Report:
Austin Renewable Energy Workforce Assessment

AngelouEconomics
technology-based economic development

www.angeloueconomics.com

Presented to:

WorkSource
Austin Community College
Capital Idea
Greater Austin Chamber of Commerce

WorkSource

Austin Community College District

Capital Idea
Connecting People to Their Future

Austin Chamber of Commerce

SEPTEMBER 2007
DRAFT

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EXECUTIVE SUMMARY

The *Austin Renewable Energy Workforce Assessment* is the first of two reports to be developed in the creation of an education and training program to prepare workers for jobs in the renewable energy industry.

Key Points

This first report, the *Austin Renewable Energy Workforce Assessment*, takes a global view of the renewable energy industry, spotlights the industry and its growth in the Austin area, reviews the workforce for the renewable energy industry and the skills workers must have to perform jobs in the industry, and provides an employer perspective on the type of skills workers should have to perform successfully in the industry. The report concludes by examining the current production of workers that renewable energy businesses need.

While the Austin region is renowned for its environmental-friendliness and innovative public utility, the Austin region's renewable energy industry is only beginning to emerge as a true source of jobs and wealth for the region. AngelouEconomics' assessment of the renewable energy industry and workforce focuses on the following issues:

- Providing a workforce to service this industry is complicated by the start-up, emerging nature of the industry and the current needs for experienced, jack-of-all-trades employees.
- The Austin region has a broad base of companies participating in virtually every sector of the renewable energy industry, but also has emerging clusters of solar energy, wind power, energy storage and energy services companies, which will enable the region to better focus its workforce development efforts as employers grow and mature over time.
- The Austin region has an excellent track record of training and equipping similar workforces for the semiconductor and electronics manufacturing industries.
- The mismatch between regional educational and workforce development enrollment trends and types of employees being sought by renewable energy companies indicates the need for targeted marketing and educational activities within the engineering, construction, and associated trade occupations.

Data Sources

AngelouEconomics used a variety of sources to collect the quantitative and qualitative information used in our analysis. To begin, the consulting team collected numerous studies and plans developed for the Austin region regarding the renewable energy industry and workforce development within the renewable energy industry. AngelouEconomics also gathered qualitative data through focus groups, community tours, and other community fieldwork. AE received the input of individuals representing solar, wind, biofuels, and energy efficiency businesses in the Austin area.

Before we begin the report, we would like to provide one note of caution regarding data sources for the renewable energy industry. The availability of accurate quantitative data – including economic, demographic, and other types of data – is limited by the small size of the renewable energy industry relative to Austin's economy as a whole. Where possible, AngelouEconomics has noted particularly large discrepancies within data that could influence workforce decisions or the characterization of the region's renewable energy industry. AngelouEconomics has made every effort to mitigate these factors in order to ensure the highest degree of data reliability possible given the state of data on this industry. Quantitative data was collected from national, state, and local sources, including the Texas Workforce Commission, the U.S. Bureau of Labor Statistics, DecisionData Resources, ESRI, and Dun & Bradstreet.

Workforce development and education should be the cornerstone of any economic development initiative, particularly in the renewable energy industry. Labor, and an educated and trained workforce have become much more critical factors in expansion and relocation decisions of renewable energy companies over the past few years as today's jobs transition from experimental technologies to manufacturing, installation, operations, and service jobs.

A region's economic strength will depend heavily on its ability to attract, retain, and develop a human capital base that is skilled and flexible. Skilled human capital is at a premium in an era when workforce growth is declining. Not only do employees switch jobs more often, the growth rate of that workforce is slowing.

For these reasons, communities are competing furiously amongst themselves to attract and retain the brightest talent available across all ages and demographics. Reports vary in which is most important, but the top three aspects considered by the 25-44 age demographic in deciding their location are their particular job offer, the overall job market in a region, and the quality of life offered in a region. Younger generations may place additional emphasis on the overall job market and quality of life factors. Next Generation Consulting reports "3 out of every 4 young people under the age of 28 first pick a place to live and then find a job."

Therefore, communities that lack the environment to support their populations are at a competitive disadvantage. A case in point: access to human capital drove computer maker Gateway Inc. to relocate its headquarters from North Sioux City, South Dakota to San Diego, California. To grow requires the very best and brightest executives and engineers, and few wanted to call South Dakota home. "San Diego was an excellent move for us, because it's ideal for attracting the kind of talent in the numbers that are required now for us at Gateway," explained John Heubusch, Gateway's vice president of public affairs.

To create a competitive advantage in a global economy, any community must have an aggressive and forward-thinking plan that integrates workforce and economic development efforts. National, regional, state, and local economies are facing an increasing crisis in workforce development—the process of identifying and developing the skills needed by businesses, nonprofit and government employers, individuals, communities, and other social institutions. Technological advancements in all economic sectors have accelerated the need for improved technology and business skills among workers at all levels. Lifelong learning is now necessary in order to obtain and maintain these skills. Innovative thinking, increased collaboration, and more integrated processes and systems within workforce and economic development are now required to position oneself competitively for future growth and prosperity.

By continuing to expand on accelerated workforce development programs in key industries such as renewable energy, supporting quality of life in the region, and maintaining open lines of communication among renewable energy companies, economic development organizations such as the Austin Chamber of Commerce, educational institutions, and workforce development agencies, Austin can capitalize on the growth of perhaps the most important emerging industry today – renewable energy.

In this section, we explore the larger trends shaping the Austin MSA's workforce capabilities. From population growth and age to educational attainment and wages, these underlying data demonstrate the momentum in the Austin economy, and point to continued success in the future. By creating jobs and raising incomes through continued increases in the technology-based economy and the expected successes of emerging new industries like the renewable energy industry, Austin can maintain its trajectory of high-quality economic growth.

REGIONAL ECONOMIC OVERVIEW

POPULATION

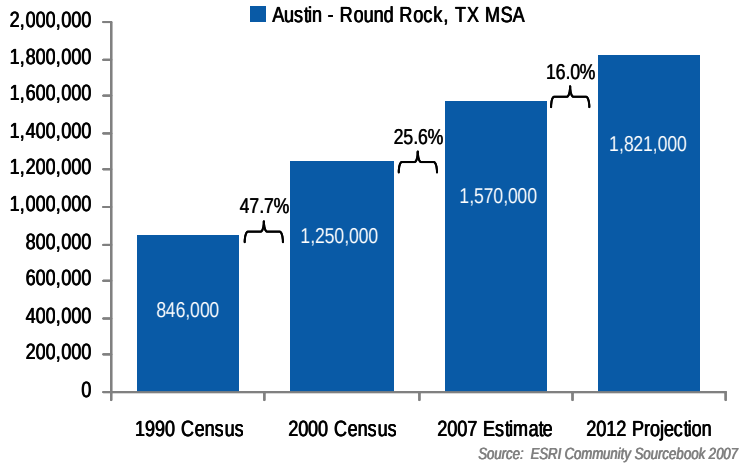
- The Austin MSA has experienced continuous rapid growth for 20 years, providing companies with growth opportunities in providing renewable energy services as well as providing a rapidly expanding pool of people from which to draw an adequate workforce. The Austin MSA is projected to have more than doubled in size from 1990 to 2012, from nearly 850,000 people in 1990 to more than 1.8 million people in 2012.

- Austin's population growth is primarily coming from in-migration to the region and natural growth from within the region. Austin tends to attract most of its growth from California, major MSAs within Texas, as well as from Chicago and New York. The Austin MSA is also increasingly attracting residents from overseas, though it has a net loss of residents to Seattle, Washington, DC, and Tennessee.

DEMOGRAPHIC BREAKDOWN

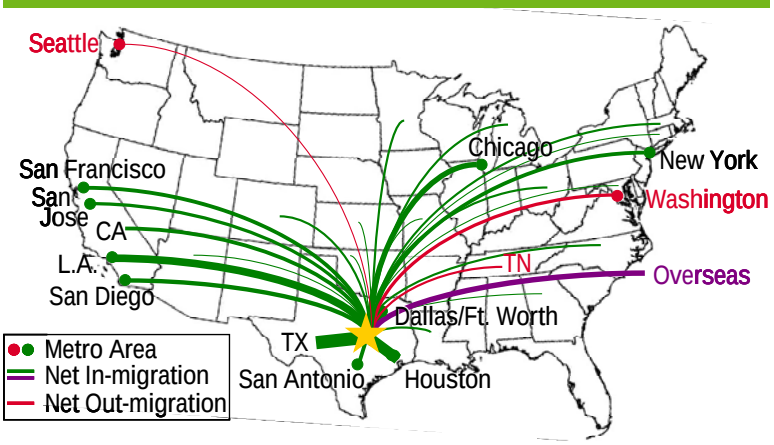
- In 2006, the Austin MSA had 56.4% of its population of prime working age, with 34.1% of its population between the ages of 25 and 44, and an additional 22.3% between 45 and 64.

AUSTIN MSA POPULATION, 1990-2012



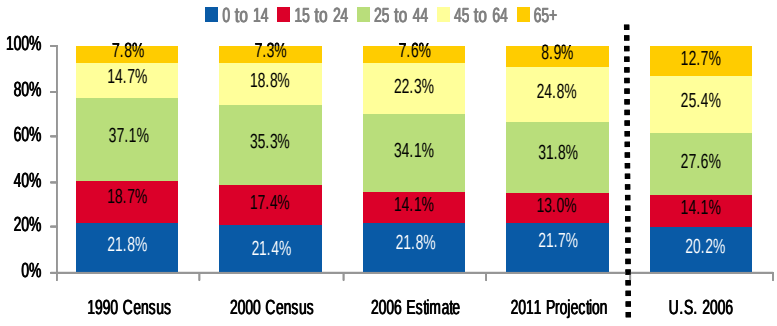
Source: ESRI Community Sourcebook 2007

AUSTIN MSA MIGRATION PATTERNS, 2005



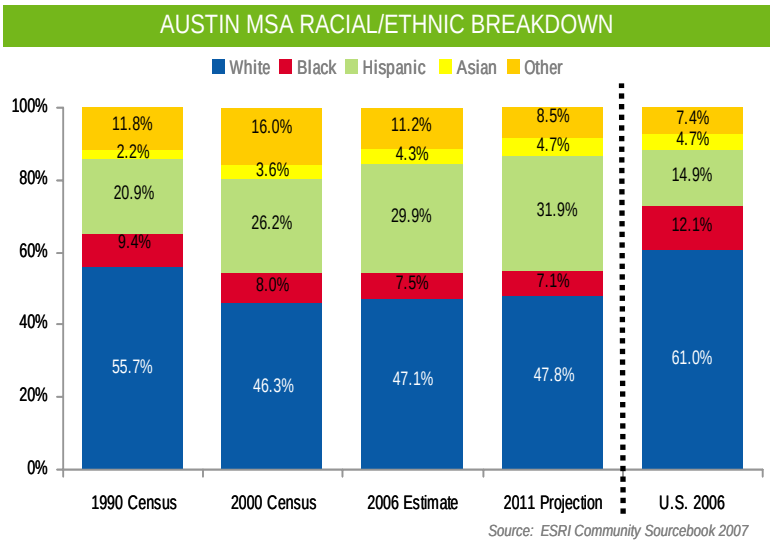
Source: IRS County to County Migration Patterns

AUSTIN MSA AGE DISTRIBUTION, 1990-2011



Source: ESRI Community Sourcebook 2007

- The Austin MSA had a median age of 32.9 in 2006, almost 4 years younger than the U.S. median age of 36.5. This very young population indicates strong population growth among desirable demographics in the region, even as the region and the country as a whole age.

