?

4] Do you think the market for your products/services in New Mexico is large enough and growing quickly enough? If not, can you provide suggestions on how to improve local markets?

[5] Does the local labor force have the skills and knowledge your company needs? Explain.

[6] Do local educational institutions provide adequate training for your needs? Explain.

[7] What local support industries/services do you utilize in your current business operations? For example, suppliers, distributors, components manufacturers, and other partners locally.

[8] What local support industries/services would you like to have, that you don't now have? For example, special legal counsel, recruitment agents, nonprofit assistance like TVC, etc

[9] Do you agree that a Central New Mexico solar technology cluster currently exists?

[10] How might your company benefit as part of a Central New Mexico solar technology cluster?

[11] Would a local solar technology cluster association be useful to your company? Explain.

[12] What suggestions do you have to improve the business climate in New Mexico?

Questionnaire for Educational Institutions

Regional development clusters are generally defined as groups of companies and institutions co-located in a specific geographic region and linked by interdependencies in providing a related group of products and/or services.

The Mid-Region Council of Governments is conducting a study of the evolving development cluster of solar energy and technology industries in Central New Mexico. An element of this solar technology cluster study involves targeted interviews with some of the key industries engaged in the development, production, and/or installation of solar energy systems. Specialized education and workforce training is crucial to the success of a solar technology cluster. Your participation will be greatly appreciated as a contribution to this study.

[1] Do you agree that a Central New Mexico solar technology cluster currently exists?

[2] What is the school doing to prepare, train, or educate a workforce with skills necessary for the solar technology field?

[3] Does the school have direct connections with any solar companies (local or national)?

[4] Is the school doing any research on solar technology? If so, what type of research?

[5] Is the school involved in any start-up programs for the solar industry? Explain.

[6] Is the school involved in solar technology transfer or commercialization? Please describe your efforts.

APPENDIX C

STRATEGIC PRIORITIES FOR THE RENEWABLE ENERGY AND GREEN TECHNOLOGIES ECONOMIC CLUSTER

(Excerpt from the 2010 - 2015 Comprehensive Economic Development Strategy)

Expand Access to Financial and Human Capital	Refine Legal and Policy Structures to Build Cluster	Expand Renewable Energy and Green Technologies Markets	Create Consistent, Streamlined Regulations	Promote the Cluster and Its Economic Benefits
<ul style="list-style-type: none"> • Create a Funders Table (comprised of venture capitalists, bankers, and government agency reps) to field funding requests • Work with state government to publicize incentives available to businesses in this cluster • Promote power purchases by third parties with resales to schools and municipal governments • Leverage existing resources available through the national labs, state universities, and existing businesses 	<ul style="list-style-type: none"> • Establish an energy financing district • Change the authorizing legislation for the Renewable Energy Trans-mission Authority (RETA) to allow transmission lines and to provide other tools • Create regional energy policy model that addresses supply and demand and that can be replicated throughout the state • Use finance mechanisms through property tax assessments & encourage adoption of energy efficiency tools and renewable energy alternatives 	<ul style="list-style-type: none"> • Incubate technology and create ways to move into production more efficiently (technology transfer) • Develop markets for products at the utility and rooftop scales • Support energy efficiency upgrades in municipal buildings—as a model for future efforts for homes and businesses. • Consider expanding the use of alternative fuels in municipal fleet vehicles. 	<ul style="list-style-type: none"> • Develop clear guidelines for renewable energy including rules on construction and installations • Work with jurisdictions in the region to increase the consistency of policies, codes, and regulations • Develop an advocacy campaign aimed at utilities and gov. jurisdictions to streamline regulations 	<ul style="list-style-type: none"> • Build our vision and crystallize agreement to act on it • Promote cluster as a vehicle for creating sustainable jobs with low environmental impact • Identify barriers to growth of the cluster • Collaborate with organizations involved in economic development activities related to the cluster • Use websites (such as the site hosted by the NM Economic Development Dept. and nmsitesearch.com) to promote the cluster

APPENDIX D

INDUSTRY REVIEW

Solar Roundtable Discussion hosted by the New Mexico Green Chamber of Commerce
Thursday, January 10, 2013 10:00am-2:00pm



NEW MEXICO
GREEN CHAMBER OF COMMERCE
POWER UP YOUR BUSINESS

Attendees:

1. Odes Armijo Caster, COO of Sacred Power, Green Energy Council
2. Tom Styer, General Manager, Consolidated Solar Technologies
3. Sandra Gaiser, AICP, Regional Planner of Mid-Region Council of Governments
4. Derrick Webb, Regional Planner, Mid-Region Council of Governments
5. Patricia Mattioli, Consolidated Solar Technologies
6. Tommy A. Trujillo, Consolidated Solar Technologies
7. Rachel Hillier, formerly Business Development at Affordable Solar
8. Wendy Beach, Array Technologies
9. Subhash L. Shinde, Manager – Concentrating Solar Technologies, Sandia National Laboratories
10. Jason Marks, former PRC Commissioner
11. Mark Gaiser, Principal Applications Engineer, Solar Array Engineering
12. Elizabeth Kistin Keller, Program Leader, Sandia Science & Technology Park, Sandia National Laboratories
13. Ann H. Simon, Economic Development Program Manager, MRCOG
14. Clayton Abbey, Government Affairs Representative, CNM
15. Lisa Aldon, MA, CPP, Program Coordinator, CNM Workforce Training Center
16. Charles Hanley, Sandia National Laboratories
17. Peter Lorenz, CEO Unirac
18. David Hughes, CEO of Affordable Solar
19. Tom Young, DPW
20. Eddie Sessa, CST
21. James Mosher, Operations Manager, CST
22. Sarah Cottrell Propst, Executive Director, Interwest Energy Alliance
23. Allan Oliver, CEO, NMGCC
24. Lindsay Laine, Statewide Project Coordinator, NMGCC

Additional Feedback and Expertise

1. Brian Birk, Sun Mountain Capital
2. Kim Sanchez-Rael, Flywheel
3. Marcelo Gomez, UNIRAC Inc.
4. Andrea Sisneros-Wichman, CNM Solar Program
5. Regina Wheeler, Positive Energy



**Prepared by
Mid-Region Council of Governments staff**

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Derrick Webb
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