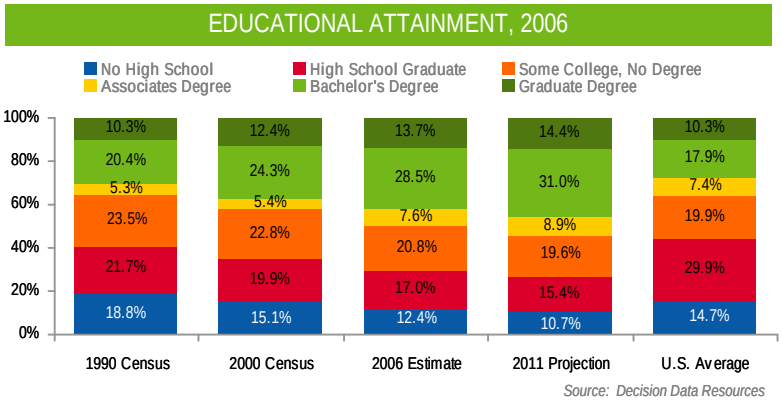


- The Austin MSA is very diverse, with no racial or ethnic majority group. In 2006, 47.1% of the population was White, almost 30% of the population was Hispanic, 7.5% Black, 4.3% Asian, and 11.2% of other races or ethnicities.

- Employers value diverse workforces for providing additional points of view in company management, different sources of creativity and technical expertise, and for the ability to serve diverse customer bases.

EDUCATIONAL ATTAINMENT

- In 2006, Austin was one of the top 5 MSAs in the U.S. for educational attainment, with 42.2% of the population having achieved a bachelor's degree or higher. This is one of the most significant strengths of the Austin MSA for attracting employers and building a regional economy in highly technical industries such as renewable energy.



- In addition, Austin has a very high and growing percentage of its population with some college but no degree or with an associate's degree. This 28.4% of the population represents an excellent opportunity for targeted workforce training directed at moving people into renewable energy jobs.

- The region has a diverse and strong base of two and four year institutions, including The University of Texas at Austin, Texas State University, Southwestern University, St. Edwards University, and Concordia University, along with the Austin Community College System. While most of this system is geared toward producing 4-year college graduates, Austin Community College also serves as the regional workforce training provider and produces skilled workers for many different types of jobs in all regional industries.

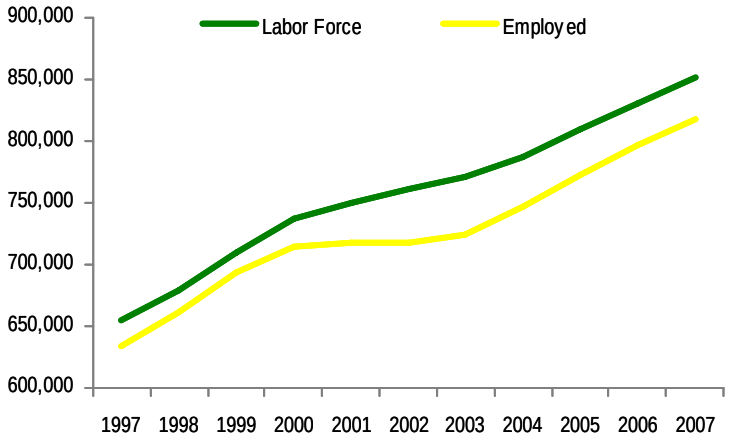
LABOR FORCE AND UNEMPLOYMENT

- The Austin MSA labor force has been growing steadily over time, with some slowdown between 2000 and 2004 as the region recovered from the dot.com bust. There are more than 800,000 employees in the Austin MSA in 2007.
- Employment across the region remained virtually steady from 2000 until 2003, and since has continued its rise along virtually the same trajectory as from 1997-2000.
- Austin's unemployment rate has risen substantially since 1999 when it stood near 2%, an unsustainable rate of unemployment. Except for the immediate post-bust era, Austin's unemployment rate has remained substantially below the national average. In July 2007, the unemployment rate stood near 4.0%.

WAGES AND INCOME

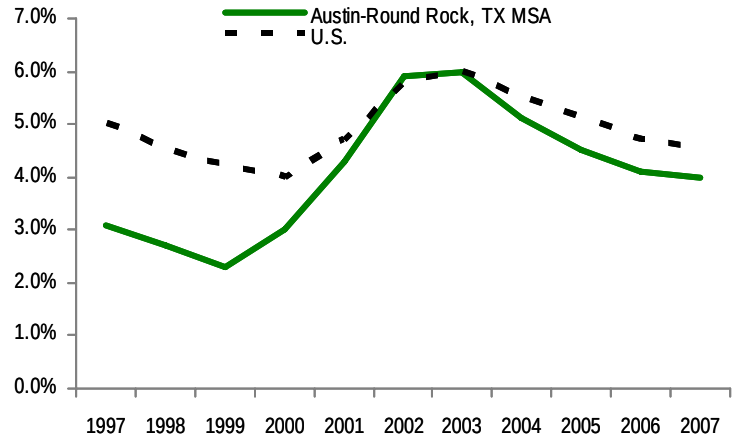
- Annual wages in the Austin MSA have been climbing steadily since 2002, gaining roughly 16.7% percent over the last five years. Average annual wage in the Austin MSA now stands near $47,000 per year, versus only $42,000 annually in the U.S. as a whole.

AUSTIN MSA LABOR FORCE & EMPLOYMENT, 1997-2007



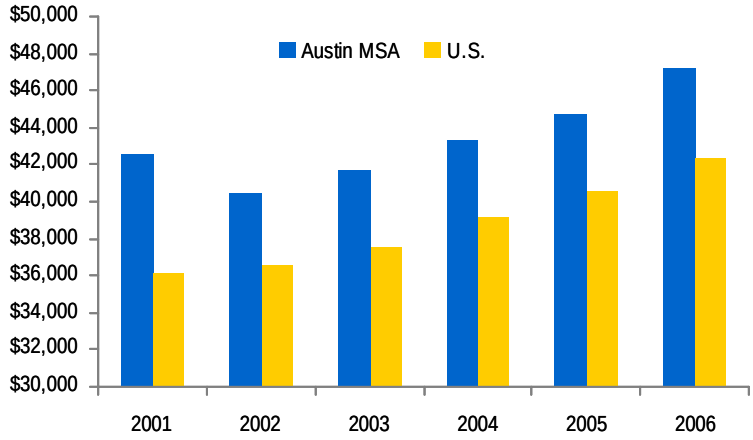
Source: Bureau of Labor Statistics

AUSTIN MSA UNEMPLOYMENT RATE, 1997-2007



Source: Bureau of Labor Statistics

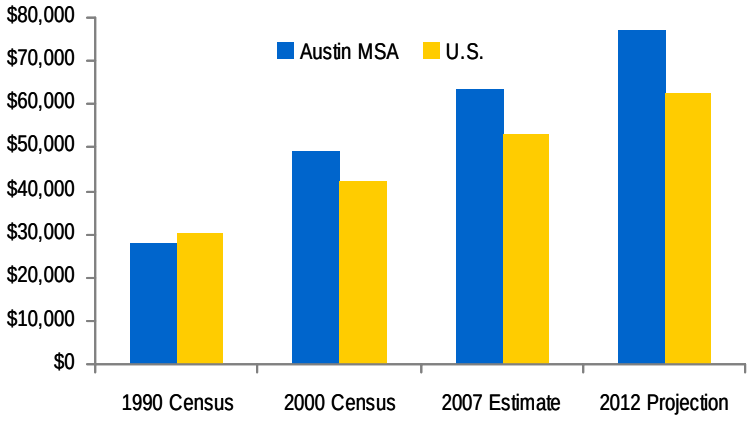
AVERAGE ANNUAL WAGES, 2001-2006



Source: Bureau of Labor Statistics

- In addition, median household incomes have been rising extremely fast as well, due to both the explosion of dual-earner households as well as to higher average wages in the Austin MSA. In 1990, Austin's median household income was below the national median; since 2000, Austin has surpassed the national median and continues to grow faster, with median household incomes projected to approach $80,000 by 2012.

MEDIAN HOUSEHOLD INCOME, 1990-2012



Source: ESRI Community Sourcebook 2007

REGIONAL ECONOMIC OVERVIEW SUMMARY:

The Austin region has an extremely well-educated population and excellent higher education resources. As the region continues to grow in population, diversify ethnically and racially, and attract people from around the country and around the world, Austin is well positioned to take advantage of emerging fields at the intersection of its environmentally-minded spirit and its high-technology industrial focus.

INDUSTRY DEFINITION

Renewable energy, in the tradition of electronics, biotechnology, and other technology waves, has become the newest industry to attract the attention of investors and economic developers worldwide. The renewable energy industry is broadly defined by technologies and services that reduce or eliminate the environmental impact of primary energy production, energy consumption and electricity generation. Renewable energy companies focus on providing cost-effective, non-polluting sources of energy for electricity production or transportation fuels or in reducing the needs for polluting sources of energy. The renewable energy industry has traditionally been analyzed in terms of technologies, with solar power, geothermal, wind, clean coal, biofuels, and fuel cells comprising the primary technologies. The industry is also driven by advances in green building and energy and water conservation, battery technologies and energy storage, ocean and wave power, superconducting electrical transmission lines, and a wide variety of electronic, mechanical, and industrial processes and services.

Because of the distributed nature of the industry across the U.S. and its start-up status, attempts to define renewable energy through traditional government employment statistics are at best outlines of a broad group of industries with some relation to renewable energy. Below, we describe the sub-sectors within the renewable energy industry in which companies often compete. Many companies within these sectors, however, do not produce renewable energy technologies or services, while some renewable energy companies may fall outside of this narrow definition.

RENEWABLE ENERGY INDUSTRY DEFINITION – BLS NAICS CODES

NAICS Code	Industry Definition	Industry Explanation	Value Chain Location	In Austin MSA?
325193	Ethyl Alcohol Manufacturing	Ethanol Production	Manufacturing	NO
333610	Turbine and Power Transmission Equipment	Wind Turbine Manufacturing	Manufacturing	YES
334413	Semiconductor and Related Devices	Solar Panel Manufacturing	Manufacturing	YES
335512	Motor and Generator Manufacturing	Hybrid Vehicle Technology Manufacturing	Manufacturing	NO
335999	Miscellaneous Electrical Equipment	Fuel Cell Manufacturing	Manufacturing	YES
237130	Power/Communication System Construction	Solar & Wind Power Installation (Commercial)	Sales & Installation	YES
238290	Other Building Equipment Contractors	Solar & Wind Power Installation (Residential)	Sales & Installation	YES
423690	Other Electronic Parts Merchant Whsle	Solar Cell Wholesalers	Sales & Installation	YES
423720	Plumbing Goods Merchant Wholesalers	Solar Heater Wholesalers	Sales & Installation	YES
221119	Other Electric Power Generation	Alternative Energy Generation	Generation, Operations, & Maintenance	YES
221121	Electric Bulk Power Transmission	SmartGrid Technology	Generation, Operations, & Maintenance	YES
541330	Engineering Services	Environmental Engineering Services	Services & Research	YES
541380	Testing Laboratories	Environmental Testing Laboratories	Services & Research	YES
541620	Environmental Consulting Services	Environmental Consulting Services	Services & Research	YES
541690	Other Technical Consulting Services	Energy Consulting Services	Services & Research	YES
541710	Physical/Engineering/Biological Research	Alternative Energy Research & Development	Services & Research	YES

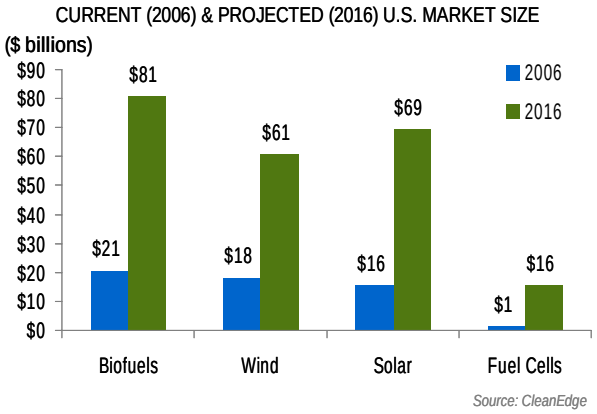
Source: AngelouEconomics

NATIONAL GROWTH TRENDS

Renewable energy is a long-term growth industry. As the American economy continues to grow, energy consumption will rise, although recent trends indicate that U.S. energy consumption has temporarily stopped growing as higher oil prices have fostered growing demand for energy conservation. The U.S. growth in high-tech equipment and personal electronics is contributing to increased energy use as well; energy consumption per capita is expected to rise 17 percent through 2025. The United States lacks the domestic fossil fuel resources to meet projected energy demand, and renewable energy sources are being developed rapidly to step into the breach. In many cases, renewable energy has become a commercially viable alternative to traditional polluting energy sources such as coal and other fossil fuels, and is widely available domestically.

Falling costs for renewable energy technologies combined with rising prices for conventional fuels have made many of these technologies feasible today. For these reasons, renewable energy sources have risen as a solution for many of our energy related problems.

RENEWABLE ENERGY GROWTH



Source: CleanEdge

In addition, the energy and utility industries are undergoing a series of transformations as geopolitical, environmental, and regulatory trends combine to affect the ways in which energy and utility companies operate and what core competencies they will choose to build their companies on in the future. These companies face many uncertainties and challenges, including responding to higher energy prices, competition for customers in what have traditionally been regulated markets, meeting state and national government mandates for renewable electricity and clean fuels production, and reducing risk in the face of anticipated restrictions on emissions of global warming gases. In addition, as oil and natural gas prices have risen, excess capital available to traditional energy companies is being poured into company-level venture capital funds which are investing in a variety of traditional and renewable energy technologies. Energy companies must manage these myriad changes with an eye toward new technological innovations and the spread of less controllable distributed energy systems.

Transportation systems are also beginning to undergo similar transformations, with stricter emissions standards, rising gasoline prices, and renewed competition among car companies for "green" status driving innovation. With new engine and propulsion technologies being explored that could bring an end to the hundred-year reign of the internal combustion engine and the petroleum-based fuels needed to supply it, the separation of energy production for transportation and energy production for electricity could cease to exist.

These fundamental changes in the constraints of energy production and consumption all drive the growth of the renewable energy industry. Renewable energy is now the fastest growing segment of the energy industry; with market size in its four primary sectors (biofuels, wind, solar, and fuel cells) expected to increase from $56 billion in 2006 to $227 billion over the next decade. Austin's regional economy, and indeed the world economy, depends on having clean, reliable, and affordable energy – which is increasingly coming to mean renewable energy.

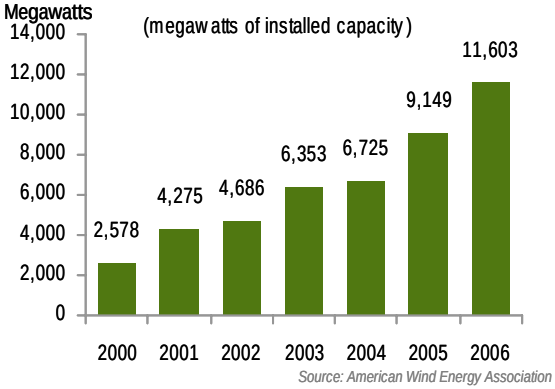
RENEWABLE ENERGY TECHNOLOGIES – PRIMARY ENERGY PRODUCTION

Wind Energy

Wind energy is rapidly rising as a commercially viable source of electricity. Driven by a federal production tax credit and renewable portfolio standards (RPS) requiring utilities in many states to produce a certain amount of electricity from renewable sources, wind energy has grown dramatically over the last 7 years, with Texas now leading the nation in wind energy production. Wind power provides predictable electricity costs for utilities, and long-term contracts lock in prices to reduce uncertainty in decision-making for utilities. Unfortunately, much of the wind power potential in the United States is located far from major urban areas of power consumption, and only new electrical transmission lines will alleviate the problem.

- Global capacity of 75,000 megawatts, with 15,000 megawatts added in 2006
- U.S. capacity of 11,600 megawatts, with 2,500 megawatts added in 2006
- Top U.S. states for wind energy include Texas, California, Iowa, Minnesota, and Washington
- 30 U.S. states have utility-scale turbines in operation

WIND ENERGY



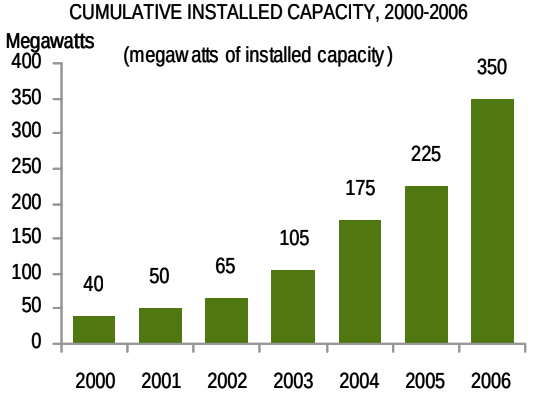
Source: American Wind Energy Association

Because wind farms require permanent employees to maintain and operate them, wind energy produces jobs at different levels – in operation as well as in wind turbine component manufacturing and construction. These jobs, unlike other high-paying jobs in technology-based industries are widely available in rural areas where wind farms are located, and manufacturing plants are likely to be located in areas near wind farms because turbine blades are difficult to transport over long distances due to their size.

Solar Power

Solar power, though not currently cost competitive for most industrial applications, continues to advance in technical and cost terms, with renewable portfolio standards, innovative new solar technologies, and growing power demand in the sun-blessed Southwest driving demand for solar power. New breakthroughs in nanotechnology and plastics could substantially reduce the cost of solar power and provide mechanisms for placing solar power on nearly any surface without specialized solar cells. Indeed, some of these startup companies have recently entered wide scale production, introducing plastic thin film solar strips to the market.

GRID-TIED SOLAR PHOTOVOLTAICS



Source: Solar Energy Industries Association

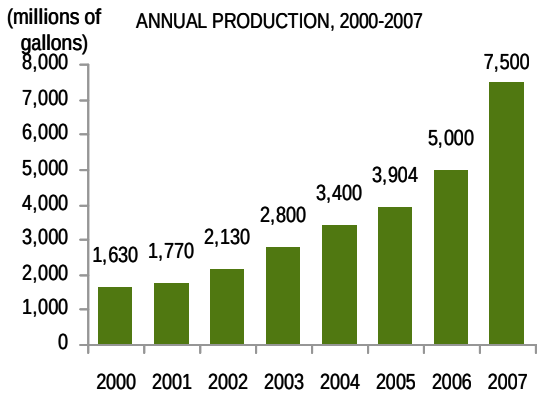
Solar power opportunities also exist in commercial-scale concentrated solar power projects, where solar panels concentrate energy into a collecting lens, which then superheats a liquid to turn electricity-generating turbines. Finally, solar hot water heating, which provides hot water from solar panels on the roofs of houses, shows excellent promise in expansion, given a stable regulatory and incentives environment.

Solar power provides excellent potential for creating jobs, with a recent UC Berkeley study showing that every megawatt of solar capacity installed creates 20 manufacturing and 13 installation and maintenance job-years. Manufacturing solar cells requires similar technologies to the first process in manufacturing computer chips, so many of these manufacturing jobs will be located in high-tech communities.

Biofuels and Biomass

Biofuels provides another success story driven by regulatory changes. Biofuels, including ethanol and biodiesel, are the fastest growing portions of the energy industry, with ethanol production capacity expected to double by 2010 to over 10 billion gallons of production per year. In 2005, methyl tertiary butyl ether (MTBE), a gas additive, was phased out of use in the United States due to leakage problems from underground storage tanks and its tendency to contaminate underground water sources and was replaced with ethanol.

U.S. ETHANOL PRODUCTION



Source: U.S. Energy Information Agency

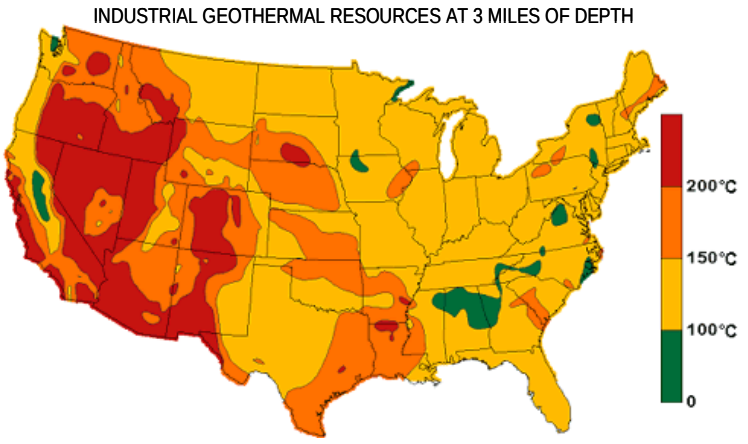
Ethanol in America is primarily made from corn by converting corn sugars into ethanol through a refining process. Corn-based ethanol production is rapidly bumping up against supply constraints as corn is needed for animal feed, driving increases in the commodities price of corn. Corn-based ethanol enjoys protectionist tariffs penalizing cheaper sugar cane-based ethanol from Brazil from being imported to meet U.S. fuel demands. Ongoing research into cellulosic ethanol promises breakthroughs in converting cellulose, or woody biomass, including the stems and branches of brush and agricultural byproducts into ethanol.

Ethanol's cousin "biodiesel" is derived from leftover cooking oils, vegetable oils, and other cooking byproducts, and burned in regular diesel trucks. In addition, growth of soybean production could expand availability of biodiesel as another alternative transportation fuel. Interestingly, some ethanol plants are being fueled by solid biomass, burning manure from dairies to power the ethanol and biodiesel manufacturing processes. Because of the difficulty in transporting ethanol long distances (ethanol is corrosive to traditional petroleum pipelines and must be trucked to its final destination), ethanol production and mixing with gasoline will increasingly occur close to large demand centers. As cellulosic ethanol becomes commercially available, the economic development potential for this segment of the renewable energy industry promises to become more dispersed and available to communities nationwide as a primary job driver.

Geothermal

While geothermal energy technologies often bring to mind exploiting steam and heated rock in seismically active areas, geothermal technologies range from residential heat pumps heating and cooling a single houses with simple technologies to commercial power plants producing power for thousands of houses. Industrial-scale geothermal technologies are in many cases already tested, and provide continuous electrical

U.S. GEOTHERMAL RESOURCES



Source: Energy Information Agency, U.S. Dept of Energy

production in California, Japan, and Iceland among other areas. While industrial scale technologies have the capability of providing electrical production with virtually no emissions, these plants must be optimized for each individual site, increasing costs and complexity, and requiring the expertise of highly-educated (and highly-paid) geologists.

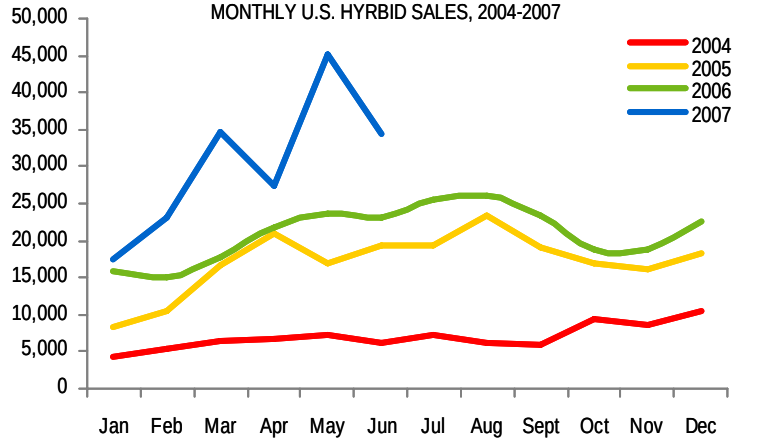
Geothermal technologies are just beginning to be exploited for commercial and residential uses, and will increasingly draw on a variety of sources for heating and cooling like simple in-ground heat exchangers. Geothermal heating and cooling, which relies on the constant temperature of the ground beneath the uppermost layer of soil can reduce the need for electricity consumption dramatically. This technology is still immature in terms of providing cost-effective reductions of energy consumption, but as traditional electricity prices rise and technology continues to evolve, residential and commercial heat exchangers may gain in popularity and availability.

RENEWABLE ENERGY TECHNOLOGIES – ENERGY CONVERSION

Vehicle Systems

The vehicle systems niche industry within the renewable energy industry is a broad category focused on the conversion of primary energy, either in the form of electricity or petroleum-based fuels, into transportation power. Companies are pursuing many different methods for powering transportation in the future, from gasoline-electric and diesel-electric hybrid systems commercially available today to more robust electric vehicles with advanced battery packs capable of operating for hundreds of miles without recharging. Future technologies seem sure to include fuel cells for automobiles, advanced materials to make automobiles stronger and lighter without sacrificing safety, and advanced engine and power train improvements. With ground transportation comprising the vast majority (more than 85%) of all U.S. petroleum consumption, and increasing emphasis on addressing not only global warming but energy dependence on foreign countries, vehicle systems technologies are being heavily researched and invested in across the U.S. and the world.

U.S. HYBRID AUTOMOBILE SALES



Source: Green Car Congress

Fuel Cells

Fuel cells, one of the most hyped early technologies associated with the renewable energy industry, continue to evolve toward commercial availability. Fuel cells produce electricity through an electrochemical process, and produce only water as emissions. Fuel cells currently have only niche applications in the renewable energy industry, and the fuel cells industry as a whole and virtually all fuel cell companies have yet to turn an annual profit in any given year. As fuel cell technologies move from military and remote telecommunications applications to mainstream energy applications, this technology should provide on-site electricity generation

with virtually no emissions, enabling more distributed electricity production and reducing losses from electricity transportation.

Energy Storage

Energy storage may provide the missing link to catapult renewable energies from niche contributors to electricity production and transportation energy to becoming the full-scale basis for the U.S. electrical grid and transportation industries. Because many renewable energy resources (particularly wind, already commercially viable) do not provide energy according to when energy in consumed, but produce energy whenever the resource is available, electric utilities find some difficulty in scheduling traditional power production and may have to forego renewable energy production to stabilize the electric power grids during times of high wind production and low electricity consumption. In addition, while gasoline can be stored virtually indefinitely, automobiles using electrical power are hamstrung by their ability to store electrical power in heavy, bulky battery technologies.

Through advanced technologies such as flywheels, advanced battery technologies, and others, energy storage can provide solutions tied to other platforms, such as renewable energy technologies, vehicle systems, or fuel cells to ensure that the timing of energy production matches the timing of energy consumption. These technologies aim to enable electricity storage so that wind farm electricity production can be stored until it is needed, and automobiles can use electricity for energy instead of liquid fuels.

RENEWABLE ENERGY TECHNOLOGIES – ENERGY CONSERVATION

Green Building

Green building encompasses a broad category of activities, often incorporating several renewable energy generation technologies along with newer technologies in advanced windows, insulation, and a systematic approach to building for reduced energy and water consumption. Green building has gained a wider acceptance among commercial developers than among residential developers, but the practices of designing buildings to take advantage of their natural environments and new technologies available for reducing energy consumption are slowly trickling down into residential construction as well.

AUSTIN COMMERCIAL GREEN BUILDINGS

Building	Owner	LEED Rating
Austin City Hall	City of Austin	Gold
Far Southeast Austin EMS Station	City of Austin	Gold
Lowe's of Southwest Austin	Lowe's Companies, Inc.	Gold
Circle C EMS & Fire Station	City of Austin	Silver
Combined Transportation Emergency & Communications Center	City of Austin	Silver
Green Mountain Energy Corporate HQ	Green Mountain Energy	Silver
Bank of America Circle C Branch	Bank of America	Certified
George Washington Carver Branch Library	City of Austin	Certified
George Washington Carver Museum & Cultural Center	City of Austin	Certified
IBM/Tivoli Systems Building 1	IBM Corporation	Certified
UT Research Office Complex	University of Texas	Certified
Whole Foods Market - Lamar	Whole Foods Market	Certified

Source: U.S. Green Building Council

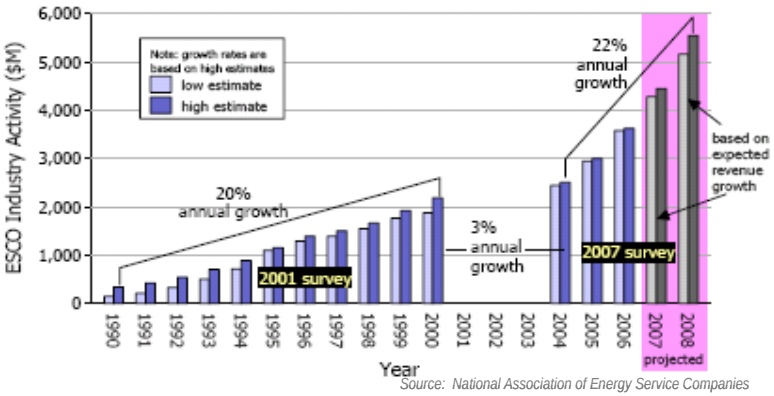
Austin Energy's Green Building Program® is among the most successful programs for constructing energy conserving residences in the country, while the U.S. Green Building Council promotes its LEED (Leadership in Energy and Environmental Design) standards for commercial buildings. These programs promote technology sharing in the industry, and ensure that buildings receive public credit for verifiable results in energy and water

conservation in the built environment. As green building construction costs have increasingly come to par with traditional construction costs, the lower operating costs of green buildings will continue to encourage developers to think about "green" in a different way.

Energy Services

Energy services companies provide a wide variety of services related to the renewable energy industry, with an emphasis on renewable energy project development, energy conservation auditing and energy conservation services, and energy finance. Energy services companies tend to focus on reducing energy consumption for commercial users, and thus require highly skilled industrial and mechanical engineers to determine process improvements for energy efficiency. Additional growth comes from the ties between these companies and green building services, where energy services companies can help traditional buildings consume less energy and can help construction companies build and design buildings for reduced energy consumption. These energy service companies are growing at nearly 22% annually, with U.S. industry revenues expected to exceed $5 billion in 2008.

ENERGY SERVICES COMPANIES GROWTH, 1990-2008



Source: National Association of Energy Service Companies

In addition, because of Texas' long-standing energy ties, energy consulting services, renewable energy project development, and energy finance services are growing in importance in the Austin region. These type of energy service companies provide professional expertise to help utilities develop greener electricity generation through finance structuring, help to work out ground leases for wind farms, and provide expertise in long-term energy contract negotiations.

INDUSTRY SITE SELECTION REQUIREMENTS

The renewable energy industry is just beginning to emerge as an industry that strategically selects its locations based on a variety of data-driven criteria. Austin is particularly well positioned within these site selection criteria, with excellent assets in virtually all areas considered by firms.

Structural Assets

Many of these companies are little more than small labs that typically require flex industrial space with an office component. Access to area research facilities can be important to firms within the clean energy industry. Additionally, experience in renewable energy financing, contract structuring, and other legal and financial areas within the law and finance sectors of the industry must be in place to aid up and coming companies. In addition, having supportive local policies, including local green-building programs, electric utilities willing to provide

access to the grid for testing, and supportive incentives at the state level all provide renewable energy companies with opportunities for growth and expansion at lower than average cost.

Costs of Doing Business

Companies will look for areas with a low overall recurring cost base. Due to the high salaries of scientists and technical workers and extensive research and testing, general operating costs must be low. Renewable energy firms will closely analyze state and local energy policies. Large-scale generators will look to states with renewable energy portfolio standards and other renewable incentives. Manufacturers will typically search for spots with large amounts of Generally, companies prefer states that have an active retail market for electricity, giving consumers the choice to use renewable sources of energy.

Research & Development

Outside the largest industry firms such as GE Wind Power and Vestas, industry firms are typically very small, averaging between fewer than 10 employees, and have limited resources. Companies face significant hurdles to design, test, and deploy products that meet a variety of governmental standards. Because of these demanding research needs and lack of funds, having available lab space within an area university or incubator is increasingly important. Firms also want to be near areas that work as testing ranges; a solar firm wants to be located in an area with abundant sunlight, and access to public utilities for real-world testing provides a leg up on competitor companies.

Much of the industry's research is extremely high-risk and could take years to reach commercialization. The majority of this research takes place in federal labs tasked with clean energy research. These labs are located in a handful of states, including California, Colorado, and New Mexico, though Texas is increasingly a hotbed for this type of research among private sector companies. Industry firms in need of outside expertise, access to research facilities, and a potential workforce will cluster around these labs and other similar research assets.

Economic Conditions

Research and production firms locate near metropolitan areas with large high tech clusters and a growing economy, and often use the local market to test their new products. They often locate near a university or research institution to access a talent pool of engineers and scientists. Start-up firms in this industry tend to locate in progressive communities that support their endeavors.

Workforce

The industry requires highly paid scientists, technicians, and professionals with a range of skills from chemistry, biology, physics, engineering, management, and other technical and scientific backgrounds. The access to an adequate workforce has rapidly emerged as perhaps the most important site selection criteria for start-up and manufacturing operations. Due to the nature of the industry, an entrepreneurial spirit is necessary as many employees transfer from high tech companies familiar with a start-up environment.

AUSTIN RENEWABLE ENERGY INDUSTRY

Based on the above technologies and NAICS codes, AngelouEconomics has determined the general operating characteristics of the renewable energy industry in the Austin region. As noted above, these statistics provide a general picture of employment, wages, and companies in the renewable energy or renewable energy-related industries. With these wage and employment trends in mind as a rough overview of the industry, AngelouEconomics then provides more specific company and employment data which demonstrates a truer picture of the industry in Austin.

NAICS-BASED RENEWABLE ENERGY-RELATED INDUSTRY COMPANIES, 2000-2006

NAICS Code	NAICS Definition	2000	2001	2002	2003	2004	2005	2006	% Change
23829	Other Building Equipment Contractors	24	26	25	32	36	39	37	57.4%
33361	Turbine and Power Transmission Equipment	5	4	N/A	N/A	N/A	N/A	N/A	N/A
221119	Other Electric Power Generation	N/A	N/A	3	3	4	5	N/A	50.0%
221121	Electric Bulk Power Transmission	3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
237130	Power/Communication System Construction	32	38	44	42	37	46	52	65.1%
334413	Semiconductor and Related Devices	49	55	54	52	55	56	53	7.7%
335999	Miscellaneous Electrical Equipment	8	6	6	6	5	4	4	-43.3%
423690	Other Electronic Parts Merchant Whsle	99	103	106	101	108	119	129	30.0%
423720	Plumbing Goods Merchant Wholesalers	32	26	24	24	27	26	27	-17.2%
541330	Engineering Services	451	470	487	483	489	516	533	18.1%
541380	Testing Laboratories	54	60	55	51	52	52	52	-4.2%
541620	Environmental Consulting Services	56	57	57	60	56	60	62	10.8%
541690	Other Technical Consulting Services	47	56	64	66	69	75	84	80.2%
541712	R&D: Physical, Engineering, & Life Sciences	85	84	86	78	93	107	123	44.6%
999999	**Total**	**936**	**984**	**1,007**	**998**	**1,029**	**1,101**	**1,155**	**23.4%**

Note: N/A indicates non-disclosed data; Source: Texas Workforce Commission

NAICS-BASED RENEWABLE ENERGY-RELATED INDUSTRY EMPLOYMENT, 2000-2006

NAICS Code	NAICS Definition	2000	2001	2002	2003	2004	2005	2006	% Change
23829	Other Building Equipment Contractors	469	503	392	472	492	503	481	2.5%
33361	Turbine and Power Transmission Equipment	94	89	N/A	N/A	N/A	N/A	N/A	N/A
221119	Other Electric Power Generation	N/A	N/A	209	220	290	292	N/A	39.7%
221121	Electric Bulk Power Transmission	97	N/A	N/A	N/A	N/A	N/A	N/A	N/A
237130	Power/Communication System Construction	681	823	781	763	878	1,153	1,196	75.8%
334413	Semiconductor and Related Devices	18,519	17,822	14,631	12,932	12,125	11,914	12,692	-31.5%
335999	Miscellaneous Electrical Equipment	408	184	77	63	63	59	58	-85.7%
423690	Other Electronic Parts Merchant Whsle	1,124	1,376	1,048	1,030	1,089	1,078	1,119	-0.4%
423720	Plumbing Goods Merchant Wholesalers	235	214	218	241	319	310	325	38.0%
541330	Engineering Services	6,189	6,889	6,300	6,533	6,688	7,324	7,816	26.3%
541380	Testing Laboratories	511	635	590	579	607	657	701	37.2%
541620	Environmental Consulting Services	941	972	902	948	866	868	883	-6.2%
541690	Other Technical Consulting Services	114	145	190	225	192	230	274	141.0%
541712	R&D: Physical, Engineering, & Life Sciences	3,146	3,352	3,315	2,988	3,013	3,427	3,880	23.3%
999999	**Total**	**32,253**	**33,005**	**28,497**	**26,992**	**26,549**	**27,668**	**29,423**	**-8.8%**

Note: N/A indicates non-disclosed data; Source: Texas Workforce Commission

NAICS-BASED RENEWABLE ENERGY-RELATED INDUSTRY WAGES, 2000-2006

NAICS Code	NAICS Definition	2000	2001	2002	2003	2004	2005	2006	% Change
333610	Turbine and Power Transmission Equipment	$34,229	$40,077	N/A	N/A	N/A	N/A	N/A	N/A
334413	Semiconductor and Related Devices	$73,978	$75,471	$78,335	$80,667	$93,679	$112,997	$159,286	115.3%
335999	Miscellaneous Electrical Equipment	$29,549	$33,920	$44,689	$53,499	$62,428	$64,692	$70,320	138.0%
238290	Other Building Equipment Contractors	$49,985	$49,464	$43,770	$43,677	$45,631	$46,480	$47,408	-5.2%
237130	Power/Communication System Construction	$31,903	$32,240	$33,836	$33,695	$37,499	$47,195	$58,462	83.2%
423690	Other Electronic Parts Merchant Whsle	$77,276	$64,506	$66,005	$68,268	$71,797	$77,106	$87,360	13.0%
423720	Plumbing Goods Merchant Wholesalers	$39,552	$39,920	$45,103	$44,189	$44,748	$49,388	$52,837	33.6%
221119	Other Electric Power Generation	N/A	N/A	$66,537	$66,545	$61,728	$70,301	N/A	5.7%
221121	Electric Bulk Power Transmission	$54,659	N/A	N/A	N/A	N/A	N/A	N/A	N/A
541330	Engineering Services	$62,195	$65,022	$65,893	$65,966	$65,746	$67,456	$71,864	15.5%
541380	Testing Laboratories	$40,741	$41,522	$44,770	$46,153	$48,563	$47,757	$50,167	23.1%
541620	Environmental Consulting Services	$48,417	$51,935	$54,016	$57,264	$65,799	$65,411	$68,447	41.4%
541690	Other Technical Consulting Services	$51,960	$52,608	$57,087	$62,308	$62,779	$67,923	$84,100	61.9%
541712	R&D: Physical, Engineering, & Life Sciences	$62,532	$66,416	$61,803	$62,766	$65,147	$62,589	$64,618	3.3%
999999	**Total**	**$67,510**	**$68,433**	**$69,538**	**$70,461**	**$76,671**	**$84,891**	**$107,545**	**59.3%**

Note: N/A indicates non-disclosed data; Source: Texas Workforce Commission

This broad picture shows that while the number of companies has increased 23.4% in the renewable energy and related industries, employment across these companies has fallen almost 9% since 2000. Wages, however, have increased an astonishing 68% over 6 years, largely due to the increases in average wages of

semiconductor and related devices employees. This may be attributable to the reduced workforce availability of these workers compared to the demand for them, but also likely indicates the presence of several noteworthy headquarters operations in the Austin region. Even without the semiconductor industry, wages have risen broadly across these industries, with only slight decreases in the Other Building Equipment Contractors industry.

AUSTIN RENEWABLE ENERGY COMPANIES

While discussion of the renewable energy industry has focused on applying new technology to offset traditional energy sources, renewable energy today is more than a source of fuel. It is a source of jobs. Employment growth for the renewable energy industry varies for each segment of the industry, but new breakthroughs in renewable energy technologies will come from the growing sectors of the industry, including architectural and engineering services and scientific research & development. In addition, utilities are an area for pioneering a number of renewable energy technologies, from superconducting power lines which reduce the 20 percent loss of electricity due to transmission, to clean coal technologies, to distributed power technologies which will reduce the losses from transmission and supply more reliable localized power and enable power production all across the electrical grid. Increasingly, however, energy conservation technologies and new renewable energy advances will come from all areas of the economy, and may not necessarily be captured by traditional industry sources of energy technologies.

Austin Renewable Energy Companies and Trends

Austin's renewable energy focus is founded on the strengths of the high-tech industry in the region – access to venture capital, excellent understanding of semiconductor and software industries – along with extremely supportive local public policies, including innovative green building support programs and financial incentives from Austin Energy for solar panel installation. As oil and natural gas prices have risen, two industry trends have driven the increased investment in renewable energy: growing venture capital available to startup companies, particularly in the solar and energy storage industries, and electric utilities needing to meet renewable portfolio standards and reduce natural gas costs for electricity generation.

AUSTIN RENEWABLE ENERGY COMPANIES, 2007

Company	Employees
LCRA	680
Austin Energy	600
TECO-Westinghouse Motor Co.	338
Active Power	164
Green Mountain Energy Co.	120
Texas Power Construction	80
Site Controls	40
Cold Watt	40
Valence Technology	37
Clean Fuel USA	21
Meridian Energy Systems	20
Texas Solar Power Co.	14
Fallbrook Technologies	12
Renewable Energy Systems	10
HelioVolt	9
Frontier Associates	9
NanoCoolers	8
Good Company Associates	8
Gamesa Energia Southwest	7
Tierra Energy	7
Nuventix (Innovative Fluidics)	6
effenergy	6
eeStor	6
Crystatech	6
Austin BioDiesel	6
Sunergie	5
Armadillo Solar	5
Airtricity	5
Fremantle Energy	4
Austin BioFuels (Safe Renewab	4
Global Energy Designs	4
TekSUN PV Manufacturing Inc.	3
Skyonic	3
e60 Vision	3
Cielo Wind Power	3
GT Energy Finance	3
Xtreme Power	2
Smithfield BioEnergy, LLC	2
RLE Technologies (RSET)	2
Espinoza Energy	2
DT Solar (Turner Renewable En	2
AstroWatt	2
ACE Geothermal Inc.	2
Venti Energy	1
Trina Solar	1
Renewable Fuels of Austin, LLC	1
NewPoint Energy Solutions	1
Green Habits Austin	1
GeoTek Energy	1
Fellows Research Group	1
Chuck Wright Consulting, LLC	1
TOTAL	2,318

Source: Dun & Bradstreet, Austin Chamber of Commerce, AngelouEconomics

In addition, Austin's strengths in software, electronics R&D and manufacturing, proximity to West Texas wind resources, supportive local utilities in Austin Energy and LCRA, and a fertile local market for solar installation led to the rise of a multi-layered industry among the most diverse in the country which is competing in virtually every portion of the value chain for every major technology in the industry. While the list of companies on the previous page may not incorporate the entirety of the renewable energy industry in Austin, particularly with regards to the green building industry, these companies comprise approximately 2,300 employees. This total does not include related semiconductor firms such as Applied Materials (with an additional 2,500 employees) because their solar activities are largely contained outside of the Austin region. Austin's establishments, employment, and wages are all growing rapidly, though wage data particular to these small number of companies is unavailable.

In particular, Austin is emerging as a center for solar, wind, and energy-storage technologies, with firms locating across the value chain, from manufacturing and installation to generation and services. Austin provides many advantages for the industry: access to nearby expertise in utility law, energy law, and finance among Houston's (and increasingly, Austin's) law firms and banks; proximity to West Texas, where the topography produces windy conditions; access to the Port of Houston for importing and transporting wind turbine parts to wind farms; rapidly growing population and power demands; and supportive utilities in the region. As a boon to Austin wind production companies, in October 2006, Governor Rick Perry announced plans to significantly upgrade the electrical transmission lines to the Texas Panhandle, and secured $10 billion in pledges from Texas wind power producers, including some of the largest renewable energy producers in the country.

Austin's venture capital and the Austin Clean Energy Incubator, along with significant investment in resources from the City of Austin and the Greater Austin Chamber of Commerce are increasingly driving venture capital funding in the energy industry, and with many large technology venture capital funds choosing to invest the majority of their funds in renewable energy technologies, Austin stands to become a major center for renewable energy companies and employment.

Though they are not considered traditional renewable energy companies, Texas Power Construction (based in Bastrop) and Good Company Associates (based in Austin) each bring significant renewable energy expertise to the region. Texas Power Construction constructs high voltage power lines and works with major utilities across the region and state to help connect far-flung sources of energy to demand in the urban areas of Texas. Texas Power Construction is perhaps one of the most rapidly growing companies within this industry, and has plans to grow by another 50% within the next couple of years. Good Company Associates provides energy industry expertise in research and analysis, supportive policy development, and business development for renewable energy companies, providing small growing firms access to significant expertise in the industry.

Prime Competitor Regions

Austin is competing for renewable energy firms with other traditionally university-centered research areas, including San Jose (Stanford University), Ann Arbor (University of Michigan), Boulder (University of Colorado), Trenton (Princeton University), and Albany (SUNY-Albany). In addition, Austin is competing for renewable energy jobs with traditional high-tech metropolitan areas like San Francisco, New York, Colorado Springs, and Washington DC, along with metropolitan areas traditionally associated with engine manufacturing, like Dothan, AL. Most of these cities offer a combination of skilled workers and quality of life along with successful industry- or university-sponsored research to create high-paying jobs. Perhaps surprisingly, Houston is emerging as Austin's most significant local competition, given the incredible expertise in the energy and utility industries housed within the Houston region and Houston's rapid growth in biofuels and wind energy companies and employment.

AUSTIN RENEWABLE ENERGY WORKFORCE

While NAICS- and technology-based industry analysis is not foolproof, it adequately describes the general employment atmosphere and wages renewable energy companies must provide to be successful. NAICS-based analysis does not, however, lend itself easily to understanding the workforce requirements of Austin's renewable energy industry. AngelouEconomics believes that a core understanding of the value chain of an industry provides this insight into the cross-technology workforce that the Austin region needs to successfully build a renewable energy industrial cluster.

By dividing the industry into four value chain categories, including: 1) **manufacturing** of renewable energy equipment; 2) **sales and installation** of equipment; 3) that equipment's **generation** of electricity or clean fuels along with the **operation and maintenance** of that equipment, and 4) **services and research and development** leading to breakthroughs in energy conservation and new renewable energy technologies, we can look for similar workforce requirements across industries.

AUSTIN RENEWABLE ENERGY VALUE CHAIN AND TECHNOLOGY MATRIX

X = Strong X = Weak N/A = Not Present		RENEWABLE ENERGY TECHNOLOGIES								
		PRIMARY ENERGY PRODUCTION				ENERGY CONVERSION			ENERGY CONSERVATION	
		Wind	Solar	Biofuels	Geothermal	Vehicle Systems	Fuel Cells	Energy Storage	Green Building	Energy Services
VALUE CHAIN	Manufacturing	X	X	X	N/A	X	X	X	X	X
	Sales & Installation	X	X	X	N/A	N/A	N/A	X	X	X
	Generation, Operations, & Maintenance	N/A	X	X	N/A	N/A	N/A	N/A	X	X
	Services & Research	X	X	X	X	X	X	X	X	X

Source: AngelouEconomics

Though many high-tech industries almost exclusively require highly educated workers with masters or doctoral degrees, the renewable energy industry requires a healthy mix of occupations. Occupational data also demonstrates that the renewable energy industry creates a variety of high-paying jobs, many of which take advantage of manufacturing skills currently going unused as manufacturing continues to undergo restructuring in the U.S. Annual wages in all sectors of the renewable energy industry are significantly higher than U.S. average wages. Top occupations in the renewable energy industry include many jobs which require associate's degrees, long-term on-the-job training, or trade certifications, including electrical grid repairers, electrical technicians, plumbers and electricians, mechanical engineering technicians, and environmental science technicians, all of which pay higher than U.S. average wages.

AngelouEconomics has provided below information from the Bureau of Labor Statistics that describes the most highly sought-after occupations in the renewable energy. This information is broken down by standard occupational classifications into four charts: two describing the most highly sought-after occupations broken down by education level, and two additional charts ordered by fastest-growing occupations in the industry also broken down by education level. This baseline occupational data, including comparisons between U.S. average wages and Austin MSA average wages for each occupation sets the stage for more qualitative discussion of the workforce needs of the renewable energy industry.

Key Occupations in the Renewable Energy Industry Requiring a Bachelor's Degree or Higher

OCCUPATIONS ORDERED BY REPRESENTATION WITHIN THE RENEWABLE ENERGY INDUSTRY, 2006

Occupation		Median Wage		Occupational Information	
Title	10-year U.S. Growth Projection	US	Austin MSA	% with Bachelor's Degree+	Education
Civil engineers	16.5%	$72,120	$66,260	87%	Bachelor's degree
Surveyors	15.9%	$51,390	$63,410	82%	Bachelor's degree
Materials scientists	8.0%	$77,010	$56,610	94%	Bachelor's degree
Natural sciences managers	13.6%	$107,970	$98,950	90%	Bachelor's degree, plus work experience
Environmental engineers	30.0%	$72,590	$65,380	87%	Bachelor's degree
Hydrologists	31.6%	$68,230	$57,280	93%	Master's degree
Electrical engineers	11.8%	$78,900	$92,160	83%	Bachelor's degree
Mechanical engineers	11.1%	$72,580	$71,880	80%	Bachelor's degree
Geoscientists, except hydrologists and geographers	8.3%	$79,890	$67,630	93%	Master's degree
Engineering managers	13.0%	$110,030	$125,570	84%	Bachelor's degree, plus work experience
Environmental scientists and specialists, including health	17.1%	$61,120	$52,220	93%	Master's degree
Cartographers and photogrammetrists	15.2%	$52,600	$55,350	82%	Bachelor's degree
Engineers, all other	15.4%	$81,750	$76,190	81%	Bachelor's degree
Materials engineers	12.2%	$75,960	$74,600	68%	Bachelor's degree
Landscape architects	19.4%	$60,480	$56,890	86%	Bachelor's degree
Statisticians	4.6%	$69,080	$60,970	89%	Master's degree
Electronics engineers, except computer	9.7%	$82,820	$72,480	83%	Bachelor's degree
Chemists	7.3%	$66,040	$52,120	94%	Bachelor's degree
Technical writers	23.2%	$60,850	$54,820	73%	Bachelor's degree
Health and safety engineers, except mining safety inspectors	13.4%	$68,400	$75,910	70%	Bachelor's degree
Computer hardware engineers	10.1%	$91,280	$93,670	69%	Bachelor's degree
Commercial and industrial designers	10.8%	$59,340	$68,110	54%	Bachelor's degree
Urban and regional planners	15.2%	$58,940	$48,150	93%	Master's degree
Architects, except landscape and naval	17.3%	$69,760	$59,850	86%	Bachelor's degree
Industrial engineers	16.0%	$70,630	$74,990	70%	Bachelor's degree
Computer software engineers, systems software	43.0%	$87,250	$92,790	83%	Bachelor's degree
Logisticians	13.2%	$65,640	$52,010	52%	Bachelor's degree
Construction managers	10.4%	$82,760	$64,820	30%	Bachelor's degree
Computer software engineers, applications	48.4%	$82,000	$84,450	83%	Bachelor's degree
Database administrators	38.2%	$67,460	$67,940	72%	Bachelor's degree
Computer systems analysts	31.4%	$72,230	$68,780	66%	Bachelor's degree
Operations research analysts	8.4%	$69,100	$70,770	65%	Master's degree
Petroleum engineers	-0.1%	$101,620	$73,460	82%	Bachelor's degree
Computer and information systems managers	25.9%	$107,250	$117,060	70%	Bachelor's degree, plus work experience
Network and computer systems administrators	38.4%	$65,260	$55,880	51%	Bachelor's degree
Purchasing managers	7.0%	$86,020	$97,990	58%	Bachelor's degree, plus work experience
Network systems and data communications analysts	54.6%	$67,460	$55,600	60%	Bachelor's degree
Sales engineers	14.0%	$83,080	$81,690	86%	Bachelor's degree
Budget analysts	13.5%	$63,920	$53,460	75%	Bachelor's degree
Occupational health and safety specialists	12.4%	$59,270	$55,520	78%	Bachelor's degree
Computer programmers	2.0%	$69,500	$78,130	72%	Bachelor's degree
General and operations managers	17.0%	$99,280	$97,460	48%	Bachelor's degree, plus work experience
Business operations specialists, all other	27.0%	$60,240	$65,460	42%	Bachelor's degree
Training and development specialists	20.8%	$51,100	$52,310	57%	Bachelor's degree

Source: BLS Occupational Employment Statistics

Key Occupations in the Renewable Energy Industry Requiring a Bachelor's Degree or Higher

OCCUPATIONS ORDERED BY PROJECTED JOB GROWTH 2004-2014

Occupation		Median Wage		Occupational Information	
Title	10-year U.S. Growth Projection	US	Austin MSA	% with Bachelor's Degree+	Education
Network systems and data communications analysts	54.6%	$67,460	$55,600	60%	Bachelor's degree
Computer software engineers, applications	48.4%	$82,000	$84,450	83%	Bachelor's degree
Computer software engineers, systems software	43.0%	$87,250	$92,790	83%	Bachelor's degree
Network and computer systems administrators	38.4%	$65,260	$55,880	51%	Bachelor's degree
Database administrators	38.2%	$67,460	$67,940	72%	Bachelor's degree
Hydrologists	31.6%	$68,230	$57,280	93%	Master's degree
Computer systems analysts	31.4%	$72,230	$68,780	66%	Bachelor's degree
Environmental engineers	30.0%	$72,590	$65,380	87%	Bachelor's degree
Business operations specialists, all other	27.0%	$60,240	$65,460	42%	Bachelor's degree
Computer and information systems managers	25.9%	$107,250	$117,060	70%	Bachelor's degree, plus work experience
Technical writers	23.2%	$60,850	$54,820	73%	Bachelor's degree
Training and development specialists	20.8%	$51,100	$52,310	57%	Bachelor's degree
Landscape architects	19.4%	$60,480	$56,890	86%	Bachelor's degree
Architects, except landscape and naval	17.3%	$69,760	$59,850	86%	Bachelor's degree
Environmental scientists and specialists, including health	17.1%	$61,120	$52,220	93%	Master's degree
General and operations managers	17.0%	$99,280	$97,460	48%	Bachelor's degree, plus work experience
Civil engineers	16.5%	$72,120	$66,260	87%	Bachelor's degree
Industrial engineers	16.0%	$70,630	$74,990	70%	Bachelor's degree
Surveyors	15.9%	$51,390	$63,410	82%	Bachelor's degree
Engineers, all other	15.4%	$81,750	$76,190	81%	Bachelor's degree
Cartographers and photogrammetrists	15.2%	$52,600	$55,350	82%	Bachelor's degree
Urban and regional planners	15.2%	$58,940	$48,150	93%	Master's degree
Sales engineers	14.0%	$83,080	$81,690	86%	Bachelor's degree
Natural sciences managers	13.6%	$107,970	$98,950	90%	Bachelor's degree, plus work experience
Budget analysts	13.5%	$63,920	$53,460	75%	Bachelor's degree
Health and safety engineers, except mining safety inspectors	13.4%	$68,400	$75,910	70%	Bachelor's degree
Logisticians	13.2%	$65,640	$52,010	52%	Bachelor's degree
Engineering managers	13.0%	$110,030	$125,570	84%	Bachelor's degree, plus work experience
Occupational health and safety specialists	12.4%	$59,270	$55,520	78%	Bachelor's degree
Materials engineers	12.2%	$75,960	$74,600	68%	Bachelor's degree
Electrical engineers	11.8%	$78,900	$92,160	83%	Bachelor's degree
Mechanical engineers	11.1%	$72,580	$71,880	80%	Bachelor's degree
Commercial and industrial designers	10.8%	$59,340	$68,110	54%	Bachelor's degree
Construction managers	10.4%	$82,760	$64,820	30%	Bachelor's degree
Computer hardware engineers	10.1%	$91,280	$93,670	69%	Bachelor's degree
Electronics engineers, except computer	9.7%	$82,820	$72,480	83%	Bachelor's degree
Operations research analysts	8.4%	$69,100	$70,770	65%	Master's degree
Geoscientists, except hydrologists and geographers	8.3%	$79,890	$67,630	93%	Master's degree
Materials scientists	8.0%	$77,010	$56,610	94%	Bachelor's degree
Chemists	7.3%	$66,040	$52,120	94%	Bachelor's degree
Purchasing managers	7.0%	$86,020	$97,990	58%	Bachelor's degree, plus work experience
Statisticians	4.6%	$69,080	$60,970	89%	Master's degree
Computer programmers	2.0%	$69,500	$78,130	72%	Bachelor's degree
Petroleum engineers	-0.1%	$101,620	$73,460	82%	Bachelor's degree

Source: BLS Occupational Employment Statistics

Key Occupations in the Alternative Energy Industry Requiring Less than a Bachelor's Degree

OCCUPATIONS ORDERED BY REPRESENTATION WITHIN THE RENEWABLE ENERGY INDUSTRY, 2006

Occupation		Median Wage		Occupational Information	
Title	10-year U.S. Growth Projection	US	Austin MSA	% with Bachelor's Degree+	Education
Civil engineering technicians	14.1%	$42,380	$37,090	18%	Associate degree
Environmental engineering technicians	24.4%	$43,100	$49,750	18%	Associate degree
Mechanical engineering technicians	12.3%	$47,710	$44,270	18%	Associate degree
Architectural and civil drafters	4.6%	$43,900	$39,680	22%	Postsecondary vocational award
Surveying and mapping technicians	9.6%	$34,590	$31,040	11%	Moderate-term on-the-job training
Chemical technicians	4.4%	$40,970	$40,430	27%	Associate degree
Electrical and electronics drafters	1.2%	$49,610	$62,480	22%	Postsecondary vocational award
Mechanical drafters	5.5%	$45,960	$49,030	22%	Postsecondary vocational award
Environmental science and protection technicians	16.3%	$40,260	$42,620	47%	Associate degree
Millwrights	5.9%	$47,820	$32,390	3%	Long-term on-the-job training
Electrical power-line installers and repairers	2.5%	$49,900	$35,280	5%	Long-term on-the-job training
Construction and building inspectors	22.3%	$48,620	$40,930	31%	Work experience in a related occupation
Electrical and electronic engineering technicians	9.8%	$50,840	$47,240	18%	Associate degree
Engineering technicians, except drafters, all other	12.3%	$53,850	$54,380	18%	Associate degree
Electro-mechanical technicians	9.7%	$46,540	$45,680	18%	Associate degree
Helpers, construction trades, all other	1.8%	$24,820	$21,030	2%	Short-term on-the-job training
Structural iron and steel workers	15.0%	$43,950	$36,030	4%	Long-term on-the-job training
Purchasing agents	8.1%	$54,160	$53,030	45%	Work experience in a related occupation
Occupational health and safety technicians	17.1%	$44,340	$52,370	78%	Postsecondary vocational award
Industrial engineering technicians	10.5%	$50,920	$51,480	18%	Associate degree
Cost estimators	18.2%	$56,820	$65,360	33%	Work experience in a related occupation
Computer specialists, all other	19.0%	$69,370	$69,320	66%	Associate degree
Pipelayers	9.9%	$33,710	$23,300	5%	Moderate-term on-the-job training
Helpers--installation, maintenance, and repair workers	16.4%	$24,210	$20,610	5%	Short-term on-the-job training
Electrical repairers, commercial and industrial equipment	9.7%	$45,670	$40,440	6%	Postsecondary vocational award
Operating engineers and construction equipment operators	11.6%	$40,560	$29,730	2%	Moderate-term on-the-job training
Managers, all other	7.8%	$87,250	$90,050	51%	Work experience in a related occupation
Construction laborers	5.9%	$29,930	$21,630	6%	Moderate-term on-the-job training
Insulation workers, floor, ceiling, and wall	3.0%	$34,280	$35,220	3%	Moderate-term on-the-job training
Installation, maintenance, and repair workers, all other	11.0%	$35,560	$29,450	10%	Moderate-term on-the-job training
Excavating and loading machine and dragline operators	8.0%	$35,740	$27,970	4%	Moderate-term on-the-job training
First-line supervisors of construction trades	10.9%	$57,500	$48,730	10%	Work experience in a related occupation
First-line supervisors of installers and repairers	12.4%	$56,110	$54,400	12%	Work experience in a related occupation
Sales representatives, technical and scientific products	14.4%	$72,700	$61,640	50%	Moderate-term on-the-job training
Computer support specialists	23.0%	$44,350	$40,640	41%	Associate degree
Compliance officers, except health and safety	11.6%	$50,890	$50,200	58%	Long-term on-the-job training
Mobile heavy equipment mechanics, except engines	8.8%	$41,390	$36,060	6%	Postsecondary vocational award
Avionics technicians	9.1%	$47,380	$58,370	14%	Postsecondary vocational award
Construction and related workers, all other	27.5%	$32,880	$21,090	5%	Moderate-term on-the-job training
Welders, cutters, solderers, and brazers	5.0%	$32,880	$28,790	2%	Long-term on-the-job training
Plumbers, pipefitters, and steamfitters	15.7%	$45,830	$42,320	5%	Long-term on-the-job training
Sales representatives, services, all other	18.7%	$56,420	$56,160	48%	Moderate-term on-the-job training
Control and valve installers and repairers	4.9%	$45,290	$36,590	13%	Moderate-term on-the-job training
Production, planning, and expediting clerks	7.7%	$40,000	$38,140	29%	Short-term on-the-job training
Maintenance workers, machinery	2.8%	$36,390	$28,340	8%	Short-term on-the-job training
Industrial production managers	0.8%	$83,970	$107,830	45%	Work experience in a related occupation
Structural metal fabricators and fitters	2.9%	$31,440	$29,530	1%	Moderate-term on-the-job training
Electricians	11.8%	$46,620	$35,560	6%	Long-term on-the-job training

Source: BLS Occupational Employment Statistics

Key Occupations in the Alternative Energy Industry Requiring Less than a Bachelor's Degree

OCCUPATIONS ORDERED BY PROJECTED JOB GROWTH 2004-2014

Occupation		Median Wage		Occupational Information	
Title	10-year U.S. Growth Projection	US	Austin MSA	% with Bachelor's Degree+	Education
Construction and related workers, all other	27.5%	$32,880	$21,090	5%	Moderate-term on-the-job training
Environmental engineering technicians	24.4%	$43,100	$49,750	18%	Associate degree
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Insulation workers, floor, ceiling, and wall	3.0%	$34,280	$35,220	3%	Moderate-term on-the-job training
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Industrial production managers	0.8%	$83,970	$107,830	45%	Work experience in a related occupation

Source: BLS Occupational Employment Statistics

WORKFORCE AND EDUCATION ISSUES

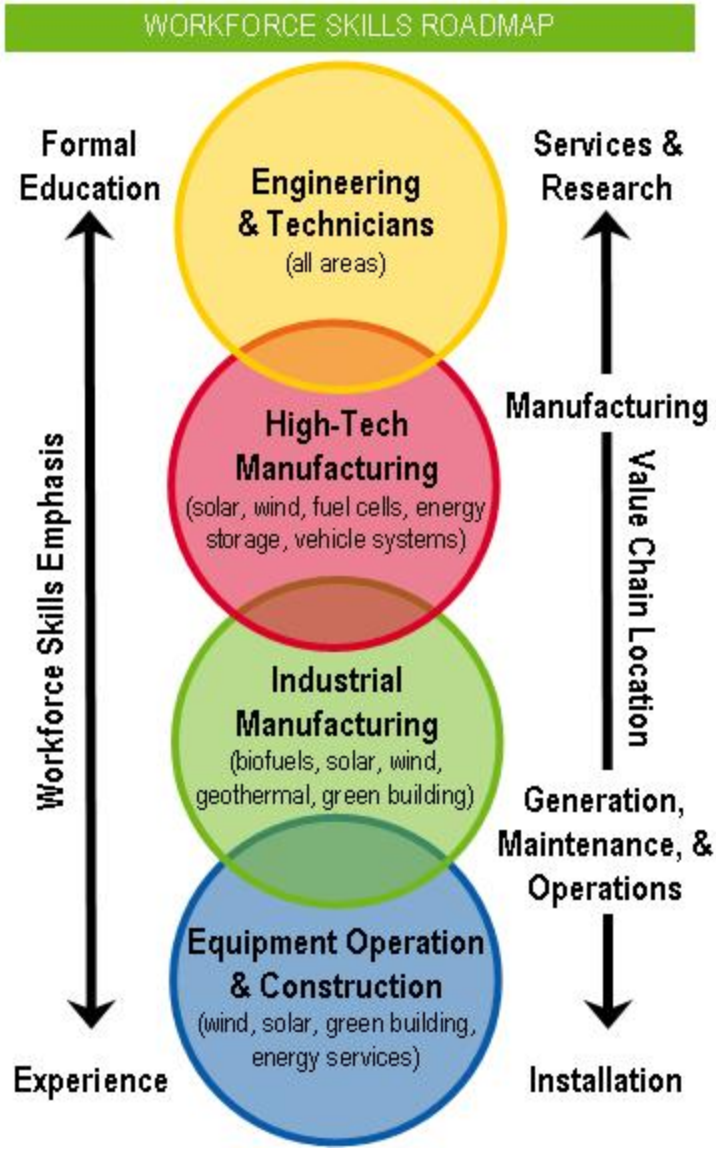
The remainder of this section outlines the critical issues facing the Austin region's workforce development and education programs as they relate to the renewable energy industry. However, before identifying the issues, it is also important to recognize and recap the **strong assets** that the region possesses in this arena. These include, but are not limited to:

- Tremendous **university resources**, with the University of Texas's outstanding school of engineering, one of the top such schools in the country and Austin Community College's industry-focused workforce development systems
- Extremely high percentage of **college-educated young professionals, among the top regions in the U.S.**
- Focus and cooperation on workforce development issues at WorkSource, Austin Community College, the Greater Austin Chamber of Commerce, and industry leaders to **develop a regional workforce development strategy for the renewable energy industry.**

Workforce Skills Emphasis

To better delineate the importance of different types of workforce skills to various renewable energy technologies and companies, AngelouEconomics has developed the simple graphic to the right. The graphic represents the types of jobs employers in different renewable energy companies are offering, the relative importance of experience, formal education, or some combination of the two in the hiring process, which technologies would most likely be hiring which occupational types, and where these jobs fit within the value chain.

This roadmap shows the need for a variety of workforce skills, from construction technology and equipment operations for installation of wind and solar farms, green building, and helping conduct energy conservation audits, to more industrially and mechanically focused jobs in biofuels production, wind manufacturing, green building and green building construction. In addition, high-tech manufacturing skills, including



electronics assembly experience, precision mechanical manufacturing, and semiconductor manufacturing experience are required by a variety of energy technology manufacturing operations, while engineers and engineering technicians are required by virtually every company in the value chain, with a focus on service provision and additional research. By examining this roadmap, AngelouEconomics will build workforce development recommendations building off of existing workforce training programs to help better target workforce training programs to place employees within renewable energy companies.

What are Employers Looking For?

In an attempt to gain more perspective on the skill requirements employers in renewable energy businesses are looking for, AngelouEconomics conducted two focus groups with representatives from companies specializing in solar energy, wind energy, biofuels, and energy conservation to determine their workforce needs and how those needs might be met. The focus groups had representation from the following renewable energy companies:

AUSTIN RENEWABLE ENERGY COMPANIES INTERVIEWED	
Earth Solar Group	Teksun Photovoltaic
Armadillo Solar	Fallbrook Technologies
Texas State Energy Conservation Office	Austin Biofuels
NewPoint Energy Solutions	Xtreme Power Solutions
Balcones Recycling	TECO – Westinghouse
Meridian Energy Systems	Clean Energy Incubator
Austin Energy	Global Design Systems

Also present were representatives from Austin Community College and the University of Texas at Austin to discuss educational programs and the skill sets workers in renewable energy industries need.

The discussion in these focus groups centered around several questions:

- What are your greatest unmet workforce needs? What types of specific skills are you looking for?
- What will be required to help you meet your greatest workforce needs?
- How effective is the current workforce development and education system in helping train people for the workforce in renewable energy industries?

Employer skill needs fall into two general categories: 1) specific skills or occupations needed in renewable energy industries, and 2) more general skill sets that employer feel are lacking in many of the applicants seeking employment at their firms.

Specific skills or occupations that are vital to renewable energy industries include:

- Installation (applicants with estimating installation costs and the ability to handle power tools);
- Electrical (DC electronics as well as AC electricians);
- Construction (roofers, construction laborers);
- Plumbers (applicants may need to know fluid dynamics, pump sizing, etc.);
- Mechanical skills (applicants need to have some level of knowledge about machinery and how it works);
- Heavy manufacturing and assembly;

- Design for manufacturing experience;
- Semiconductor manufacturing; and
- Electrical and mechanical engineering.

There are also some general skills that employers consider important. In many cases, job applicants either do not possess these skills do not possess an adequate level of these skills.

- Applicants need a wider range of basic skills when they begin their careers. According to focus group participants, in some cases, applicants have "too many gaps in knowledge" in areas that are important to job performance.

- Applicants need more "hands-on" experience before coming on the job. Many applicants lack adequate practical skills to perform jobs in renewable energy, and this limits their effectiveness on the job until they develop those practical skills. Bachelor's degrees, associate degrees, and special certifications are important but are usually not enough to prepare workers for jobs in renewable energy industries. The need for practical experience was a common and powerful theme among participants in both focus groups we conducted.

- Employers need employees who are adept at a variety of skills. Due to the start-up nature of the renewable energy industry, employers are searching for employees that do not require constant close supervision. In the words of one focus group participant, "I'm looking for football players," meaning the employer needs someone who can perform skillfully in one job, and then move to the next job and perform it just as skillfully.

When asked how students and job applicants can be better prepared to enter the renewable energy workforce, focus group participants had several valuable suggestions:

- Students need to develop a wider range of basic job skills before leaving school. These skills include construction and manufacturing knowledge, operation of machinery and other equipment, and safety skills.

- Students need to participate in more "laboratories" that give them the opportunity to work on the types of problems and with the type of technology they will be using in the workplace. This speaks again to the need for practical, hands-on experience.

- Students need to have the opportunity to serve in internships and co-ops to gain practical experience before joining the workforce.

- Students need to have the opportunity to participate in renewable energy competitions while in college. These competitions require students to work in teams to design, build, and operate a product that incorporates the technology of a renewable energy field. Perhaps the best-known competition is the Solar Decathlon, a competition sponsored by the U.S. Department of Energy that involves teams from colleges and universities around the world in designing, building, and operate the most attractive and energy-efficient solar powered home. These competitions not only give students hands-on experience, but also give them an opportunity to work in a "real world" setting in applying what they've learned.

- If we want to build a skilled workforce in sufficient numbers to fill the jobs in the growing renewable energy industries, **we will have to start before college**. Students in high school who are beginning to consider career choices need to know that there are career opportunities in renewable energy. They also need to understand what workers in those industries actually do on a daily basis to get a realistic idea of whether or not a job in renewable energy is right for them. That could be accomplished through internships for high school students as well as "job shadowing" opportunities during which students spend time with workers on the job, witnessing first hand the skills and responsibilities those jobs require.

- To complete the process of ensuring that renewable energy firms have an adequate pool of skilled labor, we must **build a strong "skill pipeline"** from high school into college and to the workplace to provide an adequate number of skilled applicants for every type of position.

Austin Company Hiring Data

The limited availability of employees with technical trade expertise (machinists, welders, construction workers, technicians, etc…) is a national concern. While employers expressed concerns with the lack of such employees, are Austin's renewable energy companies actively pursuing employees in these fields? AngelouEconomics conducted research of companies' expressed hiring needs via job advertisements on their websites.

In general, companies expressed needs similar to the needs they expressed in interviews and focus groups. While the emphasis from interviewed companies focused on workers for installation jobs, such as construction workers, electricians, and plumbers, a wider variety of jobs were available for workers in Austin's renewable energy industry.

Companies are searching for engineers of all types, though companies focus on electrical and mechanical engineers, and want engineers with bachelor's degrees in engineering, at least 5 years of experience, and a Professional Engineer certification. In addition, project managers with 5-10 years experience in the renewable energy industry are sought, and employers want these employees to have master's degrees in business, finance, or related fields. Employers also require bachelors' degrees for safety advisors, though there is more emphasis placed here on experience than on formal education.

CURRENT COMPANY HIRING NEEDS, 2007

Expressed needs	Percentage	Notes
Not hiring	64.7%	Some emphasis on future hiring: PV installers, semiconductor technicians
Engineers	25.5%	Virtually every company hiring is seeking engineers, primarily electrical and mechanical, although some need for civil, chemical
Other	11.8%	A wide variety of jobs, including: electrical linemen, supervisors and crew foremen, equipment operators, CAD operators, construction inspectors, wind farm mechanics
Sales	7.8%	Searching for salespeople with industry experience
Engineering Technicians	5.9%	Primarily for research assistance; some installation-focused jobs
Electricians	5.9%	Journeymen as well as master electricians
Plumbers	3.9%	Journeymen as well as master plumbers
Project Managers	3.9%	Primarily for services-oriented firms, seeking experience in renewables
Machinists	3.9%	Wide variety of machine operators
Safety	3.9%	Safety advisors to meet OSHA requirements

Source: AngelouEconomics

Trade-focused jobs comprised the bulk of the jobs advertised on Austin companies' websites. Companies are seeking sales people with any industry experience to sell residential solar systems as well as helping to sell wind development projects to financiers. Engineering technicians with associates degrees in engineering technology or similarly focused degrees are highly desired for both continuing technology research as well as installation focused jobs. Machinists for manufacturing, electricians, and plumbers of all levels of experience are sought after, particularly anyone with any level of experience in solar installation or precision machining equipment.

Finally, a wide variety of jobs appeared infrequently among Austin companies desires, including supervisors for installation and operations shifts, electrical linemen among both the large regional utilities and Texas Power Construction, along with heavy equipment operators, construction inspectors, wind farm mechanics, and CAD operators. Virtually all employers seeking employees for these jobs wanted an associate's degree or other certification, plus experience if possible.

Austin Workforce Gap Analysis

With the needs of Austin companies in the renewable energy industry in mind, AngelouEconomics examined the production of workers in renewable-energy related occupations from the University of Texas at Austin and Austin Community College, the two primary drivers of workforce development in the region. By examining course enrollment data from Austin Community College and major declaration data from the University of Texas at Austin, AngelouEconomics built a fuller picture of the current workforce training capabilities of the Austin region (see chart on next page).

While many of the jobs in demand in the renewable energy industry are being served with focused educational and workforce training programs, enrollment in several of these programs has been declining over the past five years, particularly within the engineering field. While this echoes national trends in engineering education, the specific data from the University of Texas does not bode well for companies hiring workers in these fields, as they will have fewer local graduates to choose from, and may be unable to meet their workforce needs without recruiting from outside the region.

Given the number of openings for engineers and engineering technicians in the renewable energy industry in Austin, the declining enrollments in targeted workforce programs at the University of Texas and Austin Community College must be a primary concern of regional workforce development officials. Similarly, while other programs with high workforce demands from the renewable energy industry have growing enrollments, such as building construction technology and engineering design graphics, our interviews and searches of company job advertisements indicates that these occupations are still highly sought after by renewable energy employers. All of these signs point to a mismatch in students' job expectations within the industry or a lack of understanding of the availability of jobs for people with specific skills and training (specifically construction workers, electricians, plumbers, machinists, CAD operators, and in the near future semiconductor technicians) within the renewable energy industry. This mismatch should be the focus of workforce development marketing and advertising efforts to effectively train students with the specific skills required by renewable energy employers and direct these students to employers in the industry.

AUSTIN MSA WORKFORCE DEVELOPMENT PIPELINE, 2002-2006

Enrollment/Majors in Red are decreasing over time.	2002 Enrollment and Majors				2003 Enrollment and Majors				2004 Enrollment and Majors				2005 Enrollment and Majors				2006 Enrollment and Majors			
	ACC	UT Ugrad	UT Grad	Subtotal	ACC	UT Ugrad	UT Grad	Subtotal	ACC	UT Ugrad	UT Grad	Subtotal	ACC	UT Ugrad	UT Grad	Subtotal	ACC	UT Ugrad	UT Grad	Subtotal
Environmental Engineering	110	31	0	*141*	85	32	0	*117*	90	34	1	*125*	132	39	3	*174*	175	40	3	*218*
Civil Engineering		436	314	*834*		447	318	*854*		457	315	*861*		480	312	*901*		477	294	*873*
Electrical Engineering		1,854	611	*2,465*		1,738	626	*2,364*		1,564	592	*2,156*		1,433	612	*2,045*		1,331	658	*1,989*
Mechanical Engineering		1,096	231	*1,327*		1,046	254	*1,300*		1,005	228	*1,233*		987	235	*1,222*		975	238	*1,213*
Materials Science & Engineering	84	0	73	*73*	89	0	60	*60*	89	0	55	*55*	109	0	53	*53*	102	0	51	*51*
Geosystems Engineering		21	0	*21*		19	0	*19*		14	0	*14*		15	0	*15*		22	0	*22*
Petroleum Engineering		*215*	*129*	*344*		*316*	*157*	*473*		*378*	*147*	*525*		*381*	*152*	*533*		*429*	*128*	*557*
Industrial Engineering		0	78	*78*		0	79	*79*		0	69	*69*		0	64	*64*		0	60	*60*
Chemical Engineering		614	163	*777*		613	180	*793*		579	189	*768*		544	182	*726*		575	180	*755*
Engineering (Total)	194	4,267	1,599	*6,060*	174	4,211	1,674	*6,059*	179	4,031	1,596	*5,806*	241	3,879	1,613	*5,733*	277	3,849	1,612	*5,738*
Building Construction Tech	258			*258*	332			*332*	325			*325*	339			*339*	365			*365*
Heating, A/C, & Refrigeration Tech	159			*159*	179			*179*	187			*187*	188			*188*	200			*200*
Engineering Design Graphics	496	0	0	*496*	444	0	0	*444*	387	0	0	*387*	392	0	0	*392*	464	0	0	*464*
Electrical and Electronics Tech	451			*451*	327			*327*	230			*230*	201			*201*	288			*288*
Surveyors	47			*47*	43			*43*	48			*48*	40			*40*	53			*53*
Welding Technology	394			*394*	328			*328*	288			*288*	337			*337*	324			*324*
Chemists	1,351	285	217	*1,853*	1,380	292	213	*1,885*	1,460	326	204	*1,990*	1,512	326	208	*2,046*	1,587	361	222	*2,170*
Architects		300	115	*415*		289	131	*420*		290	151	*441*		274	167	*441*		248	174	*422*
Landscape Architects	0	0	0	*0*	0	0	15	*15*	0	0	32	*32*	0	0	36	*36*	0	0	36	*36*
Urban and Regional Planners		0	73	*73*		0	83	*83*		0	88	*88*		0	101	*101*		0	88	*88*
Cartographers (Geography)	413	180	42	*635*	492	214	49	*755*	469	216	40	*725*	499	213	35	*747*	523	228	35	*786*
Computer Programmers	3,687	1,944	236	*5,867*	2,812	1,454	244	*4,510*	2,669	1,152	254	*4,075*	2,630	936	275	*3,841*	2,641	818	287	*3,746*
Statisticians	0	0	16	*16*	0	0	12	*12*	0	0	16	*16*	0	0	12	*12*	0	0	12	*12*
Other Occupations (Total)	7,256	2,709	699	*10,664*	6,337	2,249	747	*9,333*	6,063	1,984	785	*8,832*	6,138	1,749	834	*8,721*	6,445	1,655	854	*8,954*
Total Enrollment in Classes/Majors	7,450	6,976	2,298	*16,724*	6,511	6,460	2,421	*15,392*	6,242	6,015	2,381	*14,638*	6,379	5,628	2,447	*14,454*	6,722	5,504	2,466	*14,692*

Note: ACC is number of enrolled students in subject area; UT is number of declared majors in subject area. Sources: University of Texas, Austin Community College Fact Book 2006-2007

NEXT STEPS

Delivering the necessary workforce for Austin's renewable energy industry will require the cooperation of all regional workforce development partners, economic developers, and the renewable energy industry. In our next report, AngelouEconomics will outline specific strategies these partners can take to ensure that the Austin economy trains, attracts, and retains the best and brightest workforce for the future growth of the renewable energy industry.

Our next report, the *Austin Renewable Energy Workforce Education* Plan will provide strategies for workforce development focused on aligning current and planned educational offerings with the skills and training that renewable energy companies have indicated they need. These recommendations will include curriculum-based recommendations for occupational training, opportunities to educate and re-educate workers with similar sets of skills for renewable energy jobs, ways to transfer knowledge from generation to generation within the renewable energy industry, and best practice examples for renewable energy workforce training programs in other communities.